

## E-Poster Viewing



### Allied Health Professions

#### AS13-004

#### OCCUPATIONAL THERAPY EFFICACY ON UPPER-EXTREMITY FUNCTIONAL OUTCOMES AFTER STROKE

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**Background and Aims:** Robot-assisted devices improve post-stroke occupational therapy (OT) outcomes are of great interest and have a positive impact on hand motor function recovery. Identifying the most effective OT intervention is a recognized priority for stroke research and provides an opportunity to achieve a more desirable effect.

**Purpose:** To evaluate the efficacy of robotic therapy (Armeo<sup>®</sup>Spring) in OT for motor hand function recovery in stroke patients.

**Methods:** Totally were included 36 patients  $64.5 \pm 5.3$  years old and  $8.41 \pm 4.27$  weeks after stroke onset. Patients were randomly divided in two groups – the experimental (Armeo robot, n = 17), and a control (traditional OT, n = 19). In total 10 sessions, 45–60 min/day. Hand motor function recovery was compared using the Fugl-Meyer Assessment Upper Extremity, Modified Ashworth Scale, Hand grip strength, Tapping test, Box and Block Test, and Range of Motion.

**Results:** The significant improvement was reached for all hand motor functions and activities in both groups ( $P < 0.05$ ), however the higher recovery was in experimental group ( $P < 0.001$ ). Robot-assistive device provides affected arm weight support and an opportunity to make most accurate tasks, while traditional OT methods does not support and arm movements are less accurate. The optimal training session duration we recommend is 30 min, in order to achieve the higher effect.

**Conclusions:** Even a 10 session's trainings program with robot-assisted trainer had a positive effect and significantly recovered hand motor ability. However, the potential efficacy robot therapy needs to be investigated in greater depth, as effective results may depend on training duration, intensity, patient's distribution according stroke type, affected arm and sex.

**Trial registration number:** Nr.158200-17-912-422.

#### AS13-005

#### KINECT-BASED SYSTEM IN OCCUPATIONAL THERAPY FOR HAND MOTOR FUNCTIONAL RECOVERY AFTER STROKE

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**Background and Aims:** Virtual reality has been shown to be an effective intervention in post-stroke rehabilitation. Video games in virtual reality can provide benefits in occupational therapy (OT) sessions to patients who have difficulty with daily activities and impaired hand motor function.

**Aim:** To evaluate the efficacy of virtual reality (VR) with "Microsoft Xbox Kinect 360" for hand functional movements in daily living activities after stroke.

**Methods:** In totally 42 post-stroke patients ( $66.7 \pm 4.6$  years old, 85% men, 70% affected right hand – hemiparesis, 65% ischemic stroke) participated in research. Patients were randomly divided into two groups: I experimental group – during OT was used VR trainings (n = 22); II control group – conventional OT activities (n = 20). During inpatient rehabilitation program (4 weeks) participants 5 times per week had OT trainings 60–30 min/d. with virtual reality. Hand functional movements were measured by Fugl-Mayer Assessment (FMA), Hand grip strength (dynamometry); functional level in daily activities was evaluated by Barthel Index (BI) and the Functional Independence Measure (FIM).

**Results:** Our results indicated, that the greatest improvement on functional independence was detected after VR trainings, especially in self-care, transfers and mobility skills ( $P < 0.05$  for FIM and BI). Hand functional movements significantly improved in both groups, but after VR trainings decreased flexor/extensor synergy, more improved volitional movements, MASS flexion, ( $P < 0.05$ ), than hand grip and thumb functions significantly more improved during conventional OT ( $P < 0.05$ ).

**Conclusions:** Trainings with virtual reality is more effective, than conventional OT activities, for improving self-care and mobility skills, also have a positive effect on hand motor function recovery.

**Trial registration number:** Nr.158200-17-912-422

### WITHDRAWN

**WITHDRAWN**

time to treat a stroke patient. The objective of this project was to assess if education of EMS providers' knowledge of pre-hospital stroke care resulted in increased number of stroke pre-notifications and decreases door-to-needle time.

**Methods:** We conducted a quality improvement project at the ED where research students administered an educational survey and provided one-on-one education to EMS providers about methods to identify stroke, barriers to pre-notification and methods for providing EMS feedback from June-August of 2018. The percentage of stroke pre-notifications received and door-to-needle times were compared from 4 months before and after the project. Using descriptive statistics we evaluated whether this short term educational intervention to EMS resulted in shortened door-to-needle time in our emergency department.

**Results:** 301 EMS providers were surveyed and educated. Prior to the educational intervention, pre-notification for stroke was 30.9% of patients brought by EMS as compared to 33% after completion of educational surveys. Door-to-needle times for IV thrombolysis dropped significantly from a mean of 58.5 minutes prior to the intervention to 49.9 minutes after EMS one-on one education was completed.

**Conclusions:** One-on-one EMS education had a significant effect on decreasing door-to-needle time in patients receiving IV thrombolysis for acute ischemic stroke. There was a trend towards increased number of pre-notifications in all stroke patients brought in by EMS.

**Trial registration number:** N/A

**AS13-027****NEUROPSYCHOLOGICAL ASSESSMENT AND COMMUNITY-BASED NEUROREHABILITATION FOLLOWING STROKE – A VALID METHOD?**

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**Background and Aims:** Community-based neurorehabilitation programs address cognitive, emotional, and behavioral issues that can drastically interfere with daily functioning and reintegration into employment following stroke. However, due to limited referral and funding, and to practical and ethical restraints on research examining their efficacy, such programs are not widely accessible. The current pilot study was part of a broad effort to demonstrate their value and evaluate obstacles impeding their widespread implementation.

**Methods:** The Israeli National Institute for the Rehabilitation of the Brain Injured provides both structured and individually-tailored holistic rehabilitation programs, which include neuropsychological assessment, individual and group psychotherapy and cognitive training, family therapy, vocational workshops, and job placement services. A retrospective database of 1017 participants with brain damage (various etiologies) who attended such programs nationwide for 6–12 months was analyzed with respect to event-to-referral time gaps and pre- and post-rehabilitation measures of employment, quality of life, and community integration. The 62 participants who had experienced stroke were analyzed separately and compared to groups with other etiologies.

**Results:** On average, participants were referred 2.6 years following stroke. Upon intake, this time gap was not correlated with quality of life or community integration, both of which improved significantly ( $N = 36$ ;  $p < .001$  and  $p < .05$ , respectively) between program start and end. The number of employed participants also grew significantly ( $p < .01$ ).

**Conclusions:** The positive results support the need for neuropsychological assessment and community-based neurorehabilitation following

**AS13-042****ONE-ON-ONE EMS EDUCATION AND FEEDBACK REDUCES DOOR TO NEEDLE TIME IN ACUTE ISCHEMIC STROKE PATIENTS**

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**Background and Aims:** Early recognition, accurate emergency medical services (EMS) dispatch, rapid EMS transport, and stroke team activation upon emergency department (ED) arrival helped shorten door-to-IV rt-PA time, but EMS pre-notification of stroke still remains crucial in saving

stroke, and encourage continued research in and allocation of resources to this area.

**Trial registration number:** N/A

## AS13-011

### STROKE SURVIVORS' ATTACHMENT ORIENTATION TOWARD A PET: ASSOCIATION WITH ACTIVITY, PARTICIPATION, AND QUALITY OF LIFE

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**Background and Aims:** There are contradicting findings regarding the influence of pets on their owners' health. Previous studies suggest that individual differences in the attachment orientation of owners to their pets may predict the owners' ability to gain from the relationship with the pet. This study is first to examine the effect of pet attachment in a clinical population of stroke survivors.

**Study aims:** (a) To examine the differences in activity, participation and Quality of life (QOL) of stroke survivors living with/without a pet; (b) To examine whether attachment orientation to a pet, and cognitive and executive functions can predict the activity, participation, and QOL of stroke survivors living with a pet.

**Methods:** 51 stroke survivors (16 women, 35 men), ages 47–87, 6+ months since stroke onset, living independently in the community, were divided into two matched groups: living with or without a pet. Several assessment tools were used to examine aspects of participants' body functions, attachment orientation, activity, participation, and QOL.

**Results:** No significant differences were found in the levels of daily activities [ $F(4,45) = 1.60, p = 190$ ] or QOL [ $F(4,46) = 96, p = 438$ ] between the two groups. Stroke survivors owning a pet showed significantly better performance on a cognitive functioning task than did those not owning a pet. Analyses are now being conducted to investigate a potential effect of pet attachment.

**Conclusions:** Results are consistent with previous studies showing mixed effects of living with a pet on people's activity and QOL. Further analyses will investigate the ability of pet attachment to explain the contradictory findings.

**Trial registration number:** registration number- 005/15

## AS13-008

### LOW PHYSICAL ACTIVITY IS ASSOCIATED WITH HIGH BLOOD PRESSURE AND HIGH PLASMA GLUCOSE IN STROKE SURVIVORS AT 12 MONTHS FOLLOWING REHABILITATION

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Neurosciences and Mental Health- University of Melbourne, Stroke Division, Melbourne, Australia

**Background and Aims:** Stroke survivors are at a high risk of having a second stroke and are known to participate in low levels of physical activity (PA). The objective of this longitudinal study was to measure PA over 12 months in stroke survivors who had completed rehabilitation and investigate relationships between PA and cardiovascular risk factors.

**Methods:** Survivors of first ever stroke admitted to a large metropolitan rehabilitation hospital were recruited.

The primary outcome was duration of moderate-vigorous PA (MVPA) (minutes/day) measured by the Sensewear Armband. Secondary

outcomes included other PA measures (steps/day, sedentary and light PA time bouts of MVPA) and cardiovascular risk factors (blood pressure, fasting lipid profile and plasma glucose).

**Results:** Participants ( $n = 61$ ) had mean age 64 [SD 14], median gait speed 1.3m/s (IQR 0.9,1.5) and 22 were female (36%). On average MVPA was high (median 73 minutes/day, IQR 24,131), but steps/day was low (median 3780, IQR 765,6703).

At 12 months following rehabilitation completion there was a weak relationship between lower MVPA and higher systolic blood pressure ( $rS = -0.2449, p = 0.06$ ). Shorter MVPA bout duration was associated with higher plasma glucose levels ( $rS = -0.2645, p = 0.04$ ). No other PA variable was associated with cardiovascular risk markers.

**Conclusions:** At 12 months post completion of rehabilitation stroke survivors who completed less MVPA tended to have higher systolic blood pressure and plasma glucose and are therefore at a higher risk of future stroke and cardiovascular disease. Promoting strategies to incorporate MVPA into stroke survivors' lives should be a focus for health professionals.

**Trial registration number:** N/A

## AS13-038

### EFFECTS OF FOOT WEDGE AND CARRYING WEIGHTED BAG ON LOADING THE PARETIC LOWER LIMB AFTER STROKE

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**Background and Aims:** Weight bearing in human subjects is dynamic and entails ongoing changes in force and its distribution over the foot. Few attempts were made to provide a definitive picture of weight bearing difference on the paretic and non-paretic lower limbs after stroke. The purpose of this study was to investigate the effect of foot wedge and carrying weighted bag on loading the paretic lower limb in individuals with hemiparesis after stroke.

**Methods:** Cross-sectional study. A convenient sample of 22 hemiparetic subjects evaluated. Twenty matched normal Subjects acted as a control group. Using two calibrated scales, measurements of weight supported on each lower limb were obtained under four different standing conditions.

**Results:** During quiet standing, the percentage of weight supported on the paretic limb was 29.79% with symmetry index equals 0.54. Standing with the non-paretic foot is placed on a lateral foot wedge, was the best condition that increased the percentage of weight supported on the paretic limb to 39.43% and improved the symmetry index to 0.80. Non-significant improvement of symmetry index 0.58 was recorded when carrying a weighted bag with the paretic hand, but carrying with the non-paretic hand unnecessarily loads the non-paretic limb and further decreases the symmetry index to 0.43.

**Conclusions:** Using a lateral foot wedge beneath the non-paretic foot and carrying a weighted bag with the paretic hand improve the loading function of the paretic limb and relief the non-paretic limb from overloading.

**Trial registration number:** N/A

## AS13-028

### CAN ASYNCHRONOUS TELEREHABILITATION ASSIST PEOPLE WITH CHRONIC APHASIA TOWARDS SELF- MANAGEMENT? PRELIMINARY FINDINGS FROM A FEASIBILITY STUDY

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**Background and Aims:** Post-stroke aphasia is a chronic communication disorder. Ultimately, individuals with aphasia need to move towards self-management of their communication. One way in which individuals may transition towards self-management is through engaging in asynchronous telerehabilitation. eSALT is a novel asynchronous telerehabilitation platform that allows for clinician monitored therapy to be accessed anywhere on a mobile device.

This study aimed to explore whether asynchronous telerehabilitation through eSALT had the capacity to promote autonomy and potentially empower the client towards self-management.

**Methods:** Eight individuals with post-stroke aphasia (4 male, 4 female; mean age 68.5 years [SD 11.63], mean TPO 7.5 years [SD 5.67]) and three clinicians participated in this pre-post feasibility study. Clinicians used eSALT to tailor therapy for each participant and tasks were sent to mobile devices for participants to access. Task data automatically transferred back to the clinician who remotely monitored and adapted the therapy over four weeks. Each participant completed a 35 question survey as an interview about their use of eSALT and clinicians were interviewed about their experience using eSALT. Interviews were analysed using content analysis.

**Results:** The participants engaged in therapy for an average of 59 minutes per day (SD 20.46; range 36–97). Fourteen of the survey questions related to concepts of new skills, autonomy, motivation, engagement and benefits. Participants reported that accessing therapy through eSALT enabled convenient and more frequent practice. They experienced increased confidence using technology and learned new skills. Clinicians said that eSALT enabled supported yet independent therapy.

**Conclusions:** Asynchronous telerehabilitation has capacity to promote independence.

**Trial registration number:** N/A

## AS13-026

### THE COMPLEXITIES OF AN INTERVENTION TO PROMOTE PSYCHOSOCIAL WELL-BEING AFTER STROKE: IMPLICATIONS FOR TRIAL OUTCOME

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**Background and Aims:** Psychosocial challenges are common after stroke, affecting motivation, functioning and quality of life. A complex intervention aimed at promoting psychosocial well-being after stroke was developed and tested for implementation in the primary care setting. The dialogue-based intervention consisted of eight dialogue-based sessions, targeting feelings, thoughts and experiences related to the life after stroke. The intervention was delivered by occupational therapists and nurses in the participants' homes. The aim of this study was to discuss how factors within the complex intervention itself may influence the outcome of an RCT.

**Methods:** The intervention was developed using qualitative methodology, tested in a feasibility study, and finally, evaluated in an RCT. The primary outcome of the trial was mood at 6 months measured by the General Health Questionnaire-28 (GHQ-28).

**Results:** In the RCT, 322 participants were randomly assigned to the intervention group ( $n = 166$ ) or the control group ( $n = 156$ ). After controlling for the baseline values, no significant benefit of the intervention on mood was found at 6 and 12 months post-stroke. In this study, we found that a number of interacting components within the intervention may have influenced the results of the trial. In this presentation we will present and discuss these factors.

**Conclusions:** A major challenge in interpreting the neutral findings in this RCT was all the interacting factors in the complex intervention.

**Trial registration number:** .

## AS13-031

### REHABILITATION OF UPPER LIMB IN STROKE PATIENTS: PILOT STUDY OF FUNCTIONAL AND NEUROMOTOR OUTCOME OF A TASK ORIENTED APPROACH INCLUDING MECFES AND ROBOTIC TREATMENT

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**Background and Aims:** Functional recovery of the upper plegic limb is fundamental for autonomy in daily activities of stroke subjects. Re-learning can be facilitated through the use of myoelectrically controlled FES (MeCFES) during functional movements and by robotic therapy which allows many repetitions of motor gestures. This study evaluated the efficacy of combined utilization of MeCFES and robot in a task oriented approach for the plegic upper limb in stroke.

**Methods:** 15 stroke patients (age  $60.4 \pm 16.2$ ) were allocated into three groups. All groups received 20 treatments of 45 minutes each. The experimental group (M-RG) received a combined treatment of functional electric stimulation with MeCFES during task-oriented reaching movements and a planar robotic treatment, the Robotic group (RG) planar robotic treatment and the control group (CG) received conventional therapy aimed at the recovery of the upper limb. Functional change was evaluated through clinical scales for the upper limb: Fugl Meyer Upper Limbs (FM-UE, primary outcome), Reaching Performance Scale (RPS), Action Research Arm Test (ARAT) and QuickDASH. Ratio RMS between antagonist and agonist arm muscles was derived from EMG signals during a task of reaching.

**Results:** Following intervention the M-RG had a statistically significant improvement on FM-UL ( $p = 0.01$ ), the RPS ( $p = 0.04$ ) and ARAT ( $p = 0.04$ ), while RG and CG did not change. The Antagonist/Agonist Ratio RMS of M-RG became similar to that of healthy persons in elbow and wrist ( $p < 0.05$ ).

**Conclusions:** Combining MeCFES and robotic treatment was effective for recovery of motor abilities of the plegic upper limb probably due to

the mix of motor learning techniques. The improved muscular control of arm movements indicates a central neuromotor reorganization.

**Trial registration number:** N/A

## WITHDRAWN

**Data Extraction:** Data was extracted by three authors and analyzed independently.

**Results:** Nine studies performed HIIT on a treadmill, one cycling, one NuStep, one task-oriented, and one study on a stepper. HIIT improved VO<sub>2</sub> max in the post-stroke population in five out of seven articles. Of the five, one study found continued improvement after one year. Participants in eight out of nine studies had improved walking performance following HIIT. Individually, four studies found gains in grip strength, skill retention, functional reach, and HR peak. HIIT has improved corticomotor excitability and nerve conduction latency in two separate studies.

**Conclusions:** With proper pre-screening and monitoring, HIIT in post-stroke rehabilitation proved to be both feasible and more effective than conventional therapy protocols. Incorporating principles of HIIT into treatment programs can improve walking performance, increase aerobic capacity, and overall quality of life.

**Trial registration number:** N/A

## AS13-015

### PERSPECTIVES OF PEOPLE WITH APHASIA POST-STROKE TOWARDS PERSONAL RECOVERY AND LIVING SUCCESSFULLY: A SYSTEMATIC REVIEW AND QUALITATIVE EVIDENCE SYNTHESIS

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**Background and Aims:** One third of people with stroke experience aphasia (language impairment) but are excluded from most stroke research. A lack of evidence base will impact on service quality and consistency. Processes of personal recovery and living successfully (PR-LS) are understudied. Research is essential for designing person-centred, integrated support in line with health policy. Aim: to establish what is known about the perspectives of people with post-stroke aphasia (PWA) towards PR-LS.

**Methods:** Comprehensive, systematic searching across 7 electronic databases targeting qualitative interview or focus group studies that aimed to examine the perspectives of PWA (18+ years) towards topics relating to PR-LS. We used a rigorous thematic synthesis process to integrate studies and advance conceptual understanding.

**Results:** 31 studies with 350 PWA in 10 countries were included. Analysis generated 5 themes: (1) Aphasia occurs in the context of a wider social network that provides valued support and social companionship and has its own need for formal support. (2) PWA want to make a positive contribution to society. (3) The participation of PWA is facilitated by enabling environments and opportunities. (4) PWA benefit from access to a flexible, responsive, life-relevant range of services in the long-term. (5) Accessible information and collaborative interactions with aphasia-aware healthcare professionals empower PWA to navigate the health system and direct their recovery.

**Conclusions:** The themes advance theoretical understanding of what is important to PWA with implications for policy and practice. The findings are being validated with an advisory group and will inform planned studies examining the quality of services in Ireland.

**Trial registration number:** N/A

## AS13-035

### THE EFFECTS OF HIGH-INTENSITY INTERVAL TRAINING ON THE POST-STROKE POPULATION: A SYSTEMATIC REVIEW

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**Background and Aims:** Conduct a systematic review to determine the feasibility and effectiveness of high-intensity interval training (HIIT) on the post-stroke population.

**Methods: Data Sources:** Academic Search Ultimate, CINAHL, and PubMed Central were searched April 2018-January 2019. Inclusion criteria included: studies published between 2010–2019, in English, participants were of the post-stroke population, and HIIT interventions.

**Study Selection:** Thirteen studies were identified: six randomized controlled trials and seven outcome studies. PEDro scores ranged from three to eight. Points were commonly lost secondary to lack of blind subjects, therapists, and assessors. All articles were included in PEDro scoring, as well as two additional studies used as informational references.

**AS13-016****SUPPORTING PEOPLE WITH POST-STROKE APHASIA TO LIVE WELL: A CROSS-SECTIONAL SURVEY OF SPEECH & LANGUAGE THERAPISTS IN IRELAND**

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**Background and Aims:** To live well, people with post-stroke aphasia (PWA) need responsive, collaborative health and related support services (HRSS) for themselves and their social networks, and opportunities to contribute and participate autonomously in their communities. In Ireland, there is a lack of data about what supports are available. Aim: To profile the range and relevance of HRSS for PWA in Ireland according to Speech & Language Therapists (SLT's).

**Methods:** A self-administered, web-based cross-sectional survey (Survey Monkey) was developed and piloted. Questions were informed by a systematic review with input from an aphasia advisory group. SLT's working with PWA were invited to respond in 2018. Descriptive statistics were applied in Stata.

**Results:** 95 SLT's representing community (38%), inpatient (35%) and rehabilitation (19%) settings responded. 73% identified that SLT was available. There was a lack of mental health support: 21% identified none was available. A minority reported the availability of supports for families. 39% identified that PWA accessed information online. 49% identified that other healthcare professionals were given aphasia training / information. 76% identified that PWA had some choice in service delivery.

**Conclusions:** While there has been a move to more holistic care there are still shortcomings in HRSS for PWA in Ireland. The data address an evidence-lack essential for planning person-centred, integrated stroke services in line with national and international health policy. This study is part of a larger project to produce provisional recommendations around promoting living well with aphasia, which will be validated by an advisory group and will have national and international relevance.

**Trial registration number:** N/A

**AS13-017****SUPPORTING THE MEANINGFUL PARTICIPATION OF PEOPLE WITH APHASIA TO ENHANCE THE VALIDITY AND RELEVANCE OF RESEARCH. A DESCRIPTION OF ONGOING TECHNIQUES**

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**Background and Aims:** One third of people with stroke experience aphasia (language impairment) but are often excluded from stroke research. Qualitative research methods are increasingly applied in the context of aphasia. Standard methods (e.g. of interviewing) may require adaptation to support the authentic involvement of people with aphasia (PWA) but there is a lack of clear methodological guidance. Responsive, relevant service planning must incorporate the perspectives of PWA. AIM: To describe our ongoing approach to supporting authentic involvement of PWA in a multi-study project examining the quality and relevance of health and related services for PWA of working age in Ireland.

**Methods:** An aphasia advisory group of 4 PWA of working age was convened. We used a participatory learning and action (PLA) research

approach to create a collaborative, democratic and aphasia-friendly research space. The group experienced (and suggested) a range of communication strategies to be used in interviews with people with aphasia.

**Results:** Aphasia-friendly communication strategies included supported conversation techniques, accessible written materials and presentation slides, informed consent processes and using strategies suggested by group members.

**Conclusions:** The group was supported to validate findings of a systematic review and to help plan interview and survey studies and to advise on addressing the challenge of supporting PWA, including severe aphasia, to give rich, relevant information in qualitative interviews. This study addresses issues of inclusion and equity for PWA. The use of participatory techniques has supported meaningful inclusion of PWA and will help to increase the relevance and validity of the research.

**Trial registration number:** N/A

**WITHDRAWN****AS13-020****RE-PURPOSING MY SELF: A GROUNDED THEORY STUDY OF YOUNG ADULTS' EXPERIENCES OF HAEMORRHAGIC STROKE**

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**Background and Aims:** There is a notable increase in stroke occurrence in young adults (< 55 years) and the prevalence of haemorrhagic stroke, in particular, is on the rise. Despite this, studies of the impact of

ischaemic strokes and stroke in older adults (>65 years) continue to dominate the literature. There is, therefore, a paucity of research specific to the impact of haemorrhagic stroke in young adults. Thus, we aimed to enhance understanding of how haemorrhagic stroke impacts the lives of young adult stroke survivors living in the community.

**Methods:** A Classic Grounded Theory methodology was adopted. Six, semi-structured, one-to-one interviews were conducted with young adult haemorrhagic stroke survivors, recruited on a volunteer basis. Interviews focused on the trajectory of life experiences post-stroke.

**Results:** Results highlight the centrality of reclaiming a sense of a purposeful and meaningful self post-stroke. These young adults engaged in a dynamic, non-linear, re-purposing process that spans three phases:- 1) Reeling from the Shock, 2) Living Cautiously and 3) Reshaping Life. These distinct, yet interlinked, phases are presented as a model that highlights the key struggles that participants experienced and account for the fluctuating and evolving sense of self over time.

**Conclusions:** Recovery from the impact of haemorrhagic stroke is multifaceted, dynamic and continues over time. Based on our data, it is proposed that accessible psychotherapy, within a psychosocial rehabilitation process, informed by the recovery model identified here, could help address the immediate and long-term impacts of haemorrhagic stroke and inform future service provision for this cohort.

**Trial registration number:** N/A

## WITHDRAWN

### AS13-019

#### THE ASSOCIATION BETWEEN CONTRAVERSIVE LATEROPULSION AND OUTCOMES POST STROKE: A SYSTEMATIC REVIEW

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**Background and Aims:** Contraversive lateropulsion is common after stroke. Overall recovery of function, rehabilitation length of stay and discharge destination in those exhibiting lateropulsion may differ from stroke survivors without lateropulsion. This systematic review explores the association of presence and severity of contraversive lateropulsion after stroke with recovery of lateropulsion, functional outcome, rehabilitation length of stay, and discharge destination.

**Methods:** Medline, CINAHL and Embase database searches were undertaken. Journal articles published in English reporting on recovery of post-stroke lateropulsion, functional outcome, rehabilitation length of stay and / or discharge destination are included for review. Single case reports were excluded. Studies are assessed independently for inclusion by two authors, and discrepancies adjudicated by a third reviewer. Two assessors independently assess risk of bias using the Risk of Bias Assessment Tool for Nonrandomized Studies (RoBANS), and discrepancies adjudicated by the third reviewer.

**Results:** To date, 91 articles have been identified for screening. Thirteen articles meet the inclusion criteria: 12 reported on recovery of lateropulsion, nine on length of stay, eight on functional outcome and five on discharge destination. Nine (69%) of articles included are small case series or cohort studies.

**Conclusions:** People with contraversive lateropulsion after stroke can achieve similar levels of function and have similar likelihood of returning home as their counterparts without lateropulsion, but require a longer period of rehabilitation to achieve these outcomes. This finding has implications for resourcing rehabilitation services, and the potential to reduce long term cost and burden of care needs cannot be underestimated.

**Trial registration number:** N/A

## WITHDRAWN

classification of Function, Disability and Health (ICF) and evaluation tools and approaches were matched to ICF domains. Descriptive statistics were calculated and significance of differences between chart recorded information and best practices were assessed using Chi-Square and analysis of variance.

**Results:** Overall, 46 distinct evaluation tools were used with only 22 of those recognized by the Canadian Stroke Best Practices. Tools evaluating motor, cognitive, visuo-perceptual functions as well as driving, daily and instrumental activities were most often used by OTs. OTs working in in-patient rehabilitation facility were more likely to focus on functions and used a larger array of tools than OTs providing out-patient care.

**Conclusions:** Despite persistence of gaps between current practice and best practices, patient's problems appear to be well evaluated by OTs. This study highlights the need for greater use and development of standardized tools in OT practice.

**Trial registration number:** N/A

## WITHDRAWN

**Background and Aims:** Aphasia is a communication disorder that's caused by damage or injury to the brain, most commonly from a stroke. Aphasia affects a person's ability to use language; understanding, speaking, reading and/or writing. The aim of the study was to establish whether participants' knowledge and attitudes (KAA) towards aphasia were different after watching an educational video describing the impact of aphasia on stroke survivors.

**Methods:** An aphasia friendly KAA questionnaire was designed and disseminated amongst the public attending a Stroke Symposium (November 2018). A quantitative, descriptive design was chosen to objectively measure, describe and document KAA towards aphasia after watching the video. Fourteen questions pertaining to the KAA towards aphasia were generated in line with the constructs of the Capability, Opportunity and Motivation Behavioural (COM-B) model and Theoretical Domains Framework (TDF).

**Results:** Data were collected, collated and entered into SPSS. A 90% ( $n = 90$ ) response rate was achieved. Participants included nine (10%) stroke survivors, 12 (13.3%) family member or carer of stroke survivors and 69 (76.6%) others, comprising academics, researchers, students and members of the public. A reliability analysis was conducted to determine the level of internal consistency for the attitude statements. All alpha coefficients were above 0.7 (alpha = 0.933) indicating good internal consistency of the scale.

**Conclusions:** The results highlight that this is a reliable questionnaire, with an aphasia friendly approach, which can be used in practice. The questionnaire will now be amended to create pre and post questionnaires to understand changes in people's KAA towards aphasia in future stroke symposiums and educational workshops.

**Trial registration number:** N/A

## AS13-037

### COGNITIVE ASSESSMENT IN PATIENTS WITH POST-STROKE COMMUNICATION IMPAIRMENT – JOINT WORKING INVOLVING SPEECH AND LANGUAGE THERAPISTS IN A COMMUNITY NEUROREHABILITATION SETTING

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**Background and Aims:** Current UK guidance advises cognitive assessment in conjunction with a speech and language therapist (SLT) for patients with post-stroke communication impairment. We sought to review its implementation.

**Methods:** St Pancras Neurorehabilitation Unit London is a 17-bed community neurorehabilitation unit. We performed a retrospective review of consecutive SLT referrals from February 2017. All functional and paper-based assessments were reviewed.

**Results:** Of 50 patients, mean age 75 years (SD 11), 60% female, communication impairment was present in 90%: dysarthria 23(46%), aphasia 22(44%), apraxia of speech 12(24%), and dysphonia 9(18%).

Of 29(58%) who would have benefitted from joint cognitive assessment, SLT was present for either functional wash-and-dress/kitchen or formal cognitive assessment for 18(62%). SLT presence was more likely for paper-based (59%) than functional assessments (43%).

Of 10 with moderate/severe aphasia who were able to undertake formal cognitive testing, nine were administered an aphasia-validated assessment. Of eight using the Oxford Cognitive Screen (OCS), five (63%) were unable to attempt the visual neglect and executive-function subtests, yet completed 58% of remaining subtests.

## AS13-034

### KNOWLEDGE AND ATTITUDES TOWARDS APHASIA

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Of 19 patients with communication impairment undertaking the OCS, fewer subtests were completed by the six who were assessed with SLT present. These six were more impaired than those assessed without SLT (median Patient Categorisation Tool 29.5 vs 27.5).

**Conclusions:** Over half of patients were felt to benefit from joint SLT cognitive assessment but under two-thirds of them received this. Joint working happened more often for formal paper-based than functional assessments. Insufficient support for patients with communication impairment entails risk that extent of cognitive impairment is misdiagnosed.

**Trial registration number:** N/A

## WITHDRAWN

### AS13-021

#### TEC4HOME STROKE: A PILOT STUDY ASSESSING FEASIBILITY OF HOME TELEMONITORING TECHNOLOGY IN MANAGING HYPERTENSION AFTER STROKE/TIA

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<sup>5</sup>University of Saskatchewan, College of Pharmacy and Nutrition, Saskatoon, Canada

**Background and Aims:** Blood pressure (BP) control is associated with reduced risk of first-ever and recurrent stroke. However, strategies to optimize treatment of hypertension in the “real world” are not known. Home telemonitoring may be an effective option in controlling BP for secondary stroke prevention.

**Methods:** We assessed the feasibility of a home telemonitoring program in managing hypertension. Participants with minor stroke/TIA (NIHSS < 5) within one year and BP>140/90 mmHg were enrolled and followed for 6 months. Participants or their caregivers measured BP three times per week and entered this information on a secure website. Average BP was assessed weekly by a nurse for one month, then monthly to direct medication titration (target below 135/80 mmHg) using an algorithm based on Canadian best practice recommendations.

**Results:** 42 of 50 total participants have been enrolled (40% female, mean age 68.5 years ± 9.9). Participants had ischemic strokes (62%), TIAs (21%) and intracerebral hemorrhages (7%). Thirty-eight participants managed their own measurements; four were managed by a caregiver. Mean BP at enrollment was 146/82 mmHg, 131/77 at 1 month (n=28), 125/75 at 3 months (n=19) and 126/78 at 6 months (n=10).

## WITHDRAWN

Ten participants completed follow-up with eight achieving BP target. One participant died before study completion and six were lost to follow-up. Four withdrew their consent due to lack of time to monitor (2), normal home BP (1), and preference for GP management (1).

**Conclusions:** Despite a high drop-out rate, home telemonitoring may be a suitable model of care for selected patients adherent to its use.

**Trial registration number:** NCT03712033 (ClinicalTrials.gov Identifier)

## AS13-018

### RETURN TO WORK AS A PROTECTIVE FACTOR OF DEPRESSION AFTER STROKE

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**Background and Aims:** A third of all strokes occurs in people under the age of 65 years. Return to Work represents a main goal in the rehabilitation of this group and therefore, may reduce the risk depression after stroke. We investigated the effect of Return to Work within the first year after stroke while controlling for established risk factors of post-stroke depression.

**Methods:** People with ischemic stroke were consecutively recruited from two German inpatient rehabilitation clinics and followed-up six and twelve months later. Assessments included demographic, stroke-related and psychological variables. Within the subsample of participants below age 65 ( $n = 158$ ), multiple linear regression analyses were used to predict depressive symptoms as measured by the Geriatric Depression Scale at two follow-ups (6 and 12M-FU).

**Results:** At 6M-FU, 22 out of 89 (13.9%) participants were back at work. Depressive symptoms at 6M-FU were predicted by pre-stroke depression ( $\beta = .24$ ), social support ( $\beta = -.35$ ), and current employment status ( $\beta = .39$ , all  $p < .05$ ). At 12M-FU, 34 out of 95 (21.5%) were back at work. Depressive symptoms at 12M-FU were predicted by pre-stroke depression ( $\beta = .30$ ), social support ( $\beta = -.29$ ), stroke severity ( $\beta = .19$ ), and current employment status ( $\beta = -.24$ , all  $p < .05$ ).

**Conclusions:** Return to Work may represent a protective factor of depression within the first year after stroke. These results emphasize the importance of vocational rehabilitation for mental health in younger people with stroke.

**Trial registration number:** N/A

### Atrial Fibrillation, Cardioembolism & Heart-Brain Interactions

## AS25-012

### ATRIAL CARDIOPATHY AND ATRIAL FIBRILLATION IN CRYPTOGENIC STROKE: THE PATHOGENIC ROLE OF INFLAMMATION.

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**Background and Aims:** About a third of ischemic strokes are cryptogenic (CS). In many patients with CS there is a strong suspicion of a cardioembolic source, therefore looking for silent atrial fibrillation (AF) is important in order to provide clues to the mechanism of stroke. However, the relationship between AF and stroke appears more complex than a simple cause-effect mechanism, suggesting that the association

between AF and stroke may be due to other systemic and atrial factors including systemic inflammation that may lead to atrial remodeling and subsequent atrial cardiopathy. The aim of the study was to evaluate the relationship among atrial cardiopathy, inflammatory markers and in-hospital AF occurrence after acute CS.

**Methods:** 222 patients with CS underwent 12-lead resting ECG at admission and 7-day in-hospital ECG monitoring. The following indices were evaluated: P-wave dispersion (PWD), P-wave index, P-wave axis, atrial size and high-sensitivity-C reactive protein (CRP).

**Results:** AF was detected in 44 patients. AF-group had significantly higher PWD, P-wave index, PR interval, CRP and greater frequency of abnormal P-wave axis in comparison with no-AF group. There was a significant correlation between CRP and PWD ( $r = 0.28$ ); in particular, PWD was a significant mediator variable of the relationship between CRP and AF occurrence, accounting for 40% of the association.

**Conclusions:** In CS, high PWD is partly due to systemic inflammation that increases AF risk possibly via atrial electric remodeling. These findings could also suggest inflammation as a possible therapeutic target in order to prevent atrial electrical alterations and finally AF occurrence in CS.

**Trial registration number:** N/A

## WITHDRAWN

**WITHDRAWN**

**Background and Aims:** Atrial fibrillation (AF) has been associated with gait problems and risk of falls. Brain lesions subsiding this possible association are unknown. Our aims were to investigate: 1) motor performances in a cohort of elderly patients with AF; 2) the possible association between motor impairment and brain vascular lesions (cerebral small vessel disease (SVD) and non-SVD).

**Methods:** Strat-AF Study is an ongoing observational study evaluating the role of biological markers for cerebral bleeding risk stratification in patients with AF on oral anticoagulants. Motor performances were evaluated by means of Short-Physical-Performance-Battery (SPPB, range0-12). History of falls was recorded. On brain MR, non-lacunar infarcts and signs of SVD were visually rated.

**Results:** Among the 127 enrolled patients (mean age =  $77.5 \pm 6.5$ ; F = 34%), white matter hyperintensities were detected 93%, lacunar infarcts in 29%, CMB in 32%, cSS in 6%, PVS (>20) in 52%, severe atrophy in 62%; non-lacunar infarcts in 19% of patients. Mean SPPB score was  $9.2 \pm 2.2$ . In the year prior enrolment, 21% of patients fell at least once. Motor performances were significantly worst in patients with fall history, female sex and older patients. Among neuroimaging variables, in linear regression analyses, lacunar infarcts ( $\beta = 1.75$ ,  $p = 0.049$ ), cortical atrophy ( $\beta = -0.233$ ,  $p = 0.08$ ), and superficial-siderosis ( $\beta = -0.173$ ,  $p = 0.05$ ) were significantly associated with SPPB total score. Adjusting for age, sex, education, and MR variables, only cortical atrophy retained an independent effect.

**Conclusions:** In our cohort of elderly patients with AF, motor impairment is frequent and independently associated with cortical atrophy.

**Trial registration number:** N/A

**AS25-071**

### LEFT ATRIAL APPENDAGE OCCLUSION IN CEREBRAL AMYLOID ANGIOPATHY WITH MINIMAL ANTITHROMBOTIC THERAPY: A CASE SERIES AND SYSTEMATIC REVIEW

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**Background and Aims:** Atrial fibrillation in survivors of intracranial haemorrhage (ICH) associated with cerebral amyloid angiopathy (CAA) is an important indication for left atrial appendage occlusion (LAAO). Little data exists on the outcome of LAAO in these patients, who are at very high risk of ICH which might be increased further by standard post-procedure antithrombotic regimens. We describe outcomes for CAA patients undergoing LAAO with minimal antithrombotic therapy, and systematically review other published cases.

**Methods:** We identified patients from a prospective tertiary centre database of all referrals for LAAO, classifying CAA status by modified Boston criteria. Follow-up was through hospital electronic records.

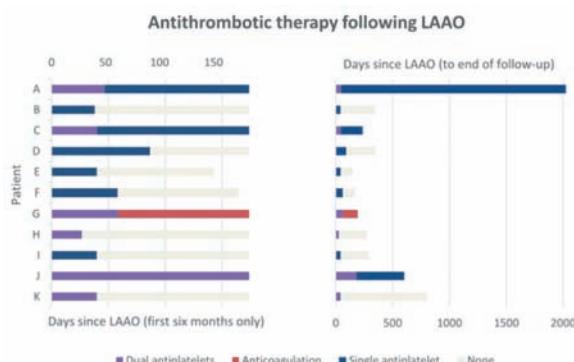
**Results:** Thirteen CAA patients underwent LAAO, eleven successfully, using Amplatzer or Watchman devices. Post-procedure antithrombotic regimens are summarised in figure 1. Five patients received short-term aspirin monotherapy only (median 42 days, IQR 41–76). During follow-up (median 346 days, range 150–2025), there was one asymptomatic device-related thrombus, in a patient receiving dual antiplatelets, and a single lobar ICH, in a patient off antiplatelets.

**AS25-072**

### MOTOR PERFORMANCES IN PATIENTS WITH ATRIAL FIBRILLATION AND POSSIBLE ASSOCIATIONS WITH DIFFERENT TYPES OF VASCULAR BRAIN LESIONS: PRELIMINARY DATA FROM STRAT-AF STUDY

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A systematic review identified five papers describing 32 patients (table 1). Although few outcomes were presented for CAA specifically, overall event rates were low. Long-term single antiplatelet therapy was typically used.

**Table 1:** Summary of key results from LAAO case series including CAA patients. Device-related thrombus rates are for the whole study group. The follow-up and outcome duration presented is CAA-specific where available. For "partially" available data, the outcome rates are CAA-specific but the only the overall study follow-up duration was available. Duration is mean +/- SD unless otherwise stated.

Study	Total patients	CAA patients	CAA-specific data available?	Device	Main antithrombotic regimen	Follow-up duration (months)	Device-related thrombi	Ischaemic strokes	ICH
Renu et al., 2017	46	25	No	Amplatzier Amulet (87%), Watchman (13%)	Aspirin >6 months (94%) (long-term in 56%)	12.6 +/- 7.2	1	2	1 (CAA patient)
Korschlom et al., 2017	107	3	No	Amplatzier Cardiac Plug/Amulet	Aspirin long-term (85%)	28 (median, IQR 1.6–3.2)	2	6	4 (at least 1 in a CAA patient)
Hornmann et al., 2014	20	2	Partially	Amplatzier Cardiac Plug	DAPT three months, aspirin long-term	13.6 +/- 8.2	1	0	0
Hawkes et al., 2016	7	1	Yes	Amplatzier Cardiac Plug	Aspirin three months	9	0	0	0
Fayos-Vidal et al., 2017	9	1	Partially	Amplatzier Amulet	Aspirin or clopidogrel six months (56%) or long-term (44%)	15 (range 3–24)	0	0	0

**Conclusions:** We found few reports describing the outcome of LAAO in survivors of ICH due to CAA; our case series suggests that LAAO with short-term single antiplatelet therapy might be safe and effective in such patients. Further observational and randomised trial data are needed to improve AF stroke prevention in this high-risk population.

**Trial registration number:** N/A

## AS25-015

### TREATMENT STRATEGY IN PATIENTS WITH CRYPTOGENIC STROKE AND PFO. A RETROSPECTIVE SINGLE-CENTER STUDY

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<sup>2</sup>Complejo Asistencial Universitario de León, Cardiology, León, Spain

**Background and Aims:** The recent European position paper on the management of patients with patent foramen ovale (PFO) aims to perform studies to analyze clinical practice regarding PFO-closure. In a retrospective study we evaluated the experience to PFO-associated stroke management, the factors influencing the treatment choice and the outcomes in a tertiary centre.

**Methods:** We analyzed consecutive patients admitted in our stroke unit over a ten year period. The patients were divided in  $\leq 60$  and  $> 60$  years old. We investigated clinical variables [risk factors, history of venous thromboembolism (VT), RoPE score, imaging pattern, criteria of

paradoxical embolism (PDE), shunt size] and stroke recurrence. In the intervention group, we assessed the procedure-related complications

**Results:** Of 167 consecutive patients with cryptogenic stroke (CS) and PFO 31 underwent PFO-closure. The factors associated with PFO closure in the  $\leq 60$  years old group ( $n = 113$ ; 23 PFO-Closure) were: age (42.2  $\pm$  10.8/ 47.9  $\pm$  8.9), normotensive patient, large shunt and embolic pattern. For patients  $> 60$  years old ( $n = 54$ ; 8 PFO-closure), PDE, VT and large shunt were related to PFO-closure. In the medical treatment group, 16 patients suffered a stroke recurrence, unlike 1 patient in the intervention group. Complications occurred in 3 patients: 2 atrial fibrillation and 1 cardiac perforation.

**Conclusions:** Our experience shows that some aspects in the indications of PFO-closure still remain unclear. Amongst patients with CS and PFO we observed differences in the treatment strategy related to the age. An interdisciplinary cardio-neurological work in the patient's management is necessary in order to reach agreement on the treatment criteria.

**Trial registration number:** N/A

## AS25-036

### SAFETY OF EARLY TREATMENT WITH EDOXABAN IN PATIENTS WITH ISCHAEMIC STROKE AND ATRIAL FIBRILLATION: PRELIMINARY DATA.

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<sup>1</sup>Università Cattolica del Sacro Cuore Fondazione Policlinico Gemelli, UOC Neurologia, Roma, Italy

**Background and Aims:** Vitamin K antagonists or new direct oral anti-coagulants (eg. apixaban, dabigatran, edoxaban, rivaroxaban,) are recommended for prevention of stroke in patients with atrial fibrillation. However, no data are available to address the question of optimal timing for starting oral anticoagulation after a stroke or TIA. In this observational ongoing perspective study the safety of early initiation (within 72 hours) of full dose (60 mg) of edoxaban is evaluated in patients with acute ischemic stroke. Primary objective is to evaluate any fatal/severe bleeding in the first 90 days of treatment; secondary endpoint is the symptomatic hemorrhagic transformation in the first 3 days of therapy as evaluated by brain CT or MRI scan.

**Methods:** Inclusion criteria are: age  $> 18$  yo; CT/MRI signs of  $< 1/3$  MCA infarction involvement; nonvalvular atrial fibrillation; no previous treatment with any other anti-coagulant; preserved swallowing function. Exclusion criteria are: renal failure (eGFR  $< 50$  ml/min); body weight  $< 60$  kg; treatment with cyclosporin, dronedaron, eritromicine, ketoconazole; any other contraindication to anti-coagulant treatment.

**Results:** 14 patients were recruited so far, mean age is 78.5. The mean NIHSS was 5.4 (range 1–15) when edoxaban was started. Neither symptomatic intracranial bleedings were observed nor stroke recurrence in the follow up. Three patients showed HII hemorrhagic transformation not associated with neurological deterioration and none of the recruited patients stopped the therapy.

**Conclusions:** Our preliminary data need to be confirmed on a larger sample size but they suggest that edoxaban can be safely administered early, in acute stroke patients with small ischemic lesions.

**Trial registration number:** N/A

**AS25-030**

**BODY MASS INDEX, TRIGLYCERIDE AND CREATININE ARE INDEPENDENT PREDICTORS OF OCCURENCE OF STROKE IN PATIENTS ADHERENT WITH NOVEL ORAL ANTICOAGULANT FOR NON-VALVULAR ATRIAL FIBRILLATION**

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<sup>1</sup>University at Buffalo Jacobs School of Medicine and Biomedical Sciences, Department of Neurology, Buffalo- New York, USA; <sup>2</sup>University at Buffalo Jacobs School of Medicine and Biomedical Sciences, Neurology, Buffalo, USA

**Background and Aims:** Novel oral anticoagulants (NOAC) are used for the prevention of stroke in patients with non-valvular atrial fibrillation (NVAF). However embolic strokes were observed in patients who remain adherent with NOAC.

We therefore sought to determine whether certain variables are predictive of occurrence of stroke.

**Methods:** Patients admitted to Buffalo General Medical Center from November 2011 to December 2018 with embolic stroke were included. Age, gender and race matched controls include patients on NOAC without stroke. Past medical history, laboratory and demographics were obtained. Independent T tests were applied for continuous and Chi Square for categorical variables. Logistic regression was used to assess whether certain variables were predictive of stroke. P-value of < 0.05 was considered statistically significant.

**Results:** A total of 25 patients adherent with NOAC were admitted. Of these, 15 were on apixaban, 6 on rivaroxaban, 4 on dabigatran. Mean age (mean  $\pm$  SD) was  $74 \pm 2$ . 56% were males, 88% were Caucasians, 12% African Americans. Controls consisted of 612 patients. Significant differences between study patients and controls include: triglycerides (133 vs. 94, p = 0.01), A1c (6.3 vs. 5.7, p = 0.03), creatinine (1.18 vs. 0.92, p = 0.01), Weight (kg) (93 vs. 78, p = 0.04) and BMI (32.4 vs. 27.1, p = 0.03). Multivariate analysis found that only BMI (RR = 1.11, p = 0.05), triglycerides (RR = 1.02, p = 0.04) and creatinine (RR = 8.6, p = 0.05) and were significant predictors.

**Conclusions:** In summary, BMI, triglyceride and creatinine were independent predictors of stroke occurrence in patients adherent with NOAC.

**Trial registration number:** N/A

**AS25-004**

**IMPLEMENTATION OF ATRIAL FIBRILLATION OPPORTUNISTIC SCREENING IN PEOPLE 60 YEAR-OLD: RESULTS, BARRIERS AND ENABLERS (AFOSS PROSPECTIVE STUDY)**

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**Background and Aims:** The incidence of atrial fibrillation (AF) and its complications increase with the aging of the population. The main objective was identifying the barriers to opportunistic AF screening (AFs) in the population  $\geq 60$  year-old and related stroke incidence.

**Methods:** Observational, longitudinal, prospective and multicentric study cohort of 48336 people between 01/01/16-31/12/2017. Opportunistic pulse palpation and/or ECG. Adjusted incidence of new AF and stroke, number of screening cases needed to diagnose a new AF. Adjusted multivariate model and ROC curve.

**Results:** 61.2% had record of AFs. Increase in the prevalence of AF was quantified (5.9%vs7.7%, p < 0.001). 26.3% of AF was diagnosed by the realization of AFs. The adjusted incidence in AFs group [6.8 CI95% 5.8-7.8] was not different in not AFs group [6.9 CI95% 5.6-8.2]. The number needed for a new AF was 147. The variables associated with the no-performance of the AFs were: age < 70 year-old, urban residence, institutionalized status, Pfeiffer score  $\geq 2$  or "cognitive impairment" record, Charlson score  $\leq 3$ , and a number of visits lower than the territory average. The ROC curve score was 0.745 (CI95% 0.74-0.7 9, p < 0.001). The use of anticoagulant treatment it is significantly higher in the population with AFs (85.3%vs 74.9 %, p < 0.001). The incidence ratio of stroke was 1.13 [CI95% 0.398-3.252, p = 0.856].

**Conclusions:** After two years, the AFs showed neither significant difference in new AF diagnosed nor in the adjusted incidence of stroke. Variables associated to use of health care could influence the results of AFs implementation.

**Trial registration number:** ClinicalTrials.gov Identifier: NCT03589170.

**AS25-017**

**RIVAROXABAN'S IMPACT ON RENAL OUTCOMES IN PATIENTS WITH NON-VALVULAR ATRIAL FIBRILLATION: THE RIVAL STUDY**

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**Background and Aims:** Warfarin has been associated with renovascular calcification and worsening renal function; whereas, rivaroxaban may provide a degree of renoprotection by decreasing vascular inflammation. We sought to compare rivaroxaban and warfarin's impact on renal outcomes in NVAF patients treated in routine practice.

**Methods:** Using MarketScan data from 1/2012-12/2017, we identified NVAF patients newly-initiated on rivaroxaban or warfarin with  $\geq 12$ -months insurance coverage prior to initiation. Patients with stage 5 chronic kidney disease (CKD) or receiving hemodialysis at baseline were excluded. Differences in baseline covariates between cohorts were adjusted using inverse probability-of-treatment weights based on propensity scores (standardized differences < 0.1 achieved for all covariates following adjustment). Endpoints-of-interest included rates (events/100 person-years) of hospital/emergency department admission for acute kidney injury (AKI) or progression to stage 5 CKD or need for hemodialysis. Patients were followed until an event, anticoagulant discontinuation/switch, insurance disenrollment or end-of-data availability. Hazard ratios with 95% confidence intervals (CIs) were estimated using Cox regression.

**Results:** We assessed 36,318 rivaroxaban (19.8% received a reduced dose) and 36,281 warfarin users. Median (25–75% range) age = 69 (60–79) years, CHA2DS2-VASc = 3 (2–4) and duration of available follow-up = 1.8 (0.8–3.3) years. Stages 3 and 4 CKD were present in 5% and 1% of patients at baseline and proteinuria was present in 2%. Rivaroxaban was associated with a 19%, 95%CI = 13–25% reduction in the hazard of AKI (rates = 4.91 versus 8.45) and an 18%, 95%CI = 9–26% reduction in progression to stage 5 CKD or hemodialysis (rates = 2.67 versus 4.12).

**Conclusions:** Rivaroxaban appears associated with lower risks of undesirable renal outcomes versus warfarin in NVAF patients.

**Trial registration number:** N/A

## AS25-020

### AUTOMATED CONTINUOUS ELECTROCARDIOGRAM MONITORING TO DETECT ATRIAL FIBRILLATION AFTER ISCHEMIC STROKE ON A HYPER ACUTE STROKE UNIT : THE ACEM-AF STROKE STUDY

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**Background and Aims:** Rapid and sensitive detection of atrial fibrillation (AF) is of paramount importance for starting adequate antithrombotic preventive therapy early after stroke. Stroke Unit care includes continuous ECG monitoring (CEM) but the optimal exploitation of recorded ECG traces is controversial.

**Methods:** In this retrospective, unsponsored single-centre study, we compared the yield of routine CEM versus an automated continuous electrocardiogram monitoring (ACEM) based on remote software algorithm (SRA-clinic-Apoplex-technologies) to detect AF in patients admitted to our Stroke Unit. We also investigated whether ACEM shortens the time of AF detection compared to CEM. We identified consecutive patients with acute ischemic stroke who were in sinus rhythm on admission and no history of AF. Patients were identified during two distinct recruitment phases: between 1<sup>st</sup> June and 31<sup>st</sup> August 2017 for the CEM cohort, and between 1<sup>st</sup> June and 30<sup>th</sup> September 2018 for the ACEM cohort.

**Results:** Overall, 208 of the 407 patients (51.11%) in the CEM group and 114 of the 241 patients in the ACEM group (47.30%) fulfilled the eligibility criteria (Table 1). We found a lower rate of newly-detected AF in the CEM cohort compared to the ACEM cohort (10.1% vs. 15.8%,  $p < 0.001$ ). Moreover, median time to first detection of AF was longer in the CEM cohort compared to the ACEM cohort [46.50 hours (IQR 0–108.25) vs. 10 hours (IQR 0–23),  $p < 0.001$ ] (Table 2) (Figure 1).

**Conclusions:** This study supports that ACEM results in a higher rate of AF detection than CEM. ACEM accelerates AF detection and may support earlier initiation of anticoagulation.

**Trial registration number:** N/A

## AS25-075

### CEREBRAL CORTICAL MICROINFARCTS: A NOVEL MRI MARKER OF CEREBROVASCULAR DISEASE IN PATIENTS WITH HEART FAILURE

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**Background and Aims:** Patients with heart failure (HF) are at risk for cerebrovascular disease (CeVD). Cerebral cortical microinfarcts (CMIs) are a novel MRI marker of CeVD, associated with stroke and dementia. The occurrence of CMIs in patient with HF and their clinical correlates are unknown.

**Methods:** As part of the Heart-Brain study, 133 patients with clinically stable HF (mean age  $69 \pm 10$ , 65% male) and 123 controls (mean age  $66 \pm 7$ , 52% males) were evaluated for CMIs on 3-Tesla MRI. CMI presence in HF was related to vascular risk profile, cardiac function and other MRI markers of CeVD.

**Results:** CMIs were more common in patients with HF (20%) than controls (8%) (OR 2.8; CI 1.3–6.0;  $p = 0.11$ , after correction for age, sex and vascular risk factors OR 1.9; 0.8–4.7;  $p = 0.49$ ). In HF, CMI presence was associated with hypertension (OR 2.6; 1.1–6.4;  $p = 0.043$ ) and obesity (OR 2.6; 1.1–6.5;  $p = 0.037$ ), but not with cardiac function (Table 1). Moreover, presence of CMIs was associated with a higher burden of other MRI manifestations of CeVD, especially large cortical infarcts (OR 3.5; 1.1–10.9;  $p = 0.033$ ).

Table 1: Cardiac function and history of patients with heart failure with and without cerebral cortical microinfarcts.

	HF CMI present (n=26)	HF CMI absent (n=107)	P
Age (years)	69.3 ± 7.5	69.4 ± 10.1	.968
Sex (males)	17 (65%)	73 (68%)	.781
Left ventricular ejection fraction (%)	42.4 ± 9.0	42.4 ± 6.8	.980
Cardiac output (mL)	5193 ± 1171	5347 ± 1250	.597
Duration of HF < 5 years	15 (58%)	62 (59%)	.900
Cause of heart failure			.719
Coronary artery disease	15 (58%)	57 (54%)	
Other/unknown	11 (42%)	49 (46%)	
(Paroxysmal) atrial fibrillation	5 (19%)	18 (17%)	.786
PCI	13 (50%)	32 (31%)	.061

ABBREVIATIONS: HF=heart failure; CMI=cerebral cortical microinfarct; PCI= percutaneous coronary intervention; Data are presented as group mean ± SD and n (%).

**Conclusions:** CMIs are a novel MRI marker of CeVD in patients with HF that relate to vascular risk profile rather than HF-related cardiac dysfunction. Further studies are needed to identify the etiology of CMIs in patients with HF and prognostic value for stroke and dementia in these patients.

**Trial registration number:** N/A

## AS25-031

### ALERT ON

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**Background and Aims:** Cardiac biomarkers are significantly increased in cerebrovascular conditions, especially in class III/IV, C/D New York

Heart Association (NYHA) and American Cardiology Association (ACA) patients (Fiori P. et al., 2018).

The aim of our study was to assess the relevance of fibrinogen and d-dimer for better assessment of thrombophilic risk and for improving reliability of prognosis.

**Methods:** Exclusion criteria were the presence of clotting disorders, hepatic dysfunctions, anticoagulation therapies.

**Results:** D-dimer levels were higher in all Chronic Cerebro-Vascular Diseases (CCVD) and Acute Stroke (AS) compared to Other Neuropsychiatric Disorders (OND). The differences in fibrinogen and d-dimer were statistically more significant in class I/II, A/B, compared to class III/IV, C/D NYHA and ACA, because of increased standard deviation in the latter. In class I/II, A/B, significant correlations were observed between cardiac biomarkers and fibrinogen in AS and D-dimer in all patients, while in class III/IV, C/D, only troponin was correlated with fibrinogen in CCVD and in AS. In class III/IV, C/D CCVD, we observed significant correlations between fibrinogen, D-dimer, brain natriuretic peptide, troponin with GCS and MRS at admission and at day VII.

**Conclusions:** Thrombophilic cascade may be early activated also in mild cardiological dysfunction. It is a red flag along the course of acute and chronic conditions. However, d-dimer is a final product of clotting cascade, while fibrinogen is more reliable for assessing the actual risk. Circulatory overload and multisystem organ dysfunction may mask significant changes of these parameters in severe, irreversible heart failure and account for increased risk of haemorrhagic complications.

**Trial registration number:** N/A

## AS25-079

### NON ECG-GATED CARDIAC CT ANGIOGRAPHY FOR DETECTION OF CARDIO-AORTIC SOURCES OF EMBOLISM IN THE ACUTE PHASE OF ISCHEMIC STROKE

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**Background and Aims:** To investigate the image quality and diagnostic yield of extending the non ECG-gated CT-angiography (CTA) to the heart for detection of structural cardio-aortic sources of embolism in the acute phase (eligible for reperfusion therapy) of ischemic stroke.

**Methods:** We performed a single-center retrospective cohort study in 82 consecutive acute ischemic stroke patients who were potentially eligible for reperfusion therapy. Patients underwent a non ECG-gated CTA in the acute phase, including the heart, complete aortic arch, cervical and intracranial arteries. We predefined potential structural sources of embolism from the heart and aortic arch. CTA images were systematically scored on a consensus basis by two cardio-radiologists.

**Results:** Median age was 74 years (IQR 63–83), 50/82 (61%) were male and median NIHSS was 5 (IQR 3–11). Median duration of heart-brain CTA was 7 seconds (IQR 6–8). Image quality of the heart was poor in 32/82 (39%) patients, as a result of many (movement) artefacts and/or poor contrast opacification. Fourteen high-risk sources of embolism were detected on CTA in 13/82 (16%) patients: left atrial appendage thrombus (N=3), left ventricular thrombus (N=1), dilated cardiomyopathy (N=3), prosthetic valve abnormalities (N=2), and large (range 5–10mm) ulcerated noncalcified aortic arch atheroma (N=5).

**Conclusions:** Despite suboptimal image quality, high-risk structural cardio-aortic sources of stroke were found in a substantial proportion of patients scanned in the acute phase of ischemic stroke. Applying ECG-gating and repositioning of the arms above the head may improve image quality and increase diagnostic yield of cardiac CTA. Comparison of yield to echocardiography also needs to be determined.

**Trial registration number:** N/A

## AS25-073

### PREVALENCE OF SYSTOLIC, DIASTOLIC DYSFUNCTION AND HEART FAILURE IN ACUTE ISCHAEMIC STROKE: THE SICFAIL (STROKE INDUCED CARDIAC FAILURE IN MICE AND MEN) COHORT STUDY

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**Background and Aims:** Data on cardiac dysfunction in ischaemic stroke (IS) according to standardised echocardiographic and clinical criteria are lacking. We assessed prevalence and characteristics of diastolic dysfunction (DD), systolic dysfunction (SD) and heart failure (HF) in acute IS patients.

**Methods:** Data were collected within the prospective hospital-based SICFAIL study. In consecutive IS patients, cardiac function was assessed at baseline (median = 4 days after IS) including clinical examination, standardised echocardiography by an expert sonographer, and blood sampling. Cardiac dysfunction was defined according to current guidelines and classified based on echocardiographic criteria into DD ( $>= 3$  signs of DD), SD (left ventricular ejection fraction (EF)  $< 52\%$  (men) or  $< 54\%$  (women)); HF type was classified according to echocardiographic criteria and clinical symptoms (Framingham criteria) into HF with reduced (HFrEF), mid-range (HFmrEF) or preserved EF (HFpEF).

**Results:** Between 01/2014 and 02/2017, 696 IS patients were included. Echocardiography was available in 644 (92.5%), with DD assessment in 94.4%. Prevalence of cardiac dysfunction and HF was: DD 23.9%; SD 9.6%; HFpEF 4.3%; HFmrEF 0.3%; HFrEF 0.8%. A higher (+) or lower (-) prevalence of cardiac dysfunction was observed for: older age (DD+, HF+), female sex (DD+), hypertension (DD+, SD-, HF+), HF pre-stroke (SD+, HF+), atrial fibrillation (DD+), myocardial infarction (SD+, HF+), impaired kidney function (DD+), increased troponin and NT-proBNP levels (DD+, SD+, HF+); there were no differences in stroke severity or stroke aetiology.

**Conclusions:** SICFAIL provides reliable data on the prevalence and characteristics of cardiac dysfunction in acute IS patients allowing further clarification of its aetiological and prognostic role.

**Trial registration number:** DRKS00011615

**AS25-037****THE RISK OF STROKE AMONG PATIENTS WITH ATRIAL FIBRILLATION WHO HAVE ACTIVE CANCER****J.Y. Hsu<sup>1</sup>, P.S. Liu<sup>2</sup> and A.B. Liu<sup>3</sup>**

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**Background and Aims:** Cancer is a time-varying risk factor of ischemic stroke. The effect especially exists in active cancer and is attenuated by 6 months. The lower risk of ischemic stroke reported in atrial fibrillation patients with a cancer history might lead physicians to not initiate anticoagulation therapy. However, the time-varying effect is unclear. Thus, we investigated stroke risks in patients with active cancer.

**Methods:** We enrolled atrial fibrillation patients with cancer between 2010 and 2015 in the Taiwan National Health Insurance Research Database and Taiwan cancer registry database. Those diagnosed with cancer before atrial fibrillation and < 6 months' follow-up were excluded. Primary outcomes were in-hospital diagnosis of stroke with brain imaging during active cancer. Each selected patient was matched for age and sex to two patients without cancer. Follow-up started from the time of cancer diagnosis to the occurrence of stroke or death, or the end of the active phase or study.

**Results:** The cancer cohort included 5,611 patients, of whom 250 had ischemic stroke and 39 had hemorrhagic stroke. The adjusted hazard ratios (95% confidence interval [CI]) were 0.9 (0.77–1.04) and 0.61 (0.42–0.87) for ischemic and hemorrhagic strokes, respectively. Patients with stage 4 cancer, lung cancer, liver cancer, and gastric cancer; no cancer treatment; and one stroke risk factor except sex in the CHA2DS2-VASc score received less anticoagulants, especially non-vitamin K anticoagulants.

**Conclusions:** Atrial fibrillation patients with active cancer bear a similar risk of ischemic stroke as those without cancer, and thus, should receive anticoagulants for stroke prevention.

**Trial registration number:** N/A

**AS25-043****PATIENTS WITH ATRIAL FIBRILLATION SIGNIFICANTLY OVEREXPRESS FIBRIN-BINDING PLATELET SURFACE RECEPTOR GPVI-DIMER. A FUTURE ANTI-THROMBOTIC TARGET?**

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**Background and Aims:** Platelet surface receptor glycoprotein (GP) VI-dimer, rather than its inactive monomer, activates platelets through binding collagen and fibrin. GPVI-dimer is over-expressed on the platelet surface after ischaemic but not haemorrhagic stroke, however, it is unclear whether this is a pre-existing platelet phenotype or due to acute thrombosis. Therefore, we investigated whether patients with atrial fibrillation (AF), who have never had a stroke, exhibited higher GPVI-dimer also.

**Methods:** Patients with AF admitted acutely to general medicine (n=63) at Addenbrookes Hospital, Cambridge UK were recruited. Flow cytometry analysed whole blood for surface expression of total platelet GPVI (monomer and dimer), just GPVI-dimer and resting platelet P-selectin expression (platelet activation marker) using specific antibodies. Results were compared against a control non-AF population, n=301. Serum D-dimer, fibrinogen, brain-natriuretic peptide and high sensitivity C-reactive protein were collected.

**Results:** Median age (IQR) of AF cohort was 74yrs (66–92); control population 60yrs (47–68) ( $P < 0.0001$ ). 40% had paroxysmal AF and 74% were anticoagulated. Total GPVI was not significantly different ( $p = 0.63$ ), but GPVI-dimer was overexpressed in AF compared to control groups ( $P = 0.006$ ). P-selectin expression was also higher in the AF group ( $P < 0.0001$ ). Anticoagulation/antiplatelets or paroxysmal vs. persistent AF made no significant difference to GPVI-dimer levels. Age was not correlated with GPVI-dimer expression. Serum fibrinogen levels were independently associated with higher GPVI in AF.

**Conclusions:** AF patients who have never had a stroke still demonstrate significantly higher resting platelet activity and specifically GPVI-dimer overexpression. This is not altered by AF-type or current anti-thrombotics. Therefore, GPVI-dimer inhibition represents a viable future pharmacological target in ischaemic stroke.

**Trial registration number:** N/A

**AS25-084****LONG TERM CARDIOEMBOLIC STROKE MORTALITY IN LATVIAN POPULATION DEPENDING ON PATIENTS FUNCTION OUTCOME AT DISCHARGE FROM 2014 TO 2017**

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**Background and Aims:** Cardioembolic stroke is most severe of ischemic stroke subtypes and is associated with high long term mortality. We evaluated the difference in cardioembolic stroke mortality depending on patients functional outcome at discharge from hospital.

**Methods:** In a prospective study were included a total of 1580 cardioembolic stroke patients discharged from P. Stradiņš Clinical University Hospital, Riga, Latvia in 2014 to 2017. All patients were evaluated by modified Rankin scale (mRs) on discharge were score of 0–3 considered a satisfactory functional outcome. Patients were followed up by phone in 30–90–180–365 days after leaving the hospital.

**Results:** Of all patients discharged 841 (53,23%) had satisfactory function outcome, 739 (46,77%) patients were severely disabled. The average mortality in 30d was 16,65%, in 90d 23,99%, in 180d 29,99% and one year mortality was 32,85%. In patient group with satisfactory stroke outcome mortality after 30d was 2,97%, 90d 5,23%, in 180d 7,25% and one year mortality was 10,34%. But in severely disabled patients group mortality after 30d was 32,21%, 90d 45,33%, 180d 53,72% and one year mortality was 58,46%.

**Conclusions:** In Latvia cardioembolic stroke mortality is high. But the mortality rate is significantly lower in patient group with satisfactory stroke outcome at discharge.

**Trial registration number:** N/A

**AS25-025**

## **SECONDARY PREVENTION FOR STROKE BY DIRECT ORAL ANTICOAGULANTS (DOACs) IN PATIENTS WITH ATRIAL FIBRILLATION AND CANCER**

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**Background and Aims:** Cardioembolic (CE) stroke is one of the causes of morbidity and mortality in cancer survivors. However, it is still unclear about the efficacy and safety of direct oral anticoagulants (DOACs) for prevention in CE stroke patients with atrial fibrillation (AF) and cancer.

**Methods:** We extracted the patients with AF and active cancer from consecutive CE stroke 1250 patients treated with DOACs for secondary prevention in our stroke data base from March, 2011 to the April, 2018 and analyzed retrospectively

**Results:** The number of the consecutive CE stroke patients which coexisted AF and active cancer was 88(7.0%), interestingly that was significant higher than in non-CE stroke patients with cancer (3%). In CE patients with cancer, the CHADS2 Score was significant lower ( $3.0 \pm 1.1$ ) than CE stroke patients without cancer ( $3.9 \pm 0.9$ ). In 66.7% of patients with cancer, chemotherapy was carried out, considering the interaction of DOACs and anticancer agents to avoid organ functional disorders. Whereas no significant decline of renal or liver function was observed after chemotherapy, notably, heart failure significantly occurred (34%). Overall, in an observation period (median: 606 days and IQR: 331–1333), Ischemic-stroke was observed in 2.3% of patients with AF and cancer, no intracranial-hemorrhage, no major bleeding, and minor bleeding 4.3%. Mortality was 12.7% (due to a cancer or heart failure).

**Conclusions:** The efficacy and safety of DOACs were suggested in CE stroke patients with AF and cancer. It is important to consider the interaction with the pharmacokinetics of each DOACs with anticancer agents, incorporating the insight of cardio-oncology into the stroke prevention.

**Trial registration number:** N/A

**AS25-021**

## **DIAGNOSTIC YIELD OF ATRIAL FIBRILLATION DETECTION BY IMPLANTABLE CARDIAC MONITORING IN PATIENTS WITH CRYPTOGENIC STROKE AND EMBOLIC STROKE OF UNDETERMINED SOURCE: SYSTEMATIC REVIEW AND META-REGRESSION ANALYSIS**

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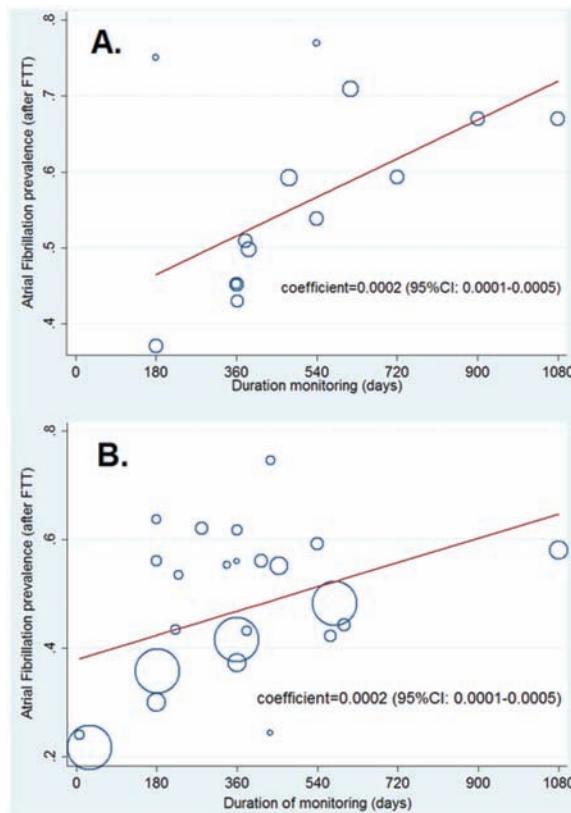
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**Background and Aims:** In the present systematic review and meta-regression analysis we sought to investigate the potential difference in the yield of atrial fibrillation (AF) detection by implantable cardiac monitoring (ICM) in patients with cryptogenic stroke/transient ischemic attack (CS) or embolic stroke of undetermined source (ESUS).

**Methods:** We included studies reporting AF detection rates by ICM in CS or ESUS patients with negative initial AF screening. We performed random-effects meta-regression analyses to evaluate the association of AF detection with monitoring time for CS and ESUS patients, using the all available time points providing AF prevalence rates within each study.

**Results:** We identified 25 studies (16 CS, 9 ESUS) that included 3,521 patients. The cumulative proportion of AF detection by ICM was not different ( $p = 0.197$ ) between ESUS (30%, 95%CI:24-38%) and CS (25%, 95%CI:21-29%). Although no difference ( $p = 0.205$ ) on the association of AF detection rate with monitoring duration was found between ESUS (Figure A) and CS patients (Figure B), monitoring duration increased the AF detection yield in both groups.



**Conclusions:** Extended duration of ICM monitoring appears to increase substantially the yield of AF detection for both CS and ESUS patients. ESUS subtype appears not be associated with a higher yield of AF detection compared to CS.

**Trial registration number:** N/A

**AS25-066**

**COMPARATIVE SAFETY AND EFFECTIVENESS OF NON-VITAMIN-K ORAL ANTICOAGULANTS VS PHENPROCOUMON IN PATIENTS WITH NON-VALVULAR ATRIAL FIBRILLATION AND RENAL DISEASE – RESULTS FROM THE RELOADED STUDY**

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**Background and Aims:** Data on effectiveness and safety of Factor-Xa non-vitamin-K oral anticoagulants (NOACs) in patients with non-valvular atrial fibrillation and renal disease is scarce. We aimed to compare the risk of several effectiveness and safety outcomes in new users of individual NOACs vs. phenprocoumon with renal disease.

**Methods:** We conducted a new user cohort study in patients with non-valvular atrial fibrillation and renal disease based on German claims data between January 1st, 2013 and June 30th, 2017. A multiple Cox-regression was performed to calculate confounder-adjusted hazard ratios (HRs) for the risk ischemic stroke/systemic embolism (IS/SE), intracranial haemorrhage (ICH), fatal bleeding, end stage renal disease and acute kidney injury in new users of NOACs (rivaroxaban, apixaban and edoxaban) vs. new users of phenprocoumon.

**Results:** The study population comprised 5,121 initiators of rivaroxaban, 4,750 of apixaban, 682 of edoxaban and 7,289 of phenprocoumon (Table 1). In the confounder-adjusted analysis, a comparable risk of IS/SE was observed for all NOACs compared to phenprocoumon (Table 2). With regards to ICH, we observed a beneficial effect for both, rivaroxaban and apixaban over phenprocoumon. In addition, we found statistically significant risk reductions related to end stage renal disease for rivaroxaban (73%) and apixaban (57%). For the risk of acute kidney injury, this trend was only seen for rivaroxaban.

Table 1 Selected baseline characteristics of NOAC and phenprocoumon initiators with renal disease

Variable	Rivaroxaban N=5,121	Apixaban N=4,750	Edoxaban N=682	Phenprocoumon N=5,121
Mean age (SD)	75.9 (9.4)	78.5 (9.1)	77.0 (9.2)	77.2 (8.4)
Women (%)	40.4%	44.1%	38.3%	39.8%
Reduced dose (%)	43.4%	52.8%	42.6%	NA
Mean CHA2DS2-VASc SCORE (SD)	4.6 (1.7)	5.1 (1.7)	4.6 (1.6)	4.9 (1.6)
Mean modified HAS-BLED Score (SD)	3.6 (0.9)	3.8 (0.9)	3.6 (0.8)	3.7 (0.8)
Frailty (%)	38.1%	50.2%	38.6%	37.8%
Diabetes mellitus (%)	48.2%	49.1%	48.7%	50.3%
Chronic heart disease (%)	51.3%	51.9%	47.7%	59.2%
History of IS/TA/SE (%)	18.5%	27.2%	15.6%	19.7%
History of major bleeding (%)	6.6%	4.3%	5.3%	6.8%
Cancer (excl. non-melanoma skin cancer) (%)	20.6%	22.0%	21.7%	20.2%
Chronic kidney disease stage 3/4 (%)	38.1%	50.2%	38.6%	37.8%

Table 2 Confounder-adjusted hazard ratios of effectiveness and safety outcomes (HRs) with 95% confidence intervals for NOACs vs. phenprocoumon

Variable	Ischemic stroke/systemic embolism	Intracranial hemorrhage	Fatal bleeding	End stage renal disease	Acute kidney injury
Phenprocoumon (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)
Rivaroxaban	0.95 (0.73-1.24)	0.62 (0.37-1.01)	0.63 (0.42-0.95)	0.27 (0.16-0.43)	0.77 (0.58-1.01)
Apixaban	0.99 (0.74-1.30)	0.41 (0.23-0.74)	0.39 (0.24-0.62)	0.43 (0.29-0.63)	0.90 (0.69-1.17)
Edoxaban	count<5	count<5	count<5	count<5	0.86 (0.45-1.65)

**Conclusions:** Our study confirmed findings regarding effectiveness and safety of NOACs vs. phenprocoumon on IS/SE and ICH in patients with or without renal disease. Moreover, it indicates a beneficial effect of NOACs in renal function worsening over time when compared to phenprocoumon.

**Trial registration number:** N/A

**AS25-069**

**COMPARATIVE SAFETY AND EFFECTIVENESS OF NON-VITAMIN-K ORAL ANTICOAGULANTS VS PHENPROCOUMON IN PATIENTS WITH NON-VALVULAR ATRIAL FIBRILLATION AND DIABETES – RESULTS FROM THE RELOADED STUDY**

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**Background and Aims:** Data on effectiveness and safety for Factor-Xa non-vitamin-K oral anticoagulants (NOACs) for patients with non-valvular atrial fibrillation and diabetes in a real-world setting is limited. We aimed to compare the risk of effectiveness and safety outcomes of individual NOACs vs. phenprocoumon in Germany.

**Methods:** We conducted a new user cohort study in patients with non-valvular atrial fibrillation based on German claims data between January 1st, 2013 and June 30th, 2017. A multiple Cox-regression was performed to calculate confounder-adjusted hazard ratios (HRs) for the risk of ischemic stroke/systemic embolism (IS/SE), intracranial haemorrhage (ICH), fatal bleeding, end stage renal disease and acute kidney injury in new users of NOACs (rivaroxaban, apixaban and edoxaban) vs. new users of phenprocoumon.

**Results:** The population with NVAF and diabetes comprised 6,997 initiators of rivaroxaban, 5,438 of apixaban, 865 in of edoxaban and 8,545 of phenprocoumon. In the confounder-adjusted analysis, a comparable risk of IS/SE was observed for each NOAC compared to phenprocoumon with a trend towards better effectiveness for rivaroxaban (Table 1). For the risk of ICH, we observed a numerical benefit for NOACs over phenprocoumon and statistically significant risk reductions related to end stage renal disease for rivaroxaban (68%) and apixaban (40%). For the risk of acute kidney injury, only rivaroxaban showed a risk reduction (28%).

**Table 1** Confounder-adjusted hazard ratios of effectiveness and safety outcomes (HRs) with 95% confidence intervals for NOACs vs. phenprocoumon

Variable	Ischemic stroke/systemic embolism	Intracranial hemorrhage	Fatal bleeding	End stage renal disease	Acute kidney injury
Phenprocoumon (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)
Rivaroxaban	0.83 (0.65-1.07)	0.77 (0.49-1.21)	0.96 (0.63-1.48)	0.32 (0.19-0.53)	0.72 (0.53-0.97)
Apixaban	1.03 (0.80-1.32)	0.41 (0.22-0.74)	0.68 (0.40-1.15)	0.60 (0.40-0.89)	1.07 (0.82-1.41)
Edoxaban	0.64 (0.31-1.30)	count<5	count<5	count<5	0.56 (0.23-1.37)

**Conclusions:** Our study adds evidence for a NOACs vs. VKA in a diabetes population. Moreover, it indicates a beneficial effect of NOACs on renal function worsening over time when compared to phenprocoumon. Further studies are warranted to consolidate these findings.

**Trial registration number:** N/A

## AS25-070

### DIFFERENT APPROACHES TO ESTIMATE THE DOSE OF VITAMIN-K ANTAGONISTS IN COMPARATIVE EFFECTIVENESS STUDIES COMPARING NON-VITAMIN-K ORAL ANTICOAGULANTS VS PHENPROCOUMON – RESULTS FROM THE RELOADED STUDY

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**Background and Aims:** Information on dose for vitamin-k antagonist (VKA) is often lacking in studies based on administrative healthcare databases. We aimed to assess effects of different methods to estimate VKA dose on the comparative effectiveness and safety comparing Factor-Xa non-vitamin-K oral anticoagulants (NOACs) vs. phenprocoumon.

**Methods:** We conducted a new user cohort study in patients with non-valvular atrial fibrillation based on German claims data between January 1st, 2013 and June 30th, 2017. A multiple Cox-regression was performed to calculate confounder-adjusted hazard ratios (HRs) for ischemic stroke/systemic embolism (IS/SE) and intracranial haemorrhage (ICH) applying three different methods to estimate phenprocoumon dose and duration: (i) empirical dose derived from field study (0.606 mg per day), (ii) personalized daily dose (pDDD) derived from claims data and (iii) 1 tablet per day, unrelated to dose.

**Results:** The study population comprised 22,339 initiators of rivaroxaban, 16,201 of apixaban, 2,828 in edoxaban and 23,552 of phenprocoumon. Different exposure time approaches led to diverging mean follow-up times in the analysis of both outcomes: empirical dose = 1.1 years, pDDD = 1.2 years and 1 tablet per day = 0.5 years. In the confounder-adjusted analysis, comparable risk estimates of IS/SE were observed for all approaches (Table 1). For ICH, the pDDD approach shifted the risk estimates towards a null-effect resulting in a non-significant effect for rivaroxaban compared to phenprocoumon.

**Table 1** Confounder-adjusted hazard ratios of effectiveness and safety outcomes (HRs) with 95% confidence intervals for NOACs vs. phenprocoumon

Variable	Empirical dose		pDDD		1 tablet per day	
	Ischemic stroke/systemic embolism	Intracranial hemorrhage	Ischemic stroke/systemic embolism	Intracranial hemorrhage	Ischemic stroke/systemic embolism	Intracranial hemorrhage
Phenprocoumon (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)
Rivaroxaban	0.95 (0.73-1.24)	0.63 (0.42-0.95)	0.39 (0.29-0.55)	0.70 (0.41-1.10)	1.00 (0.72-1.38)	0.50 (0.29-0.86)
Apixaban	1.03 (0.80-1.32)	0.41 (0.22-0.74)	0.68 (0.40-1.15)	0.60 (0.40-0.89)	0.50 (0.29-0.82)	0.40 (0.22-0.80)
Edoxaban	0.64 (0.31-1.30)	count<5	count<5	count<5	count<5	count<5

**Conclusions:** Different approaches to estimate the dose and related exposure time duration may lead to strong variations regarding the observed follow-up time for VKAs and may affect the risk estimates of comparative studies of NOACs vs. VKA.

**Trial registration number:** N/A

## AS25-005

### CARDIOEMBOLIC STROKE AND NON-VALVULAR ATRIAL FIBRILLATION: THROMBODYNAMICS TEST FINDINGS

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**Background and Aims:** Atrial fibrillation (AF) is one of the major causes of ischemic stroke (IS). Histologic studies (Sporns et al., 2017) show that clot composition may vary in different stroke subtypes. In a cardioembolic stroke, thrombi are more organized and clinical outcomes are usually less favorable (Boeckh-Behrens et al., 2016). The goal of this study was to estimate fibrin clot properties in acute IS using a thrombodynamics test.

**Methods:** 49 acute IS patients treated according to local guidelines were enrolled (6 patients were thrombolysed). At 1–3rd day, baseline thrombodynamics test was done, repeated at 6–8th and 13–15th days. Patients were divided into subgroups based on AF and cardioembolic stroke diagnosis and on a poor 21-day outcome (modified Rankin Scale score of 3–6).

**Results:** In cardioembolic stroke patients ( $n=13$ ), baseline clot density was higher compared to other stroke subtypes [28931 [IQR 24470–30004] vs. 24532 [IQR 22923–27872] a.u.,  $p=0.018$ ) independently of AF type. High baseline clot density was associated with poor 21-day outcome (for a 1000 a.u. increase in clot density, adjusted OR was 1.457 [95% CI 1.046-2.030,  $p=0.026$ ]). In patients receiving dabigatran ( $n=6$ ), delay before clot formation (Tlag) at 13–15th day was higher [139.5 [IQR 89.3-161.3] vs. 66.0 [IQR 60.0-80.3] seconds,  $p=0.002$ ] compared to non-anticoagulated patients ( $n=26$ ).

**Conclusions:** Thrombodynamics is a promising plasma global coagulation test. In stroke patients, it may prove useful in monitoring DOAC effect and in unfavorable outcome predicting. More studies are needed to fully encompass thrombodynamics potential applications in vascular neurology.

**Trial registration number:** N/A

## WITHDRAWN

**Background and Aims:** To examine the choice of antithrombotic agents (ATs) in the acute stroke inpatient with atrial fibrillation after discharge and factors that influence the treatment initiation.

**Methods:** This study analyze the databases from the stroke center and Chang Gang Electric Medical Record (CGEMR) between March 1, 2012 and September 30, 2016. Cox proportional hazards regression and logistic regression evaluated initiation over time of ATs.

**Results:** The study included 698 stroke inpatient with atrial fibrillation. AT initiation rates increased significantly from 81% at discharge to 88% in the following one month. Patients with age  $\geq 75$  years old, ATs were more likely to be late initiated. Higher stroke risk (CHA2DS2 VASc score, 7–9 points) was found to be associated with early initiation [odds ratio (OR)=0.28, 95% confidence interval (CI) 0.11 – 0.72]. Additionally, patients with intracranial hemorrhage (ICH) or hospital stays longer than 19 days were less likely to treatment initiation of ATs after discharge. Age, stroke type, the history of dyslipidemia, length of stay, or the stroke risk were associated with the choice of the discharge medication.

**Conclusions:** This study highlights potential gaps in the care of patients in the routine practice and clinical trials. The proportion of patients with AF who should receive anticoagulant treatment was lower than previously reported and differed slightly by some risks. There is a need for healthcare professionals more emphasis on this clinical condition.

**Trial registration number:** N/A

## AS25-047

### PREDICTION OF OCCULT PAROXYSMAL ATRIAL FIBRILLATION IN PATIENTS WITH TIA AND NON-DISABLING STROKE

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**Background and Aims:** The detection of paroxysmal atrial fibrillation (pAF) in TIA and stroke is resource intense with a range of monitoring devices available. Monitoring can be done during inpatient admission for stroke, but strategies optimised for use in TIA and minor stroke clinics are also necessary.

**Methods:** Patients recruited to the Oxford Vascular Study, who were in sinus rhythm at the time of presentation with TIA or minor stroke, underwent clinical assessment, neuroimaging, blood sampling, and 5-day ambulatory cardiac rhythm monitoring. Patients were split into derivation ( $n=300$ ) and validation ( $n=300$ ) cohorts. Using logistic regression we determined the predictive value for pAF of candidate variables identified from a systematic review of previous studies: age, NT-proBNP ( $<300/300-900/ >900 \mu\text{mol/L}$ ), left atrial dilatation, stroke severity and acute lesion on brain imaging.

**Results:** Among the 600 patients, pAF was identified in 46. Predictors in the validation cohort were age (reference  $<65$ ; 65–75 – OR = 1.12, 95% CI = 0.31–4.11; age  $>75$  – 2.95, 1.00–8.68), NT-proBNP (reference  $<300 \mu\text{mol/L}$ ; 300–900  $\mu\text{mol/L}$  – 2.19, 0.67–7.18;  $>900 \mu\text{mol/L}$  – 3.66, 1.03–12.99) and acute lesion on brain imaging (2.52, 1.03–6.16). A possible score based on these variables (age 65–75, 1 point,  $>75$ , 2 points; NT-proBNP  $>300$ , 1 point,  $>900$ , 2 points; acute lesion – 3 points) had reasonable predictive value in the validation cohort (C-statistic = 0.79, 0.68–89,  $p < 0.001$ ; pAF rate = 14% at score  $>2$  and 2.2% at  $<2$ ).

**Conclusions:** Using established risk factors it may be possible to improve prediction of pAF detection in TIA and minor stroke. With further validation, triaging patients for more urgent monitoring may be feasible.

**Trial registration number:** N/A

## AS25-048

### CEREBRAL ISCHEMIA IN PATIENTS ON DIRECT FACTOR XA-INHIBITORS: INAPPROPRIATE DOSE-REDUCTION IS ASSOCIATED WITH LOWER PLASMA LEVELS AND HIGHER STROKE SEVERITY

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**Background and Aims:** Factor Xa-inhibitors require dose adjustments based on certain clinical criteria. However, off-label use of the reduced doses without meeting the formal criteria for dose adjustment in patients with atrial fibrillation is common. Data concerning the effect of inappropriate dose adjustment on the functional Xa-plasma levels and the clinical stroke severity in patients with acute cerebral ischemia while on treatment with Factor Xa-inhibitors is sparse.

**Methods:** Data from our observational registry including all patients admitted with acute cerebral ischemia while taking factor Xa-inhibitors (Apixaban, Rivaroxaban, Edoxaban) for atrial fibrillation between April 2016 and December 2018 were investigated. Functional plasma levels were measured using the calibrated Xa-activity on admission. The Xa-inhibitor doses were classified as “appropriate” or “inappropriate” in consistency with the European Medicines Agency labelling. The effect of underdosing on functional plasma levels and the clinical stroke severity were investigated.

**Results:** 251 patients admitted with cerebral ischemia while on factor Xa-inhibitors were included. In 160 patients (63.7%) the factor Xa-inhibitor dose was in accordance with the EMA-labelling and 68 patients (27.1%) were underdosed. Xa-inhibitor plasma levels were available in 191 subjects (76.1%). Patients with insufficient dose of factor Xa-inhibitor on admission had significantly lower plasma levels (median 74.5 (IQR 0.0–121.6) vs. 126.7 (56.2–205.2);  $p < 0.001$ ) and had significantly higher scores on the NIHSS on admission (median 3 (IQR 1–7) vs. 5 (1–10);  $p = 0.042$ ).

**Conclusions:** In patients with acute cerebral ischemia inappropriate dose reduction of factor Xa-inhibitors resulted in lower functional plasma levels and higher clinical stroke severity.

**Trial registration number:** N/A

## AS25-003

### ASSOCIATION BETWEEN ECHOCARDIOGRAPHIC DIASTOLIC FUNCTION PARAMETERS AND FUTURE NONVALVULAR ATRIAL FIBRILLATION IN ISCHEMIC STROKE PATIENTS

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**Background and Aims:** There is evidence that diastolic dysfunction leads to left atrium (LA) dilation, which is a risk factor for the occurrence of nonvalvular atrial fibrillation (NVAF). We analyzed the association between diastolic dysfunction and the detection of NVAF in patients with ischemic stroke.

**Methods:** Observational prospective study on 110 patients with acute ischemic stroke with no history of atrial fibrillation or significant cardiovascular disease. We analyzed the data provided by transthoracic echocardiography performed up to 3 days after stroke onset and continuous electrocardiographic monitoring for up to 5 days.

**Results:** The stroke etiology was: cardioembolic (29.09%), atherosclerosis of large vessels (50.90%), lacunar (3.64%), cryptogenic (14.54%) and other causes (1.81%). New NVAF was present in 31.81% patients. The patients with cardioembolic stroke had a greater tendency to LA dilation [significantly bigger LA diameter ( $p = 0.004$ ), area ( $p = 2e-06$ ), and volume ( $p = 3e-05$ )] and to diastolic dysfunction [demonstrated by higher E/E' ( $p = 0.005$ ), E/Vp ( $p = 0.009$ ), and E wave deceleration time ( $p = 0.0002$ )]. The same was true for patients with new NVAF: significantly bigger LA diameter ( $p = 2e-2$ ) and volume ( $p = 0.0001$ ) and a more pronounced tendency to diastolic dysfunction [reflected in higher E/E' ratio ( $p = 0.02$ ), E/Vp ( $p = 0.01$ ), and E wave deceleration time ( $p = 3e-05$ )].

**Conclusions:** Diastolic dysfunction could be a predictor for the occurrence of the NVAF and should be a selection criteria for prolonged electrocardiographic monitoring.

**Trial registration number:** 83

## AS25-067

### STROKE AND TRANSIENT ISCHEMIC ATTACK INCIDENCE IN PATIENTS AFTER BIOPROSTHETIC AORTIC VALVE REPLACEMENT

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**Background and Aims:** Stroke and transient ischemic attack (TIA) are relevant complications occurring after bioprosthetic aortic valve replacement (BAVR) with an annual rate of 0.9-2.2%. Post-operative atrial fibrillation (AF) is an additional risk factor for this condition.

The aim is to describe the annual incidence and incidence-density of ischemic stroke and TIA in patients with aortic bio-prosthesis and to point out differential clinical and echocardiographic characteristics between patients with and without ischemic events.

**Methods:** Retrospective cohort study of patients who underwent aortic valve replacement with a bioprosthesis  $\pm$  aortocoronary bypass between 2004–2016.

**Results:** 122 patients were included without previous AF, of whom 12% had aortocoronary bypass associated. Median age was  $72.7 \pm 4.9$ . Median follow-up was  $6.1 \pm 4.7$  years, during which 9 patients presented thromboembolic events (7.4%): 3-TIA, 6-ischemic stroke with  $79.1 \pm 7.5$  years. Motor deficit was clinical onset in 44.4%. 66.6% had embolic profile and 33.3% cryptogenic. Mean annual incidence of TIA/stroke was 1.23% and incidence-density  $1228 \times 100000$  patients-year. Of those patients, hypertension had a significant association (100% vs 69.6%;  $p < 0.001$ ). There was a trend toward higher prevalence of CHA2DS2VASc's scale factors ( $3.2 \pm 1.4$  vs  $3.7 \pm 1.2$ ;  $p = 0.26$ ) or AF appearance (50% vs 32.1%;  $p = 0.25$ ) as well as enlarged left atrial diameter ( $43.3 \pm 7.2$  vs  $41 \pm 4.9$  mm), higher ventricular mass index ( $148.4 \pm 69.8$  vs  $138.7 \pm 37.9$  g/m<sup>2</sup>;  $p = 0.48$ ) or less VMI regression (20vs41%;  $p = 0.27$ ) but we found no significant differences.

**Conclusions:** Patients with BAVR suffer higher incidence of cardioembolic stroke than general population. These patients tend to show different clinical and echocardiographic characteristics. Nevertheless, studies with larger samples may be necessary to clarify these results.

**Trial registration number:** N/A

## AS25-065

### INSULAR-NON INSULAR STROKE UNDERLYING CARDIAC FAILURE (INSU COR): A PROSPECTIVE CASE-CONTROL STUDY

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**Background and Aims:** Clinical and experimental evidence suggests that ischemic stroke (IS) might prompt the development of cardiac complications, especially if the insular cortex is affected. We established a single-centre prospective case-control study to assess the time course of systolic dysfunction (SD) and markers of cardiac function in patients with acute IS affecting or not affecting the insular cortex.

**Methods:** Patients free of SD at baseline with (cases) or without (controls) IS-related insular damage are consecutively enrolled within three days after symptom onset. Investigation at baseline and follow-up (day 7, 30 as well as 90 after index event) includes medical history, cardiopulmonary and neurological examination, sampling of blood-based biomarkers and transthoracic echocardiography to assess the incidence of new-onset SD. Urinary catecholamines are measured at baseline only.

**Results:** Between October 2017 and December 2018, 1,044 patients were screened. Of 103 eligible patients, 33 cases (median age 71.5 years (IQR 64.5–78.6), male 63.6%) and 28 controls (median age 67.7 years (IQR 54.8–77.6), male 64.3%) have been enrolled. On admission, the median National Institute of Health Stroke Scale score was 8 (IQR 4–12) in cases and 2 (IQR 1–4.5) in controls. A first episode of atrial fibrillation was diagnosed in-hospital in six (9.8%) patients. Currently, 85% of all study patients completed the entire followed up.

**Conclusions:** The investigator-initiated INSU Cor study will address the impact of IS-related insular damage on cardiac function.

**Trial registration number:** DRKS00012454

## AS25-009

### DETECTION OF ATRIAL FIBRILLATION AND CONSEQUENT SECONDARY STROKE PREVENTION IN 2009. VS. 2016. – WHAT HAS CHANGED?

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**Background and Aims:** Atrial fibrillation (AF) is a leading preventable cause of recurrent stroke for which early detection and treatment are

critical. Our aim was to compare AF detection and secondary stroke prevention in patients treated in 2009. vs. 2016.

**Methods:** We performed analysis of data on stroke patients treated in the Stroke Unit of Clinical Centre of Serbia in period: 01.01-31.12.2009. and 01.01-31.12.2016. The only difference in diagnostic protocol between two groups is that in the group from 2016. a special attention was paid to examination of 72h-ECG monitoring.

**Results:** In 2009., from 249 hospitalized stroke patients, AF was detected in 20 (8%), while in 2016., from 292 hospitalized stroke patients, AF was detected in 94 patients (32%). In 2009., 16 patients (80%) knew for previous AF, and 6(30%) were taking oral anticoagulant therapy (OAC) in primary prevention. In 2016., 55 patients (58.5%) knew for previous AF, 28(29.8%) were on previous OAC. There were no statistically significant differences between two groups regarding: age ( $p=0.465$ ), gender ( $p=0.164$ ) and functional outcome measured by modified Rankin scale ( $p=0.668$ ). In 2009., 43% of patients were discharged with vitamin K antagonist (VKA), 57% with antiplatelet for secondary stroke prevention. In 2016. 25% of patients were discharged with VKA, 27% with direct oral anticoagulant and 48% with antiplatelet agent.

**Conclusions:** As a result of stroke protocol modification (72-h ECG monitoring) as well as education of doctors and nurses to search for AF, especially paroxysms, a significant improvement was registered in detection of this heart rhythm disorder.

**Trial registration number:** N/A

## AS25-034

### ATRIAL CARDIOPATHY AND ISCHEMIC STROKE: A MECHANISM UNVEILED BY ULTRASOUND

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**Background and Aims:** Atrial fibrillation (AF) is associated with left atrium derangements, collectively called atrial cardiopathy, which could account by themselves for thrombogenesis/embolism in cryptogenic strokes (CS). We aimed to investigate whether, in CS patients, atrial cardiopathy is related to micro-embolic signals (MES) at trans-cranial Doppler (TCD), or to recurrent strokes.

**Methods:** We enrolled all consecutive CS patients, first retrospectively (Padua, 2015–2017), and later prospectively (Padua/Giessen, March-June 2018). We assessed the presence of atrial cardiopathy markers: plasmatic level of atrial natriuretic peptide (BNP); P-wave terminal force in VI (PTFVI); presence of excessive supraventricular ectopic activity; left atrial enlargement. The prospective cohort underwent, within 24 hours from stroke onset, a bilateral 60-minutes TCD monitoring for MES detection in the middle cerebral artery. Medical records were reviewed to detect new-onset AF and recurrent strokes.

**Results:** Among 130 retrospective CS patients, during a 17-months follow-up, 33% presented a new-onset AF and 12% had a recurrent ischemic stroke/TIA; 59% had at least one marker of atrial cardiopathy. Left atrial enlargement (LAE) and an excessive supraventricular ectopic activity (ESEA) predicted both new-onset AF and recurrent stroke (ESEA: OR 8.8, 95% CI 2.5-30.8,  $p < 0.001$ ; LAE: OR 5.5, 95% CI 1.0-32.1,  $p = 0.05$ ). Among the prospective cohort ( $n = 39$ ) MES were detected in 33%. LAE (RR 7.9, 95% CI 2.1-30.3,  $p = 0.002$ ) and older age (RR 1.2, 95% CI 1.0-1.5,  $p = 0.02$ ) predicted MES detection, independently from new-onset AF.

**Conclusions:** Atrial cardiopathy markers are related to the presence of MES in the acute phase of stroke and represent a risk factor for AF and recurrent stroke.

**Trial registration number:** N/A

## AS25-081

### ATRIAL CARDIOPATHY IN SUBJECTS WITH PAROXYSMAL ATRIAL FIBRILLATION COMPARED WITH AGE- AND GENDER-MATCHED HEALTHY CONTROLS, POPULATION-BASED COHORT.

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**Background and Aims:** To evaluate the prevalence of transthoracic echocardiogram (TTE) and electrocardiogram (EKG) markers of atrial cardiopathy in subjects with paroxysmal atrial fibrillation (AF), compared with age-and gender-matched healthy controls.

**Methods:** Data were obtained in the framework of National Research Program: Progetto FAI, Italian Ministry of Health-CCM, coordinated by Tuscany Region, a population-based study aiming to estimate AF prevalence in a representative sample of elderly population. A subcohort of patients with paroxysmal AF and without evidence of valvular or ischemic heart disease was assessed by TTE and 12-lead resting EKG. Atrial cardiopathy was defined by TTE atrial enlargement or EKG P-wave terminal force lead VI (PTFVI)  $> 4000 \mu\text{V}^*\text{ms}$ .

**Results:** We included 32 subjects with paroxysmal AF (14 males, mean age  $76.99 \pm 7.12$ ) and 32 age- and gender-matched healthy controls (14 males, mean age  $76.61 \pm 7.06$ ). Left atrial dilatation was significantly more frequent in paroxysmal AF than in controls: left atrial area ( $23.66 \pm 4.44$  vs  $19.66 \pm 4.89 \text{ cm}^2$ ;  $P = 0.001$ ), left atrial volume ( $71.44 \pm 20.99$  vs.  $52.2 \pm 18.78 \text{ mL}$ ;  $P < 0.001$ ), left atrial volume index ( $38.66 \pm 13.44$  vs.  $29.27 \pm 9.68$ ;  $P = 0.003$ ), left atrial diameter ( $48.25 \pm 18.22$  vs  $36.91 \pm 4.44 \text{ mm}$ ,  $P = 0.001$ ). Atrial cardiopathy, was about 30 % more frequent in AF subjects than in controls ( $71.9\%$  vs  $40.3\%$ ,  $P = 0.028$ ). Conversely, the presence of abnormal PTFVI did not differ between the two groups.

**Conclusions:** In this analysis from a population-based study, TTE signs of atrial enlargement proved the only marker of Atrial Cardiopathy. The same association was not found as far as isolated EKG marker of left atrial abnormality is concerned

**Trial registration number:** N/A

## AS25-076

### DISTRIBUTION OF CARDIOEMBOLIC STROKE – A COHORT STUDY

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**Background and Aims:** A cardiac origin in ischemic stroke is more frequent than previously assumed, but it remains unclear which patients benefit from cardiac work-up if obvious cardiac pathology is absent. We hypothesized that thromboembolic stroke with a cardiac source occurs more frequently in the posterior circulation compared with thromboembolic stroke of another etiology.

**Methods:** We used data from a prospective multi-center observational study totaling 3311 consecutive patients with ischemic stroke from 2009 until 2014 in the Netherlands. Poisson regression analysis was used to calculate risk ratios for patients with a posterior stroke from a cardiac source compared with patients with another stroke etiology. Stepwise backward regression analysis was used to assess associations between baseline characteristics and cardiac etiology for ischemic stroke.

**Results:** In 1428 patients both stroke localization and cardiac etiology was determined. The proportion with a posterior stroke amongst patients with a cardiac origin of their stroke (28%) did not differ statistically significant to those with another origin (25%), age and sex adjusted RR 1.16; 95%CI 0.96-1.41. Use of oral anticoagulants, no recent history of smoking, no hyperlipidemia, male sex, and a higher NIHSS score were associated with a cardiac etiology of ischemic stroke in 2334 patients.

**Table 3. Chance for cardioembolic etiology of ischemic stroke based on stepwise backward logistic regression.**

	Model 1	Model 2
	Odds ratio (95% CI)	Odds ratio (95% CI)
Recent or current smoking	0.48 (0.28-0.84)	0.41 (0.24-0.68)
Hyperlipidemia	0.75 (0.32-0.92)	0.82 (0.53-1.28)
BMI (per point increase)	0.96 (0.91-1.01)	0.96 (0.92-1.01)
NIHSS score (per point increase)	1.06 (1.01-1.11)	1.05 (1.01-1.09)
Posterior stroke	1.55 (0.94-2.54)	1.47 (0.93-2.32)
Use of antiplatelets	1.60 (0.97-2.63)	0.86 (0.53-1.38)
Male sex	1.73 (1.08-2.77)	1.85 (0.53-1.38)
Use of oral anticoagulants	12.0 (6.36-22.5)	-

**Conclusions:** We could not confirm that posterior stroke localization is associated with a cardiac etiology, and therefore posterior stroke localization on itself does not necessitate additional cardiac examination. The lack of determinants of atherosclerosis are stronger risk factors for a cardiac source of ischemic stroke.

**Trial registration number:** N/A

## WITHDRAWN

**Table 1. Stroke etiology in all 3311 patients with ischemic stroke**

Stroke subtype	N (%)
Atherosclerosis	802 (24%)
Cardioembolism	578 (18%)
Small vessel occlusion (lacune)	632 (19%)
Other	321 (10%)
Undetermined	944 (29%)
Unknown	43 (1%)

**Table 2. Chance for cardioembolic etiology of ischemic stroke in case of posterior localization**

	cardioembolism (n=388)	no cardioembolism (n=1040)	Relative risk (95% CI)	Adjusted relative risk (95% CI)
Posterior stroke	110 (28%)	259 (25%)	1.14 (0.94-1.37)	1.16 (0.96-1.41)
Anterior stroke	278 (72%)	781 (75%)		

**AS25-016****PREDICTION AND DETECTION OF OCCULT ATRIAL FIBRILLATION IN PATIENTS AFTER ACUTE CRYPTOGENIC STROKE AND TRANSIENT ISCHEMIC ATTACK (PROACTIA)**

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**Background and Aims:** In patients with embolic strokes of undetermined sources (ESUS), 20–37% have episodes of atrial fibrillation (AF) during extended monitoring. Studies of implantable cardiac rhythm monitors (ICRM) have demonstrated detection rates up to 30%. Hence, long-term non-invasive ECG monitors or implanted loop recorders should be considered to document silent atrial fibrillation in patients with ESUS. However, available resources and cost are currently limiting the use of this technology in all patients with ESUS. The PROACTIA study is conducted to seek to refine and evaluate a novel scoring system that can stratify subjects into high-, intermediate- and low-risk groups for undetected AF in cryptogenic stroke.

**Methods:** Patients were included if routine work-up including, carotid Doppler and 24 Holter ECG monitoring did not expose the cause of stroke. Upon inclusion additional blood samples were drawn for the purpose of creating a biobank. Transthoracic- and transesophageal echocardiography and implantation of ICRM were performed in all patients during the index hospitalization. I

**Results:** In total 251 patients were included. Among the 147 patients followed up for at least one year, 49 patients (33%) were diagnosed with atrial fibrillation and switched from antiplatelet therapy to OAC.

**Conclusions:** PROACTIA confirms that ICRM is a highly effective way to detect silent AF and to initiate adequate secondary prophylaxis in a timely fashion in patients with ESUS. However, it is a costly and resource intensive follow-up strategy. After completion of follow up, we will use the results to build a scoring system for risk stratification for AF.

**Trial registration number:** N/A

**AS25-046****“PSEUDO-FAILURE” OF DIRECT ORAL ANTICOAGULANTS IS MORE LIKELY THAN “TRUE FAILURE” FOR NONVALVULAR ATRIAL FIBRILLATION PATIENTS WITH ISCHEMIC STROKE**

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**Background and Aims:** For stroke prevention in Nonvalvular Atrial Fibrillation (NVAF), Direct Oral Anticoagulant (DOAC) use continues to rise, however some patients may still develop an ischemic stroke on this medication regardless. DOAC “True failure” involves drug malabsorption, hypermetabolism, and clearance problems, while DOAC “Pseudo-failure”

is from C.H.A.M.P. – (C) ompliance concerns, (H)ypertensive lacunar disease, (A)rterial atherosclerosis/dissection, (M)alignancy/hypercoagulable state, and (P)atent Foramen Ovale. The incidence of DOAC “True failure” versus DOAC “Pseudo-failure” is unknown.

**Methods:** An IRB-approved retrospective review was conducted at our comprehensive stroke center to identify patients who were prescribed DOAC for NVAF, and then between 2012 and 2017 developed an ischemic stroke while presumably taking this medication.

**Results:** Overall, the proportion of DOAC Pseudo-failures were higher than the DOAC True failures ( $p$ -value < 0.001), however significantly different only for Dabigatran ( $p$ -value < 0.001) and Apixaban ( $p$ -value < 0.001), but not Rivaroxaban ( $p$ -value 0.289). DOAC Pseudofailure cases (CHAMP) were: Compliance concerns (49.4%), Malignancy/hypercoagulability (26.4%), Arterial disease (17.2%), Hypertension (5.7%) and PFO (2.3%). Although Rivaroxaban had more compliance than Dabigatran or Apixaban, it had the highest True Failure rate.

**Conclusions:** DOAC medication cannot be culpable for non-NVAF causes of ischemic stroke, for which multiple etiologies exist. Although lack of DOAC efficacy can occur, it is less common than alternate causes of stroke such as (C)ompliance concerns, (H)ypertension, (A)rterial disease, (M)alignancy, and (P)FO, which we have named DOAC “Pseudo-failures” and listed via the mnemonic C.H.A.M.P. The proportion of DOAC Pseudo-failures were higher than True failures with Dabigatran and Apixaban but not Rivaroxaban, despite higher compliance.

**Trial registration number:** N/A

**AS25-024****RISK FACTORS FOR CEREBROVASCULAR COMPLICATIONS IN PATIENTS WITH LEFT VENTRICULAR ASSIST DEVICE: EXPERIENCE IN A SINGLE ACADEMIC COMPREHENSIVE STROKE CENTER**

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**Background and Aims:** The amount of LVAD implantation's increased in past years, together with an increase in the incidence of ischemic (IS) and hemorrhagic strokes (HS). Our study aimed to investigate possible risk factors in LVAD population from 2011 to 2016.

**Methods:** A total of 32 out of 192 LVAD-related strokes were retrospectively identified. Relevant clinical data and risk factors were collected. We used logistic regression to calculate odds ratio.

**Results:** A total of 32 out of 192 LVAD patients suffered cerebrovascular complications (2011–2016) (Incidence = 16.6%); 59.38% had an IS and 40.63% had a HS. The patients with HS, were significantly younger than IS ( $50.08 \pm 12.93$  vs  $61.37 \pm 10.17$ ,  $p = 0.0097$ ). There were no significant differences between the groups (IS or HS) for type of LVAD, gender, race, coagulopathy, MAP, infection, or presence of LVAD thrombosis. However, the NIHSS was slightly higher in the HS group as expected. In this univariate analysis, anti-platelet therapy and septicemia were marginally significant. On multiple logistic regression analysis, while age was negatively associated with a HS (OR 0.912, 95% CI 0.84–0.99), INR and anti-platelet therapy (OR 1.63, 95% CI 1.02–2.60) were positively associated (area under the curve of the model for predicting a good outcome; overall probability of being correct = 0.9316, Pseudo R-square = 0.53).

**Conclusions:** We identified that factors such as young age, high INR and use of concomitant anti-platelet therapy were associated with significantly increased incidence of hemorrhagic complications. More studies are needed to identify modifiable risk factors that can help defining treatment guidelines to avoid these complications in LVAD population.

**Trial registration number:** N/A

**AS25-011****ISCHEMIC STROKE AND ADVANCED INTERATRIAL BLOCK. EXPERIENCE IN A TERTIARY HOSPITAL****A. Sánchez<sup>1</sup>, J.M. Vieitez<sup>2</sup>, V. Ros Castello<sup>1</sup>, E. Natera Villalba<sup>1</sup>,****A. Gómez Lopez<sup>1</sup>, G. Alonso Salinas<sup>2</sup> and J. Masjuan Vallejo<sup>1</sup>**<sup>1</sup>Hospital Ramón y Cajal, Neurology, Madrid, Spain; <sup>2</sup>Hospital Ramón y Cajal, Cardiology, Madrid, Spain

**Background and Aims:** Bayés syndrome is an under-recognised condition characterized by advanced interatrial block (aIAB) in ECG, and it's a known risk factor for develop atrial fibrillation (AF). That's why this anomaly is related to embolic ischemic stroke (IS), and is particularly relevant in cryptogenic stroke.

The objective of our study was to examine the correlation between aIAB and aetiology of IS in patients admitted to the Neurology department in sinus rhythm.

**Methods:** Prospective analysis of 50 patients admitted for IS between January-May 2018 at our stroke reference centre.

We admit patients  $\geq 18$  years with ECG in sinus rhythm at the onset of IS, who have no previous history of AF/flutter. Epidemiological variables, aetiology of IS, ECG and echocardiogram at development of AF during admission were collected.

We differentiate two groups depending on the presence of aIAB.

**Results:** 9 patients (18 %) presented aIAB at the time of admission. During admission, 2 patients with aIAB developed AF, while one patient without IAB developed AF (22% vs 2.43%,  $p = 0.023$ ). IAB pattern was significantly associated with cardioembolic stroke (30% vs. 7.31%,  $p = 0.022$ ), but there was no association between IAB and cryptogenic stroke (50% vs 41.37%,  $p = 0.81$ ). We didn't observe neither differences between traditional risk factors or volume and diameter of the left atrium in both groups.

**Conclusions:** aIAB is a frequent phenomenon in patients with IS. The patients with aIAB had a significant tendency to develop more AF during admission, so the origine of their stroke is considered cardioembolic. Therefore, clinical trials are needed to demonstrate this association.

**Trial registration number:** N/A

**AS25-078****UNDER AND OVERDOSAGE OF NOAC PRESCRIPTION IN ATRIAL FIBRILLATION IN PRIMARY CARE**

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**Background and Aims:** Non vitamin K antagonists oral anticoagulants (NOAC) have demonstrated efficacy and safety in cerebrovascular prevention. However, it is common to identify patients receiving doses other

than those formally recommended. Some of these patients are exclusively in Primary Health Care (PHC), and the frequency and reasons for these dosing decisions are frequently unknown.

**Methods:** A multi-center observational study including all patients with non-valvular AF followed in thirteen units of PHC. Biometric, clinical data, CHA2DS2-VASc and HAS-BLED were collected. NOAC's dosage was classified as adjusted, infratherapeutic (ITD) or supratherapeutic (STD) according to European label. The study had Ethics Committee approval.

**Results:** We obtained a sample of 861 patients with non-valvular AF treated with NOAC, mean age 76.8 years (SD: 9.2), 52% male. From these, 257 (31.7%) were not prescribed NOAC's in the label dosage – 41 patients (4.8%) with STD and 216 (26.7%) with an ITD. In univariate analysis, there was a significant association between dosage and age ( $p < 0.001$ ) and chronic renal disease ( $p < 0.001$ ). In multivariate analysis, only chronic renal disease was an independent predictor of the ITD ( $p < 0.001$ ). STD was associated with chronic renal disease ( $p < 0.001$ ), female gender ( $p < 0.001$ ), history of symptomatic hemorrhage at any location ( $p = 0.032$ ), and lower frequency of stroke ( $p = 0.003$ ).

**Conclusions:** This study shows of a significant percentage of NOAC prescribed at an unadjusted dose, mainly by ITD. Some groups were also defined in which there seems to be unadjusted dose prescription tendencies.

**Trial registration number:** N/A

**AS25-041****ETIOLOGY AND SECONDARY PREVENTION OF ACUTE ISCHEMIC STROKE IN PATIENTS WITH HEART FAILURE**

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**Background and Aims:** Heart failure (HF) is highly prevalent among patients with acute ischemic stroke. Stroke etiology is referred to cardioembolism with presumed atrial or ventricular origin in most cases. However, heart failure can be transient and concurrent causes of stroke might remain undetected.

**Methods:** Clinical cohort study among patients with ischemic stroke and acute recanalization therapies between 2006 and 2016 at a university stroke center.

**Results:** 1209 patients with acute ischemic stroke undergoing intravenous thrombolysis and/or mechanical recanalization were included. HF was present in 378 patients (31%) and showed to be an independent predictor of unfavorable outcome. 32% had the diagnosis of HF established prior to hospital admission for stroke. The medical treatment regimen for HF was consistent with the recommendations of international guidelines in only 53%. 207/378 patients (55%) used anti-platelet therapy and 50 patients (13%) used oral anticoagulation. In 61% ischemic stroke was considered to be of cardioembolic origin (atrial fibrillation: 56%). In 10% another determined etiology of stroke was present: 8% macroangiopathy with high-grade arterial stenosis, 1% microangiopathy and 1% other etiologies. The etiology remained undetermined in 29%. In patients without HF, the rate of unknown causes (45%) was higher and cardioembolic origin less common (35%,  $p < 0.001$ ). Subsequently, patients with HF were more often treated with oral anticoagulation at discharge ( $p < 0.001$ ).

**Conclusions:** Almost every second patient with stroke and a past medical history of HF was lacking sufficient treatment for HF prior to

admission. Concurrent etiologies of stroke are common and of particular clinical relevance for secondary stroke prevention.

**Trial registration number:** N/A

## AS25-035

### PRE-STROKE ANTICOAGULANT USAGE PRACTICES IN ATRIAL FIBRILLATION RELATED ISCHEMIC STROKES IN ANKARA, TURKEY

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**Background and Aims:** Atrial fibrillation (AF) is the most common cause of cardioembolic stroke. Although it is well established that anticoagulant therapy is the treatment of choice for stroke prevention in high-risk AF patients, a significant proportion of AF patients suffer from ischemic stroke while not being optimally anticoagulated. Herein, we evaluated use of pre-stroke anticoagulant therapy in ischemic stroke patients, and tried to get an insight on factors that might be related to suboptimal anticoagulation, from a local and national perspective.

**Methods:** We performed a prospective study of acute ischemic stroke patients admitted between 2016 and 2018 to three major academic centers in Ankara, Turkey. Demographic data, clinical and laboratory parameters related to vascular risk factors, and pre-stroke CHA2DS2-VASc scores were recorded. Per the purposes of this study, analyses were restricted to patients with AF-related stroke.

**Results:** Among 787 patients, 155 (19.7%) had cardio-aortic embolism due to AF; approximately half of them ( $n = 75$ ; 48.4%) had their AF diagnosis established before the incident stroke. Fifteen of these patients were not using anticoagulants, despite being in the high-risk category per the CHA2DS2-VASc score prior to stroke. Among the remaining 60 patients, only 21 were optimally anticoagulated, constituting 13.5% of the overall AF-related stroke population. We were not able to identify any clinical features that might be suggestive of anticoagulant prescription or adherence.

**Conclusions:** Only a minority of AF-related ischemic stroke population is being optimally anticoagulated prior to stroke in Turkey. In addition to unknown AF diagnosis, issues with anticoagulant prescription and adherence underlie this major healthcare problem.

**Trial registration number:** N/A

## AS25-001

### PREDICTING NEWLY DIAGNOSED ATRIAL FIBRILLATION AFTER ISCHEMIC STROKE BASED ON A NATIONWIDE COHORT

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**Background and Aims:** Early detection of atrial fibrillation (AF) is essential for secondary prevention of ischemic stroke. We aimed to develop and validate a risk score to predict newly diagnosed AF (NDAF) after ischemic stroke.

**Methods:** Adult patients who were hospitalized for ischemic stroke but did not have known AF were retrieved from a nationwide population-

based database. The outcome measure was NDAF within 5 years following stroke. A stepwise Cox proportional hazards model was used to screen predictive factors. Beta coefficients for the independent predictors were converted to integer points, which were summed to create a risk score.

**Results:** We identified 4 positive predictors and 3 negative predictors for NDAF. The CHASE-LESS score (Coronary Heart failure Age SEverity – LipidEmia Sugar prior Stroke) comprises coronary artery disease (1 point), congestive heart failure (1 point), age (1 point for every 10 years), stroke severity (National Institutes of Health Stroke Scale; 1 point for 6–13 and 3 points for  $\geq 14$ ), hyperlipidemia (-1 point), diabetes (-1 point), and prior history of stroke or transient ischemic attack (-1 point). The overall rate of NDAF within 5 years was 8.4% (1,429/17,076). The model achieved C-statistics of 0.723 in the derivation sample and 0.691 in the independent internal validation sample. It was externally validated in AFTER-PULSE trial patients ( $n = 834$ ) with a C-statistic of 0.688.

**Conclusions:** The CHASE-LESS score could aid clinicians to identify patients at risk of developing NDAF and help prioritize patients for advanced cardiac monitoring in real-world practice.

**Trial registration number:** N/A

## WITHDRAWN

Table. Univariate and multivariate analyses of predictors of stroke in post-AMI patients with LVT

Variables	Univariate Analysis			Multivariate Analysis		
	OR	95% CI	p value	OR	95% CI	p value
<b>Patient Demographics</b>						
Age	1.00	0.97-1.02	0.78			
Male	2.57	0.62-10.73	0.20			
BMI	0.94	0.87-1.02	0.14			
<b>Co-morbidities</b>						
Current and Past Smoking	1.22	0.61-2.41	0.57			
Atrial Fibrillation	<b>4.32</b>	<b>1.03-18.09</b>	<b>0.05</b>	4.43	0.89-22.13	0.07
Hypertension	1.97	0.97-3.98	0.06	1.37	0.61-3.08	0.45
Diabetes Mellitus	1.31	0.66-2.57	0.44			
Previous Stroke/TIA	1.24	0.48-3.23	0.65			
Heart Failure	2.05	0.89-4.73	0.09	0.91	0.28-2.95	0.88
Chronic Kidney Disease	1.49	0.61-3.62	0.38			
NSTEMI	1.05	0.49-2.26	0.90			
HAS-BLED Score	1.11	0.91-1.36	0.30			
<b>Echocardiogram Results</b>						
Ejection Fraction	<b>0.96</b>	<b>0.93-0.99</b>	<b>0.02</b>	0.98	0.94-1.01	0.22
LVIDd	0.97	0.93-1.01	0.13			
LVIDs	0.99	0.96-1.03	0.63			
LVOT	0.98	0.79-1.21	0.85			
LV Aneurysm	0.88	0.31-2.50	0.81			
Thrombus Mobility	0.05	0.00-	0.59			
		3389.83				
Thrombus Protrusion	<b>3.61</b>	<b>1.68-7.73</b>	<b>&lt;0.01</b>	<b>3.04</b>	<b>1.25-7.41</b>	<b>0.01</b>
Thrombus Size	1.28	0.81-2.02	0.29			
<b>Treatment Characteristics</b>						
<b>Revascularization</b>						
PCI		1 (Ref)				
None	2.10	0.62-7.14	0.24			
CABG	2.00	0.97-4.10	0.06	1.51	0.44-5.23	0.52
<b>Anticoagulation Therapy for LV Thrombus</b>						
Anticoagulation + DAPT		1 (Ref)				
Anticoagulation alone	2.28	0.67-7.75	0.19			
Anticoagulation + SAPT	1.54	0.64-3.70	0.33			
<b>Initial Outcome</b>						
Failure of initial thrombus resolution	<b>2.76</b>	<b>1.29-5.94</b>	<b>&lt;0.01</b>	<b>3.03</b>	<b>1.23-7.45</b>	<b>0.02</b>
Thrombus recurrence	<b>3.67</b>	<b>1.50-9.00</b>	<b>&lt;0.01</b>	<b>4.20</b>	<b>1.46-12.11</b>	<b>&lt;0.01</b>
Change in ejection fraction	1.03	0.98-1.08	0.22			

**Conclusions:** Incidence of AIS in this Asian population of post-AMI patients with LV thrombus was 11.8%. Duration of anticoagulation may need to be individualised for patients who are at higher risk for stroke occurrence after LV thrombosis.

**Trial registration number:** N/A

## WITHDRAWN

**AS25-074**

**CLINICALLY AVAILABLE BIOMARKERS AS PREDICTORS OF ATRIAL FIBRILLATION IN PATIENTS WITH CRYPTOGENIC STROKE THE NORDIC ATRIAL FIBRILLATION AND STROKE STUDY (NOR-FIB)**

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**Background and Aims:** Widely utilized cardiovascular and novel biomarkers have been suggested as indicators of atrial fibrillation (AF) in patients with cryptogenic stroke. None of these are established in clinical praxis for selecting patients for prolonged cardiac rhythm monitoring. In the ongoing Nordic Atrial Fibrillation and Stroke study (NOR-FIB) we evaluate the incidence of AF in patients with cryptogenic stroke using insertable cardiac monitors, and measure the biomarker levels. The purpose of the interim analysis from our center was to evaluate whether clinically available biomarkers show association with AF detected before 6-month follow-up.

**Methods:** Blood samples from 53 patients were collected in the period from January 2017 to January 2019 in Østfold Hospital Trust with 40 patients reaching 6-month follow-up. TnI, BNP, fibrinogen, and D-dimer levels were measured. Mann-Whitney U test was performed to compare biomarker levels between patients with and without detected AF. Area under the receiver operating characteristic curve (AUC) was calculated for all of the tested biomarkers. Individual odds ratios (OR) were further computed.

**Results:** By 6 months, the AF detection rate was 27.5%. Mean ( $\pm$  SD) times to inclusion after the index event and to AF detection after inclusion were  $9.3 \pm 3.4$  days and  $55.7 \pm 66.4$  days respectively. Significant differences between the groups were found in TnI levels. The highest AUC was observed for TnI (0.742) as well as significant association with AF, OR 8.0 95% CI (1.65, 38.79).

**Conclusions:** TnI seems to be a good predictor of AF in cryptogenic stroke. New interim analyses with updated results including other biomarkers will be presented.

**Trial registration number:** NCT02937077

**AS25-058**

**ESTABLISHMENT AND CLINICAL EVALUATION OF A NOVEL METHOD TO MEASURE APIXABAN IN PATIENTS WITH ATRIAL FIBRILLATION USING DRIED BLOOD SPOT SAMPLE COLLECTION**

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**Background and Aims:** Apixaban is a non-vitamin K oral anticoagulant (NOAC) which specifically inhibits factor Xa. Apixaban concentration in patients' plasma can vary with disease status and concurrent medications, thus concentration monitoring should be considered to ensure its safety and efficacy. Dried blood spot (DBS) sampling strategy gained high attentions in recent years because of the growing importance of personalized medicine. We have established a novel method to measure apixaban concentration in DBS.

**Methods:** The postcolumn infused-internal standard (PCI-IS) method was adapted for correction of matrix effect in liquid chromatography-electrospray ionization-mass spectrometry and estimation of blood volume on DBS cards. Paired plasma and DBS samples collected from patients with atrial fibrillation were used to establish the correlation between plasma and DBS concentrations.

**Results:** Under optimal conditions, apixaban could be quantified within 5min. Validation results indicated the accuracies of the method were within 93.3-97.0 % and intra-day and inter-day precisions were all below 10.0% for four concentration levels. The correlation analysis also showed good linear relationship between DBS and plasma concentrations with the Pearson correlation coefficient (R<sup>2</sup>) being 0.970. The conversion factor was calculated from the ratios between plasma and DBS concentrations and over 90% of the calculated concentrations were within the 95% confidence interval of bias using the conversion factor for concentration estimation.

**Conclusions:** This novel DBS concentration measurement method represented as an efficient and effective strategy for monitoring apixaban concentration in patients which could benefit personalized medicine for apixaban therapy.

**Trial registration number:** N/A

**AS25-023**

**PREDICTIVE FACTORS OF ATRIAL FIBRILLATION IN PATIENTS' BASAL ELECTROCARDIOGRAM WITH EMBOLIC STROKE OF UNDETERMINED SOURCE**

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**Background and Aims:** Detection of paroxysmal atrial fibrillation (PAF) is essential to select an antithrombotic therapy in patients with

embolic stroke of undetermined source (ESUS). The implantable cardiac monitoring improves the detection of PAF but it consumes time and economic resources. Therefore, a predictor of FAP may be useful for an adequate selection of patients. P-wave terminal force in lead VI (PTFVI) is a marker of left atrial abnormality in the electrocardiogram associated with increased risk of PAF.

In this study, we aimed to investigate the usefulness of predictors of PAF (PTFVI/PR interval/cQT interval/atrial premature complexes /left anterior or fascicular block) in patients with ESUS.

**Methods:** Patients with a long-term insertable cardiac monitoring were included consecutively (June 2015-January 2018). Those with a known history of PAF or cardiac pacemaker were excluded. Clinical and electrocardiographic characteristics of patients with or without PAF were retrospectively analyzed. To confirm the accuracy of the electrocardiographic measurements a second investigator performed independently blinded measurements

**Results:** The sample was 44 patients, mean age 73.2 ( $\pm$  9.1) years. The 61.4% were men. The 27.27% were diagnosed with PAF. PTFVI was significantly higher in patients with PAF than those without PAF (0.054 versus 0.042 mm · s,  $p = 0.021$ ). The Pearson's correlation coefficient for measurements between the 2 readers was 84% ( $p = 0.000$ ).

**Conclusions:** PTFVI could be a strong predictor of PAF detection in patients with ESUS.

**Trial registration number:** N/A

## AS25-019

### YIELD OF IMPLANTABLE CARDIAC MONITORING FOR ATRIAL FIBRILLATION DETECTION AND STROKE RECURRENCE IN PATIENTS WITH CRYPTOGENIC STROKE: A CASE-CONTROL STUDY

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**Background and Aims:** The optimal diagnostic strategy for atrial fibrillation detection (AF) in patients with cryptogenic stroke (CS) has not been determined. The present case-control study sought to compare the yield of implantable cardiac monitoring (ICM) with standard outpatient non-invasive monitoring strategy (single or multiple 24-hour Holter-ECG recordings) in AF detection, oral anticoagulation (OAC) initiation and stroke recurrence.

**Methods:** Consecutive patients with cryptogenic stroke following a comprehensive work-up underwent ICM using Reveal LINQ during an 18-month period (cases) in a tertiary care stroke center. Cases were compared to historical controls consisting of CS patients who underwent single or multiple 24-hour Holter-ECG recordings over a 36-month period prior to ICM implementation in the same center.

**Results:** Study population included 67 cases and 184 controls. AF detection was more frequent in cases than controls (18% vs 5%,  $p = 0.002$ ). The median elapsed time between Reveal LINQ implantation and AF detection was 72 days (IQR: 9–164). The mean AF duration detected with ICM was  $448 \pm 809$  min. OAC initiation was more common in patients than controls (16% vs. 5%,  $p = 0.005$ ). The mean follow-up duration was similar in two cohorts (13 $\pm$ 11 months & 14 $\pm$ 13 months in cases and controls). Stroke recurrence tended to be less prevalent in cases than controls (1.5% vs. 4.9%,  $p = 0.297$  by Fisher exact test).

**Conclusions:** This pilot case-control study indicates that ICM appears to substantially increase the yield of AF detection and OAC initiation in

CS. The former association may result in lower stroke recurrence rates in patients undergoing ICM compared to outpatient non-invasive standard cardiac monitoring.

**Trial registration number:** N/A

## AS25-022

### PROLONGED CARDIAC RHYTHM MONITORING AND SECONDARY STROKE PREVENTION IN PATIENTS WITH CRYPTOGENIC CEREBRAL ISCHEMIA: A SYSTEMATIC REVIEW AND META-ANALYSIS

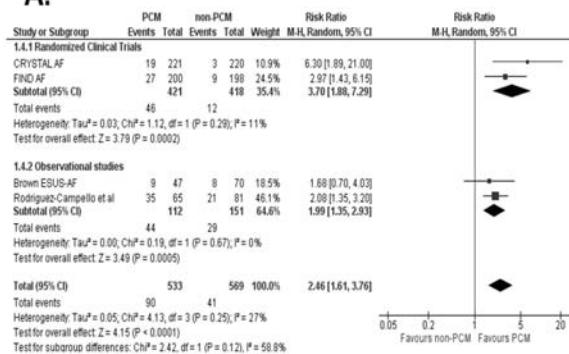
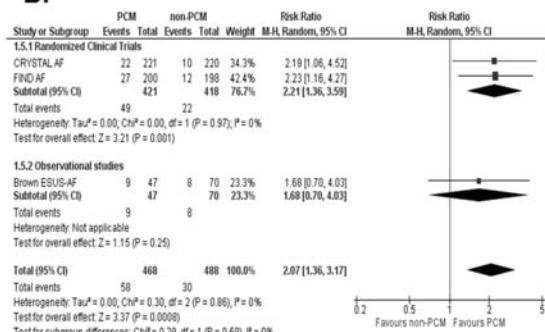
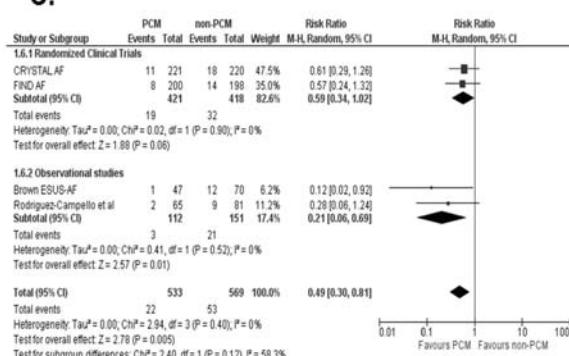
**G. Tsivgoulis<sup>1,2</sup>, A. Katsanos<sup>1,3</sup>, B. Mac Grory<sup>4</sup>, M. Köhrmann<sup>5</sup>, B. Ricci<sup>4</sup>, K. Tsiofis<sup>6</sup>, S. Cutting<sup>4</sup>, C. Krogias<sup>3</sup>, P.D. Schelling<sup>7</sup>, A.R. Campello<sup>8</sup>, E. Cuadrado-Godia<sup>8</sup>, D.J. Gladstone<sup>9</sup>, T. Sanna<sup>10</sup>, R. Wachter<sup>11</sup>, K. Furie<sup>4</sup>, A.V. Alexandrov<sup>2</sup> and S. Yagh<sup>1</sup>**

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**Background and Aims:** Although prolonged cardiac rhythm monitoring (PCM) can reveal a substantial proportion of ischemic stroke (IS) patients with atrial fibrillation (AF) not detected by conventional short-term monitoring, current guidelines indicate an uncertain clinical benefit for PCM. We evaluated the impact of PCM on secondary stroke prevention using data from available to date randomized clinical trials (RCTs) and observational studies.

**Methods:** We performed a comprehensive literature search to identify studies reporting stroke recurrence rates in patients with history of cryptogenic IS or transient ischemic attack (TIA) receiving PCM compared to patients receiving conventional (non-PCM) cardiac monitoring.

**Results:** We included 4 studies (2 RCTs and 2 observational studies), including a total of 1102 patients (mean age: 68 years, 41% women). We documented an increased incidence of AF detection (RR = 2.46, 95% CI: 1.61-3.76; Figure A) and anticoagulant initiation (RR = 2.07, 95% CI: 1.36-3.17; Figure B), and decreased risk of stroke recurrence during follow-up (RR = 0.49, 95% CI: 0.30-0.81; Figure C) for IS/TIA patients who underwent PCM compared to IS/TIA patients receiving conventional cardiac monitoring.

**A.****B.****C.**

**Conclusions:** PCM appears to have a significant impact on secondary stroke prevention. PCM is associated with higher rates of AF detection, resulting in prompt anticoagulation initiation and a reduction in stroke recurrence in patients with cryptogenic IS/TIA.

**Trial registration number:** N/A

## AS25-068

### CARDIAC DYSFUNCTION AND FUNCTIONAL OUTCOME ONE YEAR AFTER ISCHAEMIC STROKE: PRELIMINARY RESULTS OF THE SICFAIL (STROKE INDUCED CARDIAC FAILURE IN MICE AND MEN) COHORT STUDY

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**Background and Aims:** Information on the impact of cardiac function in acute ischaemic stroke (IS) on long-term outcome is lacking. We investigated the role of cardiac dysfunction and heart failure (HF) in acute IS patients on functional outcome after one year.

**Methods:** Data were collected within the prospective hospital-based SICFAIL study. At baseline, cardiac function was characterized in consecutive IS patients including medical history, clinical examination standardized echocardiography by an expert sonographer, and blood sampling. Diastolic dysfunction (DD), systolic dysfunction (SD) and HF (with reduced (HFrEF), mid-range (HFmrEF), or preserved left ventricular ejection fraction (HFpEF)) were defined according to current guidelines, based on echocardiographic criteria and clinical symptoms (Framingham criteria). Blockwise adjusted logistic regression was used to identify factors associated with unfavourable one-year functional outcome (modified Rankin Scale (mRS)>2). DD, SD and HF were added into separate models.

**Results:** Between 01/2014 and 02/2017, 696 acute IS patients were enrolled. Of 644 (92.5%) patients with baseline echocardiography, information on one-year functional outcome was available in 520 (80.7%) patients (median age = 71 years (IQR 60–79), 62.7% male, median mRS = 1 (IQR 0–3)). Unfavourable functional outcome (n = 142 (27.3%)) was associated with age, stroke severity on admission, pre-stroke dependency, atrial fibrillation, diabetes and stroke-related insular damage. Independent of these factors, SD at baseline was associated with unfavourable outcome (OR = 2.35, 95% CI[1.05–5.30]), while DD and HF had no statistically significant effect.

**Conclusions:** SD after acute IS was independently associated with unfavourable one-year outcome. Ongoing annual follow-up of the SICFAIL cohort will further clarify the prognostic role of cardiac dysfunction and HF on long-term outcome.

**Trial registration number:** DRKS00011615

**AS25-060**

**CLINICAL OUTCOMES AMONG NON-VALVULAR ATRIAL FIBRILLATION PATIENTS WITH RENAL DYSFUNCTION TREATED WITH WARFARIN OR REDUCED DOSE RIVAROXABAN**

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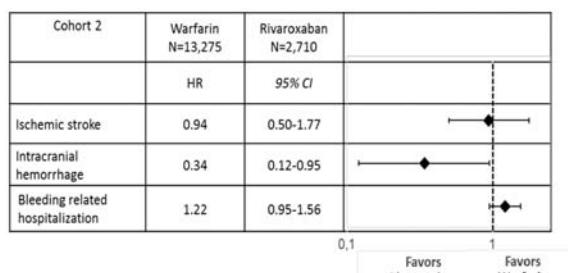
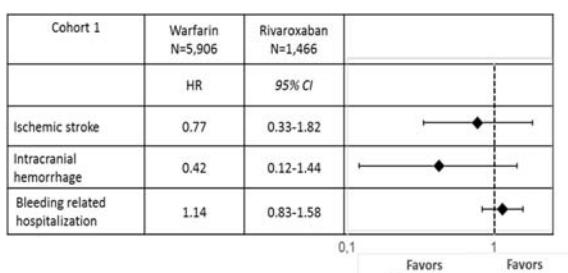
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**Background and Aims:** The aim is to evaluate the risk of ischemic stroke, intracranial hemorrhage and bleeding-related hospitalization in non-valvular atrial fibrillation (NVAF) patients with renal dysfunction treated with the reduced dose rivaroxaban (15 mg once daily) compared to warfarin in routine practice.

**Methods:** Individual level data for warfarin- and rivaroxaban-naïve NVAF patients with renal dysfunction from the MarketScan database for years 2012 through 2017 were used. Two different approaches to define “renal dysfunction” were applied. Approach 1 comprised chronic kidney disease stage 3 and 4 only, and was extended by additional specific kidney diseases to build approach 2 resulting in a larger cohort. Both approaches were assumed to enable identification of patients correctly prescribed the reduced dose rivaroxaban as per label. An inverse probability of treatment weighting was used to adjust for imbalances in baseline patient characteristics.

**Results:** Two renal approaches resulted in identification of 7,372 (5,906 warfarin; 1,466 rivaroxaban) – cohort 1 and 15,985 (13,275 warfarin; 2,710 rivaroxaban) – cohort 2 of NVAF patients with renal dysfunction. Hazard ratios and 95%CI of 0.77 (0.33; 1.82)/0.94 (0.50; 1.77) for ischemic stroke, 0.42 (0.12; 1.44)/0.34 (0.12; 0.95) for intracranial hemorrhage and 1.14 (0.83; 1.58)/1.22 (0.95; 1.56) for bleeding-related hospitalization were obtained for cohort 1/2 (Figures).

**Conclusions:** The reduced dose of rivaroxaban was associated with a trend towards lower risk of ischemic stroke and intracranial hemorrhage and with a comparable risk of bleeding-related hospitalization versus warfarin in NVAF patients with renal dysfunction. The risk reduction of intracranial hemorrhage was significant for cohort 2.



**Trial registration number:** N/A

**AS25-028**

**THE ADDITIONAL VALUE OF AN AUTOMATED DETECTION ALGORITHM FOR ATRIAL FIBRILLATION AT THE STROKE UNIT**

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**Background and Aims:** The rate of newly detected (paroxysmal) atrial fibrillation (AF) during inpatient cardiac telemetry is low. The objective of this study was to evaluate the additional diagnostic yield of an automated detection algorithm for AF on telemetric monitoring compared with routine detection by a stroke unit team in patients with recent ischemic stroke or TIA.

**Methods:** Patients admitted to the stroke unit with acute ischemic stroke or TIA and no history of AF were prospectively included. All patients had telemetry monitoring, routinely assessed by the stroke unit team. The ST segment and arrhythmia monitoring (ST/AR) algorithm was active, with deactivated AF alarms. After 24 hours the detections were analyzed by a trained physician, and compared with routine evaluation.

**Results:** Five hundred and seven patients were included (52.5% male, mean age  $70.2 \pm 12.9$  years). Median monitor duration was 24 hours (interquartile range 22–27). In 6 patients (1.2%) routine analysis by the stroke unit team concluded AF. In 24 patients (4.7%), the ST/AR algorithm suggested AF. Interrater reliability was low ( $\kappa$ , 0.388,  $p < 0.001$ ). Suggested AF by the algorithm turned out to be false positive in 11 patients. In 13 patients (2.6%) AF was correctly diagnosed by the algorithm. None of the cases detected by routine analysis were missed by the ST/AR algorithm.

**Conclusions:** Automated AF detection during 24-hour telemetry in ischemic stroke patients is of additional value to detect AF de novo compared with routine analysis by the stroke unit team alone. Automated detections need to be carefully evaluated.

**Trial registration number:** N/A

**AS25-029**

**THE DIAGNOSTIC AND THERAPEUTIC YIELD OF TRANSTHORACIC ECHOCARDIOGRAPHY IN 474 PATIENTS WITH ISCHEMIC STROKE OR TIA OF UNDETERMINED CAUSE**

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**Background and Aims:** The evaluation of ischemic stroke and TIA of undetermined cause often includes transthoracic echocardiography (TTE). Since there is ongoing controversy regarding the indication for echocardiography in this setting, our aim was to assess the diagnostic and therapeutic yield of TTE in patients with recent ischemic stroke or TIA of undetermined cause.

**Methods:** We retrospectively evaluated all patients with ischemic stroke or TIA of undetermined cause after standard diagnostic work-up, who were treated between January 2014 and December 2017, and had undergone TTE for evaluating a possible cardioembolic source. A major cardioembolic source was defined as an echocardiographic finding probably related to stroke or TIA warranting change of therapy. A minor cardioembolic source was defined as a possible cause of stroke or TIA, however not warranting different therapy.

**Results:** Four hundred seventy-four of 667 patients with ischemic stroke or TIA of undetermined cause underwent TTE. Mean age was  $65.6 \pm 13.8$  years, 260 (54.9%) were male and 383 (80.8%) had ischemic stroke. In 30 patients, TTE showed a potential cardioembolic source corresponding with a diagnostic yield of 6.3%. In 10 patients a major cardioembolic source was found, corresponding with a therapeutic yield of 2.1%. Eight of these 10 patients had cardiac complaints or ECG abnormalities.

**Conclusions:** The therapeutic yield of routine TTE in patients with ischemic stroke or TIA of undetermined cause is low. Our current multi-center registry aims to develop a prediction model for selecting patients based on certain criteria, in order to improve the (cost-)effectiveness of TTE in these patients.

**Trial registration number:** N/A

## AS25-026

### THE UTILITY OF MEASURING LEFT ATRIAL VOLUME FOR THE PREDICTION OF PAROXYSMAL ATRIAL FIBRILLATION

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**Background and Aims:** Atrial fibrillation (AF)/ paroxysmal atrial fibrillation (pAF) is the leading cause of cardiogenic embolic infarction. Detecting or predicting the pAF is crucial not only for the primary, but also for the secondary prevention. Although transesophageal echocardiography (TEE) of intracardiac thrombus is the most accepted measure to predict pAF, its invasiveness hinders the clinical application, especially in the acute phase. The use of transthoracic ultrasonography (TTE) is less-invasive, although the measurement of left atrium dimension (LAD) is not as sensitive to predict pAF.

The aims of this study are to evaluate the utility of measuring left atrial volume (LAV) by TTE for the prediction of pAF in comparison with the measurement of LAD.

**Methods:** 112 patients with ischemic stroke who were admitted to Saitama City Hospital from year 2017 to 2018 were included and their LAD and LAV were evaluated with TTE.

**Results:** 37 patients were diagnosed as having cardiogenic embolic infarction. Their mean age was  $79 \pm 9.5$  years old, with male-predominance (64%). The mean CHADS2 score and the serum BNP level were  $2.4 \pm 1.2$  and  $3193 \pm 4358$  pg/ml, respectively. Their Mean LAD and LAV were  $41.0 \pm 7.8$  mm (cut-off: 40 mm) and  $61.7 \pm 22.4$  ml (cut-off: 35 ml), respectively. Among those 37, LAD was considered normal in 12 patients, whereas LAV was exceeding the cut-off in all patients. For reference, non-cardiogenic patients were evaluated, and the specificity of LAV measurement was 86.1%, which was superior to that of LAV (66.1%).

**Conclusions:** Measuring LAV by TTE may be a new less-invasive measure to predict pAF.

**Trial registration number:** N/A

## AS25-085

### AN RCT TO DETERMINE IF SCREENING FOR PAROXYSMAL ATRIAL FIBRILLATION REDUCES STROKE AND MORTALITY: THE SAFER PROGRAMME-SCREENING FOR ATRIAL FIBRILLATION WITH ECG TO REDUCE STROKE

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**Background and Aims:** Atrial Fibrillation (AF) is a major risk factor for ischaemic stroke unless treated with an anticoagulant. Detecting AF can be difficult because it is often paroxysmal and asymptomatic.

Many clinicians support AF screening. The UK National Screening Committee and the US Preventive Services Task Force have highlighted a lack of evidence that screening for AF is beneficial. The 8-year NIHR-funded SAFER Programme aims to determine if screening for AF in people  $\geq 65$  years does prevent stroke, does not cause significant harm, and is cost-effective.

**Methods:** Patients will attend their GP practice for instruction in the use of a handheld single-lead ECG device (Zenicor). They will continue screening at home over a 2–4 week period. Treatment for AF will follow national guidelines.

1. Feasibility study (starting February 2019)

To determine whether it is feasible to implement screening within primary care.

2. Internal pilot trial

Cluster randomising practices (10 screening, 20 control) to determine AF detection rate and inform power calculation for main trial.

3. Main trial

Cluster randomising practices (100 screening, 200 control; 120,000 patients). 5-year follow-up of electronic medical records will determine if screening leads to fewer strokes, heart attacks and deaths, and whether it increases the risk of serious bleeding.

4. Qualitative

Interviews and observations with patients and staff to clarify how to best carry out screening.

5. Health economics

A within trial analysis and decision modelling analysis to determine whether screening is cost effective.

**Results:**

**Conclusions:** Due to report in 2026, this is the world's largest AF screening trial to date.

**Trial registration number:** N/A

**AS25-044**

**DETECTION OF HIDDEN ATRIAL FIBRILLATION IN PRIMARY CARE WITH A WEARABLE LONG-TERM ECG REGISTRATION SYSTEM IN POPULATION AT RISK: THE DESCUBRE-FA STUDY. PRELIMINARY RESULTS**

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**Background and Aims:** Atrial fibrillation (AF) is one of the major causes of stroke. We evaluated the benefit and feasibility of a new technology based on biomedical textiles (Nuubo®) that allow the prolonged recording of ECG without affecting the quality of life of the patient in a primary care setting.

**Methods:** Multicentric prospective study in a population >70 years selected by a combination of risk factors. A 2-week ECG recording was performed. According to the results, patients were classified into three groups: 1. Non-AF; 2. AF detected during the first 30 minutes. This group will be considered as a control group because it could be detected with a conventional ECG. 3. Hidden AF. Our final aim is to enroll 600 patients, here we present the preliminary results.

**Results:** N = 223. Mean age: 78 years, 64% women. Recorded average time: 210h/patient. Hyperthyroidism 2.7%, obesity 33.2%, congestive heart failure, 2.7%, myocardial infarction 9.9%, hypertension 86.1%, diabetes 24.7%, stroke 10.8%, systemic embolism 1, 3%, COPD 7.6%, DL 76.2%, peripheral arterial disease 4.5%, renal insufficiency 24.7%, hepatopathy 2.2%, smoking 4.0%, alcohol 4.0%. Detection of hidden-AF (group 3) was achieved in 10 cases (4.5%) in comparison to 2 cases (0.9%) in the control group.

**Conclusions:** This new device has increased the detection of AF more than 4 times over conventional diagnostic methods. Through the initiation of oral anticoagulation, up to 1 in 20 participants in the study could benefit from the primary prevention of a stroke. The completion of the projected study will confirm these preliminary results.

**Trial registration number:** N/A

**Brain Reorganisation and Recovery**

**AS20-006**

**EVIDENCE FOR TIME-LIMITED NEUROPLASTICITY IN HUMANS AFTER ISCHAEMIC STROKE**

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<sup>1</sup>UCL, Sobell Department of Motor Neuroscience, London, United Kingdom

**Background and Aims:** Recovery in motor function after stroke appears to asymptote after 2–3 months, whilst rodent models show a short-lived bihemispheric increase in dendritic sprouting and synaptogenesis for 10–14 days post-stroke. It remains unclear whether this early period of maximal recovery in humans corresponds to a period of enhanced neuroplasticity. We present the first data to support such a phenomenon in human stroke patients using transcranial magnetic stimulation (TMS).

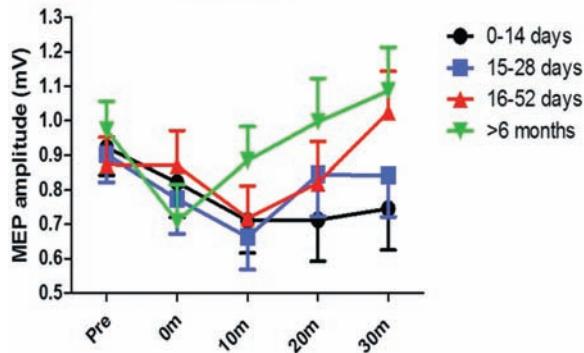
**Methods:** Data were collected from acute ischaemic stroke patients at the Institute of Neurology, UCL, London. 29 patients (average age 63yrs)

attended for recording from the contralateral hemisphere at 2, 4 and 6 weeks (acute phase) and at 6 months (chronic phase) after first ischaemic stroke. All subjects had made a good functional recovery with FMUL > 58 or ARAT > 55 by 6 months.

Subjects received TMS in a continuous theta-burst protocol to contralateral M1 (inducing LTD-like synaptic plasticity), with change in motor evoked potentials (MEPs) over 30 minutes as a measure of neuroplastic effect. Averaged normalised MEPs were analysed for each group in a two-way rmANOVA with factors TIME and PLASTICITY.

**Results:** There was significant interaction of TIME and PLASTICITY ( $p = 0.03$ ), with maximal neuroplastic effect at the 2 week mark and decreasing with time post infarct.

**Raw data**



**Conclusions:** These data represent the first neurophysiological evidence in humans for a window of enhanced neuroplasticity in the early (c. 4–6 weeks) post-stroke period.

**Trial registration number:** N/A

**AS20-008**

**FLUOXETINE ADJUNCT TO THERAPEUTIC EXERCISE PROMOTES MOTOR RECOVERY IN RATS WITH CEREBRAL ISCHEMIA: ROLES OF NUCLEUS ACCUMBENS**

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**Background and Aims:** The study aimed to explore the molecular mechanism of fluoxetine adjunct to therapeutic exercise improving motor recovery using a rat cerebral ischemic model with middle cerebral artery occlusion. We hypothesized nucleus accumbens may be one of the responding areas to fluoxetine where relevant elevations in 5-HT and ΔFosB were associated with motor behavioral recovery.

**Methods:** Male SD rats were randomly divided into five groups: rats without intervention; rats underwent MCAO without exercise or fluoxetine; rats underwent MCAO only treated with fluoxetine; rats underwent MCAO only treated with exercise; rats underwent MCAO treated with both exercise and fluoxetine. Motor function and motivation was assessed by the fault footstep test and the forced swimming test. 5-HT level in bilateral NAc and the expression of 5-HT<sub>2C</sub> receptor and ΔFosB in ipsilesional NAc were measured.

**Results:** Our results indicated either treatment helped improve the grasp dexterity of the affected limb, and motor motivation as well as resilience to adverse environment in MCAO rats. The dual treatment

with fluoxetine and exercise may hasten the recovery process. The dual treatment helped restore the balance of 5-HT level between bilateral NAc. Either treatment could resume the expression of 5-HT2CR and the dual treatment significantly increased the expression of FosB in the ipsilesional side of the NAc.

**Conclusions:** In conclusion, NAc played an important role in driving physical motivation which was possibly related to motor recovery after stroke. Fluoxetine hastened the effectiveness of therapeutic exercise was possibly via regulating 5-HT and its receptors in the NAc.

**Trial registration number:** N/A

## AS20-005

### QUANTITATIVE EEG ANALYSIS DURING AN ACTIVE HAND-GRASPING TASK IN ACUTE ISCHEMIC STROKE AS A POTENTIAL PREDICTOR OF FUNCTIONAL RECOVERY

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**Background and Aims:** Neurophysiological mechanisms of motor functional recovery (MFR) after ischemic stroke are in part unknown, hindering the possibility to develop targeted rehabilitative strategies. Emerging evidence suggests that an interplay with secondary areas of the motor system facilitates MFR. We hypothesized that a task-based quantitative EEG analysis (qEEG) performed in the acute phase might help precisely predict the degree of MFR at follow-up.

**Methods:** We recruited 14 adult patients with ischemic stroke (9 cortical, 5 subcortical) and contralateral upper extremity weakness. Patients underwent a 128-channel EEG recording in the acute phase (T0) during resting state (eyes closed, EyCl) and while continuously opening and closing the affected hand with eyes closed (LHEC). Clinical recovery was assessed at T0, 6 weeks (T1), and 3 months (T2) using FMUE scale (Fugl-Meyer Upper Extremity) and NIHSS. The difference in beta power spectral density ( $\Delta\beta$ PSD) between EyCl and LHEC was calculated for every electrode, and the patient-specific averaged  $\Delta\beta$ PSD value for significantly-different electrodes was correlated with the clinically-measured recovery.

**Results:** Significantly-different  $\Delta\beta$ PSD electrodes were identified over the ipsilesional premotor cortex. When considering all strokes, averaged  $\Delta\beta$ PSD values significantly correlated with  $\Delta$ NIHSS at T0-T1 ( $p=0.028$ ). In cortical strokes, we found significant correlations between  $\Delta\beta$ PSD and  $\Delta$ NIHSS at T0-T1 ( $p=0.05$ ) and T0-T2 ( $p=0.038$ ), and with  $\Delta$ FMUE at T1-T0 ( $p=0.039$ ). Subcortical strokes did not show significant clinical recovery.

**Conclusions:** Task-based qEEG analysis of  $\Delta\beta$ PSD in acute stroke precisely predicts MFR. Its adoption in stroke care could allow for targeted rehabilitative therapies, optimizing medical resources.

**Trial registration number:** N/A

## AS20-010

### DIFFERENTIAL RESPONSES TO DUAL SEH INHIBITORS/PPAR $\gamma$ AGONISTS IN CEREBRAL ENDOTHELIAL AND GLIOMA CELLS

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<sup>2</sup>Goethe University Frankfurt, Pharmacology and Toxicology, Frankfurt, Germany

**Background and Aims:** Sphingosine-phosphate-1 (SIP) plays a central role in vasculature, immune response and cell survival. Pharmacological targeting of its pathway has shown cytoprotective, promigratory and antifibrotic effects in most tissues. Intriguingly, glioblastoma cells show enhanced sensitivity to chemotherapy after modulation of SIP-receptor-I. SIP-receptor modulators have been in clinical use for several years in multiple sclerosis but have cardiac and ocular side effects. Intracellular SIP induction via sphingosine kinases (SK1 and 2) as a potential endogenous cytoprotective mechanism might be a novel alternative strategy. Inhibitors of the soluble epoxid hydroxylase (sEH) as well as agonists of the peroxisome proliferator-activated receptor  $\gamma$  (PPAR  $\gamma$ ) have shown beneficial effects in vascular diseases. For both, intracellular SIP induction by SK1 has been demonstrated. To overcome limitations of single actors on sEH and PPAR $\gamma$ , dual modulators have recently been developed.

We aimed to investigate the effects of two dual sEH/PPAR $\gamma$  modulators in different cerebral cell lines in comparison to single modulators with a focus on downstream SIP signalling.

**Methods:** RNASequencing of brain microvessels after tMCAO, qPCR, scratch assays, LC-MS/MS.

**Results:** We observed an induction of sphingosine kinase 1 (SK1) expression in cortical endothelial cells (bEND3) which was paralleled by enhanced cell migration in a scratch assay over 48 hours. The same treatment of a glioblastoma cell line (LN229) led to a decreased expression of SK1 and inhibited migration.

**Conclusions:** Dual sEH/PPAR $\gamma$  modulation has differential effects on benign and malignant cell lines based on opposing changes of the intracellular SIP metabolism. Combined vascular protection and anticancerogenic actions make these substances a promising therapeutical strategy.

**Trial registration number:** N/A

## AS20-009

### ISCHEMIC STROKE REGENERATION INDUCED BY MYOSIN INHIBITION WITH PARA-AMINOBLEBBISTATIN

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**Background and Aims:** Non-muscle myosin-2 (NM2) and smooth muscle myosin-2 (SMM2) are potential drug targets in the nervous system as post-operative chemical therapy of ischemic stroke because NM2 regulates neuronal regeneration and neurite outgrowth while SMM2 is the key regulator of the capillary blood flow in the brain tissue.

**Methods:** For modelling ischemic stroke, transient middle cerebral artery occlusion (tMCAO) was performed on male Wistar rats followed by the injection of para-aminoblebbistatin (pAmBleb) to the damaged area. We followed the cerebral blood flow and edema size by SPECT combined with MRI. General and focal deficits were also registered to assess the neurological functions in the control and treated groups.

**Results:** Our laboratory developed a biologically safe myosin-2 inhibitor, pAmBleb, which inhibits both NM2 and SMM2, thus, restores cerebral capillary blood flow and has strong neuroprotective effect in the stroke-affected injured brain tissue. In treated animals cerebral blood flow evaluation revealed increased blood flow as well as substantial behavioral improvement.

## RELATIVE rCBF - Day 07



**Conclusions:** These results highlight the significance of the small molecule inhibition of NM2 and SMM2 initiating a novel drug development aiding the recovery from ischemic stroke after thrombectomy.

**Trial registration number:** N/A

**WITHDRAWN**

## AS20-004

### ACUTE CEREBELLAR STROKE AND MIDDLE CEREBRAL ARTERY STROKE EXERT DISTINCTIVE MODIFICATIONS ON FUNCTIONAL CORTICAL CONNECTIVITY: A COMPARATIVE STUDY VIA EEG GRAPH THEORY

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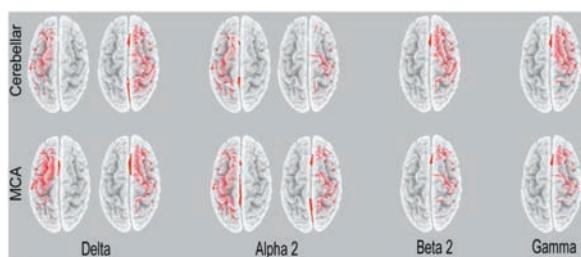
<sup>6</sup>Fondazione Policlinico Universitario A. Gemelli IRCCS, Unità Operativa Complessa Neurologia, Rome, Italy

**Background and Aims:** Acute middle cerebral artery stroke modifies EEG-related brain network topology, in particular affecting the balance between global integration and local segregation (small-worldness) in a frequency-dependent modality. We tested whether acute cerebellar stroke determine similar changes in brain network architecture.

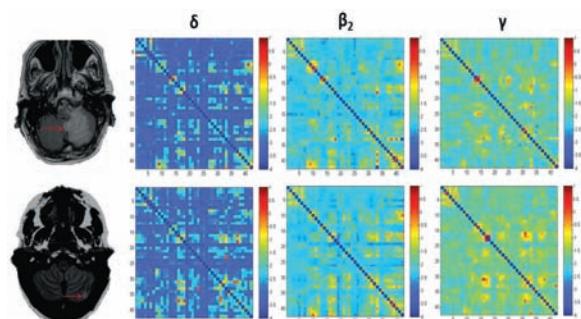
**Methods:** Lagged linear coherence-based functional connectivity network parameters of 41 consecutive stroke patients (mean age 66.5, SD 11.9, 27 males and 14 females) were analysed using eLORETA EEG sources. Network rearrangements of stroke patients were investigated in delta, alpha2, beta2 and gamma bands, in comparison with healthy subjects

**Results:** In a multiple regression model (table below), the delta network remodeling was similar in both cerebellar and middle cerebral artery strokes, with a reduction of small-worldness. Beta2 and gamma small-worldness increase only in the right hemisphere of patients with cerebellar stroke respect to healthy subjects, while alpha2 small-worldness increases only among patients with a middle cerebral artery stroke.

Variables	Delta $S_w$		Theta $S_w$		Alpha 1 $S_w$		Alpha 2 $S_w$		Beta 1 $S_w$		Beta 2 $S_w$		Gamma $S_w$	
	Right Hem	Left Hem	Right Hem	Left Hem	Right Hem	Left Hem	Right Hem	Left Hem	Right Hem	Left Hem	Right Hem	Left Hem	Right Hem	Left Hem
Age	0.107 (0.170)	0.154 (0.187)	-0.107 (0.416)	-0.012 (0.327)	0.023 (0.319)	-0.119 (0.396)	-0.298 (0.112)	-0.228 (0.077)	-0.203 (0.122)	-0.012 (0.762)	-0.081 (0.540)	0.001 (0.394)	0.001 (0.540)	0.000 (0.558)
Gender	0.012 (0.439)	0.066 (0.577)	0.019 (0.646)	0.000 (0.517)	-0.040 (0.772)	0.173 (0.265)	0.012 (0.922)	-0.108 (0.375)	0.123 (0.361)	-0.001 (0.146)	0.050 (0.420)	-0.104 (0.439)	0.027 (0.541)	-0.003 (0.446)
NHSS total score	0.181 (0.254)	-0.004 (0.376)	0.124 (0.327)	0.013 (0.749)	0.013 (0.718)	0.228 (0.116)	0.042 (0.804)	0.009 (0.800)	0.012 (0.798)	0.149 (0.242)	0.150 (0.381)	-0.174 (0.333)	0.112 (0.394)	0.184 (0.333)
MCA stroke	<b>-0.412 (-0.861)</b>	<b>-0.476 (0.864)</b>	<b>-0.334 (0.373)</b>	<b>-0.333 (0.497)</b>	<b>-0.128 (0.489)</b>	<b>-0.189 (0.116)</b>	<b>0.838 (0.840)</b>	<b>0.641 (0.808)</b>	<b>0.017 (0.924)</b>	<b>0.318 (0.042)</b>	<b>0.207 (0.240)</b>	<b>0.254 (0.181)</b>	<b>0.208 (0.242)</b>	<b>0.392 (0.294)</b>
Cerebellar stroke	<b>-0.237 (0.844)</b>	<b>-0.283 (0.823)</b>	<b>-0.017 (0.957)</b>	<b>-0.007 (0.132)</b>	<b>-0.188 (0.641)</b>	<b>-0.064 (0.146)</b>	<b>0.110 (0.274)</b>	<b>0.141 (0.053)</b>	<b>0.261 (0.106)</b>	<b>0.223 (0.050)</b>	<b>0.342 (0.088)</b>	<b>0.255 (0.062)</b>	<b>0.364 (0.032)</b>	<b>0.342 (0.084)</b>
R <sup>2</sup>	0.313	0.318	0.042	0.093	0.061	0.092	0.196	0.267	0.114	0.108	0.157	0.114	0.124	0.089



The network remodeling is independent of the size of the ischemic lesion.



**Conclusions:** In the early post-acute stages cerebellar stroke differs from the middle cerebral artery one because it does not cause alpha2 network remodeling while it determines a high frequency network reorganization in beta2 and gamma bands with an increase of small-worldness characteristics.

These findings demonstrate changes in the balance of local segregation and global integration induced by cerebellar acute stroke in high EEG frequency bands. They need to be integrated with appropriate follow-up to explore whether further network changes are attained during post-stroke outcome stabilization.

**Trial registration number:** N/A

## WITHDRAWN

### Carotid Stenosis – Large Artery Atherosclerosis

#### AS21-031

### CLINICAL FEATURES OF MOYAMOYA ARTERIOPATHY IN ITALY: PRELIMINARY RESULTS OF GEN-O-MA STUDY

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**Background and Aims:** GENetics of mOyaMoyA (GEN-O-MA) project is a multicentre observational study aimed at describing the disease phenotype and course and to discover biological and cellular markers of Moyamoya angiopathy (MA). Herein, we present the preliminary study results.

**Methods:** Nineteen centres are participating in the study. Patients with both bilateral and unilateral radiologically defined MA, diagnosed according to literature criteria, are being included in the study. For each patient, detailed demographic and clinical as well as neuroimaging data are being collected. Biological samples including blood and, in subject undergoing to revascularization surgery, cerebrospinal fluid and middle cerebral artery (MCA) specimens are being also collected for biological analysis.

**Results:** From 2015 to 2018 116 patients (age of onset mean  $\pm$  SD 40.5  $\pm$  19.1 years; 67.5% females) have been collected. Twenty (17.2%) patients were  $<$  18 years old. MA was bilateral in 76 (66%) and unilateral in 39 patients (33.9%). Forty-seven patients presented with ischemic (50%) and haemorrhagic (16.5%) stroke. Headache, cognitive, psychiatric disorders and seizures were found respectively in 51.8%, 24.3%, 22% and 27.2%. Forty per cent of these patients underwent a revascularization surgery.

**Conclusions:** At a preliminary analysis, the results of GEN-O-MA project, that is the first Italian MA network, are in line with previous studies on Western patients, except for an increased rate of headache and seizures. The wide MA population collected in Italy by GEN-O-MA project will favour the characterization of the disease phenotype and course as well as the identification of biological markers associated with the disease susceptibility.

**Trial registration number:** N/A

## AS21-042

### RISK MODELING TO OPTIMIZE CAROTID REVASCULARIZATION: IMPORTANCE OF BASELINE RISK MODEL SELECTION

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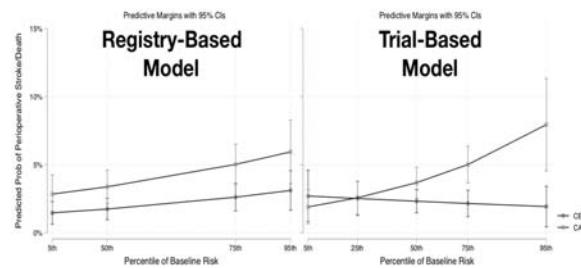
<sup>1</sup>University of Michigan, Neurology, Ann Arbor, USA; <sup>2</sup>University of Michigan, Internal Medicine, Ann Arbor, USA

**Background and Aims:** Identifying the optimal carotid revascularization procedure (Carotid endarterectomy (CEA) vs. Carotid artery stenting (CAS)) for individuals is challenging. Risk modeling can inform this decision, yet, little is known about best practices. We explored the effect of applying different baseline risk models in algorithms to identify optimal revascularization strategies.

**Methods:** Literature review identified 5 registry and 2 trial baseline risk models which were then externally validated. The registry and trial-based models with the best overall performance were used to develop risk modeling algorithms in the Carotid Revascularization Endarterectomy vs. Stenting Trial (CREST).

Risk of perioperative stroke/death in CREST was estimated using logistic regression including baseline model-based risk indices, symptomatic status and treatment arm as independent variables. These models were initially specified with an interaction between baseline risk and treatment arm. If significant, this term was retained in the final risk model. Optimal treatment algorithms combined the final model's predicted risk of perioperative stroke/death with the predicted risk of myocardial infarction from a separate risk model.

**Results:** Discrimination and calibration were similar for both algorithms. The trial-based algorithm retained a significant interaction term between treatment status and baseline risk while the registry-based model did not. This resulted in superiority of CAS for low risk patients in the trial-based model. (Figure) Predicted optimal treatment was CAS in 44% vs 13% with trial vs. registry-based models.



**Conclusions:** More CREST patients would benefit more from CEA than CAS on both algorithms. Baseline risk model selection can influence predicted optimal treatment.

**Trial registration number:** N/A

## AS21-017

### CAROTID PLAQUE NEOVASCULARIZATION DETECTED WITH CONTRAST-ENHANCED ULTRASOUND PREDICTS ISCHEMIC STROKE RECURRENCE

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**Background and Aims:** Plaque neovascularization is a hallmark of carotid plaque vulnerability. With Contrast-Enhanced Ultrasound (CEUS) it is possible to visualize plaque neovessels *in vivo*. The clinical significance of CEUS-detected neovascularization is unclear. We hypothesized that CEUS-detected neovessels were associated with stroke recurrences in patients with a recent stroke and carotid atherosclerosis.

**Methods:** We conducted a prospective study of consecutive patients with a recent anterior circulation ischemic stroke and at least one atherosclerotic plaque in the internal carotid artery. Patients with a cardioembolic stroke etiology were excluded from our study. All the patients underwent a CEUS within 15 days from the stroke. Neovascularization was graded into three categories according to the extent of neovessels. During the follow-up, we recorded stroke recurrences. A multivariable Cox regression analysis was performed to evaluate predictors of recurrence.

**Results:** We included 78 patients whose mean age was  $74.3 \pm 10.4$  years and 58 (74.4%) were men. There were 29 (37.2%) patients with a low-grade stenosis ( $< 50\%$ ). The remainder presented high-grade carotid plaques. The results of the CEUS were not interpretable in 35.9% of the patients, mainly due to calcium shadows. We detected neovascularization in 80% of the plaques. After a median follow-up of 11.1 months (IQR = 3.5-16.6) there were 13 stroke recurrences. In the Cox regression analysis, CEUS-detected neovascularization was independently associated with the risk of stroke recurrence, even after adjusting for the degree of stenosis (HR = 4.58 95%CI 1.47-14.30).

**Conclusions:** In patients with an anterior circulation ischemic stroke and ipsilateral carotid atherosclerosis, plaque neovascularization detected with CEUS was an independent predictor of stroke recurrence

**Trial registration number:** N/A

## AS21-013

### RISK OF NECK HEMATOMA IN TIA AND NON-DISABLING STROKE PATIENTS WITH SYMPTOMATIC CAROTID ARTERY STENOSIS UNDERGOING ENDARTERECTOMY WITHIN 14 DAYS FROM CEREBROVASCULAR EVENT.

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<sup>1</sup>“Attikon” University Hospital, Second Department of Neurology, Athens, Greece; <sup>2</sup>St. Josef-Hospital- Ruhr University, Department of Neurology, Bochum, Germany; <sup>3</sup>“Attikon” University Hospital, Department of Vascular Surgery, Athens, Greece; <sup>4</sup>Democritus University of Thrace- School of Medicine-, Department of Vascular Surgery, Alexandroupolis, Greece; <sup>5</sup>St. Josef-Hospital- Ruhr University, Department of Vascular Surgery, Bochum, Germany; <sup>6</sup>“Attikon” University Hospital, Second Department of Anaesthesiology, Athens, Greece

**Background and Aims:** Perioperative neck hematoma (PNH) requiring reintervention is an important complication after carotid endarterectomy (CEA). There are limited data regarding the potential risk factors associated with NH, especially in patients with symptomatic carotid artery stenosis (sCAS) undergoing early CEA. The aim of this prospective, multicenter study was to document the rate of PNH in sCAS patients treated with CEA within the first 14 days of symptom onset and to identify predictors of this complication.

**Methods:** Patients with non-disabling (mRS  $\leq 2$ ) acute ischemic stroke or transient ischemic attack due to sCAS ( $\geq 70\%$ ) underwent CEA at three stroke-centers during a seven-year period. PNH requiring surgical reintervention or transfusion during a 30-day follow-up period was determined by the attending surgeon but was also confirmed by a neurologist.

**Results:** 298 patients with sCAS underwent CEA within 14 days of ictus. PNH occurred in 10 cases (3%). Pretreatment with therapeutic anticoagulation (TA) and history of atrial fibrillation was more prevalent in patients with PNH (40% vs. 4%,  $p = 0.023$  and 12% vs. 3%,  $p = 0.05$  respectively). Pretreatment with dual antiplatelets (55% of participants), intravenous thrombolysis or prophylactic anticoagulation was not related

to PNH. Patients who underwent urgent and early CEA had similar rates of PNH. Pretreatment with TA was independently associated with higher likelihood of PNH (OR: 15.2, 95%CI: 2.1-108.8,  $p = 0.007$ ) in multivariate logistic regression models adjusting for potential confounders.

**Conclusions:** PNH is uncommon in patients with sCAS that are operated during the first 14 days of ictus. Pretreatment with TA appears to be associated with higher risk of PNH.

**Trial registration number:** N/A

## AS21-021

### DUAL-TRACER PET FOR IDENTIFICATION OF CULPRIT CAROTID PLAQUES

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**Background and Aims:** Inflammation and microcalcification are inter-related processes contributing to atherosclerotic plaque vulnerability. Positron-emission tomography (PET) enables these processes to be quantified *in vivo* with potential clinical applications.

This study investigates (1) <sup>18</sup>F-fluorodeoxyglucose (FDG) and <sup>18</sup>F-sodium fluoride (NaF) uptake in culprit versus non-culprit carotid atheroma, (2) spatial distributions of uptake, and (3) how macrocalcification affects this relationship.

**Methods:** Individuals with acute ischaemic stroke with ipsilateral carotid stenosis of  $>50\%$  underwent FDG-PET and NaF-PET. Tracer uptake was quantified using maximum tissue-to-background ratios (TBR<sub>max</sub>) and macrocalcification quantified using Agatston scoring.

**Results:** In 26 individuals, median most diseased segment TBR<sub>max</sub> [IQR] was higher in culprit than non-culprit atheroma for both FDG (2.08 [0.52] vs. 1.89 [0.40],  $p < 0.001$ ) and NaF (2.68 [0.63] vs. 2.39 [1.02],  $p < 0.001$ ). However, whole vessel TBR<sub>max</sub> was higher in culprit arteries for FDG (1.92 [0.41] vs. 1.71 [0.31],  $p < 0.001$ ) but not NaF (1.85 [0.28] vs. 1.79 [0.60],  $p = 0.10$ ). NaF uptake was concentrated at carotid bifurcations. The association between FDG and NaF TBR<sub>max</sub> differed between bifurcations with low macrocalcification ( $r_s = 0.38$ ,  $p < 0.001$ ) versus high macrocalcification ( $r_s = 0.59$ ,  $p < 0.001$ ).

**Conclusions:** This is the first study to demonstrate increased uptake of both FDG and NaF in culprit carotid plaques, with discrete distributions of pathophysiology influencing vulnerability *in vivo*. This may benefit clinical management by guiding systemic anti-inflammatory therapy versus surgical management for predominantly diffuse inflammation or focal microcalcification respectively. It also emphasises microcalcification as a potential therapeutic target. Finally, this technique may aid detection of culprit but non-stenotic atheroma in embolic strokes of unknown source.

**Trial registration number:** N/A

## AS21-023

### ACUTE AND CHRONIC CEREBROVASCULAR DISEASE SEVERITY IS ASSOCIATED WITH CAROTID ATHEROMA INFLAMMATION

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**Background and Aims:** Inflammation within atherosclerosis promotes atheroma rupture and correlates with concentrations of circulating

matrix metalloproteinases. Matrix metalloproteinases are implicated in blood-brain barrier disruption, contributing to the development of chronic cerebral small vessel disease and larger acute infarct volumes. This study investigates the association between inflammation within carotid atherosclerosis and both acute and chronic cerebrovascular disease.

**Methods:** Individuals with ischaemic strokes with ipsilateral carotid artery stenosis of >50% underwent carotid <sup>18</sup>Fluoride-fluorodeoxyglucose-position emission tomography within 14 days of stroke. Small vessel disease severity (dichotomised using modified Fazekas scale) and infarct volumes were assessed using 3-Tesla MRI acutely and after 90 days.

**Results:** Of 26 participants, 15 had no/mild and 11 had moderate/severe small vessel disease. Adjusting for cardiovascular risk factors, average carotid artery fluorodeoxyglucose uptake (measured as maximum tissue-to-background ratio) was independently associated with more severe small vessel disease (OR 6.18, 95% CI 2.1-18.2,  $P < 0.01$ ). Average carotid artery fluorodeoxyglucose uptake was also independently associated with an increase in FLAIR lesion volume at 90 days (coefficient = 0.81,  $P < 0.01$ ).

**Conclusions:** We demonstrate that generalised inflammation within carotid atherosclerosis is independently associated with more severe chronic small vessel disease and adverse evolution of the acute infarct in the early post-stroke setting. These novel findings are important for understanding how vulnerable atherosclerosis may promote a "vulnerable brain" primed for injury, and have important implications for therapeutic exploitation in the management of systemic atherosclerosis, particularly non-stenotic disease previously considered asymptomatic, to reduce the burden of both acute and chronic cerebrovascular disease.

**Trial registration number:** N/A

## WITHDRAWN

### AS21-011

## PROGRESSION OF CAROTID NEAR-OCCCLUSION TO COMPLETE OCCLUSION: RELATED FACTORS AND CLINICAL IMPLICATIONS. RESULTS FROM CAOS, A MULTICENTER REGISTRY STUDY

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**Background and Aims:** The clinical consequences and factors related to the progression from a carotid near-occlusion to a complete occlusion are not well established. Our aim is to describe the rate, predictive factors and clinical implications of the progression to complete carotid occlusion (PCCO) in a population of patients with symptomatic carotid near occlusion.

**Methods:** We conducted a multicenter, nationwide, prospective study from January 2010 to May 2016. Patients with angiography-confirmed carotid near-occlusion were included. We collected information on demographic data, clinical manifestations, radiological and hemodynamic findings and treatment modalities. A 24-month carotid-imaging follow-up of the near-occlusion was performed.

**Results:** 141 patients included. Carotid-imaging follow-up could be performed in 122 patients. PCCO occurred in 40 patients (32.8%), and was more frequent in medically-treated patients (34 out of 61; 55.7%) compared with revascularized patients (6 out of 61; 9.8%),  $p < 0.001$ ). 7 of the 40 patients with PCCO (17.1%) suffered ipsilateral symptoms. The rate of symptomatic PCCO was higher in the revascularized patients group (50% compared to 11.8%,  $p = 0.023$ ) and symptoms were more severe. Factors independently related with PCCO in the multivariate analysis, were: age  $\geq 75$  years (OR 2.93 [95% CI 1.05 – 8.13]), revascularization (OR 0.07 [95% CI 0.02 – 0.20]), and collateral circulation through ipsilateral ophthalmic artery (OR 3.25 [95% CI 1.01 – 10.48]).

**Conclusions:** PCCO within 24 months occurs in more than half of patients under medical treatment. Most of the PCCO does not associate

ipsilateral symptoms. Revascularization reduces the risk of PCCO, but when it occurs, it frequently associates severe ipsilateral symptoms.

**Trial registration number:** N/A

## AS21-018

### THE HYBRID SURGERY COMBINED CAROTID ENDARTERECTOMY AND CAROTID ARTERY STENTING IMPROVED THE OUTCOME OF PATIENTS WITH HIGH RISK CAROTID STENOSIS

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**Background and Aims:** The perioperative complication rate of carotid stenosis patients should be controlled in fewer than 6% of symptomatic cases and 3% of asymptomatic cases. Therefore, we evaluate various factors and select the surgical option, carotid endarterectomy (CEA) or carotid artery stenting (CAS), whichever is safer. However, in case of long carotid plaque formation, both CEA and CAS could be high risk options. Based on our clinical experience, we developed hybrid surgery combined CEA and CAS and got successful outcome.

**Methods:** We prospectively analyzed 238 consecutive surgical cases in patients with carotid stenosis in New Tokyo Hospital, between January 2016 and December 2018. As our first option for carotid stenosis with short lesion, we choose CEA and for CEA high risk cases including restenosis type or long lesion type, we choose CAS. In case of long vulnerable plaque, as unusually high-risk group, we performed hybrid surgery combined CEA for vulnerable plaque part and CAS for distal or proximal part of carotid stenosis at one time.

**Results:** We performed CEA for 185 cases, CAS for 43 cases and hybrid surgery combined CEA and CAS for 10 cases. The perioperative complication rate was 0.8% in total cases including one acute occlusion case and one postoperative bleeding case in wound area of CEA group. During postoperative 30 days, we had no cerebral infarction case or fetal case.

**Conclusions:** We demonstrated the successful surgical outcome of carotid stenosis cases with developing hybrid surgery combined CEA and CAS.

**Trial registration number:** not applicable

## AS21-020

### PREDICTORS OF NEW ISCHEMIC LESIONS AFTER CAROTID REVASCULARIZATION

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**Background and Aims:** Diffusion-weighted imaging (DWI) has been used as a valuable tool to detect new embolic brain lesion. We aimed to analyze the association of the presence of new lesion on DWI after carotid intervention with the intervention procedural variables.

**Methods:** Consecutive clinical and imaging findings of patients who underwent CEA or CAS were collected ( $n = 159$ ). New ischemic lesions were defined based on DWI within 3 days after carotid intervention. TCD monitoring findings during surgical operation including number of microemboli (MES), status of collateral via Willis circle, and differences of peak systolic velocity and mean velocity between pre and post-operation were evaluated.

**Results:** We analyzed 116 patients who underwent DWI before and after carotid intervention (72 in the CEA group and 44 in CAS groups). DWI revealed new ischemic lesion in 53 patients (5 in female vs. 48 in male,  $p = 0.579$ ). This non-randomized study showed a higher

rate of postprocedural ischemic lesion on DWI after CAS compared with CEA (70.5% vs. 30.6%,  $p < 0.001$ ). There were no significant association between new lesions on DWI and symptomatic stenosis ( $p = 0.624$ ) or degree of stenosis ( $p = 0.498$ ). The numbers of MES during TCD monitoring showed trend for association with new lesion on DWI ( $p = 0.056$ ). Using a shunt during operation was only independent predictor of new lesion by multivariate analysis (OR 6.92, 95% CI 1.65 to 29.98,  $p = 0.008$ ).

**Conclusions:** New ischemic lesions on DWI occur more frequently after CAS than CEA. Restriction to selective shunting during CEA can reduce new ischemic lesion after carotid interventions.

**Trial registration number:** N/A

## AS21-024

### PERCEIVED VERSUS ACTUAL PREVALENCE OF SYMPTOMATIC CAROTID NEAR-OCCCLUSION

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**Background and Aims:** Carotid near-occlusion (CNO) is severe stenosis causing distal artery diameter decrease. The diameter decrease can range from partial to full collapse. CNO is often cited as rare but seems to be systematically underdiagnosed, so CNO might be substantially more common than perceived. The aim of this study was to compare perceived and actual prevalence of symptomatic CNO among all symptomatic  $\geq 50\%$  carotid stenosis.

**Methods:** One computed tomography angiography (CTA) expert manually re-reviewed 4403 consecutive CTAs and another CTA-expert audited all possible CNO cases. Ultrasound exams were found by several local database searches. We analyzed all cases with symptomatic  $\geq 50\%$  carotid stenosis. Actual prevalence was determined by CTA review. Perceived prevalence and causes for missed diagnoses were determined by review of medical records and imaging reports, blinded to CTA-findings.

**Results:** 519 patients with symptomatic  $\geq 50\%$  stenosis on CTA or ultrasound were included: 371 (71%) examined with CTA, remaining with ultrasound alone. Prevalence of CNO was 25% (92/371). Perceived prevalence of CNO was 4% (21/515; 4 missing data). 2 perceived CNOs were false positive. 2 CNOs (1%) were detected among those examined with ultrasound alone; hence 35 CNOs were likely missed among those with ultrasound alone (assuming a 25% CNO prevalence). Of 129 CNOs, 85% ( $n = 110$ ) were missed, caused by underdiagnosing with ultrasound (39%), CTA (20%), both ultrasound and CTA (36%) and misunderstood by clinician (5%).

**Conclusions:** Symptomatic CNO is common, but is perceived to be rare due to underdiagnosing with ultrasound (poor sensitivity) and CTA (poor image interpretation).

**Trial registration number:** N/A

## AS21-025

### CAROTID ULTRASOUND HAS A VERY LOW SENSITIVITY FOR NEAR-OCCCLUSION

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**Background and Aims:** Carotid near-occlusion (CNO) is a tight stenosis causing reduction of the distal artery diameter. Diameter reduction can be moderate (partially-collapsed CNO) or severe (fully-collapsed CNO). A recent study suggested peak systolic velocity (PSV) in the

stenosis as sufficiently high in 74% of CNOs to make them indistinguishable from  $\geq 50\%$  conventional stenosis. This study aim is to assess the sensitivity of CNO with carotid ultrasound.

**Methods:** One expert re-reviewed 4403 consecutive computed tomography angiographies (CTA). Another expert audited all possible cases of CNO. We analyzed patients with a  $\geq 50\%$  stenosis or occlusion on CTA and carotid ultrasound within 30 days of the CTA.

**Results:** 387 patients were analyzed, mean delay between exams was 5 days. Sensitivity for CNO with ultrasound was 16% (15/95, 95%CI 8–23%), specificity was  $>99\%$  (290/292) compared with CTA. Ultrasound had a higher sensitivity (29%) for fully collapsed CNO than for partially collapsed CNO (9%,  $p=0.02$ ). On ultrasound, 14% of CTA-diagnosed CNOs were mistaken as occlusion, 67% were mistaken as  $\geq 50\%$  conventional stenosis and 3% mistaken for  $< 50\%$  stenosis. Among 64 CNOs mistaken for  $\geq 50\%$  conventional stenosis on ultrasound, mean stenosis PSV (430 cm/s) was higher than for conventional  $\geq 50\%$  stenosis on both ultrasound and CTA (316 cm/s),  $p < 0.0001$  (t-test).

**Conclusions:** Carotid ultrasound has a very low sensitivity for CNO. Separating CNO and conventional symptomatic  $\geq 50\%$  carotid stenosis is relevant as recommended management differs. These results challenge that carotid ultrasound can be the sole preoperative modality before carotid endarterectomy.

**Trial registration number:** N/A

## AS21-027

### CAROTID NEAR-OCCCLUSION IS OFTEN OVERLOOKED WHEN CTA IS REVIEWED IN ROUTINE PRACTICE

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**Background and Aims:** Carotid near-occlusion (CNO) is a tight stenosis causing reduction of the distal artery diameter. The diameter reduction can be moderate (partially collapsed CNO) or severe (fully collapsed CNO). CNO is believed to be rare. However, many seem to omit the NASCET-grading requirement to first exclude CNOs before percent grading. CNOs might be overlooked when computed tomography angiographies (CTA) are assessed in routine practice. The purpose of this study was to assess how often CNOs are overlooked when CTA is routinely assessed.

**Methods:** One expert re-reviewed 4403 consecutive CTAs and another expert audited all possible cases of CNO. With these findings as reference, two comparisons were performed: (1) Clinical CTAs reported for consecutive cases with  $\geq 50\%$  carotid stenosis. (2) 14 selected CTA exams (8 typical CNOs and 6 controls) were analyzed by 13 radiologists who routinely assess CTAs for carotid stenosis, recruited from 10 hospitals across Sweden.

**Results:** In the local routine practice, imaging reports was 25% (23/91) sensitive for CNO, ranging between 0–75% between six neuroradiologists who reviewed  $>5$  CNO cases; specificity was 98% (286/292). For 13 radiologists reviewing the same 8 CNOs, the average sensitivity was 10% (10/104), ranging from 0–88%; specificity was 100% (78/78). 77% (10/13) of the radiologists missed all CNOs.

**Conclusions:** CNO seems to be systematically overlooked when CTA is interpreted in routine practice, likely by lack of attention to detail and erroneous application of grading criteria.

**Trial registration number:** N/A

## AS21-009

### PROGRESSION EVALUATION IN NUMBER AND TOTAL VOLUME OF ATHEROSCLEROTIC PLAQUE USING CAROTID DUPLEX SONOGRAPHY

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**Background and Aims:** We evaluated progression of total number and volume of atherosclerotic plaques developing in common (CCA) and internal carotid arteries (ICA) measured by carotid duplex sonography (CDU).

**Methods:** We analyzed CDU data of 134 ischemic stroke patients, who underwent initial and follow-up CDU for CCA and ICA of both sides between mean 2-years interval. Volume of individual plaques was calculated using a formula ( $V = (\pi \times a \times b \times c)/6$ ), a: longitudinal length, b: axial length, c: thickness of a plaque). Total plaque volume of a patient was obtained by summation of all plaque volumes measured in the patient. Total number and plaque volumes were compared between initial and follow-up CDU. Relationships of the plaque number and volume changes with the clinical and laboratory risk factors for atherosclerosis were also analyzed using multivariate analysis.

**Results:** Total plaque number of individual patients were increased from mean  $2.2 (\text{SD} \pm 1.7)$  on initial to  $3.1 \pm 2.0$  on follow-up CDU. Total plaque volume of individual patients was increased from mean  $0.9 \pm 1.2 \text{ mm}^3$  on initial to  $1.3 \pm 1.4 \text{ mm}^3$  on follow-up CDU. The total plaque increase was related with smoking history ( $p = 0.029$ ) and high-sensitivity C-reactive protein ( $p = 0.028$ ). Total plaque volume increase was related with smoking history ( $p = 0.017$ ) and blood creatinine ( $p = 0.024$ ).

**Conclusions:** We showed progression characteristics in the total number and volume of carotid atherosclerotic plaques in mean two-year follow-up. The sonographic characteristics of carotid plaques could provide useful information to expect the atherosclerosis progression in human body.

**Trial registration number:** N/A

## AS21-035

### MEAN PLATELET VOLUME DOES NOT PREDICT IN-STENT RESTENOSIS AFTER CAROTID ARTERY STENTING IN A CAUCASIAN POPULATION

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**Background and Aims:** Mean platelet volume (MPV) indicates platelet activity and could affect patient's risk for progressive atherosclerotic disease. In-stent restenosis (ISR) represents the major long-term complication after stenting of carotid steno-occlusive disease (CAS). In an Asian study population elevated MPV predicted ISR after CAS. However, the role of MPV on ISR-development following CAS in Caucasian patients is yet unknown.

**Methods:** We retrospectively identified all patients who underwent CAS due to atherosclerotic disease between 2005 and 2017. All patients were

followed clinically and by duplex sonography at one, three and six months, and annually after CAS. ISR was defined as a  $\geq 50\%$  stenosis (NASCET criteria) in the treated vessel. MPV was assessed before CAS, at last follow-up and at the time of ISR detection.

**Results:** Of 340 CAS patients, 49 (14%) had ISR (mean follow-up: 35 months). Compared to non-ISR patients, patients who developed ISR were younger (66 versus 69 years,  $p=0.028$ ), pre-interventionally more often had high-grade stenosis ( $\geq 80\%$ ; 16 versus 7%,  $p=0.030$ ) and more frequently were active smokers (41 versus 24%,  $p=0.011$ ). However, baseline MPV was not different in ISR compared to non-ISR patients (10.7 versus 10.6 fL,  $p=0.424$ ). MPV levels did not change from baseline to ISR-detection, and were not associated with the occurrence of stroke or TIA during the follow-up period ( $p>0.1$ ).

**Conclusions:** Opposed to reports in an Asian study population, MPV had no effect on the development of ISR after CAS in this larger group of Caucasian patients. Active smoking was the only modifiable risk factor for CAS-associated ISR.

**Trial registration number:** N/A

## AS21-005

### COGNITIVE PERFORMANCE CHANGE IN PATIENTS WITH CAROTID ARTERY STENOSIS UNDERGOING SURGICAL REVASCULARIZATION

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**Background and Aims:** The effects of carotid revascularization on the neurocognitive functioning still remains elusive. The aim of this study was to evaluate the changes in cognitive performance and their predictors in patients with symptomatic high-grade internal carotid artery (ICA) stenosis undergoing carotid endarterectomy (CEA).

**Methods:** Participants were patients who underwent CEA and had history of transient ischemic attack within the past 6 months due to ipsilateral severe ICA stenosis. Coloured Progressive Matrices plus Complex Figure Copy Test, and phonemic plus categorical Verbal Fluency tests were performed to assess right and left hemisphere cognitive functions, respectively. Cerebral hemodynamics was assessed with transcranial Doppler ultrasonography by means of the cerebral vasomotor reactivity (CVR) to hypercapnia.

**Results:** One hundred and ninety patients were enrolled. At 6 months from CEA, the scores obtained in the cognitive tests exploring the revascularized hemisphere's functions and ipsilateral cerebral hemodynamics were significantly improved. At multivariate linear regression analysis, the change in cognitive performance was inversely associated with age [ $\beta = -0.17$ , 95% confidence interval (CI) -0.23 to -0.12;  $p < 0.001$ ] and pre-operative CVR on the side of carotid stenosis ( $\beta = -6.10$ , 95% CI -7.21 to -4.98;  $p < 0.001$ ).

**Conclusions:** Cognitive performance and cerebral hemodynamics were enhanced after CEA in patients with symptomatic high-grade ICA stenosis. Age and brain hemodynamic status before stenosis correction predicted the changes in neurocognitive performance. Cerebral hemodynamics may be an independent determinant of cognitive dysfunction and a target for treatment in severe carotid artery disease.

**Trial registration number:** N/A

## AS21-001

### HEMODYNAMICS AND STROKE RISK IN SYMPTOMATIC INTRACRANIAL ATHEROSCLEROTIC DISEASE

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**Background and Aims:** To investigate whether hemodynamic features of symptomatic intracranial atherosclerotic stenosis (sICAS) might correlate with the risk of stroke relapse, using a computational fluid dynamics (CFD) model.

**Methods:** In a cohort study, we recruited patients with acute ischemic stroke attributed to 50–99% ICAS confirmed in CT angiography (CTA). With CTA-based CFD models, translesional pressure ratio [PR = Pressure (post-stenotic)/ Pressure (pre-stenotic)] and translesional wall shear stress ratio [WSSR = WSS (stenotic-throat)/ WSS (pre-stenotic)] were obtained in each sICAS lesion. Translesional PR  $\leq$  median was defined as low PR and WSSR  $\geq$  4th quartile as high WSSR. All patients received standard medical treatment. The primary outcome was recurrent ischemic stroke in the same territory (SIT) within 1 year.

**Results:** Overall, 245 patients (median age 61 years; 63.7% males) were analyzed. Median translesional PR was 0.94 (interquartile range, IQR 0.87–0.97); median translesional WSSR was 13.3 (IQR 7.0–26.7). SIT occurred in 20 (8.2%) patients, mostly with multiple infarcts in the borderzone and/or cortical regions. In multivariate Cox regression, low PR (adjusted hazard ratio, HR = 3.16;  $p = 0.026$ ) and high WSSR (adjusted HR = 3.05;  $p = 0.014$ ) were independently associated with SIT. Patients with both low PR and high WSSR had significantly higher risk of SIT than those with normal PR and WSSR (risks 17.5% versus 3.0%; adjusted HR = 7.52;  $p = 0.004$ ).

**Conclusions:** This work represents a step forward in utilizing computational flow simulation techniques in studying intracranial atherosclerotic disease. It reveals a hemodynamic pattern of sICAS that is more prone to stroke relapse, and supports hypoperfusion and artery-to-artery embolism as common mechanisms for ischemic strokes in such patients.

**Trial registration number:** N/A

## AS21-043

### CEREBROVASCULAR REACTIVITY MAPPING WITHOUT GAS CHALLENGE IN PATIENTS WITH ASYMPTOMATIC CAROTID STENOSIS

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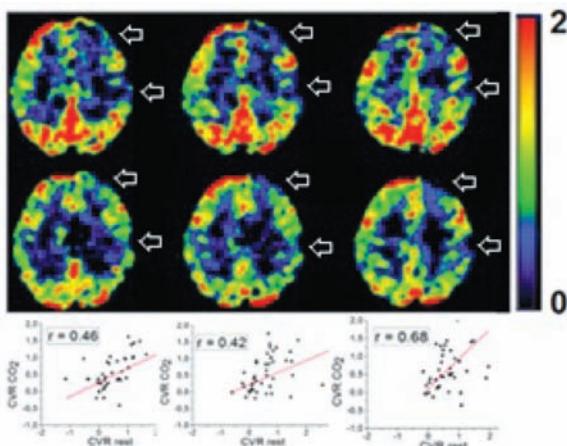
**Background and Aims:** Cerebrovascular Reactivity (CVR) mapping is typically performed using vasoactive challenges, during acquisition of

magnetic resonance imaging based on the blood oxygenation level (BOLD-MRI)<sup>1</sup>. However, there are inherent difficulties in such methodology, especially in elderly patients. We tested a new method<sup>2</sup> using BOLD images acquired at rest to map CVR in patients with asymptomatic carotid stenosis.

**Methods:** Five patients (age:  $64 \pm 8$  years) participated in this study after approval by the research ethics committee. BOLD images were acquired during resting state and under hypercapnia (carbon dioxide inhalation). Image preprocessing and analysis are described in detail in the literature<sup>2</sup>.

**Results:** Figure 1 shows the CVR maps (three slices) acquired under hypercapnia (upper line) and resting state (centerline) of a representative patient. The arrows indicate regions of reduced CVR consistent with the stenosis side.

**Conclusions:** Good correlation of CVR values was obtained comparing the two methods, as shown in the bottom line of figure 1 (r: Pearson's correlation;  $p < 0.05$ ). Therefore, we showed the feasibility of mapping CVR using BOLD-MRI during resting state. Results were consistent with the conventional CO<sub>2</sub> inhalation-based CVR maps.



Trial registration number: N/A

## AS21-029

### SIMULTANEOUS ASSESSMENT OF PLAQUE MORPHOLOGY, MICRO-EMBOLIC SIGNAL STATUS AND PLATELET BIOMARKERS ENHANCES UNDERSTANDING OF THE PATHOGENESIS OF SYMPTOMS IN SYMPTOMATIC & ASYMPOTOMATIC CAROTID STENOSIS PATIENTS

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**Background and Aims:** The relationship between plaque morphology, cerebral micro-embolic signals (MES) and platelet biomarkers in carotid stenosis is unclear.

**Methods:** Data were combined from 2 prospective, multi-centre, observational studies ('Platelets And Carotid Stenosis' and 'HaEmostasis In carotid STenosis') which assessed patients with recently symptomatic and asymptomatic moderate ( $\geq 50\text{-}69\%$ ) or severe ( $\geq 70\text{-}99\%$ ) carotid stenosis. Plaque morphology on Doppler ultrasound was graded with Gray-Scale Median (GSM) scoring. Bilateral transcranial Doppler ultrasound of middle cerebral arteries classified patients as 'MES+ve' or 'MES-ve'. Full blood counts were analysed and whole-blood flow cytometry quantified platelet CD62P and CD63 expression, leucocyte-platelet complex formation and % reticulated platelets.

**Results:** Data from 42 'recently symptomatic patients' ( $\leq 4$  weeks of TIA/ischaemic stroke) were compared with 36 asymptomatic patients. There were no differences in median GSM scores between symptomatic and asymptomatic patients (25 vs. 30;  $P = 0.31$ ). 7/42 (16.7%) symptomatic patients and 0/36 asymptomatic patients were MES+ve ( $P = 0.013$ ). There were no differences in median GSM scores between MES+ve vs. MES-ve symptomatic patients (36 vs. 25;  $P = 0.09$ ). Symptomatic patients with echodense plaques (GSM scores  $\geq 25$ ) had higher platelet counts (228 vs.  $191 \times 10^9/\text{L}$ ;  $P = 0.02$ ), neutrophil-platelet (3.3 vs. 2.7%;  $P = 0.03$ ), monocyte-platelet (6.3 vs. 4.55%;  $P = 0.02$ ) and lymphocyte-platelet complexes (2.91 vs. 2.53%;  $P = 0.001$ ) than 'asymptomatic echodense' patients. Reticulated platelets were not increased in any group/subgroup.

**Conclusions:** Recently-symptomatic carotid stenosis patients with echodense plaques have enhanced platelet production/secretion/activation compared with their asymptomatic counterparts. Simultaneous assessment with neurovascular-imaging and platelet biomarkers enhances our understanding of the pathogenesis of symptoms and may aid risk-stratification in carotid stenosis patients.

Trial registration number: N/A

## AS21-012

### ULTRASONOGRAPHIC AND HAEMODYNAMIC CHARACTERISTICS IN A MULTICENTER REGISTRY OF PATIENTS WITH SYMPTOMATIC CAROTID NEAR-OCLUSION.

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Princesa, Neurology, Madrid, Spain; <sup>17</sup>Hospital Universitario de Burgos, Neurology, Burgos, Spain

**Background and Aims:** The pathophysiology of stroke in symptomatic carotid near-occlusion (SCNO) remains unclear, as well as the diagnostic role of techniques such as ultrasonography. We aimed to describe the ultrasonographic and hemodynamic characteristics of patients with SCNO.

**Methods:** A multicenter, nationwide, prospective study was conducted from January 2010 to May 2016. Patients with angiography-confirmed SCNO were included. We collected information on clinical and demographic characteristics, ultrasonography findings, presence of full-collapse, collateral circulation and cerebrovascular reactivity (CVR).

**Results:** 141 patients were included, 120 (85.1%) were men, with a mean age of 68.71 ( $\pm$  9.05) years. Ultrasonographic and angiographic diagnosis of near-occlusion were concordant in only 44.4%. This disagreement was related to the presence or absence of full-collapse: 64.3% of patients who were misclassified with ultrasound as a carotid occlusion had a SCNO with full-collapse, and 85% of the cases interpreted as severe stenosis had a SCNO without full-collapse. Mean velocities (mV) and pulsatility indexes (PI) were significantly lower in the middle cerebral artery ipsilateral to the SCNO (43.25cm/s vs 58cm/s,  $p < 0.001$ ; 0.8 vs 1,  $p < 0.001$ ). Collateral circulation was identified in 92.2% of patients, with the anterior communicating artery (73%) being the most frequent. The CVR was decreased or exhausted in 66% of patients and did not differ with the presence/absence of full-collapse or collateral circulation.

**Conclusions:** Diagnostic concordance between ultrasonography and angiography for SCNO is poor. Decreased ipsilateral mV, PI and CVR suggest that a hemodynamic compromise may be involved in the pathophysiology of stroke in SCNO.

**Trial registration number:** N/A

## AS21-039

### ACUTE BIHEMISPHERIC STROKES FROM A SINGLE CAROTID SOURCE: FREQUENCY AND RISK FACTORS

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**Background and Aims:** Incidence and natural history of acute bihemispheric strokes (ABS) are poorly known. Aim of our study was to identify frequency, associated factors, and outcome of a consecutive series of ABS patients from a single carotid source, focusing on the Willis' polygon morphology.

**Methods:** In the ASTRAL registry (2003–18), we retrospectively reviewed data from anterior ABS patients affected by carotid atherosclerosis or dissection on DWI-MRI. Overall Willis' patency or incompleteness (i.e. absence/hypoplastic AI, PI, anterior/posterior communicating arteries) was recorded. Patients with bihemispheric lesions were compared with patients with unilateral lesion in a matched 1:3 analysis for age, grade of stenosis and TOAST. A multivariate analysis was performed to identify independent factors associated with ABS.

**Results:** Out of 186 patients with single carotid source (16% dissections), we identified 24 (13%) ABS patients. In the univariate analysis on the matched cohort, patients with ABS had lower diastolic blood pressure on admission (73 vs. 87 mmHg,  $p = 0.007$ ), more frequently contralateral internal carotid (ICA) occlusion ( $p = 0.046$ ) and absence of anterior communicating artery (ACoA) (70% vs. 25 %,  $p < 0.001$ ). On multivariate analysis, contralateral ICA occlusion and absence of ACoA were independent predictors of ABS (OR = 15.64; 95%CI:2.09-117.25 and OR = 9.19; 95%CI:2.86-25.00, respectively). ABS was associated to higher recurrence rate (18.2 vs 4.5%,  $p = 0.060$ ) and worse 3-month outcome (median mRS 3 vs 1,  $p = 0.012$ ).

**Conclusions:** Occlusion of contralateral ICA and absence of ACoA were predictors of bilateral ischemic lesions in stroke due to single carotid artery source. These findings suggest an important role of hemodynamic mechanisms in the pathogenesis of ABS.

**Trial registration number:** N/A

## AS21-015

### DIFFERENTIAL PROTEIN EXPRESIÓN IN SYMTOMATIC VS. ASYMPOTOMATIC CAROTID STENOSIS: NON-INVASIVE IDENTIFICATION OF VULNERABLE PLAQUE.

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**Background and Aims:** Carotid stenosis is one of the most prevalent causes of stroke. Surgical treatment is effective in symptomatic carotid stenosis (CS) >70%, with marginal benefit in CS 50–70%, and arguable benefit in asymptomatic CS>70%. The main objective was to identify non-invasive specific markers of vulnerable plaques that would make possible to identify high and low risk patients, allowing a better selection of patients to indicate surgical or intensive medical treatment.

**Methods:** Consecutively admitted patients with symptomatic CS >70% and with asymptomatic CS >70%. Endarterectomy samples were collected and serum samples were obtained immediately before endarterectomy. Proteomic analysis in both, surgical pieces of atheromatous plaques and serum samples, was performed by SDS-PAGE followed by liquid chromatography-mass spectrometry (LC-MS/MS). Then, we identified those proteins with differential expression between symptomatic and asymptomatic patients (plaques and serum) and finally those that was coincident in both, plaques and serum samples, were quantified by quantitative proteomics (SWATH-SM).

**Results:** We identified almost 100 proteins, mainly integrated in the immune system routes, signal transduction and hemostasis, with different plaque expression on symptomatic vs asymptomatic patients. At serum level, significant differences were detected in 79 proteins (symptomatic vs progressive asymptomatic), 89 proteins (symptomatic vs stable asymptomatic), and 21 proteins between the two types of asymptomatic patients. The main interest lies in 10 identified proteins found simultaneously in both, plaque and serum samples.

**Conclusions:** We have identified a differential protein expression pattern between symptomatic and asymptomatic CS, that can be evaluated non-invasively in peripheral blood samples. These finding could be of interest in making clinical decision.

**Trial registration number:** N/A

**AS21-036**

**CEREBRAL HEMODYNAMIC EFFECTS OF ENHANCED EXTERNAL COUNTERPULSATION (EECP) THERAPY IN NORMAL HEALTHY INDIVIDUALS- PRECLUDE TO A PHASE IIB/IIIA TRIAL FOR SYMPTOMATIC AND SEVERE INTRACRANIAL STENOSIS**

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**Background and Aims:** Enhanced External counter-pulsation (EECP) improves coronary perfusion, similar to intra-aortic balloon counterpulsation, and recruits arterial collaterals within ischemic territories. We evaluated the effects of EECP on middle cerebral artery (MCA) blood flow in normal controls as a first step to initiate a clinical trial in patients with severe stenosis of intracranial internal carotid or middle cerebral artery (MCA).

**Methods:** Healthy volunteers were assessed for baseline mean flow velocities (MFV) in both MCAs with transcranial Doppler (TCD). Standard EECP therapy was administered for 30-minutes during which both MCAs were continuously monitored by TCD. Physiological correlates of EECP-TCD waveform morphology were used to evaluate mean flow velocity (MFV) augmentation of MCAs.

**Results:** Ten subjects were enrolled in the study. Pre-EECP MCA TCD measurements were within normal limits. Onset of EECP produced an immediate change in TCD waveform configuration with the appearance of a second upstroke at the dicrotic notch, called as peak diastolic augmented velocity (PDAV). Although end-diastolic velocities did not increase, peak-diastolic-flow-velocities (PDAV) were significantly higher than baseline ( $P < 0.05$ ) during the EECP therapy. Augmented MFVs (aMFVs) were also significantly higher than baseline MFV in both MCAs ( $P < 0.05$ ). Compared to the pressure needed for optimum augmentation of finger plethysmograph (250–300mmHg), MCAs required much lower pressures (160–200mmHg) for similar augmentation.

**Conclusions:** EECP induces marked changes in cerebral arterial waveforms and augmented peak diastolic and mean flow velocities in MCA. We hypothesize that similar to the cardiac benefits, EECP therapy would improve cerebral hemodynamics and reduce recurrent ischemic events in patients with severe intracranial stenosis.

Trial registration number: N/A

**AS21-006**

**WHITE MATTER HYPERINTENSITY DETERMINES ISCHEMIC STROKE PHENOTYPE IN SYMPTOMATIC CAROTID ARTERY STENOSIS**

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**Background and Aims:** We studied predictors of the stroke severity in symptomatic carotid artery stenosis patients by using multimodal imaging

technique. Especially, we focused on the relationship between white matter hyperintensities (WMHs) and stroke severity.

**Methods:** We retrospectively collected patients with symptomatic carotid stenosis admitted to Samsung Medical Center from January 2011 to December 2016. Stroke severity score was based on National Institutes of Health Stroke Scale (NIHSS) and categorized into three levels; Transient Ischemic Attack (TIA), minor Stroke (NIHSS 1~4), moderate to severe stroke (NIHSS 5 ~). Information from carotid duplex sonography, brain magnetic resonance imaging and demographic profiles was analyzed. WMH was assessed by the exact volume of the WMHs measured by MIPAV program.

**Results:** We gathered 184 patients who had symptomatic carotid stenosis. The number of patients who had TIA, minor stroke, and moderate to severe stroke were 58 (31%), 68 (38%), and 58 (31%), respectively. In the multivariate logistic analysis, WMH volume had positive relationship with stroke severity (TIA vs. minor stroke, OR = 1.074, 95% CI = 1.008-1.142,  $p = 0.028$ ; TIA vs. moderate to severe stroke, OR = 1.166, 95% CI = 1.074-1.266,  $p < 0.001$ ; minor vs. moderate to severe stroke, OR = 1.041, 95% CI = 1.008-1.075,  $p = 0.014$ ). There was a strong correlation between WMHs and stroke severity. ( $r = 0.367$ ,  $p < 0.001$ )

**Conclusions:** Our data showed association between underlying WMHs and stroke phenotype in symptomatic carotid artery stenosis. Burden of WMHs could contribute to the vulnerability to ischemic insult in large artery atherosclerosis.

Trial registration number: N/A

**AS21-010**

**MONITORING OF PATIENTS AFTER CAROTID SURGERY IN A STROKE-INTENSIVE UNIT.**

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**Background and Aims:** Carotid artery stenosis is a major cause of ischemic stroke. The effectiveness of carotid endarterectomy (CEA) for moderate-to-severe asymptomatic or symptomatic stenosis has been established in large randomized trials, but this procedure is not without risk. Complications such as myocardial infarction, stroke, bleeding and late carotid restenosis should be expected in the postoperative phase.

**Methods:** In our institution patients after CEA are transferred to the Stroke-Intensive Unit for 72 hours to ensure comprehensive postoperative care. We have retrospectively analysed the data of patients observed in our department between 2016 and 2018.

**Results:** The data on complications from a total of 212 patients (age:  $69.02 \pm 7.12$  years, 28,3% female) were analysed. The most common events are shown in Table I.

Complication	Carotid artery stenosis		Total (n = 212)
	Asymptomatic (n = 85)	Symptomatic (n = 127)	
Stroke	0	2	2 (0,94%)
Acute Myocardial Infarction	0	1	1 (0,47%)
Minor Bleeding	9	10	19 (8,96%)
Major Bleeding	0	1	1 (0,47%)
TIA	4	11	15 (7,07%)
Death	0	2	2 (0,94%)

Table 1. Number of complications after CEA

**Conclusions:** Our data show that severe complications after CEA are rare, but their occurrence should be expected, especially in patients with symptomatic disease. Management of postoperative stroke is challenging due to the contraindication of thrombolytic therapy. Therefore, monitoring patients in a Stroke-Intensive Unit after CEA could be recommended

to ensure routine postoperative tasks and the availability of urgent recanalization procedures (mechanical thrombectomy and surgical thrombus removal).

**Trial registration number:** N/A

## AS21-002

### SURGICAL TREATMENT OF CAROTID ARTERY STENOSIS USING PLAQUE DIAGNOSIS

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**Background and Aims:** We have two surgical methods for the treatment of severe carotid stenosis, although the choice of carotid endarterectomy (CEA) or carotid artery stenting (CAS) has not been established. This report presents appropriate treatment strategy using plaque diagnosis and the clinical results of CEA and CAS.

**Methods:** After plaque diagnosis was made by carotid ultrasonography (carotid US) and black blood magnetic resonance imaging (BB-MRI), CEA was first choice for patients with soft atherosclerotic plaques and severe calcified plaques. CAS was first choice for patients with stable plaques and plaques at higher cervical level. From January 2001 to December 2018, we surgically treated carotid stenosis in 303 lesions by CEA and 337 lesions by CAS.

**Results:** Stenosis of carotid arteries was relieved in all cases after CEA or CAS. Perioperative mortality with CEA and CAS was 0.3% (1/303) and 0.3% (1/337), respectively. Morbidity by ischemic stroke with CEA and CAS was 2.3% (7/303) and 1.5% (5/337), respectively. Surgical morbidity was not high in patients with medical risk factors.

**Conclusions:** Carotid stenotic lesions can be treated with comparably low morbidity and mortality rates using CEA and/or CAS even with medical high risks, when appropriate surgical methods are selected considering each characteristic of carotid stenosis using plaque diagnosis.

**Trial registration number:** N/A

## AS21-026

### PREVALENCE AND PREDICTIVE FACTORS OF CAROTID STENOSIS IN THE PREVENTIVE ANTIBIOTICS IN STROKE STUDY (PASS)

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**Background and Aims:** Current prevalence of carotid stenosis in acute ischemic stroke patients is reported at 15–20%, but is based on older studies and up-to-date numbers remain unknown. The aim of this study was to assess the prevalence and predictors of carotid artery stenosis in acute stroke.

**Methods:** We included patients from a randomized, multicenter, open-label trial. 2538 patients were included and randomized between no antibiotic treatment or ceftriaxone on the stroke care unit. Patients with transient ischemic attacks were not included. A multivariable logistic regression analysis was performed with carotid artery stenosis ≥50% as dependent variable with backward selection of smoking (current and former), hypertension, hypercholesterolemia and gender as independent variables and was tested for multi-collinearity.

**Results:** 1425 patients with ischemic stroke of the anterior circulation and a known status of the carotid artery were included in the current analysis. Mean age was 72.91 years (standard deviation (SD) 13.46) and mean NIHSS was 8.95 (SD 7.25). A prevalence of 18.7% was found for carotid stenosis ≥50%. Multivariable logistic regression showed an odds ratio for age (per year) of 1.02 (95% confidence interval (CI), 1.007–

1.033,  $p=0.002$ ), for current smoking 1.78 (95% CI, 1.3–2.42,  $p<0.001$ ), for hypertension 1.39 (95% CI, 1.05–1.83,  $p=0.022$ ) and for gender 1.84 (95% CI, 1.38–2.45,  $p<0.001$ ).

**Conclusions:** Prevalence of carotid stenosis was 18.7%. Age, gender, hypertension and current smoking were predictive factors for the presence of carotid stenosis in stroke. This implies that treatable risk factors such as smoking and hypertension are important factors associated with carotid stenosis.

**Trial registration number:** ISRCTN66140176

## Case Reports

### AS35-089

### SPINAL INFARCTION OR ACUTE TRANSVERSE MYELITIS DIAGNOSIS DILEMMA

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**Background and Aims:** Acute bilateral leg weakness can be due to spinal cord infarction and transverse myelitis.

Acute Transverse Myelitis is a rare condition with an incidence estimated at 300 new cases per year in the UK.

Spinal stroke incidence is rare and accounts 0.3 to 1% of the total strokes.

**Case report**

**Methods:** 62 years female previously fit presented with one hour history of acute onset of lower limbs weakness associated with crushing cramps in the back of thighs.

**Results:** Her power in lower limbs was 0/5 in right and 1/5 in left, with absent reflexes, loss of tone, loss of pain, temperature sensations in lower limbs with a sensory level between T6 to T8 and absent anal tone. MRI lumbosacral spine showed ill defined signal changes in lower thoracic cord and conus on T2. Contrast MRI lumbosacral spine revealed oedema of lower thoracic cord with no enhancement. Tertiary neurology team advice was to treat as spinal infarction. 5th day lumbar puncture performed considering acute transverse myelitis. CSF result: Protein 2241, Glucose 2.8, Oligoclonal Bands Negative. PCR was negative for viruses. Patient treated for acute transverse myelitis by steroids. Second week power in lower limbs improved to 2/5 and regained knee jerks. MRI Lumbosacral spine on 15th day showed that the focal lesion in the thoracic cord and conus had partially regressed. Patient is able to walk few steps with Zimmer frame after 6 months of rehabilitation.

**Conclusions:** Acute transverse myelitis can present like spinal cord infarction. MRI and Lumbar puncture are vital in differentiating.

**Trial registration number:** N/A

### AS35-069

### INFRATENTORIAL SUPERFICIAL SIDEROSIS SECONDARY TO EPIDURAL ANGIOLIPOMA

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**Background and Aims:** Superficial infratentorial siderosis (iSS) is a rare condition where chronic subarachnoid bleeding causes iron-mediated neural degeneration and a wide range of neurological manifestations. Numerous etiologies have been described, mainly dural lesions or tumours. Iron-sensitive MRI sequences are the cornerstone for the diagnosis. We present a case of iSS secondary to epidural angiolioma.

**Methods:** 75-year-old woman presented with 2-year history of gait disturbance. Neurological examination showed bilateral sensorineuronal

hearing loss; proximal limb weakness, deep tendon reflexes diffusely brisk; bilateral hypoesthesia at hands and lower limbs, with feet hypopallesthesia and proprioceptive impairment; wide-based and unsteady gait with positive Romberg sign.

**Results:** Our patient presented with a progressive posterior-lateral spinal syndrome and hearing loss. Blood tests were negative for vitamin deficits, hormonal, infectious or autoimmune diseases. Brain and spinal cord MRI with T2 gradient echo sequence showed hemosiderin deposition along the surface of brainstem, cerebellum and all segments of spinal cord. An epidural dorsal angioma was identified. Cerebro-spinal fluid (CSF) was xanthochromic with slightly increased protein count. iSS secondary to chronic bleeding from angioma was diagnosed. Surgery of angioma was not considered and medical treatment with diperiprone, an iron chelator, was discontinued due to lack of clinical efficacy and gastrointestinal complaints.

**Conclusions:** iSS, a recent described disorder, should be considered when progressive neurological symptoms develop. Early diagnosis and treatment of its cause, if possible, is the best strategy to decrease the neuronal toxicity secondary to hemosiderine deposits. To our knowledge, angioma has never been described as the cause of chronic bleeding leading to iSS.

**Trial registration number:** N/A

## AS35-090

### CASE REPORT- YOUNG FEMALE PATIENT WITH CEREBRAL VENOUS SINUS THROMBOSIS, PULMONARY THROMBOEMBOLISM AND PHLEBOTHROMBOSIS

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**Background and Aims:** We present a 35 years old female patient that had acute onset of headache, nausea, vomitus, vertigo, photosensitivity, audiosensitivity and afterwards impaired consciousness. Previous risk factors included hyperthyreosis and tachycardia and positive familial anamnesis for vascular diseases. Urgent computer tomography of the brain showed cerebral venous thrombosis with haemorrhagic transformation. The patients than developed increased body temperature and suffered series of complex motor seizures. She was hospitalized at the Neurosurgery clinic for 10 days, and then transferred to the Neurology clinic.

**Methods:** On admission the patient was somnolent, aphasic, with right sided hemiplegia, with increased level of D-dimers ( $>4500$ ). Computer tomography and CT angiography of the lungs showed acute, massive bilateral pulmonary thromboembolism, with thrombus in the pulmonary trunk, with extension in both pulmonary arteries, both interlobar branches and bilaterally in the basal pulmonary segment branches of the lower lobe. Doppler of the lower extremities revealed phlebothrombosis on the left leg. Genetic testing showed homozygote mutation for MTHFR C677T.

**Results:** During the hospitalization, the patient was treated with anti-coagulation, antiedematous, antiepileptic, antibiotic and other symptomatic therapy. Her condition gradually improved, and she was discharged after 3 weeks in stable condition. Control CT of the lungs was normal and control CT of the brain showed postapoplectic lesion. She was prescribed oral anti-coagulation therapy, antiepileptic therapy and other symptomatic therapy.

**Conclusions:** Patients with cerebral venous thrombosis should be thoroughly investigated because they have many comorbidities, that should be treated in order to have favourable outcome

**Trial registration number:** N/A

## AS35-051

### DURAL ARTERIOVENOUS FISTULA PRESENTING AS A CEREBRAL VENOUS THROMBOSIS: CASE REPORT

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**Background and Aims:** We present a case of a 55 year old lady who presented to the hyperacute stroke unit with a generalized seizure following a two day history of headache and right sided homonymous hemianopia. An urgent CT brain showed a left occipital intracranial haemorrhage, first reported as a possible haemorrhagic transformation of an infarct. However the clinical presentation and location of the haemorrhage raised suspicion of a cerebral venous thrombosis (CVT). CT cerebral venogram demonstrated an acute or chronic venous sinus thrombosis/occlusion with associated dural arteriovenous fistula (dAVF). Transfer was arranged to the regional neurosurgical centre where a Type IIb dAVF of the left transverse sigmoid junction with thrombosis was confirmed angiographically. The patient underwent successful endovascular embolization.

A dural arteriovenous fistula is an abnormal direct connection between a dural artery and a dural venous sinus, cortical vein or meningeal vein. These are graded by venous drainage in the Cognard classification. dAVF of grade IIb-V carry an annual mortality of  $\approx 10\%$  and a haemorrhage risk of  $\approx 8\%$ .

**Methods:** N/A Case Report

**Results:** N/A Case Report

**Conclusions:** This case illustrates an important clinical differential to a cerebral venous thrombosis where management can impact the outcome. The management of CVT requires anticoagulation whereas dAVF commonly requires endovascular intervention and the avoidance of anticoagulation.

**Trial registration number:** N/A

## WITHDRAWN

**AS35-105****REVERSAL AGENT IDARACIZUMAB FOR THE MANAGEMENT OF INTRACEREBRAL HAEMORRHAGE IN DABIGATRAN TREATED PATIENT: A CASE REPORT.**

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**Background and Aims:** Dabigatran is a non-vitaminK-antagonizing oral anticoagulant (NOAC) licensed for stroke prevention in patients with atrial fibrillation. Like for other NOACS its main advantage, compared to Warfarin, is the lower risk of intracranial haemorrhage. In 2016 Idaracizumab, a specific antidote for the reversal of the anticoagulant effect of Dabigatran was approved. Our aim of our paper is to illustrate the role of Idarucizumab in emergency situations such as major bleeding.

**Methods:** A 81-years-old female was admitted to our Hospital due to acute onset of right limbs weakness and speech disorder [NIH stroke scale (baseline)= 24 points]. Due to atrial fibrillation the patient was taking dabigatran 150 mg bid. Last dose was taken 5.5 hours before symptoms onset. CT on admission revealed acute cortical-subcortical ischemia, with haemorrhagic infarction in the frontal-parietal left hemisphere and in the semioval centre. Considering the haemorrhagic infarction idaracizumab 2,5 mg x 2 was immediately administered in ER, followed by neurosurgery evaluation

**Results:** Throughout the recovery in our department clinical picture remained unchanged. Follow-up CT the day after admission revealed overlapping picture to the previous CT. On discharge on day 3 symptoms remained unchanged (NIH-SS = 24).

**Conclusions:** In Dabigatran-associated intracranial haemorrhage, Idarucizumab represents a new therapeutic tool in order to avoid bleeding expiation or prevention of intracranial haemorrhage. The clinical experience reported in this case confirms the efficacy and safety of Idarucizumab, highlighting its role in improving patient safety in emergency situations requiring rapid reversal of the anticoagulant effect of Dabigatran.

**Trial registration number:** N/A

**AS35-040****FIRST TRIAGE OF A PATIENT WITH ACUTE VERTIGO USING A TELEMEDICALLY CONTROLLED VIDEO-HEAD IMPULSE TEST (vHIT) SYSTEM**

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**Background and Aims:** Acute dizziness is a common symptom in emergency departments. Stroke has to be distinguished from vestibular diseases. Existing telestroke videoconference systems are not sensitive enough to detect subtle eye movements, neither able to examine head impulse test.

The aim was to test feasibility of a triage system in emergency departments of primary care hospitals deploying a telemedical vHIT System.

**AS35-118****ACUTE ISCHEMIC STROKE BY RADIAL ARTERY AVULSION AS RARE COMPLICATION IN CARDIAC ANGIOPLASTY**

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**Background and Aims:** Radial access is preferred for most cardiac catheterization and angioplasty procedures due to decreased risk of vascular complications or excessive bleeding. However, radial artery avulsion may result in embolism of endothelial tissue fragments.

**Methods:** We are reporting the case of a 34-year-old male, smoker, with extensive coronary artery disease (previous myocardial infarction), presented with left side hemiparesis shortly after percutaneous coronary angioplasty through radial access.

**Results:** Neurologic examination identified drowsiness, left hemiparesis and hypoesthesia, dysarthria, scoring 13 points on the National Institute of Health Stroke Scale (NIHSS).

Cerebral computed tomography angiography showed hyperdense material in the proximal segment of the right middle cerebral artery (MCA) and subsequent stenosis of the vascular lumen (85–90%), with signs of acute stroke in the right cortical temporo-parietal region on the non-contrast enhanced computed tomography of the brain.

Mechanical thrombectomy was performed at 2 hours from symptom onset, with retrieval of "white" thrombus and favorable clinical outcome: the patient scored 4 points on the NIHSS scale 24 hours after the procedure and was discharged from the hospital four days later (NIHSS = 0). Histopathological analysis of the extracted fragment was compatible with vascular intima.

Follow-up magnetic resonance imaging of the brain showed stigmas of subacute stroke in the right MCA territory.

**Conclusions:** Cerebral embolism may be due to various cardiac dysfunctions. In this particular case report, the embolism occurred through vascular endothelial damage due to the catheter tip during coronary angioplasty. Successful thromboaspiration performed in the right MCA allowed for favorable clinical outcome.

**Trial registration number:** N/A

**Methods:** An existing vHIT was integrated into an adapted telemedicine videoconference system. An algorithm based on the HINTS rule (Head-Impulse-test, Nystagmus, Test of Skew) for patients with acute dizziness was developed. The first two steps identify internal medicine causes and focal neurological signs (examined via videoconference). For step three to five, vHIT system is used to test for eye movement disturbances (slow eye movements, skew deviation, nystagmus, head impulse test) and Dix-Hallpike-manoeuvre. Patients with acute unilateral vestibular hypofunction or positional vertigo are admitted to normal ward, all others to stroke unit.

**Results:** Triage was successfully applied in a videoconference on a 30 years old man, suffering from acute vertigo with nausea and headache since the previous day. Tests showed no abnormal results, he was admitted to stroke unit with suspicion of central cause. Further examinations with MRI-Scan, duplexsonography of brain vessels and echocardiography showed normal results. Due to accompanying headache vestibular migraine was presumed as possible diagnosis for the central vestibular syndrome.

**Conclusions:** Telemedical examination of patients with dizziness using an integrated vHIT system within a defined triage algorithm is feasible and may overcome lack of neurootological expertise in rural areas.

**Trial registration number:** N/A

## AS35-096

### TANGIER DISEASE AND CEREBRAL AMYLOID ANGIOPATHY: A CASE REPORT AND LITERATURE REVIEW

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**Background and Aims:** Tangier disease (TD) is a rare genetic disease of recessive autosomal inheritance caused by a mutation in adenotriphosphate-binding cassette A1 (ABCA1) gene located on chromosome 9, leading to the production of a defective ABCA1 protein, a transporter that regulates cholesterol efflux. It is characterized by very low HDL cholesterol (<0.1g/L) and apolipoprotein A1 levels, and by cholesterol deposits in non-adipose tissues and premature atherosclerosis.

**Methods:** We report the case of a 63 year-old woman, with a genetically-proven TD and on low-dose aspirin following stenting for asymptomatic coronary disease, who presented with recurrent lobar intracerebral hemorrhages (ICH; five in 2 years).

**Results:** Brain MRI also revealed one lobar microbleed and predominantly posterior leukoencephalopathy (Figure 1). Given this picture consistent with probable cerebral amyloid angiopathy (CAA), she underwent 18F-florbetapir positron emission tomography (PET) which revealed high diffuse cortical tracer binding (Figure 2A). The absence of hippocampal dysfunction on neuropsychological tests, the normality of CSF tau and phosphotau levels and the absence of abnormal tracer distribution (except for the ICH areas) on FDG PET (Figure 2B) together argue against incipient coincidental Alzheimer disease.

**Conclusions:** The association of very active CAA and TD in this patient raises the possibility of an interaction between the two conditions. Accordingly, animal studies have suggested a link between TD and CAA, involving ABCA1 as a key factor of brain and vascular amyloid beta-peptide (A beta) aggregation and deposition via an ABCA1-ApoE-

A-beta axis. This in turn provides a plausible explanation for an accelerated CAA disease process in the context of TD.

**Trial registration number:** N/A

## AS35-085

### HAEMORRHAGIC AND ISCHAEMIC STROKE IN CARDIAC ANGIOSARCOMA

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**Background and Aims:** Cardiac tumours are uncommon with primary malignant cardiac tumours being extremely rare. They are associated with high risk of embolic stroke. We describe a patient with an intracranial haemorrhage and then bilateral MCA infarcts who was subsequently diagnosed with a primary cardiac angiosarcoma.

**Methods:** N/A

**Results:** A 42 year old female presented with a 3 week history of malaise and breathlessness. Her past medical history was breast carcinoma for which she underwent curative treatment. Examination and vital signs were initially normal. She developed right sided hemiparesis, CT brain showed large left hemispheric intracerebral haemorrhage which required neuro surgical evacuation. There was no aneurysm or other vascular abnormality demonstrated on CT angiogram. MRI brain was performed which showed no evidence of brain metastasis but bilateral acute MCA territory infarcts. A left atrial mass was demonstrated on echocardiogram. Treatment dose heparin was commenced and she underwent surgical resection of the left atrial mass. Tumour histology revealed epithelioid angiosarcoma. She made a very poor neurological recovery and was discharged home with palliative care support.

**Conclusions:** The location of the tumour in the left atrium was unusual for a cardiac angiosarcoma and associated with very high risk of emboli. The mechanism of ICH in this case was not clear with no cerebral metastasis or aneurysm demonstrated on neuroimaging, the patient was too unwell to undergo digital subtraction angiography. Cardiac tumours are a rare but important cause of embolic stroke in young patients and should be considered in the presence of unexplained constitutional or cardiac symptoms.

**Trial registration number:** N/A

## AS35-079

### INTRACRANIAL ATHEROSCLEROSIS: THE COMMON VASCULITIS MIMIC

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**Background and Aims:** Cerebral vasculitis is rare and can present as stroke in multiple vascular territories. Workup excluding vasculitis mimics and secondary causes is important to provide appropriate treatment.

**Methods:** N/A

**Results:** We present a 41-year-old male with history of medication non-compliance, diabetes, hyperlipidemia, hypertension, headaches, and right middle cerebral artery (MCA) ischemic stroke, who developed intermittent episodes of hemisensory loss and a left homonymous hemianopsia. MRI confirmed an acute left occipital stroke and the prior right middle cerebral artery stroke, and CT angiography showed focal narrowing in the right posterior cerebral artery (PCA) and MCA's bilaterally, initially concerning for possible secondary vasculitis. His extensive work-up was significant for triglycerides of 458mg/dL, A1c of 11.7 % (consistent with history of medication non-compliance), 1:80 ANA, cerebral spinal fluid (CSF) protein of 917 mg/dL without a pleocytosis, ESR of 10, and otherwise negative infectious, rheumatologic, and hypercoagulability labs.

Direct angiography confirmed diffuse intracranial stenosis most prominent in the right PCA and two dural arteriovenous fistulas in the left temporal lobe. Abrupt cessation of CSF flow on 2 LP attempts and elevated CSF protein prompted acquisition of MRI of his spine, which showed diffuse epidural lipomatosis, ligamentum flavum thickening, and prominent lumbar disc protrusion causing canal stenosis, leading to a diagnosis of pseudo-Froin's syndrome.

**Conclusions:** This is a case of a young patient presenting with multiple strokes and imaging findings concerning for vasculitis, with work up ultimately more consistent with intracranial atherosclerosis from medication non-compliance and poor risk factor control, illustrating the broad differential for cerebral vasculopathies.

**Trial registration number:** n/a

## AS35-135

### CONSTANT "EARWORM" AFTER AN ISCHEMIC STROKE

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**Background and Aims:** "Earworms" are catchy songs that are continuously heard in the absence of auditory input. Most reports of stroke induced auditory hallucinations are from strokes in the brain stem. Auditory hallucinations associated with cortical infarcts typically involve the temporal lobe and hallucinations present as the perception of speech. We present a patient with auditory hallucinations that were songs rather than speech.

**Methods:** n/a

**Results:** A 67-year-old man developed the sudden onset of a left-sided hemiparesis and dysarthria in the context of new atrial fibrillation. He received thrombolysis, but was not a candidate for thrombectomy due to a large core infarct involving the right motor cortex, dorsal right superior frontal gyrus, and temporal lobe. His stroke was determined to be cardioembolic, and anticoagulation was started. Following discharge, he complained of auditory hallucinations of childhood songs, like "Puff the Magic Dragon" that were constantly present and distressing. He denied hearing loss or psychiatric history and had two routine EEGs that did not show seizure activity. Neurological exam was significant for a left superior quadrantanopia, left facial weakness, mild dysarthria, spastic left-sided hemiparesis, and left sided neglect. He experienced the auditory hallucinations constantly for 11 months.

**Conclusions:** This case illustrates that in the absence of psychiatric disease or seizures musical hallucinations may be induced by an infarction in the right middle cerebral artery distribution that primarily injured the right frontal and temporal lobes. Though the mechanism is unclear, recognition of this uncommon syndrome is important when structuring rehabilitation and management for stroke patients with this disorder.

**Trial registration number:** n/a

## AS35-102

### SICKLE CELL DISEASE AND SPINAL CORD INFARCTION: A CHALLENGE IN COUNTRIES WITH FEW RESOURCES

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**Background and Aims:** There is evidence that sickle-cell disease represents a state of hypercoagulability. Spinal cord infarction in patients with

sickle cell disease is an extremely rare event. The approach involves exclusion other pathologies and the transfusion-exchange has an important role in the prognosis. The authors present a case of a young woman with sickle cell disease and spinal cord infarction.

**Methods:** N/A

**Results:** CASE REPORT 17-year-old female patient with sickle cell disease. She was admitted to the Emergency for a clinical presentation with a three-day course characterized by arthralgia in the upper limbs and non-specific malaise. The assessment at admission did not have alterations in the neurological examination. After 48 hours of hospitalization, began with cervical pain and tetraparesis was installed. Neurological examination revealed flaccid tetraparesis of grade III in the right hemibody and grade II in the left hemibody, decreased tendon reflexes and decreased pain and tactile sensitivity. MRI showed hypersignal T2 and FLAIR in the medullary-bulb transition associated with a slight increase in regional ischemic locus dimensions in the territory of the anterior spinal artery. Medicated with support measures, folic acid, sodium heparin and hemotransfusion. It was not possible to perform transfusion-exchange because of local unavailability.

**Conclusions:** The diagnosis and approach of this pathology constitute a challenge, especially in countries with low diagnostic and therapeutic resources.

**Trial registration number:** N/A

## AS35-076

### "UNUSUAL CAUSE OF LEFT INTERNAL CAROTID ARTERY OCCLUSION SECONDARY TO LATE COMPLICATION OF NECK CANCER RADIOTHERAPY"

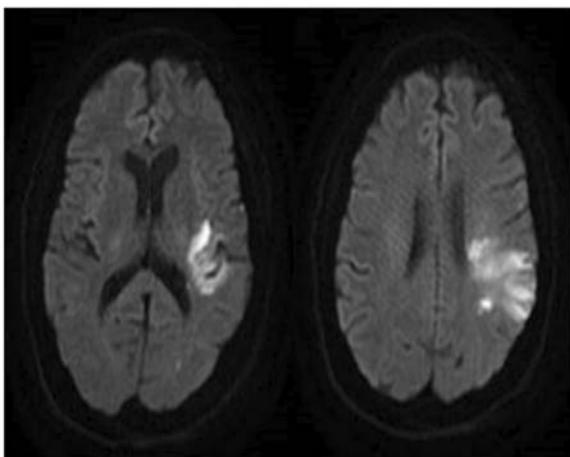
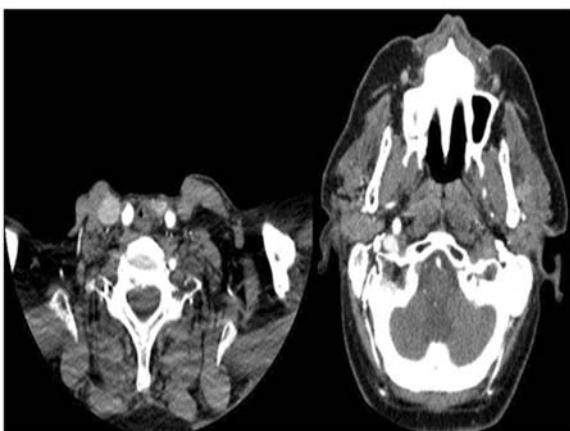
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**Background and Aims:** To present a rare case of a young patient with ACMI stroke due to complete occlusion of ACII secondary to radiotherapy for laryngeal cancer 10 years earlier.

**Methods:** A 59-year-old man ex-smoker, who underwent epidermoid carcinoma of the larynx treated with radiotherapy and chemotherapy, who was admitted with a progressive 48-hour progression of Hemiparesis and hypostasis right body. The patient progresses with right central facial palsy and motor aphasia. It is diagnosed of acute ischemic stroke of ACMI secondary to post-radiotherapy ACII occlusion.

**Results:** Complete blood analysis was performed normal, head CT without significant findings, Angio CT of TSA and polygon of Willis where occlusion of ACII is described in its origin with adequate flow of ACMI by contralateral filling, in brain MRI Acute / subacute ischemic infarction is visualized in ACMI territory, TSA Doppler: CII occluded from its origin and occluded right vertebral and echocardiogram without significant findings.



**Conclusions:** Progressive vascular arteriopathy is an infrequent late side effect of radiotherapy, with the carotid artery being the most frequent affection (30–40% of patients after cervical RT). The damage usually appears 10 years after irradiation. The pathophysiological mechanism is identical to that of arteriosclerosis fibrous thickening of the intima with marked endothelial proliferation and lipid accumulation in the absence of inflammatory vasculitis. The treatment is similar to that of atherosclerosis, although endarterectomy is more expensive due to fibrosis. Radiotherapy has been associated, infrequently, with CVA several years after irradiation due to the progressive involvement of the extracranial and intracranial arteries.

**Trial registration number:** N/A

### AS35-107

#### BICKERSTAFF BRAINSTEM ENCEPHALITIS WITH EXTENSIVE MEDULLARY INVOLVEMENT. AN UNUSUAL STROKE MIMIC

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**Background and Aims:** Bickerstaff brainstem encephalitis (BBE) is a rare disease included in the clinical and immunological spectrum of Miller-Fisher syndrome. It has an autoimmune etiology, usually mediated by anti-GQ1b antibodies.

**Methods:** We report a case of BBE mimicking acute stroke as clinical debut that received early immunosuppressor treatment.

**Results:** 24-year-old male patient with relevant medical history of sporadic ketamine consumption. He was attended at emergency department with wake-up symptoms of lower facial paralysis and dysarthria. Neurological examination showed a complex ophthalmoplegia with multiple bilateral cranial nerve palsies, multidirectional nystagmus, dysarthria and right dysmetria. Myotatic reflexes were globally increased. A multiparametric-CT was performed without showing any alteration. CSF tests had normal values. Urgent MRI was performed, demonstrating an extensive medullary hyperintensity. The patient was admitted at the ICU after clinical worsening with poorly secretion management and compromised airway. Orotracheal intubation was performed. Aciclovir IV and a 5-day immunoglobulin treatment was indicated due to the presumptive autoimmune etiology, which was eventually confirmed by positive CSF antiGM2-IgM antibodies.

The patient progressively recovered during the next 29 days of hospitalization. Electroneurography/electromyography did not show any alteration. The patient was clinically asymptomatic at 3 months.

**Conclusions:** This case report emphasises the importance of an early diagnosis of stroke mimics, which can lead to a rapid clinical worsening. Immunosuppressor treatment and compromised upper airway awareness is essential if BE is suspected. Our patient had a good clinical outcome despite showing extensive medullary involvement. The current evidence of anti-GM2 antibody-mediated BE is scarce and dysimmune neuropathies have been more frequently reported.

**Trial registration number:** N/A

### AS35-108

#### ACUTE ISCHEMIC STROKE AND A NOVEL DRUG USE: IS THERE AN ASSOCIATION?

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**Background and Aims:** Mephedrone is a popular new psychoactive substance, structurally related to amphetamine. It is mainly consumed among specific populations (specially men who have sex with men). Mephedrone has been related with tachycardia, hemodynamic changes and a case of myocardial infarction, but so far stroke has not been reported.

**Methods:** Case report

**Results:** A 32 year old male with previous history of HIV infection, treated with darunavir, cobicistat, emtricitabine, tenofovir, with CD4 above 500, was admitted in our comprehensive stroke center with acute right hemiplegia, hemihypoesthesia, hemianopia and aphasia (NIHSS 18). Multimodal computed tomography (CT) revealed occlusion of left middle cerebral artery (MCA segment M1), ASPECTS of 5/10 and CT perfusion (pCT) revealed a mismatch of 70–80% in maps of flow and volume. He underwent successful mechanical thrombectomy (TICI 2c), with improvement of neurological deficits. He was discharged 7 days after symptoms onset with mild aphasia (NIHSS 1). No small vessel, carotid or aortic vasculopathy was detected. Prolonged heart rhythm monitoring did not disclose any cardioembolic arrhythmia. Transthoracic echocardiography and thrombophilia studies were non-contributory, without detectable right to left shunt. Patient reported occasional mephedrone use, particularly the night before symptoms onset. He was discharged with treatment with acetylsalicylic acid, and a recommendation to avoid mephedrone and other recreational substances.

**Conclusions:** Herein we describe the first case of ischemic stroke profile associated with mephedrone use. Although a definite causal

association cannot be established, this report contributes to further explore this potential stroke risk factor in specific populations.

**Trial registration number:** N/A

AS35-110

## **RECURRENT DURAL SINUS THROMBOSIS AS MAIN FINDING IN BEHÇET DISEASE.**

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**Background and Aims:** Behçet disease may affect central nervous system as parenchymal or non-parenchymal Neurobehçet, the latter mainly as dural sinus thrombosis. Dural sinus thrombosis is most frequently monophasic, and recurrence is exceptional.

#### **Methods:** Case report

**Results:** A 13 year old male with history of recurrent pharyngitis was admitted because of fever, headache and diplopia. Examination showed left sixth nerve palsy and bilateral papilledema. Blood tests showed markers of systemic inflammation. Cerebrospinal fluid and computerized tomography were non-contributory. Magnetic resonance image (MRI) showed left transverse sinus thrombosis. Thrombophilia tests were negative. Recurrent oral ulcers, HLA-B51 and positive pathergy test allowed the diagnosis of Behcet disease. Treatment with prednisone (20 mg), colchicine and acenocumarol was prescribed, with thrombosis resolution in MRI at 6 months. Eighteen months after disease onset, headache and diplopia recurred, with bilateral papilledema and right sixth nerve palsy at examination. MRI showed right transverse sinus thrombosis. Prednisone dosage was raised to 40 qid.. MRI at 2 months showed complete recanalization, and steroids were tapered. Two years afterwards, the patient was admitted again because of new onset headache and papilledema. MRI disclosed superior longitudinal dural sinus thrombosis. Steroids were resumed, in addition to acenocumarol. Azathioprine 50 mg was prescribed as steroid sparing therapy and maintained indefinitely, while acenocumarol was stopped 2 years later. No further neurologic symptoms have been noted in seven year follow-up.

**Conclusions:** We describe a exceptional case of recurrent dural sinus thrombosis as the main manifestation of Behcet disease. Optimized immunosuppressant therapy and anticoagulation, were critical to obtain a sustained response.

Trial registration number: N/A

AS35-066

## A CASE OF ACUTE BILATERAL MEDIAL MEDULLARY INFARCTION

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**Background and Aims:** Medial medullary infarcts are rare and represents less than 1% of posterior circulation strokes. We present a case which posed significant diagnostic challenge both clinically and radiologically mainly due to the bilateral anatomical involvement.

#### **Methods: Case report**

**Methods:** Case report  
**Results:** A 65 year-old gentleman with a history of atrial fibrillation and hypertension experienced an acute reduction in visual acuity and altered sensation of all four limbs. He presented to the emergency department the following day after developing dizziness and ataxia. Past pointing and intention tremor were seen in the left upper limb. Initial CT head scan only showed an old established infarct, and MRI brain was reported

normal. Over the next 24 hours he developed progressive weakness of limb and bulbar muscles necessitating intubation. Guillain-Barre Syndrome was suspected and intravenous immunoglobulins administered. No improvement was noted and a lumbar puncture was inconclusive. Subsequent MRI brain and cervical spine scans showed acute bilateral medial medullary infarction along the vascular territory of the anterior spinal artery which was not obvious in the initial MRI scan. He was started on anti-platelet treatment and made slow recovery. He was extubated but required a long-term tracheostomy.

**Conclusions:** Bilateral infarctions in the medial medulla are very rare and may present with varied clinical features. Extensive literature review showed only one previous case report of medial medially syndrome clinically mimicking a peripheral polyneuropathy. This case is being presented for the rarity of the condition and also to highlight the diagnostic challenges it can pose.

**Trial registration number:** N/A

AS35-092

# ISCHEMIC STROKE AND MASSIVE RIGHT ATRIAL THROMBUS AFTER CATHETER ABLATION FOR ATRIAL FIBRILLATION

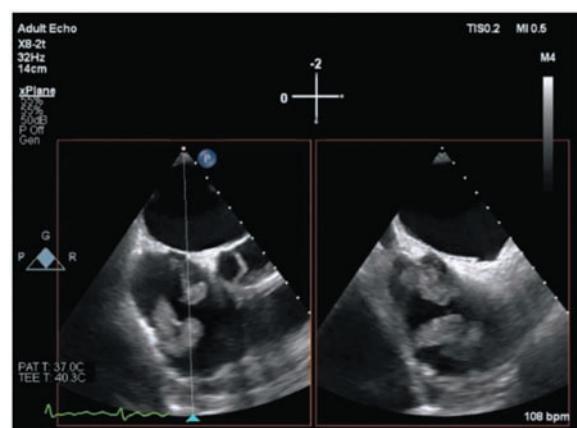
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S. García Madrona<sup>1</sup>, C. Matute Lozano<sup>1</sup>, Á. Beltrán Corbellini<sup>1</sup>,  
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**Background and Aims:** Left atrial catheter ablation (LACA)-associated stroke is an infrequent complication after atrial fibrillation ablation. Periprocedural right atrial thrombus is a well-known complication but paradoxical embolism in this context has not been described yet.

#### **Methods: Case report**

**Results:** A fifty-four-year-old man presented to our emergency department with an acute onset of speech impairment due to a left hemispheric ischemic stroke. He had a past medical history of atrial fibrillation on dabigatran 150 mg bid. Two days before admission, he went through a transseptal pulmonary vein ablation. A transesophageal echocardiography (TEE) showed a massive thrombus in the right atrium, along with a small atrial septal defect that had not been seen during the procedure. Venous ultrasound of lower extremities showed deep vein thrombosis. CT angiography revealed subclinical pulmonary thromboembolism, renal and spleen infarctions. The patient was treated with unfractionated heparin for five days, changing to low-weight molecular heparin thereafter. Subsequent TEE showed a right atrium free of thrombus.



**Conclusions:** This report describes a rare case of paradoxical embolism LACA-associated stroke with a right atrial thrombus, pulmonary embolism, deep vein thrombosis and systemic arterial infarctions.

**Trial registration number:** N/A

### AS35-013

#### INTRAVENOUS THROMBOLYSIS AND MECHANICAL THROMBECTOMY IN PATIENTS WITH ISCHEMIC STROKE AFTER TAVI

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**Background and Aims:** Transcatheter Aortic Valve Implantation (TAVI) is an increasingly treatment modality for severe aortic stenosis, which is associated with a considerable peri-procedural risk of stroke. To date, the clinical safety and efficacy of intravenous recombinant tissue Plasminogen Activator (tPA) and thrombectomy in stroke post-TAVI is not established. We describe a case-series of 12 patients from the Imperial College TAVI Registry.

**Methods:** TAVI periprocedural stroke was defined according to the consensus criteria. Using our prospective case series from January 2008 to December 2016, we described the demographics, imaging features and clinical management of twelve patients presenting with stroke after TAVI.

**Results:** Our prospective series included 349 patients, 12 (3.50%) patients suffered a stroke (Table 1). One patient received tPA therapy while two patients were treated with thrombectomy (Figure 1).

**Conclusions:** This case series emphasizes the importance of early recognition and management of stroke symptoms after a TAVI procedure. Patients should be managed in a hyperacute stroke centre (HASU) with access to thrombolysis and thrombectomy. The use of tPA in patients with acute stroke after TAVI should be considered on a case by case basis only and mechanical thrombectomy should be the standard of care in the presence of large vessel occlusion (Figure 2).

**Trial registration number:** N/A

### AS35-059

#### STROKE FOLLOWING SURGERY

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**Background and Aims:** Adverse neurological outcomes of surgery and anesthesia can be devastating. The incidence of perioperative stroke is rarely reported. We reported two case series of patients who experienced stroke after performing surgical procedure under general anesthesia.

**Methods:** Case series of 2 patients, patient 1, 38-years-old female with history of uterine fibroids who underwent hysterectomy, complained right sided weakness and symptoms of increased intracranial pressure six hours after surgery. Patient 2, 65-years-old male with decreased of consciousness, twelve hours after performing eye surgery under general anesthesia.

**Results:** A 38-years-old female complained right sided weakness six hours after hysterectomy under general anesthesia. She then experienced decreased of consciousness in addition to vomiting. Brain CT scan shows an intracranial hemorrhage on the left temporoparietal lobe, intraventricular haemorrhage and subarachnoid hemorrhage. The patient then underwent decompressive craniectomy and hematoma evacuation. After surgery, she was treated with Mannitol and Nimodipine. A week

later, Brain CT Scan evaluation shows decreased of intracranial hemorrhage with no appearance of subarachnoid hemorrhage. The patient was then discharged after fourteen days of hospitalization with right hemiparesis as a sequel. A 65-years-old male, experienced decreased of consciousness twelve hours after performing eye surgery under general anesthesia. Brain CT scan shows a lacunar infarct on the left external capsule. He was treated with Aspirin. After 6 days his consciousness improved and was then discharged from the hospital 10 days after that without sequel.

**Conclusions:** Stroke following surgery is uncommon case, and is difficult to prevent.

**Trial registration number:** N/A

### AS35-024

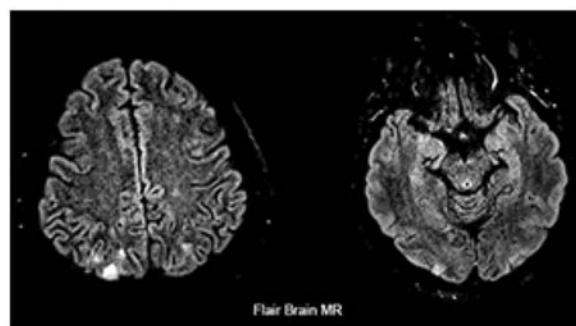
#### CO-OCCURRENCE OF POSTERIOR REVERSIBLE ENCEPHALOPATHY SYNDROME AND PERIPARTUM CARDIOMYOPATHY: IS THERE A CONNECTION BETWEEN THESE TWO RARE AND REVERSIBLE PATHOLOGIES?

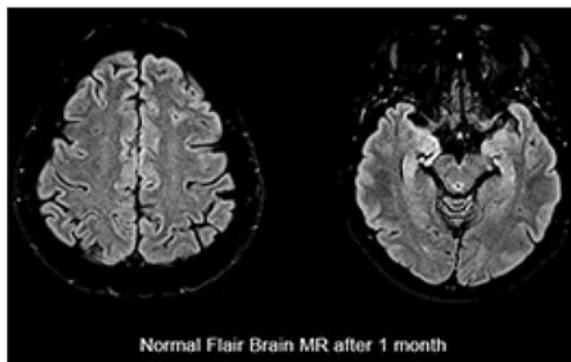
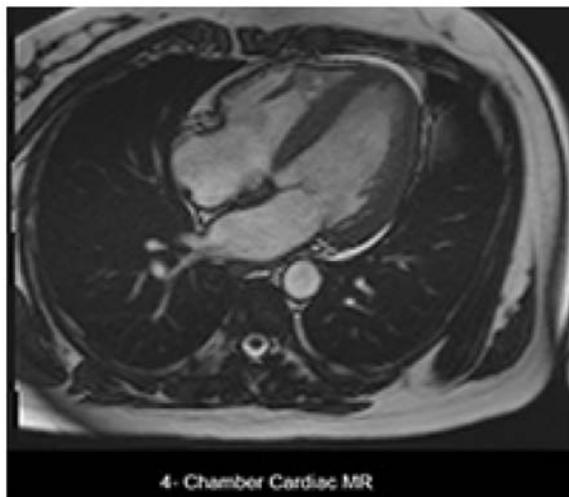
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**Background and Aims:** Posterior reversible encephalopathy syndrome (PRES) is a clinicoradiological disorder characterized by acute-onset neurological symptoms (typically seizures, encephalopathy, headache and visual disturbances) and subcortical vasogenic brain oedema. PRES is generally reversible and can be related to heterogeneous aetiologies including eclampsia. Peripartum cardiomyopathy (PPCM) is a rare cause of heart failure (HF) that affects women late in pregnancy or in the early puerperium. Also PPCM can be reversible and the incidence is higher in preeclampsia. Here we report a patient who developed PRES and subsequently PPCM 6 days after delivering and we discuss the possible pathophysiological link.

**Methods:** The patient was a 41 year-old woman who developed headache, seizures, left hemianopia and hemiparesis 6 days after cesarean delivery. Brain MRI was in keeping with the diagnosis of PRES. 3 days after she acutely developed HF with a left ventricular ejection fraction of 35% without other identifiable causes. Within 2 weeks the patient completely recovered from both neurologic and cardiologic disorders.





**Results:** In patients with PRES a susceptible endothelium might be injured by an inflammatory response characterized by cytokine release modulating the production of VEGF and nitric oxide (NO). This vascular pathway lead to breakdown of the BBB and increase vascular permeability generating vasogenic oedema. Similarly PPCM seems to have vascular pathophysiology, related to oxidative stress and inflammation. In fact cytokines elevation, VEGF and NO are involved also in PPCM.

**Conclusions:** In conclusion postpartum PRES and PPCM could have a common pathophysiology and might share future developing therapies.

**Trial registration number:** N/A

#### AS35-091

#### TRANSIENT NEUROLOGICAL SYMPTOMS (TNS) HERALDING INTRACRANIAL HAEMORRHAGE IN PATIENT WITH CEREBRAL AMYLOID ANGIOPATHY (CAA): A CASE REPORT

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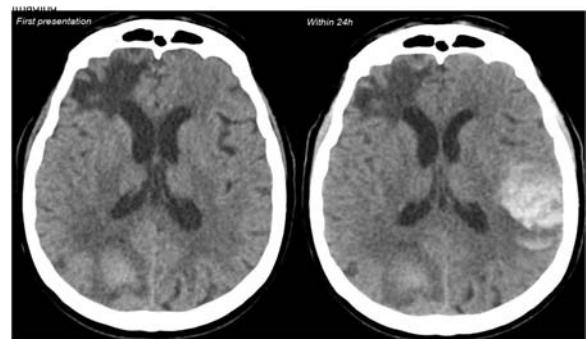
**Background and Aims:** Case report

A 71-year old woman presented to the emergency department (ER) in January 2019 with sudden onset transient faciobrachial hypoesthesia.

Family mentioned that there had also been an episode of confusion earlier. Upon further questioning, her husband confirmed comprehension problems rather than confusion. She had been admitted a few months earlier because of a spontaneous intracerebral haemorrhage (ICH) which led to the probable diagnosis of CAA.

Clinical examination and CT scan (see below) were both unremarkable and she was discharged with the diagnosis of an amyloid spell. Within 24 hours she was readmitted to the ER because of persisting confusion. Examination showed sensory aphasia. Urgent imaging revealed a large left parietal lobar haemorrhage.

**Methods:** Imaging



#### Results: Discussion

The interesting aspect about this case is that the preceding episode of "confusion" was actually transient sensory aphasia, the exact same symptom with which she presented the following day. This time however the symptoms persisted, which prompted new imaging and the diagnosis of the haemorrhage. Our hypothesis is that the TNS might have been an, on CT imaging, undetectable microbleed, which then evolved into a lobar haemorrhage.

**Conclusions:** To our knowledge this is the first published case where an ICH occurred so early after TNS which presented itself with the same deficit. Of course this may be mere coincidence, however the close association in both timing and vascular territory might have been a herald of the ICH yet to come. Is it worth considering MRI imaging in the acute setting?

**Trial registration number:** n/a

#### AS35-088

#### A CASE OF REVERSIBLE CEREBRAL VASOCONSTRICION SYNDROME: ANOTHER AETIOLOGY PROPOSED

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**Background and Aims:** Reversible cerebral vasoconstriction syndrome (RCVS) encompasses a diverse group of disorders mainly characterised by reversible multifocal stenosis of cerebral arteries usually presenting as sudden severe (thunderclap) headaches with or without associated neurological deficits. Our case illustrates the complex aetiology of this syndrome and highlights the challenge its diagnosis and management poses in the context of this multifactorial origin.

**Methods:** We describe a case of a young lady with RCVS and associated infarcts post tumour debulking.

**Results:** A 38 year-old woman was referred to neurosurgery following a one year history of deteriorating memory, headaches, absence episodes and anxiety attacks. MRI revealed a left temporal intrinsic brain tumour

for which she went awake de-bulking, leading post-operatively to a pseudomeningocoele local to the surgical site. A lumbar drain was therefore sited but resulted in low pressure headaches, which were treated with IV caffeine. In tandem, she experienced recurrent episodes of confusion, word-finding difficulties and right hand paraesthesia. Further brain imaging revealed multiple areas of infarction, diffuse irregularity of intracranial vessels with beading and multi-focal stenoses with post-stenotic dilatation. She was treated with a 6 week course Nimodipine and suffered no further strokes. Follow up 6 month MRA revealed resolution of the vessel changes and clinical improvement.

**Conclusions:** The association of RCVS with vasoactive substances including caffeine is well described. However, understanding the link with tumour resection, altered CSF dynamics and intracranial hypotension is also important in some cases, especially in the absence of headache, and in an appropriate clinical context

**Trial registration number:** N/A

#### AS35-054

### SIMULTANEOUS TREATMENT OF MULTIPLE CEREBRAL EMBOLI AND ACUTE EMBOLIC LIMB ISCHAEMIA BY INTRAVENOUS THROMBOLYSIS IN A PATIENT WITH NEW ATRIAL FIBRILLATION

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**Background and Aims:** Acute ischaemic stroke and acute ischaemic limb are potentially disabling clinical manifestations of arterial embolism. We present a case with rare occurrence of 4 simultaneous large emboli as a result of atrial fibrillation (AF), treated with intravenous thrombolysis.

**Methods:** A retrospective case review

**Results:** An 83-year-old lady with history of dementia presented with sudden unresponsiveness. On admission, GCS was 9/15(E4V1M4) and NIHSS 34. She was found to have new AF. CT angiogram and CT perfusion showed a proximal left M1 occlusive embolus, a right M2 embolus and a non-occlusive distal basilar embolus with perfusion mismatch and penumbra in all corresponding territories. Her left leg was also pale, cold and pulseless. Leg ultrasound showed an occlusive clot in the popliteal artery. She received intravenous Alteplase 1 hour 30 minutes post-onset. During infusion, consciousness improved and the popliteal pulse and colour of her leg returned to normal and repeat leg ultrasound showed complete reperfusion of the occluded artery. Repeat CT head showed a small infarct in the left MCA territory. At the time of discharge to a residential home, she had normal motor function with a degree of dysphasia and dysphagia.

**Conclusions:** In this unique case, intravenous thrombolysis led to full resolution of 3 out of 4 emboli. Although catheter-directed thrombolysis or embolectomy are preferred treatments for acute arterial limb ischaemia, intravenous thrombolysis was successful in our case. This case highlights the importance of awareness of simultaneous multi-territorial emboli in patients with AF, as prompt recognition and treatment can avoid catastrophic clinical outcomes.

**Trial registration number:** N/A

#### WITHDRAWN

#### WITHDRAWN

disclosed abnormalities in 8 patients (multifocal irregularities). In 16 patients, VW-MRI revealed a concentric contrast enhancement of arterial walls, localized in multiple vascular territories, suggesting angiitis. Abnormalities on DSA and VW-MRI were consistent in all patients. Diagnosis of probable PACNS was retained in 11 patients. Diagnosis of secondary vasculitis was retained in three patients. No patients had brain biopsy.

**Conclusions:** This case series underlies the added value of Vessel Wall-MRI to the diagnosis of underlying intracranial vasculopathy, particularly PACNS, without the use of invasive endovascular techniques, and concur in discriminating between the different mechanisms assumed to be involved in CS pathophysiology.

**Trial registration number:** N/A

### AS35-093

#### TO TEST WHETHER CEREBROLYSIN ADMINISTRATION IMMEDIATELY AFTER THROMBECTOMY IS FEASIBLE AND SAFE IN THE STROKE UNIT OF BOTKIN MUNICIPAL HOSPITAL MOSCOW

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**Background and Aims:** To test if Cerebrolysin administration immediately after thrombectomy is feasible and safe in the stroke unit

**Methods:** Patients suffered from acute ischemic stroke were transferred to the Botkin Municipal Hospital for thrombectomy after acute care in the primary hospital. Thrombectomy was performed by using a stent retriever (Solitaire<sup>®</sup>) and aspiration. Within one hour after thrombectomy patients were treated with the neuroprotective drug Cerebrolysin (30 mL). Treatment with Cerebrolysin was continued once daily for another nine days. NIHSS and mRS were assessed at arrival and discharge 10 days post-stroke.

**Results:** Case 1. Female, 74 years, suffered from cardioembolic stroke with right M1 MCA occlusion. At admission NIHSS 17, mRS 5, no thrombolysis (rivaroxaban administration) was performed. Time to door (TTD) was 320 min, time to recanalization (TTR) was 35 min. At discharge NIHSS 5, mRS 2. Case 2. Female, 63 years suffered from cardioembolic stroke with left M1 MCA occlusion. At admission NIHSS 18, mRS 5, rt-PA thrombolysis was performed. TTD was 290 min, TTR was 45 min. At discharge NIHSS 6, mRS 2. Case 3. Female, 43 years suffered from stroke due to coagulopathy (oral contraceptive drugs administration) with left ICA and M1 MCA occlusion. At admission NIHSS 20, mRS 5, no thrombolysis was performed. TTD was 330 min, TTR was 45 min. At discharge NIHSS 12, mRS 3. Cerebrolysin was well tolerated, no patient experienced any adverse events and all patients recovered well.

**Conclusions:** In these cases, adding Cerebrolysin to comprehensive recanalization treatment was safe and further research seems feasible.

**Trial registration number:** N/A

**Background and Aims:** We present a case of 69 year-old female with a history of stroke that was an inpatient on the stroke unit of Croydon University Hospital. This case aims to highlight the importance of a comprehensive medical history to identify less common causes of stroke.

**Methods:** In the month preceding this admission this lady suffered a first stroke and was investigated with carotid doppler, revealing patent carotids. In the short time following this she presented with weight-loss and jaw claudication which was being investigated when she had a second stroke. She was then found to have a raised ESR and temporal arteries biopsies were taken. Another carotid doppler was performed which showed complete occlusion of the left carotid artery and later giant cell arteritis (GCA) was histologically confirmed.

**Results:** Whilst the symptoms experienced by this lady are those fairly typical of GCA they were not fully recognised until after she had again presented with stroke. Literature has also shown that in cases of stroke secondary to GCA patients are typically older males and have a multitude of vascular risk factors, not present in this case. What this case highlights is the importance of an in-depth history to fully ascertain the signs and symptoms experienced by a patient within atypical patient groups for strokes.

**Conclusions:** We chose this case so as to highlight in patients with atypical presentations careful history taken along with relevant investigations are essential in discovering atypical causes of stroke, thus to ensure appropriate care and treatment.

**Trial registration number:** N/A

### AS35-043

#### ACUTE BILATERAL INTERNAL CAROTID ARTERIES (ICA) OCCLUSION: CAN THE BRAIN BE SALVAGED?

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**Background and Aims:** Bilateral acute occlusion of the internal carotid arteries and its proximal branches leads to coma and neurological deficits resembling basilar artery thrombosis.

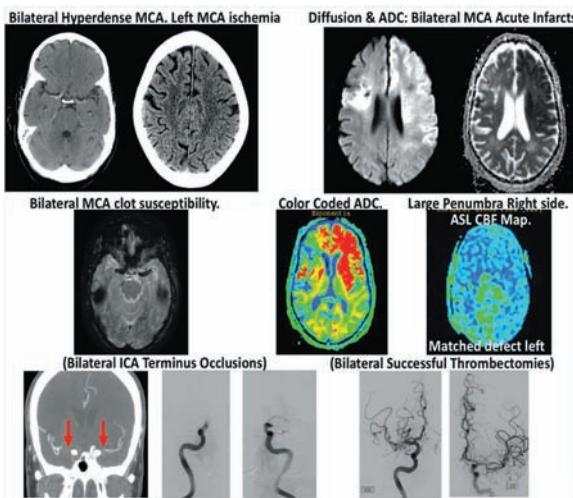
**Methods:** A 73-years-old female brought to ED one hour after a witnessed collapse. Her past medical history includes TIA and hypertension. She presented with coma and quadriplegia. She was in Atrial Fibrillation with BP of 231/125. Within minutes, Her GCS dropped from 11 to 6. She had dense left sided weakness with mild right sided weakness. NIHSS was 25. She was intubated, labetalol infusion started. CT showed bilateral MCA hyper acute ischemia. CTA showed evidence of Large Vessel Occlusion (LVO) based on bilateral terminal ICA occlusion along with their large proximal branches (M1, A1). She had good bilateral MCA collaterals. MRI DWI and perfusion Studies demonstrated large size penumbra on the right. She underwent Mechanical Thrombectomy (MT) four hours from Stroke onset with total recanalization of left side (MCA and ACA) and right ACA but partial recanalization of the right M1 artery. She was admitted to ICU. Repeat CT showed bilateral large MCA and ACA infarcts and left basal ganglia hemorrhage. Neurosurgery advised best supportive care. She died three days later.

### AS35-072

#### A CASE OF STROKE SECONDARY TO GIANT CELL ARTERITIS

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**Results:**

**Conclusions:** Acute bilateral occlusion of the ICA usually results from cardioembolism though atherosclerosis contributes. Bilateral paresis and coma are explained by sudden global ischemia though brainstem reflexes differentiate this from severe brainstem stroke. Acute bilateral ICA occlusion carries high risk of mortality despite early intervention with MT.

**Trial registration number:** N/A

**AS35-014****TOP OF THE BASILAR SYNDROME IN A PATIENT WITH DISTAL CAROTID OCCLUSION WITH VARIANT PERSISTENT TRIGEMINAL ARTERY**

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**Background and Aims:** The primitive trigeminal artery, also called persistent trigeminal artery (PTA), is the most common of the embryonic arteries that connect the internal carotid artery with the vertebrobasilar system. We present a case of a patient presenting with “top-of-the-basilar” syndrome secondary to an occlusion of the internal carotid artery and presence of PTA.

**Methods:** A 78-year-old female patient with a past medical history of hypothyroidism, dyslipidemia and hypertension presented with an acute onset of altered mental status, noted to have a left miotic pupil. Non-contrast CT scan of the head was suggestive of hyperdense basilar artery concerning for thrombus. CT angiography of the head showed severe basilar stenosis and a PTA. The patient received recombinant tissue plasminogen activator (rtPA) and was taken for emergent cerebral angiogram and clot retrieval.

Cerebral angiogram revealed a complete occlusion of the cavernous segment of the right internal carotid artery, with an anatomical variant of a PTA and a distal basilar sub-occlusive thrombus. She underwent mechanical thrombectomy using Solumbra (Solitaire and Penumbra) technique and achieved thrombolysis in cerebral infarction (TICI) 2b recanalization.

**Results:** N/A

**Conclusions:** There have been embolic strokes reported in association with a persistent trigeminal artery, however, to our knowledge none of

these were managed with rtPA and mechanical thrombectomy. We highlight the importance of considering variant anatomy when selecting patients for thrombolysis and thrombectomy in patients presenting with stroke syndromes

**Trial registration number:** N/A

**AS35-057****A RARE CASE OF CAROTID WEB IN YOUNG MAN WITH ISCHEMIC STROKE**

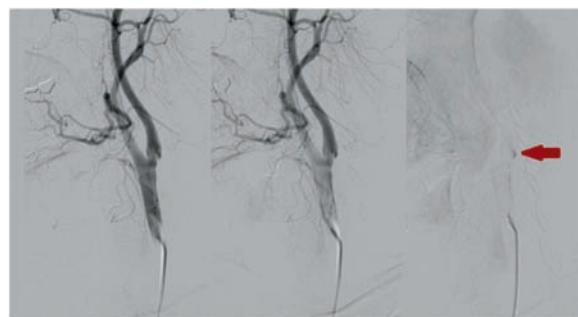
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**Background and Aims:** Carotid Web (CW) is a rare cause of Ischemic Stroke (IS) in young people. It is a nonatherosclerotic alteration of carotid artery (CA), identified radiographically as a shelf-like intraluminal filling defect on the posterolateral wall of proximal internal carotid artery (ICA). CW etiology is unknown.

**Methods:** We report a case of a young man with left CW and IS on ipsilateral Middle Cerebral Artery (MCA) territory.

**Results:** A 49-years-old man was admitted to the emergency department (ED) 45 minutes after sudden onset of right hemiparesis and aphasia (NIHSS 9). He had no previous pathology and did not use medical treatment. CT perfusion showed hypoperfusion on the left temporo-parietal lobe and a steno-occlusion of distal M1 segment of left MCA. According to Guidelines we started intravenous thrombolysis (IV) 90 minutes after symptoms onset, followed by catheter-based cerebral thrombectomy 20 minutes later with improvement of neurological status (NIHSS = 4). Cerebral Angiography showed a shelf-like intraluminal filling defect along the posterior wall of left proximal ICA with classical stasis of intravenous contrast distal to the CW. We decided to perform endovascular stenting of CW 5 days later, followed by dual antiplatelet therapy. Workup for hypercoagulability and vasculitis was normal. Renal Doppler Ultrasound was negative. MRI showed small left parietal ischemic lesion. Patient was discharged a week after stroke onset (NIHSS = 0).



**Conclusions:** CW has been accepted as a cause of 9.4-37% of cryptogenic strokes. Further studies are needed to investigate the underlying mechanism, possibly secondary to blood stasis along web surface, resulting in thrombus formation and embolism.

**Trial registration number:** N/A

**AS35-063****AN UNCOMMON CASE OF SIMULTANEOUS ACUTE ISCHEMIC STROKE AND ST-SEGMENT ELEVATION MYOCARDIAL INFARCTION**

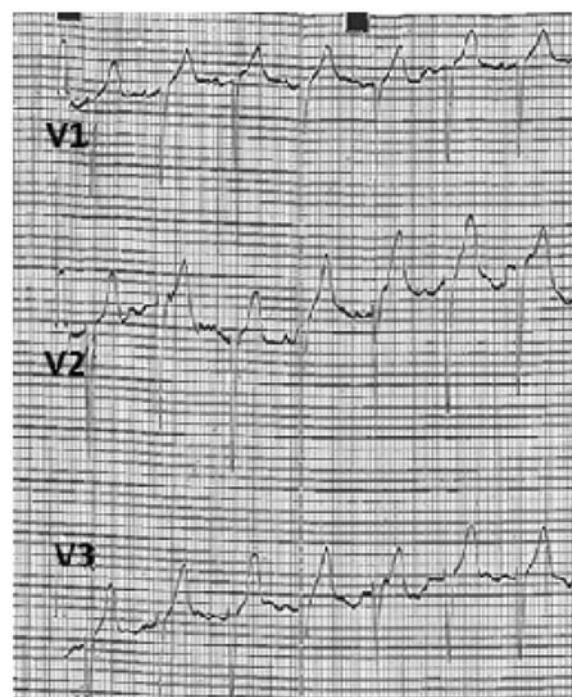
**L. Gentile<sup>1</sup>, A. Falcou<sup>1</sup>, G. Galardo<sup>2</sup>, G. Guidetti<sup>3</sup>, F. Fedele<sup>4</sup> and D. Toni<sup>1</sup>**

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**Background and Aims:** Simultaneous acute ischemic stroke (AIS) and acute myocardial infarction is a very rare condition (1–2%), and it is the single strongest predictor of in-hospital mortality.

**Methods:** We report a case of a patient with simultaneous AIS and ST-segment elevation myocardial infarction (STEMI).

**Results:** A 60-year-old man was admitted to the Emergency Department 52 minutes after sudden onset of right hemiplegia and aphasia. He was a tobacco smoker, had no previous pathology and did not use medical treatment. At admission, examination showed motor aphasia and right hemiplegia (NIHSS = 15). High-sensitivity troponin T level was significantly elevated, associated to ST-segment elevation in V1-V3 leads. Transthoracic echocardiography showed severe myocardial hypokinesis (EF 30%). AngioCT showed occlusion of proximal MI segment of left Middle Cerebral Artery (MCA). After multidisciplinary evaluation, we decided not to perform intravenous thrombolysis, due to high risk of pericardial effusion in case of percutaneous transluminal coronary angioplasty (PTCA). The patient underwent cerebral thrombectomy 90 minutes after symptoms onset. Immediately after that, a coronary angiography showed stenosis of Anterior Descending Coronary Artery (ADCA) and of Circumflex Artery (CA), treated with PTCA and stenting, 128 minutes after arrival. Clinical follow-up was excellent (3-month NIHSS and mRS = 0).



**Conclusions:** This is a rare condition of simultaneous thrombosis of 3 different arterial territories: MCA, ADCA and CA. Data on early management of simultaneous AIS and STEMI are limited and the choice of the best therapeutic strategy of two time-dependent conditions must be decided in a multidisciplinary way.

**Trial registration number:** N/A

**AS35-094****INTEGRATED MULTIDISCIPLINARY INTERVENTION IMPROVES RECOVERY IN AN ADOLESCENT PATIENT**

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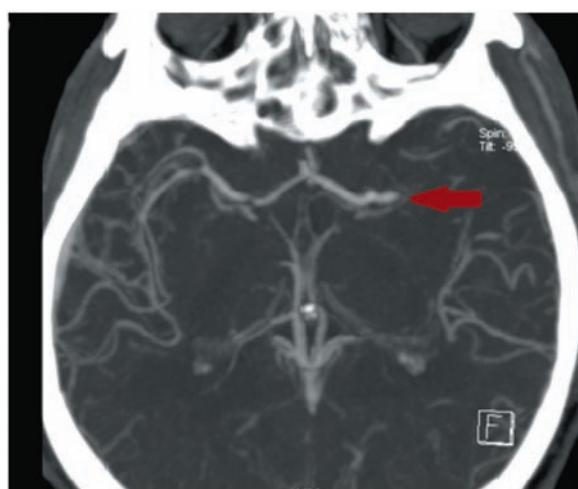
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**Background and Aims:** Pediatric stroke is a rare but recognized cause of acquired brain injury and may result in lifelong impairments, involving both motor and cognitive functions. Even if the importance and effectiveness of intensive, multimodal rehabilitation trainings is well established in adults, reports of such intervention programs appear to be rarely described in children/adolescents.

The aim of this clinical case is to provide an example of a multidisciplinary assessment and patient-centered intensive rehabilitation, including speech therapy, cognitive functions training, neuro-motor and occupational therapy and psychological support.

**Methods:** We present the case of a 13-year old healthy boy after acute ischemic stroke with resultant motor, language, cognitive and psychological disorders.

**Results:** After an intensive rehabilitation training (4.5h per day for 106 days), the patient showed significant clinical improvements involving language abilities, cognitive flexibility, logical reasoning and motor independence. A 6-month post-stroke follow-up evaluation revealed further gains



in spontaneous language, improved motivation and collaboration, reduction of impulsiveness and general motor stability.

**Conclusions:** This case highlights how a personalized rehabilitation approach is essential in order to focus on the child/teen main needs and priorities. In particular, a comprehensive rehabilitation program may maximize the spontaneous recovery and lead to a significant improvement across different domains in children/teen after acute ischemic stroke.

**Trial registration number:** N/A

## AS35-065

### MULTIPLE EXTRA- AND INTRACRANIAL VESSELS OCCLUSIONS WITH COMPLEX COLLATERAL COMPENSATIONS AND MILD NEUROLOGICAL SYMPTOMS: A TAKAYASU ARTERITIS CASE REPORT

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**Background and Aims:** Takayasu Arteritis (TAK) is a chronic vasculitis, involving the aorta and its main branches, and intracranial arteries causing stenosis, aneurysms and obstruction of arteries. Commonly, neurological symptoms include headache, dizziness, visual disturbances, seizures, transient ischemic attack, stroke and posterior reversible encephalopathy syndrome. We describe a patient with multiple cerebral vessels stenosis and occlusion presenting with a minor stroke and cognitive impairment.

**Methods:** A 53 years old man presented to emergency department reporting drowsiness, confusion, several episodes of dysarthria with left arm tingling and loss of strength. Physical examination was notable for mild left hemiparesis, asymmetry of radial pulses (right>left). Brain MRI showed multiple ischemic lesions in frontal-parietal-temporal right cerebral lobes; EEG and psychological evaluation detected right central-temporal irritative activity and attention and memory deficits, respectively. MRA and angiography demonstrated occlusion of left internal carotid artery (ICA), sub-occlusion of right extracranial ICA, occlusion of both vertebral arteries with collaterals. Coronary and total body angio-CT demonstrated mild stenosis of the anterior descending coronary artery, occlusions of mesenteric, iliac and femoral arteries with collaterals. After starting clopidogrel and dipiridamole, he underwent neurosurgical placement of a double barrel by-pass from left superficial temporal artery to middle cerebral artery.

**Results:** This case fulfilled diagnostic criteria for TAK according to the American College of Rheumatology criteria.

**Conclusions:** The patient came to our observation in the late phase of the disease, when inflammation markers were no more detectable and a large network of collateral vessels had already developed, which explains the very late clinical onset of disease.

**Trial registration number:** .

## AS35-019

### USE OF FLOW DIVERSION IN RUPTURED VERTEBRAL ARTERY ANEURYSM IN TAKAYASU ARTERITIS : A CASE REPORT

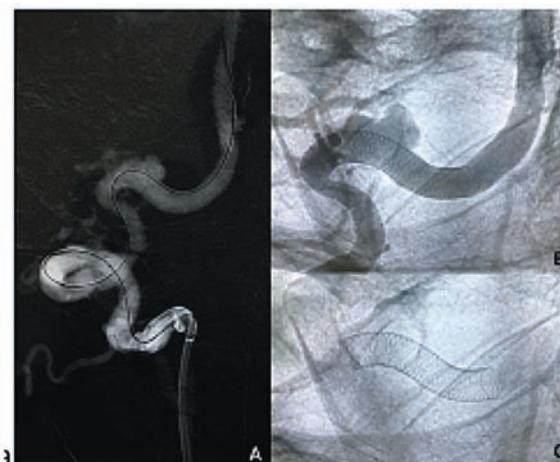
**S. Gupta<sup>1</sup>, A. Vajpejee<sup>1</sup>, D.N. Juangco<sup>1</sup> and G. Goel<sup>2</sup>**

<sup>1</sup>Pacific centre of neurosciences – Pacific medical college and hospital, Neurology, Udaipur, India; <sup>2</sup>medanta, neurosciences, gurugram, India

**Background and Aims:** Fifty two year old Indian female without prior medical history presented with thunderclap headache, subsequently was

found to have subarachnoid hemorrhage secondary to ruptured aneurysm in the right vertebral artery, diagnosed as case of takayasu arteritis on further investigation. Takayasu arteritis (TA) is a chronic, inflammatory, large-vessel vasculitis of unknown etiology involving the aorta and its main branches. It primarily affects young women and patients mostly come from Asian countries. Cerebrovascular involvement is found in 40 – 80%, most commonly with symptoms due to ischemia. In contrast, subarachnoid hemorrhage and cerebral aneurysms are very rare presentations. Traditionally, these aneurysms are treated with surgical clipping or endovascular coiling. Here we present a case of TA associated with ruptured vertebral artery (VA) aneurysm treated with flow diversion using Pipeline Flex embolization device (PED) (ev3, Irvine, California, USA). This is the first report of successful flow diversion in the setting of a ruptured aneurysm in TA. We propose a novel and safe treatment option by flow diversion using the Pipeline Flex embolization device (PED).

**Methods:** n/a



**Results:** N/A

**Conclusions:** N/A

**Trial registration number:** N/A

## AS35-139

### EFFECTS OF RADIATION THERAPY TO THE NECK IN CHILDHOOD ON THE CAROTID ARTERIES

**M. Popit<sup>1</sup>, L. Zadravec Zaletel<sup>2</sup>, B. Žvan<sup>1</sup> and M. Zaletel<sup>1</sup>**

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<sup>2</sup>Institute of Oncology Ljubljana, Oncology, Ljubljana, Slovenia

**Background and Aims:** With new treatment options the survival of children with cancer improved over the past decades and with this the risk of developing chronic diseases in this population has also increased. It is known that radiotherapy to the neck increases the risk of carotid disease and stroke in adults but little of that is known in childhood cancer survivors. The aim was to study the local and systemic effects of radiotherapy to the neck in childhood Hodgkin's disease survivors. In reviewed literature we found few studies which studied possible markers for increased atherosclerosis.

**Methods:** Our subject is a 48 year old male and was diagnosed with Hodgkin's disease at 8 years of age. He was treated with radiotherapy to the neck. We performed duplex carotid ultrasonography and FMD. We analysed data of carotid stiffness in survivor. Linear regression was performed to test the relationship between PWV and beta index, elasticity modulus (Ep), augmentation index (AI), arterial compliance (AC).

**Results:** On duplex carotid ultrasonography several fibrous and calcified plaques were found and without hemodynamically significant carotid stenosis.

We found significant relationship between Ep and PWV (B = 0.021, beta = 0.99; p < 0.01), beta and PWV (B = 0.36, beta = 0.99; p > 0.01), AC and PWV (B = -8.23, beta = 0.925; < 0.01) while AI and PWV (B = 0.027; beta = 0.302; p = 0.255) were not related significantly. The FMD value in systole was 4,98%, in diastole 5,31%.

**Conclusions:** Carotid stiffness in our subject is increased consistently throughout most of the stiffness indices. FMD seems to be decreased. Therefore, endothelial and carotid dysfunction seems to be present in our subject.

**Trial registration number:** N/A

### AS35-035

#### EMBOLIC STROKE OF UNDETERMINED SOURCE ACCOMPANIED BY LIPOMATOUS HYPERTROPHY OF INTERATRIAL SEPTUM

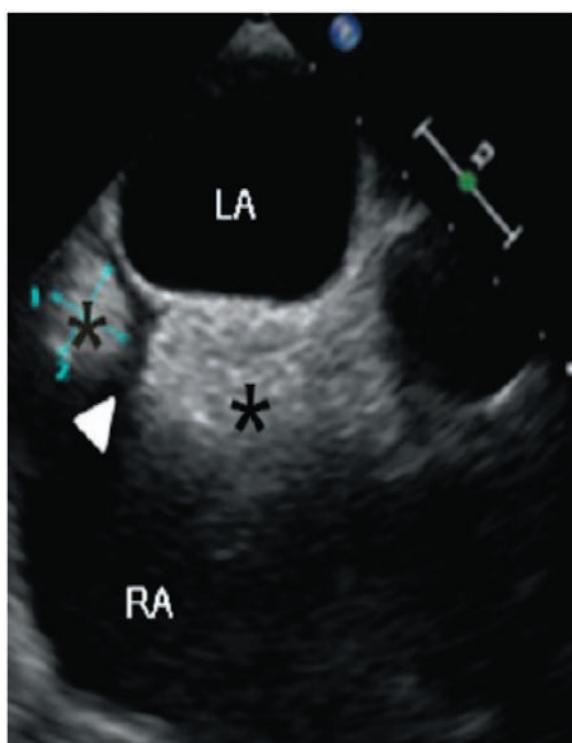
**S.W. Ha<sup>1</sup>, H. Bae<sup>1</sup> and U. Yun<sup>1</sup>**

<sup>1</sup>Veterans Health Service Medical Center, neurology, Seoul, Republic of Korea

**Background and Aims:** Lipomatous hypertrophy of interatrial septum (LHIS) is a rare benign cardiac mass. LHIS is sometimes reported to be accompanied by various arrhythmia, but the exact mechanism of its occurrence are unknown. There is nothing known about the relationship between LHIS and stroke.

**Methods: CASE 1**

A 73 years old man visited with right side weakness. DWI showed multiple ischemic lesions. There was no significant stenosis in extracranial and intracranial MRA. TTE and 24-hour ECG monitoring showed no definite embolic source. After three months, the patient was admitted again with right hand clumsiness. DWI revealed multifocal ischemic lesions. We conducted a TEE, cardiac CT. We found a dumbbell shaped echogenic mass in the right atrial septum.



**Results:** Case 2

A 75 years old man was discharged one month earlier with acute ischemic stroke. DWI showed acute ischemic lesions in right temporal periventricular white matter. There were no specific findings in the extracranial MRA, ECG, and TTE. He developed a left hemiparesis again. Multifocal recent ischemic changes were noted in DWI. TEE shows no shunt flow through interatrial septum and no visible thrombus in LA or LA appendage. But the LHIS was found.

**Conclusions:** Most of LIHS is found incidentally during the examination because it does not cause symptoms. The exact prevalence of LHIS is unknown.

In these cases, the association between stroke and LHIS is not definite. But it is possible that LHIS led to undetected paroxysmal atrial fibrillation, possibly resulting in embolic stroke. Another possibility is a blood clot was formed on.

**Trial registration number:** N/A

### AS35-086

#### TRANSIENT APHASIA AND ABNORMALITIES IN MRI IN A PATIENT WITH THROMBOTIC THROMBOCYTOPENIC PURPURA

**S. Hartinger<sup>1</sup>, J. Zinke<sup>1</sup>, D. Brämer<sup>1</sup>, S. Eisenach<sup>1</sup>, C. Klingner<sup>1</sup> and O.W. Witte<sup>1</sup>**

<sup>1</sup>University Hospital Jena, Neurology, Jena, Germany

**Background and Aims:** The acquired thrombotic thrombocytopenic purpura (TTP) is an immune-mediated deficiency of the von Willebrand factor (vWF)-cleaving protease ADAMTS13. This causes unrestrained adhesion of vWF-multimers and activated platelets and leads to microthrombosis with thrombocytopenia, hemolytic anemia and tissue ischemia.

**Methods:** We describe the case of a 55-year-old woman, which developed an aphasia and a delirium with abnormalities in MR-imaging as part of TTP.

**Results:** The patient has been in an external hospital due to thrombocytopenia, hematoma of the lower body and hematuria. She developed a TTP and was treated with prednisone. Within some days she got a delirium and an aphasia. So the patient was transferred to our hospital in order to implement plasmapheresis.

We saw an awake patient with aphasia but no paresis or sensory disturbance. In native CT-imaging and CT angiography there was no hint for cerebral infarction or vessel occlusion. Parameters of hemolysis and creatinine were highly elevated. So we started a plasmapheresis. The MR-imaging the same day revealed subacute ischemias in both thalamus and in the left hemisphere with DWI-lowering and flair hyperintensities. The ADAMTS13-activity was lower than 0,8% what proved the diagnosis of TTP.

**Conclusions:** Due to plasmapheresis the patient improved in neurological status and hemolysis parameters and renal function recovered. The aphasia was nearly gone when she was transferred to the clinic of internal medicine for continuation of plasmapheresis. Further treatment was implemented with prednisone and Rituximab. Even the abnormalities in MRI disappeared completely. The patient has been discharged from hospital after about 3 weeks.

**Trial registration number:** N/A

### AS35-047

#### A REVIEW OF ISCHEMIC STROKE IN “HAND KNOB” AREA

**J. Hernández Rodríguez<sup>1</sup>, E. Solanas Letosa<sup>1</sup>, G. Rodrigo Stevens<sup>1</sup>, Ó Durán Borrella<sup>1</sup>, I. Beltrán Rodríguez<sup>1</sup>, A. Álvarez Noval<sup>1</sup>, L. Lara Binela<sup>1</sup> and J. Tejada García<sup>1</sup>**

<sup>1</sup>CAULE, Neurology, León, Spain

**Background and Aims:** Hand weakness due to ischemic stroke, first described by Lhermitte as “pseudo peripheral palsy”, is an uncommon clinical picture. It affects MCA vascular territory, particularly motor hand cortex or “hand knob area”. In selected cases, ventroposterior thalamus and posterior limb of internal capsule may be involved. We wanted to evaluate isolated hand paresis as a clinical sign, by analyzing our experience with a cohort of patients admitted to the stroke unit over 1 year.

**Methods:** We analyzed 11 cases, collected between 2017 and 2018. Ischemic stroke in cortical or adjacent areas explaining the deficit were included. We compared age, sex, risk factors, type of motor deficit, MRI lesion location (DWI), etiology, treatment and prognosis.

**Results:** Mean age 66.1 (range 51–80), 5 ♂ / 6 ♀. Hypertension (9/11), hyper-lipidemia (7/11), diabetes (3/11), obesity (3/11), smoking (4/11), prior stroke (2/11). 7 had uniform deficit, 3 radial and 1 ulnar. 8 had MRI lesions in hand knob area (7 precentral gyrus, 1 postcentral; 3 “fragmented” multiple lesion), 3 in internal capsule. 5 atherosclerotic (2 ipsilateral ICA extracranial stenosis), 3 cardioembolic, 3 undetermined etiology (PFO). 8 received antiplatelet treatment, 2 AAS + acenocumarol, 1 PFO closure. I received rTPA. 8 improved, complete recovery in 3, and no recurrence.

**Conclusions:** Isolated arm paresis is usually caused by small cortical lesions in the motor hand cortex, but can also involve subcortical areas. Our series showed heterogeneous stroke mechanism etiologies. Risk factors appear to distribute as in most stroke populations and the clinical course was benign in all patients.

**Trial registration number:** N/A

## AS35-044

### ACUTE SPINAL CORD ISCHEMIA TREATED WITH INTRAVENOUS TROMBOLYTIC THERAPY

D. Jakubowicz-Lachowska<sup>1</sup>, K. Kapica-Topczewska<sup>1</sup>, J. Kochanowicz<sup>1</sup> and A. Kułakowska<sup>1</sup>

<sup>1</sup>Medical University of Białystok, Neurology, Białystok, Poland

**Background and Aims:**

**Introduction:**

Anterior spinal cord syndrome due to ischemic stroke is very uncommon and usually devastating. There is no causative treatment for spinal cord ischemia registered except for acetylic acid.

We report a case of acute spinal cord ischemia treated off label with intravenous thrombolysis with full recovery.

**Methods:**

**Case report:**

A 74-years old patient with medical history of arterial hypertension, coronary heart disease, (heart infarction in 1992 and CABG in 2017) was admitted to ER after sudden weakness of lower limbs which started 2 hours ago.

Neurological examination revealed paraparesis, without sensory deficit and sphincter disturbances. (NIHSS = 6; Rankin = 4).

Cerebral CT and CT-angiography were normal. CT of the thoracic and lumbosacral spine showed degenerative changes without other abnormalities. Echocardiography and abdominal ultrasound ruled out aortic dissection.

For ours after stroke onset the patient was treated with intravenous rtPA with neurological improvement.

**Results:** After 24hours follow up cerebral CT was normal. MRI of the spinal cord showed an infarct of the left side of spinal cord extending from Th10 to Th11 segments. Patient was discharged from the hospital ten days after symptoms onset, with full recovery. NIHSS = 0, Rankin = 0.

**Conclusions:** Intravenous rtPA seems to be a safe and effective treatment of the spinal cord ischemia. However further evaluation in a multicenter thrombolytic stroke-studies is necessary. Conclusion: Intravenous rtPA seems to be a safe and effective treatment of the

spinal cord ischemia. However further evaluation in a multicenter thrombolytic stroke-studies is necessary.

**Trial registration number:** N/A

## AS35-125

### ENDOVASCULAR TREATMENT IN LVAD ASSOCIATED ISCHEMIC STROKE

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**Background and Aims:** We describe a case of a 50 year old gentleman presented with an acute onset right middle cerebral artery syndrome whilst driving. He was found slumped at the wheel of his car by a passerby. On arrival, he had left sided hemiparesis, facial weakness, gaze paresis to the right and inattention. NIHSS on arrival was 12.

**Background:**

He had a background of dilated cardiomyopathy with a left ventricular assist device (LVAD) in situ. His underlying cardiac rhythm was atrial fibrillation which was rate controlled. He was warfarinised with an INR of 2.6 on admission.

**Methods:** Hyper acute imaging confirmed a right middle cerebral artery M1 thrombus. Thrombolysis was contraindicated and he proceeded to mechanical thrombectomy. The patient was pulseless in keeping with the LVAD, requiring femoral artery puncture using ultrasound guidance.

**Results:** The M1 thrombus was removed with a SOFIA aspiration device, with excellent recanalization and a TICI score of 3. On re-examination post procedure, there was a marked improvement in the clinical syndrome and NIHSS score was 0.

**Conclusions:** Patients with LVADs in situ have a 10% risk of stroke by the end of their first year. Furthermore, strokes remain the primary cause of death associated with LVAD use. This gentleman suffered a stroke in spite of being warfarinised with a therapeutic INR. Management of such patients is extremely challenging and requires multidisciplinary input from the cardiac LVAD team. Successful thrombectomy in this case allowed the patient to remain on the cardiac transplant list.

**Trial registration number:** N/A

## AS35-039

### ADULT-ONSET LEUKOENCEPHALOPATHY WITH AXONAL SPHEROIDS AND PIGMENTED GLIA PRESENTING WITH ACUTE STROKE-LIKE SYMPTOMS

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<sup>1</sup>Tan Tock Seng Hospital, Department of Rehabilitation Medicine, Singapore, Singapore; <sup>2</sup>National Neuroscience Institute, Department of Neuroradiology, Singapore, Singapore; <sup>3</sup>National Neuroscience Institute, Department of Neurology, Singapore, Singapore

**Background and Aims:** Adult-onset leukoencephalopathy with axonal spheroids and pigmented glia (ALSP) is a rare autosomal dominant progressive degenerative white matter disease characterized by axonal loss, axonal spheroids and pigmented microglia, caused by heterozygous mutations in the colony stimulating factor-1 receptor (CSF1R) gene. Patients commonly present with progressive cognitive decline and psychiatric symptoms. Motor symptoms such as gait ataxia, spasticity and dystonia may also occur.

**Methods:** The authors report a unique case of ALSP that presented initially as a young stroke with acute onset of left sided hemiparesis, in the absence of preceding history of cognitive decline or behaviour change. Subsequent cognitive decline and behavioural change lead to a consideration of an alternative diagnosis. The authors believe that the initial sites of the associated neurodegeneration in our patient could have

primarily involved the bilateral corona radiata, resulting in motor deficit as the first symptom, which led to the patient initially being diagnosed as having a stroke.

**Results:**

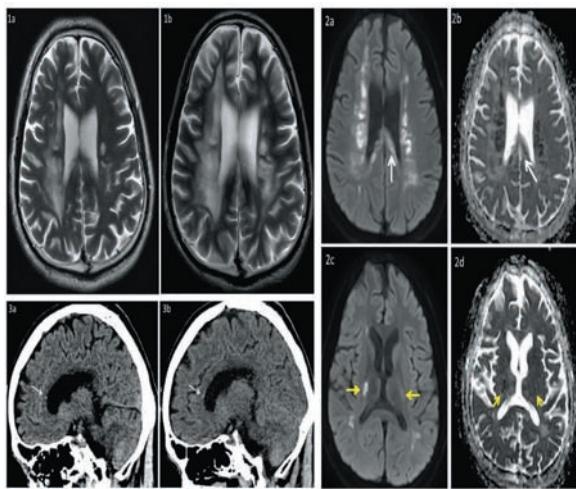


Figure 1a: Axial T2W MR image at the first presentation. Asymmetric periventricular, deep white matter and subcortical T2 hyperintensities seen, appearing more confluent on the right. Background cerebral involutorial changes and ventricular prominence appear advanced for age.  
Figure 1b: Axial T2W MR image of follow-up MR study performed almost after 7 months. There is significant progression of white matter signal changes with increased conflueness. Again noted age-advanced involutorial changes.

Figure 2a and 2b: DWI and ADC images showing striking restricted diffusion in the white matter lesions bilaterally. Note involvement of the splenium of the corpus callosum (white arrows), one of the characteristic imaging features of ALSP.  
Figure 2c and 2d: DWI and ADC images showing involvement of bilateral corticospinal tracts (yellow arrows), another characteristic imaging feature of ALSP.

Figure 3a and 3b: Thin-section sagittal non-contrast CT brain images showing punctate calcifications (white arrows) in the white matter adjacent to the frontal horns of the right and left lateral ventricles respectively, again a classic imaging feature of ALSP.

**Conclusions:** This is a novel presentation of acute stroke-like symptoms in a patient with ALSP. There has been no previous report of a similar presentation in the current literature. The authors hope that clinicians could learn from our experience to keep an open mind in considering various differentials when encountering a case of possible "stroke".

**Trial registration number:** N/A

**WITHDRAWN**

**AS35-097**

**THE SNORING HUSBAND: A CASE REPORT OF ARTERY OF PERCHERON INFARCTION**

**O. Kemp<sup>1</sup>**

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**Background and Aims:** An interesting case report of Artery of Percheron (AoP) infarction seen as the Hyper Acute Stroke Unit in Bristol, United Kingdom. The Artery of Percheron is an anatomical variant of the posterior circulation found at the top of the basilar artery. Infarction in the distribution of this artery can cause a specific syndrome of symptoms described as 'Top of the Basilar Syndrome'. The AoP variant has been seen in small sample studies ( $n = 134$ ) to be present in 20.5% of individuals and has been suggested to be present in 0.1-2% of all infarcts.

**Aims:**

- Presentation of this case of AoP infarction
- Discussion of the anatomical variants of AoP and their prevalence
- Review of the classical presentation of AoP infarction
- Discussion of the relevance of this infarction in the management of stroke

**Methods:** Review of the clinical history and investigations including images from Computed Tomography, Angiography and Magnetic Resonance Imaging. Critical appraisal of latest literature concerning AoP infarction.

**Results:** Imaging from CT, angiography and MRI. Analysis of the incidence of the AoP variant.

**Conclusions:** AoP infarction and Top of the Basilar Syndrome may be underrepresented in the diagnosis of stroke which may contribute to worse outcomes in Stroke management and rehabilitation. Understanding of the presentation of TotB syndrome and the changes seen on neurological imaging are useful skills for postgraduate neurological clerking.

**Trial registration number:** N/A

## AS35-017

### ISCHEMIC STROKE DUE TO COCAINE-INDUCED BASILAR ARTERY DISSECTION

J. Kerstens<sup>1</sup>, R. Amir<sup>2</sup>, T. Van der Zijden<sup>3</sup> and C. Loos<sup>4</sup>

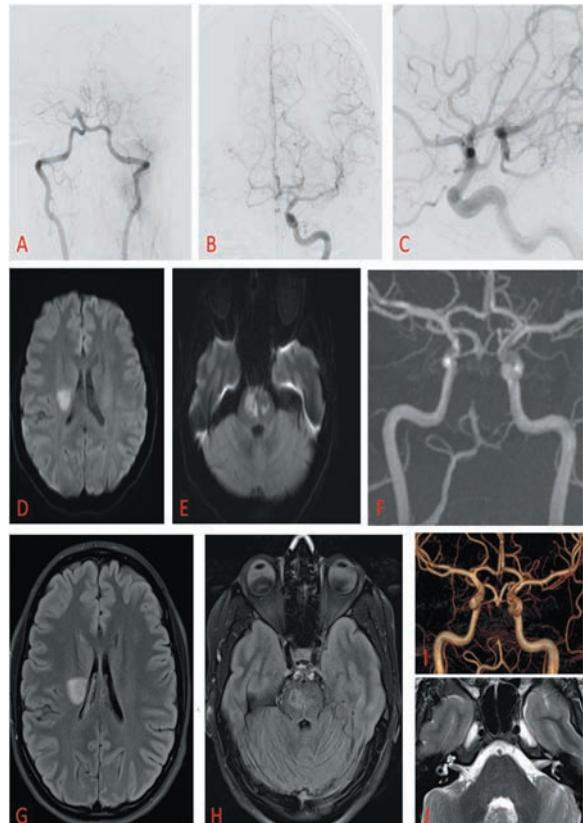
<sup>1</sup>Antwerp University Hospital, Neurology, Antwerp, Belgium; <sup>2</sup>AZ Sint-Maarten, Neurology, Mechelen, Belgium; <sup>3</sup>Antwerp University Hospital, Radiology- NeuroVascular Reference Center Antwerp NVCA, Antwerp, Belgium; <sup>4</sup>Antwerp University Hospital, Neurology- NeuroVascular Reference Center Antwerp NVCA, Antwerp, Belgium

**Background and Aims:** Cocaine use has been associated with a range of vascular complications, including arterial dissection. Both cocaine-mediated hypertension and weakening of the vascular wall due to apoptosis of vascular endothelial and/or smooth muscle cells have been postulated as underlying mechanisms.

**Methods:** We present the case of a 21-year-old woman with a two-day history of head and neck pain, presenting at the emergency department with wake-up dysarthria and left hemiparesis. She admitted to sporadic cocaine use, most recently a few hours before onset of her headache.

**Results:** Brain CT showed no intracranial hemorrhage while on CT angiography a short occlusion on the distal basilar artery was noted, with classical angiography revealing underlying dissection (Figure 1A) and collateral flow through the left posterior communicating artery (1B-C). Endovascular treatment with repositioning of the dissection flap was unsuccessful and neurological examination after the procedure was unchanged. Brain MRI one day after admission showed acute pontine and right lenticulostriate ischemic infarction (1D-F). She gradually recovered, but at her follow-up visit two months later she had residual mild left hemiparesis and mild dysarthria. MRI at that time with 3D-TOF MRA is shown in Figure 1G-J.

Figure 1



**Conclusions:** Cocaine-induced dissections of the aortic arch, coronary, renal, carotid and vertebral arteries have been previously described. Although a few cases of ischemic stroke due to cocaine-induced basilar artery thrombosis have been reported, this is the first case with an underlying basilar artery dissection. In stroke patients with spontaneous arterial dissection, cocaine and other illicit drug use should be ruled out.

**Trial registration number:** N/A

## AS35-022

### MULTIPLE CRANIAL BURR HOLES FOR INDIRECT REVASCULARIZATION IN GRAVES' DISEASE-ASSOCIATED MOYAMOYA SYNDROME

J. Kerstens<sup>1</sup>, T. Van der Zijden<sup>2</sup>, T. Menovsky<sup>3</sup> and L. Yperzeele<sup>4</sup>

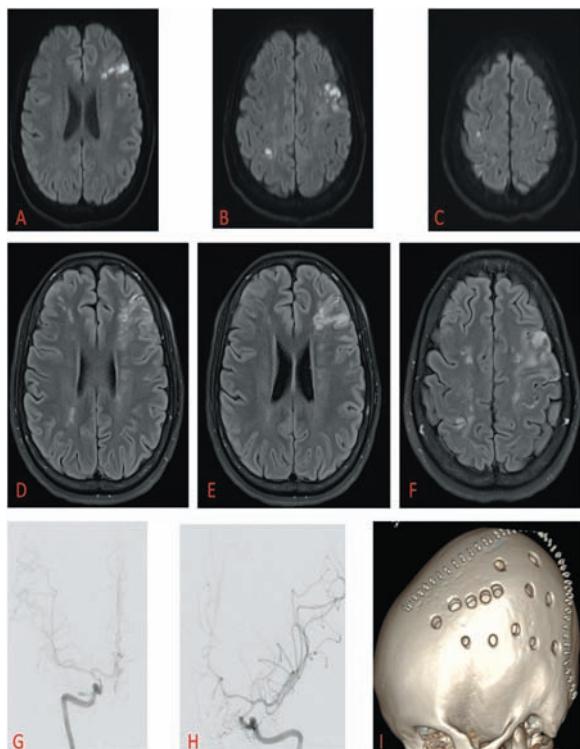
<sup>1</sup>Antwerp University Hospital, Neurology, Antwerp, Belgium; <sup>2</sup>Antwerp University Hospital, Radiology- NeuroVascular Reference Center Antwerp NVCA, Antwerp, Belgium; <sup>3</sup>Antwerp University Hospital, Neurosurgery- NeuroVascular Reference Center Antwerp NVCA, Antwerp, Belgium; <sup>4</sup>Antwerp University Hospital, Neurology- NeuroVascular Reference Center Antwerp NVCA, Antwerp, Belgium

**Background and Aims:** Moyamoya disease is a cerebrovascular disease characterized by progressive stenosis of the terminal portion of the internal carotid artery (ICA) and its main branches. Its pathophysiology remains unclear, but immune-mediated processes seem to be involved and an association with Graves' disease has been described.

**Methods:** We report the case of a 32-year-old woman with recent diagnosis of Graves' disease (treated with propylthiouracil and L-thyroxine) who presented to our clinic after two episodes of transient left-sided

sensory loss and weakness in the previous year. Clinical examination was unremarkable but brain MRI showed extensive areas of both recent and old ischemic infarction in both cerebral hemispheres (Figure 1A-F) with severe bilateral distal ICA and proximal middle cerebral artery (MCA) stenosis on classical angiography (IG-H), compatible with moyamoya syndrome.

**Results:** Despite treatment with high-dose statin and dual antiplatelet therapy she was readmitted because of two more episodes of transient neurological deficit in the following year. Laboratory studies on admission confirmed thyrotoxicosis. Follow-up brain MRI showed new recent ischemic lesions in both frontal regions, with progressive stenosis of multiple segments of both MCA and posterior cerebral arteries. After thyrotoxicosis was medically optimized, revascularization surgery was performed by making 13 cranial burr holes over the left hemisphere (I). Two months postoperatively she remains well without neurological deficit or new events. Figure



**Conclusions:** While no guidelines exist, surgical revascularization after optimal antithyroid treatment has been described as an effective therapeutic strategy. Our case is the first report on the use of cranial burr holes in Graves' disease-associated moyamoya syndrome.

**Trial registration number:** N/A

#### AS35-064

#### CEREBRAL TOXOPLASMOSIS AS A STROKE MIMIC

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**Background and Aims:** We present a case of Cerebral Toxoplasmosis and HIV, of a patient who presented with suspected posterior circulatory stroke symptoms.

After initial investigation for stroke symptoms, patient's clinical features and specific MRI head features supported the diagnosis of HIV and Cerebral Toxoplasmosis.

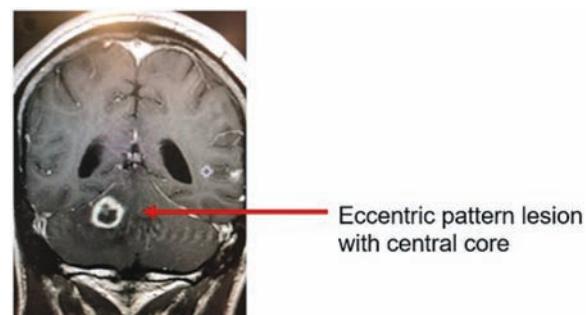
**Methods:** A 42 year old gentleman presented with loss of balance; diplopia; headache; dizziness.

It was also noted that patient had developed dry scaly, hyper pigmented, hyperkeratotic, itchy rash over his legs as shown in Figure 1.



(Figure 1)

Initially the CT head suggested bilateral cerebellar infarcts. In view of patient's presentation and background history the patient had MRI head which showed a 1.5cm intra-axial mass in right cerebellar hemisphere, eccentric pattern as shown in Figure 2.



(Figure 2)

Serology for HIV was positive. CD 4 count was 59; CD 8 was 440; CD 3 was 484; IgG was positive for Toxoplasmosis.

At this stage differentials were Toxoplasmosis; CNS lymphoma; cerebral metastasis; Kaposi sarcoma. In view of his skin lesion the patient had skin biopsy which confirmed Nodular Prurigo.

**Results:** This patient had Neuro-Oncology, infectious disease, GUM team MDT input. The patient was treated for HIV related Cerebral Toxoplasmosis with Sulfadiazine; Pyrimethamine and Folinic acid; along with anti retro virals to which the patient responded significantly well without any residual neurological symptom.

**Conclusions:** In the above case presentation our patient presented with posterior circulatory stroke symptoms. As initial CT findings were inconclusive further clinical assessment and investigation confirmed diagnosis of Toxoplasmosis with newly diagnosed HIV and the patient was managed appropriately.

**Trial registration number:** N/A

**AS35-027****THERAPEUTIC VERTEBRAL ARTERY OCCLUSION IN A PATIENT WITH AN UNUSUAL CAUSE OF RECURRENT POSTERIOR CIRCULATION STROKE****J.J.L. Cao<sup>1</sup>, R. Brown<sup>2</sup>, Y. Joshi<sup>3</sup>, N. Hannon<sup>1</sup> and K. Khadjooi<sup>1</sup>**<sup>1</sup>Addenbrooke's Hospital, Stroke Medicine, Cambridge, United Kingdom;<sup>2</sup>University of Cambridge, Clinical Neurosciences, Cambridge, United Kingdom;<sup>3</sup>Addenbrooke's Hospital, Radiology, Cambridge, United Kingdom

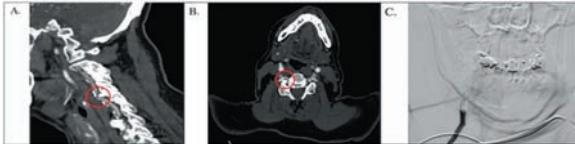
**Background and Aims:** Vertebral artery compression by a cervical osteophyte is known to lead to transient haemodynamic posterior circulation symptoms following head movements. Our case illustrates recurrent embolic strokes as a result of this phenomenon and a novel treatment strategy to prevent future events.

**Methods:** Case report

A 73-year-old man presented with 3-hour history of dizziness and slurred speech. Examination showed right facial droop, dysarthria, right hemiparesis and ataxia. Past history included 3 posterior circulation infarcts over the preceding six months due to recurrent right vertebral artery (RVA) dissection secondary to a C4-C5 osteophyte protrusion, confirmed on CTA. He was taking dual antiplatelets.

Urgent imaging showed a non-occlusive distal basilar artery thrombus and occluded RVA. Intravenous thrombolysis led to decrease in NIHSS from 8 to zero at 24 hours. Repeat CTA six weeks after discharge showed RVA markedly narrowed by the osteophyte but fully patent, supporting the diagnosis of dissection.

Due to the risk of recurrent dissections as a result of extrinsic pressure and as unsteadiness and tinnitus continued to impair the patient's quality of life, occlusion of the RVA was decided by the multidisciplinary team as a therapeutic intervention. After initial test occlusion, endovascular embolisation with a detachable balloon was performed without complications. The patient has been asymptomatic at six month follow-up.

**Results:** N/A

**Conclusions:** Vertebral artery dissection secondary to osteophyte compression is an uncommon cause of recurrent posterior circulation embolic strokes refractory to medical treatment and management can be challenging. Occluding the artery by endovascular embolisation can be effective for preventing further strokes.

**Trial registration number:** N/A**AS35-048****A CASE OF RECANALIZATION OF THE DISTAL POSTERIOR CEREBRAL ARTERY OCCLUSION BY SUCTION THROMBECTOMY USING A MICROCATHETER****H.S. Koh<sup>1</sup>, H.J. Kwon<sup>1</sup>, J.W. Lim<sup>1</sup> and J.Y. Youm<sup>1</sup>**<sup>1</sup>Chungnam National University Hospital, Department of Neurosurgery, Daejeon, Republic of Korea

**Background and Aims:** During intra-arterial (IA) thrombectomy for the patient with acute occlusion of a large cerebral artery, distal small arterial occlusion is often occurred by distal thrombus migration from

the large artery occlusion site. It is very difficult to remove the distal arterial thrombus and it may cause significant neurological deficit. We report a case of successful recanalization by direct aspiration using a microcatheter for the distal posterior cerebral artery (PCA) occlusion noted during IA thrombectomy in patient with basilar artery (BA) occlusion.

**Methods:** An 86-year-old male patient was transferred from outside hospital because of a left-side weakness and speech disorder. BA top occlusion was noted on initial MRA, and intra-venous tPA was started before IA thrombectomy. Initial NIHSS score was 14. Right PCA distal occlusion was noted on initial angiogram while BA top occlusion was recanalized. After approaching Marksman™ microcatheter to right distal PCA occlusion site and manual syringe suction was performed successfully.

**Results:** Following manual suction thrombectomy, complete recanalization was obtained to distal PCA branch. Mean time spent for recanalization was 8 minutes.

**Conclusions:** Manual microcatheter suction thrombectomy using a 50 ml syringe aspiration can be a feasible and effective treatment option for acute distal small artery occlusion occurred during IA thrombectomy in patient with large artery occlusion.

**Trial registration number:** N/A**AS35-098****CASE-REPORT: RECURRENT EMBOLIC STROKE FROM NON-TRAUMATIC PSEUDOANEURYSM OF THE EXTRACRANIAL INTERNAL CAROTID ARTERY IN A 60-YEAR OLD WOMAN****C. Kronlage<sup>1</sup>, J. Lorscheider<sup>1</sup>, B. Wagner<sup>1</sup>, P. Lyrer<sup>1</sup> and N. Peters<sup>1</sup>**<sup>1</sup>University Hospital Basel- University of Basel- Basel- Switzerland, Department of Neurology and Stroke Center, Basel, Switzerland

**Background and Aims:** Extracranial carotid artery aneurysms and pseudoaneurysms may be caused by atherosclerosis, trauma, past endarterectomy and connective tissue disorders. Aneurysms may become symptomatic by mass effect, rupture, thrombosis and embolism. Pseudoaneurysm especially of non-traumatic or postoperative etiology is rare, optimal management is unclear. Observational data suggests that with conservative treatment with antiplatelet agents or anticoagulation, ischemic complications are rare in a large number of patients. Surgical or endovascular treatment tends to be performed in high-risk settings.

**Methods:** N/A

**Results:** We present the case of a 60-year old woman who suffered three embolic ischemic strokes of the left carotid vascular territory (MI-occlusion; A2- und MI-subocclusion; MI-occlusion) within 2 months. Each time, there was a comparatively mild clinical deficit (NIHSS 3-4), and rapid recanalization by endovascular treatment (twice) or iv-thrombolysis (once), respectively, led to very good clinical recovery. A pseudoaneurysm of the left extracranial internal carotid artery was identified as the source of the emboli. We hypothesize that it resulted from past dissection caused by fibromuscular dysplasia, or possibly mechanical irritation from a prominent styloid process (Eagle's syndrome). There was no history of trauma or surgery of the neck. Antiplatelets and additional oral anticoagulation with a vitamin-K-antagonist started after the first two events proved ineffective for prevention of recurrence. Thus, endovascular repair by placement of a flow-diverter was performed.

**Conclusions:** Our case illustrates that embolism originating from a non-traumatic carotid pseudoaneurysm may recur despite aggressive medical therapy in a short time. Endovascular or surgical treatment represents an alternative for the prevention of ischemic stroke.

**Trial registration number:** N/A

**AS35-009****CASE OF ISCHEMIC STROKE WITH ESSENTIAL THROMBOCYTHEMIA AND ANTIPHOSPHOLIPID SYNDROME****Y. Kuzyk<sup>1</sup> and R. Falion<sup>1</sup>**

<sup>1</sup>Department of Pathology and Forensic Medicine- Danylo Halytsky Lviv National Med, Department of Pathology and Forensic Medicine-, Lviv, Ukraine

**Background and Aims:** Essential thrombocythemia (ET) belongs to myeloproliferative diseases. The most common with ET are thrombohemorrhagic complications, namely ischemic strokes of the brain, myocardial infarction, peripheral arterial and deep veins thrombosis. The mechanism of development of complications remains incompletely understood. To date, there is no relationship between the number of platelets and the frequency of complications of ET.

The aim – an analysis of the case of ET in a 57-year-old man, complicated by the development of ischemic stroke against the background of antiphospholipid syndrome.

**Methods:** Pathomorphological diagnostics with the use of pathologist methods has been performed

**Results:** A 57-year-old man was treated for ET for eight years. This admission to the hospital was associated with a deterioration of the general condition, an increase in body temperature to 39° C, and a general weakness. Anemia, hyperleukocytosis, thrombocytopenia, blast cells, pro-myelocytes and myelocytes were found in the hemogram. In trepanobiopsia, signs of myelofibrosis and osteosclerosis have been identified. Clinical diagnosis of essential thrombocythemia with transformation in myelofibrosis against the background of antiphospholipid syndrome has been established. In a postmortem study were observed aplasia of the back connective arteries and three ischemic stroke in the frontal lobes of 1.5 x 2 cm and 1 x 1.7 cm and in the projection of the bridge 2.5 x 1.8 cm

**Conclusions:** This case demonstrates an ischemic stroke at a low platelet count, which arose as a complication of the transformation of ET in myelofibrosis in the background of antiphospholipid syndrome

Trial registration number: N/A

**AS35-045****A GROWING PSEUDOANEURYSM OF MIDDLE CEREBRAL ARTERY THAT CAUSED RECURRENT ACUTE INFARCTIONS****K.B. Lee<sup>1</sup>, K. Im<sup>1</sup>, J.Y. Lee<sup>1</sup>, H. Roh<sup>1</sup>, S.T. Park<sup>2</sup>, B.J. Kim<sup>3</sup> and M.Y. Ahn<sup>1</sup>**

<sup>1</sup>Soonchunhyang University Hospital, Neurology, Seoul, Republic of Korea; <sup>2</sup>Soonchunhyang University Hospital, Radiology, Seoul, Republic of Korea; <sup>3</sup>Seoul National University Bundang Hospital, Neurology and Cerebrovascular Center, Seongnam, Republic of Korea

**Background and Aims:** Pseudoaneurysm can be caused by trauma, infection, neoplasm or vasculopathy, but it is very rare that occurs spontaneously on middle cerebral artery (MCA).

**Methods:** A 28-year-old man came to the emergency room presenting the right hemiparesis (MRC grade II) and dysarthria. He had no history of trauma, infection or vascular risk factors. He had experienced recurrent acute infarctions 2 times over the last 5 months even though taking antithrombotics. He got intravenous tissue plasminogen activator and discharged without any sequelae from previous 2 events.

**Results:** Brain magnetic resonance imaging (MRI) and angiography showed an acute infarct in the left corona radiata without MCA stenosis. In comparison to the first visit, however, gradient echo and CT presented an enlarged perivascular hematoma on the left MCA. Vessel wall MRI and digital subtraction angiography revealed a blister-like pseudoaneurysm which had obstructed lenticulostriate artery and induced recurrent ischemic stroke.

**Conclusions:** To prevent further infarction and intracranial bleeding by rupture, bypass surgery was successfully done between superficial temporal artery and middle cerebral artery removing thrombosed pseudoaneurysm. His motor power gradually improved to MRC grade IV with antiplatelet medication.

Trial registration number: N/A

**AS35-028****CASE REPORT: SPONTANEOUS SUBDURAL HAEMATOMA AS A CONSEQUENCE OF CEREBRAL VENOUS THROMBOSIS****W.F. Lim<sup>1</sup>, A. Spiers<sup>2</sup> and S. Elyas<sup>1</sup>**

<sup>1</sup>Royal Devon and Exeter Hospital, Stroke Medicine, Exeter, United Kingdom; <sup>2</sup>Royal Devon and Exeter Hospital, Radiology, Exeter, United Kingdom

**Background and Aims:** Spontaneous subdural haematoma (SDH) represents up to 50% of SDH recognised in clinical practice. It can be associated with a variety of causes including subarachnoid haemorrhage, aneurysm rupture and cerebrospinal fluid hypotension. Cerebral venous thrombosis (CVT) presenting as SDH has been rarely reported. We present a case of CVT presenting as spontaneous SDH and propose an underlying mechanism to alert stroke physicians about this potentially under-recognised phenomenon.

**Methods:** Case presentation: A 67-year-old woman presented to stroke clinic with tingling and numbness over the left hand lasting 10 minutes that resolved completely. She reported no headaches, visual or speech disturbance or limb weakness. There was no history of head injury. Head CT scan showed an acute on chronic right SDH. CT angiogram (CTA) showed right transverse sinus thrombosis. Anticoagulation was not commenced due to presence of acute on chronic SDH. Follow up MRI head showed SDH resolution and MR venogram confirmed the persistence of a right transverse sinus CVT. She made a good recovery and decided against anticoagulation after thorough discussion.

**Results:**

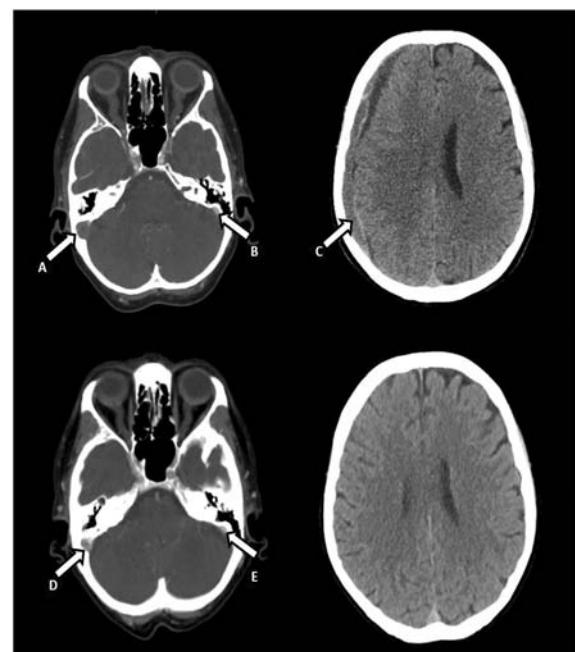


Figure 1: Venous sinus thrombosis shown on CT Venogram as filling defect in the right sigmoid sinus (A and D). Contrast can be seen flowing in left sigmoid sinus (B and E). Acute on chronic subdural haematoma (C) shown on CT scan of brain, this resolved 3 months later.

**Conclusions:****Discussion:**

CVT may present as spontaneous SDH by causing venous engorgement and increased back pressure in the leptomeningeal/dural veins leading to spontaneous rupture and SDH with or without minor trauma.

We propose silent CVT should be considered as a cause in patients with spontaneous SDH with no other obvious causes and CTV/MRV should be considered in such patients. Concomitant SDH and CVT would lead to a treatment dilemma as they need opposing treatment strategies.

**Trial registration number:** N/A

**WITHDRAWN****AS35-087****TRADITIONAL CHINESE MEDICINE COMBINED DOUBLE ANTIPLATELET TREATMENT FOR CAPSULAR WARNING SYNDROME: TWO CASE REPORTS**

**Y. Man<sup>1</sup>, M. Wang<sup>1</sup> and W. Liu<sup>1</sup>**

<sup>1</sup>The Second Hospital of Jilin University, Department of Neurology, Changchun City, China

**Background and Aims:** The capsular warning syndrome (CWS) is characterized by recurrent transient lacunar syndromes of motor and/or sensory deficits that usually precede a capsular infarction. The pathophysiological mechanism of CWS has not been fully understood. The available clinical management options remain controversial and non-effective. Previous literatures showed that the recurring episode was frequency stabilized with plural antiplatelet therapy. We sought to describe a new therapy of traditional chinese medicine combined double antiplatelet treatment for CWS.

**Methods:** We report two cases of CWS with an unusual young onset (patient 1 was a 42-year-old female, patient 2 was a 33-year-old male). The patients were described the clinical manifestation, neurological evaluation, underwent neuroimaging and treated with traditional chinese medicine combined double antiplatelet drugs.

**Results:** Two cases of CWS presented motor and/or sensory symptoms without complete ischemia. It was no use when given single antiplatelet therapy at the beginning three days. Then the patients were treated with oral traditional chinese medicine (Butylphthalide Soft Capsules) combined double antiplatelet (aspirin and clopidogrel) for the next 7 days. The recurring episodes in both cases were successfully managed and they never recurred in the 3 follow-up months.

**Conclusions:** Oral traditional chinese medicine (Butylphthalide Soft Capsules) combined double antiplatelet (aspirin and clopidogrel) are important for treatment of CWS, which may provide a new way for the clinical management, and caution is needed regarding hemorrhagic complications.

**Trial registration number:** N/A

**WITHDRAWN**

**AS35-081****DEGENERATIVE DISEASE: AN UNCOMMON STROKE MIMIC**

**S. Martínez Peralta<sup>1</sup>, O. López Agudelo<sup>1</sup>, M.D. Calabria Gallego<sup>1</sup>, B.S. Pérez Pérez<sup>2</sup>, A.D. Murillo Hernández<sup>1</sup>, A. Sierra Gómez<sup>1</sup>, F.J. González Terriza<sup>1</sup>, L. Redondo Robles<sup>1</sup> and L. López Mesonero<sup>1</sup>**

<sup>1</sup>Hospital Universitario de Salamanca, Neurology, Salamanca, Spain;

<sup>2</sup>Complejo Asistencial de Zamora, Community Medicine, Zamora, Spain

**Background and Aims:** Time is one of the most important goals in code stroke, so both false-positive (stroke mimics) and false-negative cases suppose a challenge. Given that complication rate of thrombolysis in stroke mimics is low, net balance in favour of fast thrombolysis is maintained.

**Methods:** We report a case of acute neurologic deficit finally resulting in an uncommon cause of stroke mimic.

**Results:** A 37-year-old man presented to the emergency room complaining about sudden weakness in left lower limb. In physical examination left lower proximal weakness was seen, and stroke of anterior cerebral artery was suspected. Given the time of evolution (only one hour), advanced neuroimage was taken: CT, angiographic and perfusion imaging showed normal results. After repeating physical examination, mild hypoesthesia in lateral side of the leg and dorsum of foot was related, suggesting root distribution. Lumbar MRI showed herniated disk (L4-L5) protruding to the conjunction hole, despite the patient had no pain. He was referred to the traumatologist and started a rehabilitation program.

**Conclusions:** Stroke mimics represent a significant percentage of all acute stroke hospital admissions. The most common stroke mimics are conversion/functional, seizures and postictal paralysis, brain tumours, and migraine. Lumbar herniation is a rare stroke mimic given that it usually starts insidiously, with severe pain preceding the weakness. Code stroke must be activated even when only one limb is affected, specially in a young patient. Imaging is essential for stroke mimics recognition, being perfusion imaging and angiographic studies very useful, as it was in our case.

**Trial registration number:** N/A

**AS35-126****THALAMIC HEMORRHAGE AND CLINICAL SYNDROMES**

**S. Martínez Peralta<sup>1</sup>, O. López Agudelo<sup>1</sup>, B.S. Pérez Pérez<sup>2</sup>, A. D. Murillo Hernández<sup>1</sup>, F.J. González Terriza<sup>1</sup>, M.D. Calabria Gallego<sup>1</sup>, A. Sierra Gómez<sup>1</sup>, L. Redondo Robles<sup>1</sup> and L. López Mesonero<sup>1</sup>**

<sup>1</sup>Complejo Asistencial Universitario de Salamanca, Neurology, Salamanca, Spain; <sup>2</sup>Complejo Asistencial de Zamora, Community Medicine, Zamora, Spain

**Background and Aims:** Thalamic hemorrhage represents 10% to 15% of intracerebral hemorrhage cases. Although less described, clinical manifestations are similar to those of ischaemic thalamic infarcts, generally classified into anterior, paramedian, inferolateral and posterior. In case of intracerebral hemorrhage the affected territory can be not clearly defined by imaging, and clinical syndromes play a key role.

**Methods:** We report two cases of similar thalamic haemorrhages presenting with different symptoms. We hypothesize the implicated arteries and thalamic nucleus, to explain the clinical syndromes.

**Results:** A 72-years-old man consulted for confusion and altered speech, referred by his relatives. Five days later, a 78-years-old woman presented to the emergency room with left hemiparesis; in neurologic examination, severe hemianesthesia was also described. Urgent CT was taken, and in both cases similar thalamic hemorrhage were described (left and right-sided respectively).



**Conclusions:** In our first case, neuropsychological disturbances would be related to anterior thalamic impairment (polar or tuberothalamic artery). Left-sided lesions are also associated with dysphasia, and could explain our patient's syndrome, whereas neglect is seen primarily in patients with right-sided injury. In our second case, sensorimotor stroke syndrome is usually attributed to posterolateral vascular region. Pure sensory stroke and the thalamic syndrome of Dejerine-Roussy are also related to these lesions, and thalamogeniculate branches arising from the P2 segment of the PCA are the arteries implied. Paramedian and dorsal regions complete the spectrum of vascular thalamic disorders, being associated with decreased level of consciousness, memory loss,

vertical-gaze abnormalities and homonymous quadrantanopia or horizontal sectoranopias.

**Trial registration number:** N/A

### AS35-111

#### THE MAN WHO COULD NOT HEAR HIS WIFE: A CASE OF POSTERIOR CIRCULATION STROKE PRESENTING AS ACUTE PROFOUND BILATERAL DEAFNESS

**A. McCarthy<sup>1</sup>, D. O'Keeffe<sup>1</sup>, T. O'Brien<sup>1</sup> and T. Walsh<sup>1</sup>**

<sup>1</sup>University Hospital Galway, Internal Medicine, Galway, Ireland

**Background and Aims:** A 69 year old right-hand dominant vasculopath presented to the Emergency Department with a 24 hour history of dysarthria, reduced visual acuity, non-lateralising ataxia and left-sided facial droop. He also had a 2 hour history of acute profound bilateral deafness, with reported onset during a conversation with his wife that evening. His past medical history was significant for hypertension, atrial fibrillation, a 40 pack year smoking history and stable ischaemic heart disease. Right past-pointing and inability to heel-toe walk were present on examination. Pure-tone audiometry showed profound bilateral sensorineuronal hearing loss.

**Methods:** The impression was that this patient had suffered an acute posterior circulation stroke, and treatment as per the stroke care pathway was commenced. CT brain revealed multiple bilateral cerebellar, brainstem and right occipital infarctions. CT cerebral artery angiography showed occlusion at the distal end of both vertebral arteries, prior to the basilar artery, consistent with bilateral thrombosis in the vertebral arteries before they join the basilar. Vertebral artery thrombosis was the presumed origin of the sudden bilateral deafness.

**Results:** The patient's hearing improved significantly during his 2 week inpatient stay on the stroke ward. An audiogram performed one year post-stroke revealed a 50db threshold bilaterally due to presbycusis. His speech remains dysarthric but intelligible. His mobility issues, which include scissoring gait and global dysmetria, have persisted.

**Conclusions:** This case is a rare example of a posterior circulation stroke presenting as acute profound bilateral deafness, attributable to bilateral vertebral artery thrombosis which subsequently resolved.

**Trial registration number:** N/A

### AS35-032

#### IDIOPATHIC CAROTID JUGULAR FISTULA PRESENTING AS PULSATILE TINNITUS

**M. Emamikhah<sup>1</sup>, B. Zamani<sup>2</sup> and N. Mohebi<sup>1</sup>**

<sup>1</sup>Department of neurology-Rasool-e- akram hospital- Iran university of medical sciences- Tehran- Iran, Department of neurology, Tehran, Iran;

<sup>2</sup>Department of neurology-Firoozgar hospital- Iran university of medical sciences- Tehran- Iran., Department of neurology, Tehran, Iran

**Background and Aims:** Carotid – jugular fistula (CJF), an abnormal connection between the carotid artery and jugular vein, etiologically is described as congenital or acquired. Congenital CJFs are less common. Leading causes for acquired CJFs are trauma and iatrogenic.

Other etiologic conditions have been presumed, but these rare cases mostly remain idiopathic.

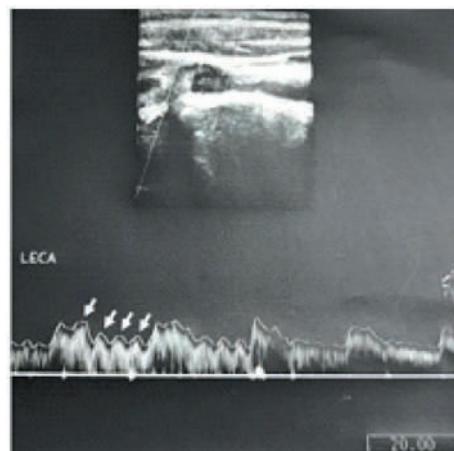
CJFs of either etiology can present with different sign and symptoms such as pulsatile mass, palpable thrill, auscultable murmur or dilated veins, wide pulse pressure, low diastolic blood pressure and in severe cases with heart failure. Decreased cerebral arterial flow or increased venous congestion can lead to neurological sign and symptoms.

The gold standard diagnostic test remains digital subtraction angiography (DSA), but duplex ultrasound (DU) is an easy sensitive method.

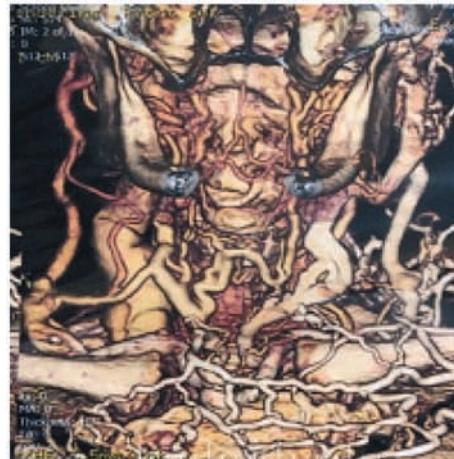
Computed tomography angiography (CTA) & magnetic resonance angiography (MRA) are other sensitive options.

**Methods:** We present a case of idiopathic CJF diagnosed during work up for pulsatile tinnitus.

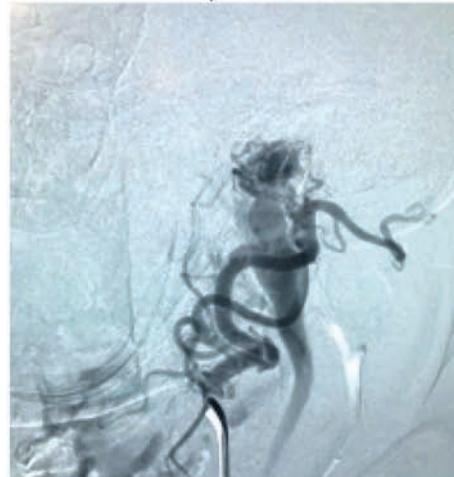
**Results:** A 72 year old female presented with a pulsating tinnitus. Routine work up was unremarkable. Cervical DU revealed internalized external carotid artery (ECA).



Cervical CTA showed marked collateralization



DSA confirmed the presence of CJF.



**Conclusions:** CJFs of non-traumatic non-iatrogenic cause should be considered in cases of neurologic symptoms of unknown etiology attributable to cerebral flow change, especially if regional or systemic circulatory symptoms are present simultaneously. Early detection by means of appropriate diagnostic tool and in time management prevents irreversible complications.

**Trial registration number:** N/A

#### AS35-034

### FREE FLOATING THROMBUS OF COMMON CAROTID ARTERY CAUSING STROKE IN AN ANEMIC PATIENT AFTER ABDOMINAL SURGERY: CASE REPORT AND REVIEW OF LITERATURE

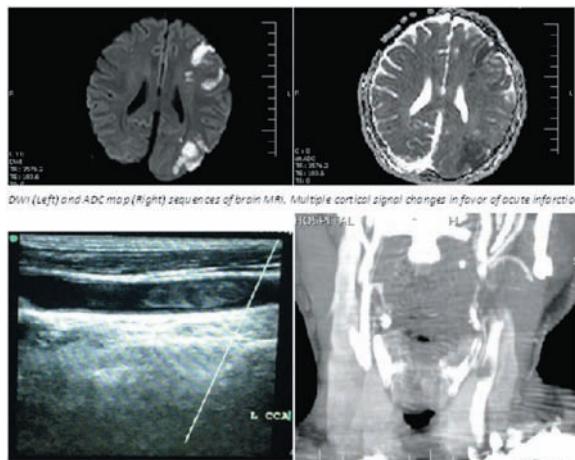
M. Emamikhah<sup>1</sup>, N. Mohebi<sup>2</sup>, M. Moghaddasi<sup>2</sup>, N. Yazdi<sup>2</sup> and M. Eslami<sup>2</sup>

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**Background and Aims:** Free floating thrombosis (FFT) of carotid artery is a rare condition leading to stroke. Atherosclerosis is the most prevalent etiology. Non-atherosclerotic causes are even much scarcer. There is no unified consensus about diagnostic approach and management of FFT patients.

**Methods:** We present a patient with FFT lacking any atherosclerotic disease and was managed successfully with a combined medical and surgical approach.

**Results:** A 49-year-old male admitted for colostomy reversal. After surgery, physical examination revealed global aphasia and right hemiparesis. Risk factors regarding atherosclerosis or hypercoagulability state were unremarkable. Brain magnetic resonance imaging (MRI) showed multiple cortical acute infarctions. Duplex sonography (DS) of carotid arteries showed a large fresh floating thrombosis in left common carotid artery (CCA) confirmed by Computerized tomography angiogram (CTA). The comprehensive laboratory investigations were normal, except for transient anemia and thrombocytosis. Anticoagulation started and was continued after urgent surgery for 10 days followed by antiplatelet. There were no further complications in 3 months follow-up.



Left: B-mode duplex sonography of left common carotid artery showed a fresh floating clot. Right: CTA showed a FFT in Lt CCA attached to medial intima, "finger sign".

**Conclusions:** FFT of carotid artery is a rare condition. CCA and carotid bifurcation are the second prevalent sites for FFT after internal carotid artery (ICA). Anemia and reactive thrombocytosis is a very rare cause reported for the condition. In this case, we used DS as screening and CTA to confirm. Since free thrombosis in CCA, can be overlooked, we suggest that every patient with ischemic stroke undergo the adequate investigation to look for FFT. Prompt diagnosis and management is crucial to prevent further ischemic event. Urgent surgery combined with medical management seems the superior approach.

**Trial registration number:** N/A

#### AS35-101

### TEMPOROMANDIBULAR PAIN AND VISUAL DISTURBANCE AT THE EMERGENCY DEPARTMENT: NOT ALWAYS A HORTON ARTERITIS

S. Moorthamers<sup>1</sup>, A. Nouini<sup>2</sup>, A. Bostan<sup>2</sup>, O. Vermeylen<sup>1</sup>, B. Dachy<sup>2</sup> and M.D. Gazagnes<sup>2</sup>

<sup>1</sup>CHU Brugmann, Emergency Department, Brussels, Belgium; <sup>2</sup>CHU Brugmann, Neurology Department, Brussels, Belgium

**Background and Aims:** A 78-year-old Caucasian woman presented to the emergency department (ED) with a 15-day left progressive temporomandibular pain and distorted vision. Physical examination showed subtle left exophthalmos, exotropia, hypotropia and binocular oblique diplopia. The patient also had orbital bruit on auscultation. Further physical neurological examination and biological evaluation were unremarkable. A CT angiography of the brain and subsequent cerebral angiography revealed a left carotid cavernous fistula (CCF), which was managed successfully by coil embolization. Later follow-up demonstrated complete resolution of the patient's symptoms.

**Methods:** N/A

**Results:** N/A

**Conclusions:** CCF are rare entities, arising from abnormal connections between the carotid arterial circulation and the cavernous sinus. Direct CCF are the most frequent type of CCF and most develop secondary to head trauma in young adult men. However, as seen in this case, CCF uncommonly occur spontaneously. Indirect CCF, more common in elderly women, are most often spontaneous. Where the diagnosis of post-traumatic direct CCF at the ED is usually straightforward. Spontaneous or indirect CCF, on the other hand, may be easily misdiagnosed at the ED, especially when patients exhibit more insidious onset of clinical symptoms or present atypical signs. Given a delay in diagnosis and treatment of CCF may result in permanent vision loss, emergency physicians should be aware of this pathology and consider the CCF in their differential diagnosis in cases of unilateral temporomandibular pain and diplopia.

**Trial registration number:** N/A

#### AS35-030

### INTRACRANIAL EMBOLIC FOREIGN BODY SYMPTOMATIC REACTIONS AFTER ENDOVASCULAR TREATMENT: A 10 CASE SERIES

A. Moreno Estébanez<sup>1</sup>, A. Luna Rodríguez<sup>1</sup>, T. Pérez Concha<sup>1</sup>, I. Ugarriza Serrano<sup>1</sup>, C. Fernández Maiztegi<sup>2</sup>, M.D.M. Freijo Guerrero<sup>1</sup>, E. González Díaz<sup>3</sup>, I. Labayen Azparren<sup>3</sup>, J. Fondevila Monso<sup>3</sup>, X. Manso del Caño<sup>3</sup>, A. Gil García<sup>4</sup>, T. González-Pinto González<sup>1</sup>, I. Campos Rodríguez<sup>1</sup>, G. Agirre Beitia<sup>1</sup> and L. Cabral Martínez<sup>1</sup>

<sup>1</sup>Cruces University Hospital, Neurology, Barakaldo, Spain; <sup>2</sup>Cruces University Hospital, Medical management, Barakaldo, Spain; <sup>3</sup>Cruces University Hospital, Neurointerventional radiology, Barakaldo, Spain;

<sup>4</sup>Marqués de Valdecilla University Hospital, Neurointerventional Radiology, Santander, Spain

**Background and Aims:** To report our experience in intracranial embolic foreign body symptomatic reactions after endovascular treatment.

**Methods:** We conducted a retrospective analysis including all patients with symptomatic intracranial inflammatory lesions after endovascular treatment in our hospital between 2013 and 2018.

**Results:** We report 10 cases (8 females, 2 males, 47-year-old mean) with an incidence of 0.15% of total endovascular procedures (10/6.602). Neurointerventional procedures consisted in 9 aneurysm embolization and 1 acute ischaemic stroke recanalization. Intracranial devices were implanted in all cases (coils (6/10), stent (2/10) or both (2/10)). The lesions appeared during the following 1–12 weeks (mean 5.8 weeks). Symptoms varied depending on lesion location. Brain MRI showed contrast enhancement in 10/10, surrounding oedema in 9/10 and mass effect in 4/10 (Figure-1). Lumbar puncture showed high protein levels in 2 cases. A brain biopsy confirmed the diagnosis in 1 case (Figure-2). Although all cultures were negative, 3 patients received antimicrobial drugs. 6 patient received immunosuppression (including those 3 with antimicrobials). No treatment was started in 2. At follow-up, 6 patients are asymptomatic. 3 patients with remote symptomatic seizures have comorbid lesions (stroke, surgery and biopsy needle-track related gliosis). Follow-up MRI is available in 8 patients, with a significant reduction of lesions in 6 and complete resolution in 2. 1 patient's treatment and outcomes data were lost to follow-up. 1 patient's treatment and outcomes data were lost to follow-up.

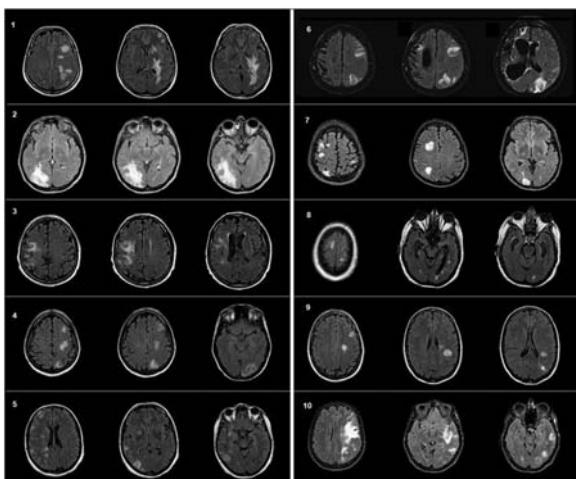


Figure 1: Brain magnetic resonance imaging, FLAIR sequence, axial slices: multifocal FLAIR hyperintense lesions are shown, ipsilateral to the hemisphere corresponding to endovascular treatment in each patient. Patient 1: aneurysm of the left anterior choroidal artery, patient 2: aneurysm of the right posterior communicating artery, patient 3: right middle cerebral artery ischaemic stroke, patient 4: aneurysm of the left intracranial carotid artery, patient 5: aneurysm of the right posterior communicating artery, patient 6: aneurysm of the left middle cerebral artery, patient 7: aneurysm of the right intracranial carotid artery, patient 8: aneurysm of the anterior communicating artery, patient 9: aneurysm of the left intracranial carotid artery, patient 10: aneurysm of the left posterior communicating artery.

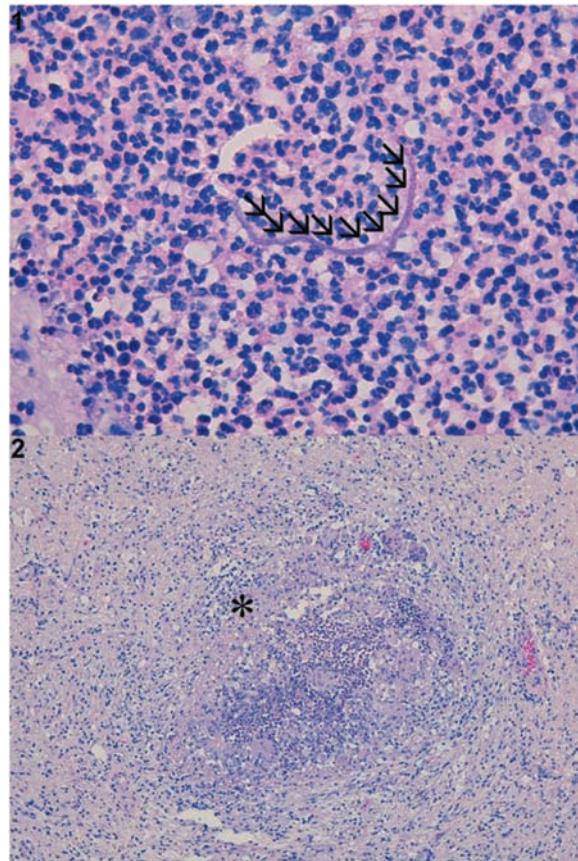


Figure 2: Brain biopsy: Lesion tissue sample, hematoxylin and eosin stain. A polymeric fibre can be shown (up (1): arrows) surrounded by inflammatory reaction. A granulomatous inflammatory reaction is shown below (down (2): star).

**Conclusions:** Intracranial embolic foreign body symptomatic reactions are uncommon complications of endovascular treatment. This entity's early recognition enables making proper diagnosis and treatment decisions.

**Trial registration number:** N/A

**AS35-104**

## NOVEL RECREATIONAL DRUG INGESTION ROUTE: 'SPEED BOMBING' CAUSING INTRACRANIAL HAEMORRHAGE, A CASE REPORT AND PUBLIC HEALTH CONCERN

**Z. Moyo<sup>1</sup>**

1) Zwelibanzi Moyo 2) David Hargroves- correspondence to david.hargroves@nhs.net 3) Tom Webb 4) Farid Anjum 5) Ibrahim Balogun 6) Hardeep Baht; <sup>1</sup>East Kent Stroke Service William Harvey Hospital, Richard Stevens Stroke Ward, Ashford, United Kingdom

**Background and Aims:** The abuse of stimulant drugs is increasing. Physiologically plausible mechanisms for cerebrovascular injury: vasoconstriction syndromes, arterial and venous infarction, and intracerebral haemorrhage. We report a novel ingestion route and harm from 'Speed Bombing (SB)' – an amphetamine wrapped in cigarette paper and ingested. This report explores the role of SB in causing haemorrhagic

stroke and warns of the need for suspicion in patients initially presenting with first seizure following drug ingestion.

**Methods:** Thirty minutes following ingestion of a SB a 27yr old healthy South American retail worker visiting the UK developed intermittent seizures. CT head scanning revealed a right frontal intracerebral haemorrhage with peripheral SAH extension. Her initial NIHSS was 12, MRS = 3.

**Results:** The patient was admitted to a hyper-acute stroke unit (HASU). She was confined to bed rest for 48hrs, sitting at 45 degrees. By day 7, following MDT rehabilitation she was discharged with an NIHSS = 8, MRS = 2.

**Conclusions:** This presentation is not suggestive of a hypertensive surge given the lobar location with prominent cortical subarachnoid (SAH) involvement. The blood pressure was not elevated. Reversible Cerebral Vasoconstriction (RCVS) is recognised to be associated with more peripheral haemorrhage, peripheral SAH and seizures. Triggers for RCVS identified include pre-eclampsia, decongestants, selective serotonin reuptake inhibitors (SSRIs) and sympathomimetic drugs of abuse. Treatment with calcium channel blockers may reduce cerebral vaso-spasm. RCVS should be considered in younger patients presenting with seizures following recreational drug use given the propensity to develop atypical intracerebral haemorrhage.

**Trial registration number:** N/A

### AS35-136

#### DIAGNOSIS AND MANAGEMENT OF" HEPARINE-INDUCED THROMBOCYTOPENIA IN NEUROLOGICAL DEPARTMENT

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**Background and Aims:** Heparin-induced thrombocytopenia (HIT) is a clinicopathological syndrome that occurs when heparin dependent IgG antibodies bind to heparin/platelet factor 4 complexes to activate platelets and produce a hypercoagulable state. The aim of this presentation is to underline the importance of a timely diagnosis and appropriate treatment of this rare but potentially life-threatening syndrome.

**Methods:** We report two cases of stroke and one case of cerebral venous thrombosis associated with HIT observed in our department during 2018

**Results:** 3 Patients, a 74 years-old female, a 67 years-old male. And a 57 years old-female presented to our clinic in 2018 for sudden onset of neurological symptoms after administration of Unfractionated Heparin or Low Molecular Weight Heparine treatment. They previously underwent different surgical procedures (cardiac surgery, hysterectomy, excision of perianal abscess) and afterwards took heparin for prophylactic or anticoagulant purposes. Two cases presented recurrent ischemic strokes associated with widespread thrombotic events involving systemic and pulmonary circulation, and one case developed endocranial hypertension linked to cerebral venous occlusion. In all cases the diagnosis was supported by blood tests showing thrombocytopenia and increase of antiPF4 antibodies levels. All the patients were treated with Argatroban after the diagnosis, and therapy was subsequently switched to oral anticoagulation. In two cases an endovascular approach was also needed to restore systemic and cerebral vascularization

**Conclusions:** HIT should be taken in consideration in patients with neurological and systemic symptoms of acute onset after administration of heparine, as best prognosis and higher probability of restoration of normal platelet values is associated with prompt treatment.

**Trial registration number:** N/A

### AS35-011

#### ENDOVASCULAR TREATMENT OF BILATERAL INTRACRANIAL VERTEBRAL ARTERY DISEASE: FOUR CASE REPORTS

T.Q. Nguyen<sup>1</sup>, T. Huy Nguyen<sup>1</sup>, N. Thanh Thi Dao<sup>1</sup> and B. Nguyen Pham<sup>1</sup>

ENDOVASCULAR TREATMENT OF BILATERAL INTRACRANIAL VERTEBRAL ARTERY DISEASE: FOUR CASE REPORTS; <sup>1</sup>People 115 Hospital, Cerebrovascular Disease Department, Ho Chi Minh city, Vietnam

**Background and Aims:** Bilateral intracranial vertebral artery (ICVA) disease often has poor outcomes. Medical therapy is probably ineffective. There is limited data about endovascular intervention of such patients in literature

**Methods:** Patients with acute posterior circulation ischemic stroke and bilateral ICVA disease were identified at People 115 hospital, Ho Chi Minh city, Viet Nam. We studied clinical characteristics, imaging, angiography, medical management, intervention, and outcomes

**Results:** A total of 4 patients were identified to have bilateral ICVA disease by DSA or MRA (2 had bilateral ICVA severe stenosis, 1 had occlusion at the junction of bilateral ICVA, 1 had left ICVA severe stenosis and contra-lateral hypoplasia). Four patients had baseline NIHSS score ranging from 2 to 6. The most common risk factors were hypertension (4/4), and dyslipidemia (3/4). All patients had brainstem and cerebellum acute lesions on MRI, were treated with infusion of high volumes of normal saline, high dose statin and dual-antiplatelet (aspirin plus clopidogrel). Three of four had clinical deterioration (NIHSS score 9–34) and one patient had three episodes of transient loss of consciousness. All patients were treated by endovascular intervention: three with stenting and one with balloon angioplasty. They had dramatic recovery (3 had mRS of 1 after 3 months; 1 had mRS of 3 after 6 months)

**Conclusions:** Acute stroke patients due to bilateral intracranial vertebral artery disease are at high risk of clinical deterioration. Endovascular treatment may play an important role in these patients

**Trial registration number:** N/A

### AS35-041

#### A RARE CASE OF ESSENTIAL THROMBOCYTOSIS WITH STROKE AND ITS UNIQUE MANAGEMENT

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**Background and Aims:** Thrombocytosis (platelet count >450,000) and more so extreme thrombocytosis (platelet count >1 million) has shown to be independent risk factor for thrombotic ischemic events with most common being stroke. Management is not clinical trial proven because of rare nature of its occurrence.

**Methods:**

**Case Report:** An 82 year-old right-handed female with history of Hypertension, diabetes, hyperlipidemia, essential thrombocytosis, presented to the ED with a fall, a right facial droop, dysarthria and right leg weakness. She was on aspirin and hydroxyurea for thrombocytosis. Examination confirmed above mentioned deficits. MRI of the brain showed left sided corona radiata and internal capsule lacunar stroke. Her platelet count was found to be 1.4 million. She was started on Plavix, doubled her hydroxyurea and underwent plateletpheresis (single session) resulting in platelets to come down to 465,000. She was then discharged to inpatient rehab.

**Results:** In patient with Thrombocytosis anti-platelets and cytoreductive therapy may reduce incidence of stroke by 50%. Pharmacologic

cytoreduction is not immediate, and in selected cases, plateletpheresis may be the only viable option to achieve rapid platelet count reduction during the first critical days, thus providing symptomatic relief and preventing new or worsening major vascular complications. According to the American Society for Apheresis, plateletpheresis is a category-II (second-line) treatment for symptomatic primary thrombocytosis. There is no role of prophylactic cytoreduction.

**Conclusions:** Plateletpheresis is a safe and efficient method to reduce platelets in patient of Thrombocytosis who are having stroke. This is a rare occurrence and rare but effective management which stroke physicians need to keep in mind.

**Trial registration number:** N/A

### AS35-042

#### RARE CASE OF FOCAL CEREBRAL ARTERIOPATHY (FCA) IN A YOUNG ADULT

**M. Niazi<sup>1</sup>, C. Elengovan<sup>1</sup>, G. Zeigler<sup>1</sup>, A. Richardson<sup>1</sup>  
and S. Lakshmi<sup>1</sup>**

<sup>1</sup>Penn State University, Neurology, Hershey, USA

**Background and Aims:** Focal Cerebral Arteriopathy (FCA) is a rare cause of ischemic stroke in young adults

**Methods:**

**Case report:** 37 year old female with history of recent right Middle Cerebral Artery (MCA) ischemic stroke, presented with intermittent left face and body numbness. Workup revealed severe focal stenosis proximal MCA approx. 5mm in length. Vessel wall imaging showed no evidence of wall enhancement. Cerebrospinal fluid and serum studies were unremarkable for infectious, inflammatory and rheumatologic etiologies. Invasive angiogram confirmed the narrowing and showed no evidence of vasculitis. Rest of the stroke etiology work up was negative. She was treated with dual anti-platelet and statin therapy. A year later CTA showed progression of the stenosis to complete occlusion of proximal MCA with distal reconstitution from collateral circulation. There is no disease specific treatment for it and she is being evaluated for surgical bypass as an option.

**Results:** Our patient clearly has slow but progressive focal solitary stenosis without traditional risk factors making possible diagnosis of FCA which is one of the etiology of ischemic strokes in healthy children. FCA in young adults is a rare entity. Several factors such as preceding varicella zoster virus infection, infections with Enterovirus, Lyme and HIV have been reported in children in association with FCA.

**Conclusions:** FCA is a rare entity in healthy young adults as opposed to the pediatric population. Careful workup to rule out other etiologies is necessary. Close follow up with repeat imaging to characterize reversible/stable/progressive arteriopathy is required. No standard treatment is available.

**Trial registration number:** N/A

### AS35-123

#### A RARE CASE OF CERVICAL INTERNAL CAROTID ARTERY THROMBECTOMY

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**Background and Aims:** Intracranial thrombectomy in Acute Ischemic Stroke (AIS) from a Large Vessel Occlusion (LVO) is a standard of care. When patient has extracranial occlusion with a large fresh clot, there are no clear guidelines. Here we present a rare case of large clot burden in extracranial internal carotid artery causing occlusion acutely who received long segment extracranial carotid Mechanical Thrombectomy (MT).

**Methods:** Seventy-two year old lady with history of hypertension, diabetes, hyperlipidemia and atrial fibrillation on Apixaban presented to emergency room with sudden onset of right gaze preference, left facial droop, left hemiparesis and dysarthria for 90 minutes with NIHSS of 18. She was not a candidate for thrombolysis secondary to being on therapeutic anticoagulation. CT Angiogram showed complete occlusion of cervical Right ICA with patent intracranial circulation. She was taken for MT using penumbra aspiration of heavy clot burden occlusion in right ICA leading to complete recanalization. She did not need any intracranial arterial intervention.

**Results:** Her NIHSS dropped to 3 right after procedure. She continued to have uneventful rest of the hospital stay and was discharged to inpatient rehab.

**Conclusions:** Massive clot burden from embolic phenomenon is very rare and seldom reported. A recent case from UCLA demonstrated a technique of pulling all clot down to common carotid and then let the clot diffuse in ECA territory with no significant untoward effects. These subset of patients are rare and unique strategies to help them should be employed.

**Trial registration number:** N/A

### AS35-138

#### A CASE OF NON-ATHEROSCLEROTIC CAROTID DISEASE AS AN UNCOMMON CAUSE OF STROKE

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**Background and Aims:** A 51-year-old African female presented to the emergency department with acute onset blurry vision and speech difficulty. Past medical history was significant for dyslipidemia and left middle cerebral artery stroke four years ago. Physical examination showed a severe aphasia, right-sided facial palsy, right-sided sensory loss and both-sided leg motor drift (NIHSS 8). Once intracerebral hemorrhage was excluded on head CT, thrombolytic therapy using intravenous tPA was initiated. Post-tPA administration NIHSS improved from 8 to 3 (severe aphasia, partial sensory loss). Initial diagnostic workup included blood analysis, cerebral CT angiography, carotid duplex ultrasound, holter ECG monitoring, cardiac ultrasound and genetic counseling. Each of these studies being without abnormality. Single-vessel cerebral angiography was performed and a 70% stenosis having angiographic aspects of atherosclerotic disease of the left extracranial internal carotid artery was found. The patient underwent carotid endarterectomy and the specimen was subjected to histopathological examination. Histological analysis showed no presence of macrophages or cholesterol as seen in atheromatous plaque, neither was it conclusive for fibromuscular dysplasia.

**Methods:**

**Results:**

**Conclusions:** Population-based studies estimated ≈ 7% of ischemic strokes are caused by extracranial internal carotid artery stenosis, mostly due to atherosclerotic carotid disease. However, as illustrated above, in young patients, identification of non-atherosclerotic carotid stenosis and therefore pathological examination of endarterectomy specimen is of great importance, since it may modify therapeutic strategy such as initiation of a statin therapy.

**Trial registration number:** N/A

**AS35-129****MULTIPLE CEREBRAL EMBOLIC INFARCTS AND SYSTEMIC EMBOLIZATION OF GASTRIC CONTENT IN A PATIENT WITH OESOPHAGO-ATRIAL FISTULA: A RARE CASE****I.T. Obi<sup>1</sup>, P. Owusu-Agyei<sup>1</sup>, L. Adamczyk<sup>2</sup> and S. Subramonian<sup>1</sup>**<sup>1</sup>Peterborough City Hospital, Stroke Medicine, Peterborough, United Kingdom; <sup>2</sup>Peterborough City Hospital, Histopathology, Peterborough, United Kingdom

**Background and Aims:** We report a rare case of multiple bilateral ischemic strokes and systemic embolization of gastric contents through the oesophago-atrial fistula, a complication of multiple oesophageal dilatations. Embolic strokes are rare complication of oesophago-atrial fistula, which may cause confusion, seizures, meningitis, focal cortical signs, and post prandial transient ischemic attack

**Methods:** A 52 year old female presented to our emergency department with acute intermittent confusion, mild right upper limb weakness and new onset paroxysmal atrial fibrillation. She had history of childhood diaphragmatic hernia repair by colonic oesophageal transposition, multiple oesophageal stricture dilatations, oesophageal stent and percutaneous endoscopic gastrostomy tube.

**Results:** Computed tomography head scan showed gyriform high density lesions in both cerebral hemispheres suggestive of infection or vasculitis. A lumbar puncture ruled out central nervous system infection. Vasculitic screen and three sets of blood cultures were negative. Magnetic resonance imaging of brain showed fresh multi territorial infarcts in both hemispheres, with some haemorrhagic transformation (see images). Transthoracic echocardiogram did not show any valvular vegetation. On day fifteen, patient had a cardiac arrest with seizures and died after a prolonged resuscitation attempt. A Post mortem showed a fistula between the lower oesophagus and the left atrium and multifocal infarcts in the brain, spleen, intestine and kidneys. This fistula allowed stomach content to flow directly to the arterial system causing blockages of the small vessels in the brain and other organs

**Conclusions:** It is advisable to maintain a high index of suspicion of oesophago-atrial fistula in patients with embolic strokes with history of oesophageal procedures.

**Trial registration number:** n/a

**AS35-029****CHURG-STRAUSS SYNDROME AS RARE ETIOLOGY OF SMALL VESSEL VASCULITIC STROKE WITH MULTIPLE CEREBRAL INFARCTS: CASE REPORT****S. Pawar<sup>1</sup>, N. Ichapor<sup>1</sup> and G. Patil<sup>1</sup>**<sup>1</sup>Jehangir hospital Pune, Neurology, Pune- Maharashtra, India

**Background and Aims:** Churg-Strauss syndrome (CSS) is rare systemic autoimmune disease primarily characterized by hyper eosinophilia, asthma and vasculitis. Neurological manifestations of CSS is uncommon. Peripheral nervous system is more involved than central nervous system

**Methods:**

**Case Report:** We report a case of 60 years old male presented with right side weakness with facial asymmetry and difficulty in talking. Magnetic Resonance imaging showed tiny infarcts in left middle cerebral artery territory, further patient worsened with hemorrhagic transformation of the same infarcts and multiple new tiny infarcts scattered in both cerebral hemisphere.

**Results:** Diagnosis of CSS made with presence of hyper eosinophilia, sinusitis, raised IGE level, p-ANCA positive with extravascular eosinophil accumulation. Patient responded well to methylprednisolone and cyclophosphamide

**Conclusions:** CSS should be considered in patients presenting with small vessel disease and hyper eosinophilia with asthma or pan sinusitis.

Our patient responded well to steroid and immunosuppression

**Trial registration number:** N/A

**AS35-012****ISOLATED CORTICAL VEIN THROMBOSIS OCCURRING AFTER DECOMPRESSIVE CRANIECTOMY FOR MALIGNANT MIDDLE CEREBRAL ARTERY STROKE SYNDROME.****M. Pellizzaro Venti<sup>1</sup>, N. Hannon<sup>1</sup> and R. Lisenik<sup>2</sup>**<sup>1</sup>Cambridge University Hospital, Stroke Unit, Cambridge, United Kingdom;<sup>2</sup>North West Anglia Foundation NHS Trust- Peterborough City Hospital, Stroke Unit, Peterborough, United Kingdom

**Background and Aims:** Isolated cortical vein thrombosis (ICVT) is a rare condition which can be challenging to diagnose either on a clinically or radiologically. There is no literature in regard of such condition occurring after decompressive craniectomy.

**Methods:** Case report of a 49 years old lady who had a decompressive craniectomy after a Right MCA infarct. The post-operative course of this patient was complicated by a generalised tonic clonic seizure. A further CT head demonstrated dense cortical veins at the vertex, which was confirmed to be a cortical vein thrombosis by a CT venogram.

**Results:** The patient was therefore treated with full treatment dose anti-coagulation and re-patriated to her local hospital, where she underwent rehabilitation with good progresses.

**Conclusions:** In the usual post-operative course of a patient with malignant MCA syndrome who undergoes decompressive craniectomy, it is not uncommon for complications such as post-stroke seizure, headache, sepsis, or deep vein thrombosis, to arise. All of the above could have contributed to this lady's post-operative deterioration, however the CT head demonstrated another, rare, presentation.

**Trial registration number:** N/A

**WITHDRAWN**

**AS35-070****MECHANICAL THROMBECTOMY FOR UNUSUAL COMPLICATED CEREBRAL VENOUS THROMBOSIS****L. Petraglia<sup>1</sup>, A. Falcou<sup>1</sup>, A. Wilderk<sup>2</sup> and D. Toni<sup>1</sup>**

<sup>1</sup>Unità di Trattamento Neurovascolare, Policlinico Umberto I – Università di Roma La Sapienza, Roma, Italy; <sup>2</sup>Neuroradiology, Policlinico Tor Vergata, Roma, Italy

**Background and Aims:** Cerebral venous thrombosis (CVT) is a rare condition, usually with favourable prognosis although 15% of patients will die or present significant disability. European guidelines strongly recommend anticoagulation for treating patients with acute CVT, also in patients with hemorrhagic infarction.

**Methods:** A 58-year-old man, with no past medical history, was admitted to Emergency Department after a two-day fever and a seizure causing a severe head trauma.

At arrival, the patient was comatose (GCS 6). Brain CT scan showed multiple cerebral hemorrhagic contusions and SAH in the left hemisphere, with filling defects in right sigmoid and transverse sinus, and right internal jugular vein. These findings suggested a CVT associated with severe hemorrhagic traumatic injury.

**Results:** We considered the traumatic cerebral hemorrhages a contraindication to anticoagulant therapy, as opposed to hemorrhages observed within venous infarction, because of different pathophysiological mechanisms. Nevertheless, the CVT risk score was high (coma 2 points + deep venous thrombosis 2 points + male gender 1 point + intracerebral hemorrhage 1 point = 6), corresponding to negative prognosis. We decided to proceed with catheter thrombectomy, obtaining a quite complete recanalization of the venous system. Clinical evolution was positive with complete regression of symptoms (mRS 0) and of cerebral lesions.

**Conclusions:** This clinical case confirms that catheter thrombectomy is a good alternative to anticoagulation in high-risk CVT patients.

**Trial registration number:** N/A

**AS35-095****DOES PROLONGED NASOGASTRIC FEEDING TRIGGER GASTROINTESTINAL BLEEDING IN STROKE PATIENTS WITH DIEULAFAY LESION (EXULCERATIO SIMPLEX)?****S. Ramanathan<sup>1</sup>, C. Osuafor<sup>1</sup> and N. Hannon<sup>1</sup>**

<sup>1</sup>Cambridge university Hospital, Stroke, Cambridge, United Kingdom

**Background and Aims:** Although relatively uncommon, Dieulafoy lesion is an important cause of acute gastrointestinal bleeding and tends to cause severe bleeding associated with hemodynamic instability. It is however amenable to life saving endoscopic therapy<sup>1</sup>. Aspirin administration has been linked with erosive gastritis in the setting of Dieulafoy lesions<sup>2</sup>. We report an interesting case where Dieulafoy lesion was the cause for an upper gastrointestinal bleed in a patient with ischaemic stroke undergoing nasogastric feeding.

**Methods:** This is a case report

**Results:** A 84-year-old female admitted with right middle cerebral artery territory infarct on aspirin, was fed via nasogastric tube (NGT) for 4 weeks. She presented during inpatient rehabilitation with acute onset of hematemesis, melena and declining haemoglobin level from 11 g/dL to 7 g/dL. Oesophago-gastro-duodenoscopy revealed fresh bleeding likely from a Dieulafoy lesion present at the incisura. Haemostasis was achieved with injection of 3ml Adrenaline 1:10,000, application of 2 endoscopic clips and supplementary blood transfusion. She made a reasonable recovery and was discharged home. We were concerned that prolonged NGT feeding triggered a gastrointestinal haemorrhage in the setting of a Dieulafoy lesion due to the endoscopic appearance of erosion and proximity of the NGT. The patient subsequently chose to accept the risks of oral intake rather than a re-insertion of NGT or other artificial feeding. She also was on antiplatelets which further increases her risk of gastrointestinal bleeding.

**Conclusions:** Medical and nursing staff on stroke units should be aware of this potentially severe but rare complication in patients undergoing nasogastric feeding

**Trial registration number:** n/a

**AS35-113****THREE CASE SERIES OF CORTICAL ISCHAEMIC STROKE AFFECTING THE PRECENTRAL “HAND KNOB” AREA****S. Ramanathan<sup>1</sup>, K. Nazimi<sup>2</sup>, N. Hannon<sup>2</sup>, G. Zachariah<sup>2</sup> and H. Markus<sup>2</sup>**

<sup>1</sup>Cambridge university Hospital, Stroke, Cambridge, United Kingdom;

<sup>2</sup>Addenbrookes Hospital, Stroke, Cambridge, United Kingdom

**Background and Aims:** Cortical ischemic stroke affecting the precentral “hand knob” area is a rare but well known stroke entity. We compare three interesting presentations and contrast them with peripheral nerve palsies.

**Methods:** 1) An 84 year old male presented with sudden onset of left hand weakness and speech disturbance. MRI brain confirmed an acute infarct in the right motor cortex 2) A 90 years old male presented with sudden onset left hand weakness. MRI brain confirmed acute infarct in the right pre-and post-central gyri and right superior cerebellum 3) A 90 year old female with HTN presented with intermittent right hand weakness. MRI Brain showed acute cortical infarction on the left precentral gyrus.

Admission Ct head/ Telemetry / Carotid Doppler's were normal for all the three cases except the second one had 50–69% stenosis on the Right side. The NIHSS score was >5 for all 3 patients.

They presented with varying degrees of impairment with mild weakness to complete wrist drop. These were treated with either Aspirin or Clopidogrel and later discharged with on-going physiotherapy

**Results:** It is worth noting that the clinical presentation can be disguised as peripheral nerve palsies, as an astute physician should take an accurate history to differentiate between the two and often a MRI scan of the brain is needed to confirm the diagnosis. Hand improvement is expected in general to be fair to good but our patients have not regained full functionality however long-term outcome depends on risk factors and stroke mechanism

**Conclusions:** as above

**Trial registration number:** n/a

**AS35-114****MANAGEMENT OF LARGE VESSEL OCCLUSION STROKE RELATED TO INFECTIVE ENDOCARDITIS: IS MECHANICAL THROMBECTOMY A SAFE OPTION?**

**C. Ramos<sup>1</sup>, S. Trillo<sup>2</sup>, J.L. Caniego<sup>3</sup>, E. Bárcena<sup>3</sup>, C. Aguirre<sup>2</sup>, L. Martínez-Vicente<sup>2</sup>, J. Villacieros<sup>2</sup>, Á. Ximénez-Carrillo<sup>2</sup> and J. Vivancos<sup>2</sup>**

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**Background and Aims:** Acute ischemic stroke (AIS) is the most common neurological complication of infective endocarditis (IE). Intravenous thrombolysis (IVT) is contraindicated in these patients due to a higher risk of hemorrhagic complications. Whether mechanical thrombectomy (MT) has some benefit in AIS secondary to septic emboli remains unanswered although some favorable results can be found in literature.

**Methods:** We report four cases of AIS due to septic emboli treated with MT in our centre.

**Results:** Median age 61.5 (IQR 15). Female sex 75%. Diagnosis of IE was previous to the diagnosis of AIS in one of the patients. There were two cases of prosthetic-valve endocarditis (mitral valve) and two cases of native aortic valve IE. Two patients were treated with IVT with an extensive subarachnoid hemorrhage in 24 hours follow-up CT. Another patient suffered an arterial perforation during the procedure without successful recanalization. There were no significant complications just in one of the treated patients. Two patients presented a significant neurological improvement, without symptoms 24 hours after MT and absence of hemorrhagic complications in follow up CT. Two patients passed away due to symptomatic intracerebral hemorrhage and one of them due to cardiac complications.

**Conclusions:** In patients with large vessel AIS related to IE, MT might be considered with some potential benefit reported. However the existence of publication bias in these cases cannot be ruled out. A probably high risk of hemorrhagic complications, as known for IVT in this condition, suggests that this procedure should be carefully evaluated in these patients.

**Trial registration number:** N/A

**AS35-109****ISCHEMIC STROKE IN LATE-ONSET SUSAC SYNDROME: A DIAGNOSIS TO BE CONSIDERED IN ELDERLY PATIENTS**

**M. Ranieri<sup>1</sup>, S. Fannucchi<sup>1</sup>, C. Marsile<sup>1</sup>, G.E. Molini<sup>1</sup> and C. Zanferrari<sup>1</sup>**

<sup>1</sup>Vizzolo Predabissi Hospital, Stroke Unit, Milan, Italy

**Background and Aims:** Susac Syndrome (SS) is a rare, immune-mediated endotheliopathy characterized by the occlusion of microvessels in the brain, retina and inner ear leading to the typical triad of encephalopathy, visual defects and cochlear hearing loss. Recently clinical and paraclinical consensus criteria for the diagnosis of SS have been proposed.

**Methods:** Clinical presentation characterized by subacute confusion associated with focal neurological deficit and corresponding restricted diffusion lesions on brain MRI have been reported.

**Results:** We present a 78 year old woman who was admitted to our Stroke Unit as she complained aphasia. Previous medical history was characterized by recurrent bilateral visual disturbances partially steroid-responsive of undetermined origin followed by sensorineural hearing loss. Brain MRI showed a severe burden of T2 hyperintense lesions in the periventricular white matter and in the corpus callosum; a DWI left temporal lesion with enhancement was observed. We performed a comprehensive diagnostic assessment in order to rule out other

cerebrovascular etiology. Cerebrospinal fluid evaluation disclosed mild pleocytosis and the presence of oligoclonal bands. Brain, retinal and vestibulocochlear involvement led us to make a diagnosis of "probable SS". The patient was therefore treated with IV methylprednisolone with clinical and radiological improvement. She was re-admitted about 3 months later for further decline in visual acuity and cognitive performance which led to start azathioprine.

**Conclusions:** SS still represents a challenging diagnosis as it is not supported by any pathognomonic makers. Although late onset and ischemic stroke presentation is atypical for SS, it must be considered in the elderly due to its treatment implications.

**Trial registration number:** N/A

**AS35-137****CASE REPORTS: SIMILAR FINDINGS AS MAY-TURNER SYNDROME ON MAGNETIC RESONANCE VENOGRAM PELVIS IN CRYPTOGENIC STROKE PATIENTS**

**J. Soomro<sup>1</sup> and S. Rao<sup>1</sup>**

<sup>1</sup>Texas Stroke Institute, Stroke and Endovascular, Dallas, USA

**Background and Aims:** May-Thurner syndrome (MTS) is caused by compression of left common iliac vein (LCIV) by the overlying of right common iliac artery (RCIA) which increases the risk of lower extremity deep venous thrombosis (DVT). Paradoxical emboli as a cause of cryptogenic stroke (CS) in association with patent foramen ovale (PFO) has been postulated to be an important association in patients with MTS.

**Methods:** We present two cases of CS patients who were found to have PFO and magnetic resonance venogram (MRV) imaging of pelvis revealed findings of iliofemoral flattening.

**Results:** We report two cases of CS patients in their late 40's. One patient presented with right middle cerebral artery stroke syndrome with a large vessel occlusion requiring thrombectomy. Other patient presented with a left subcortical hemispheric stroke. Both of the patients were healthy and had no medical history. One patient's LDL was 94 and A1c of 5. Echocardiogram (ECHO) was unremarkable except for PFO. Given ECHO findings, she underwent doppler venous ultrasound (US) of lower extremities and MRV; the US did not reveal a DVT, however, MRV showed flattening of LCIV by RCIA. Other patient, his LDL was 117 and A1c of 5.6. His ECHO also showed a PFO. US was unremarkable, but MRV showed flattening of the LCIV by the RCIA. Both patients did well and had a good clinical outcome with mRS of 1. They will follow up with cardiology for consideration of PFO closure.

**Conclusions:** These case reports puts emphasis on performing MRV routinely in patients with CS and PFO.

**Trial registration number:** N/A

**AS35-127****POSTERIOR CIRCULATION STROKE PRESENTING AS A BOW HUNTER'S SYNDROME: WHEN A DYNAMIC APPROACH IS NEEDED**

**A. Risitano<sup>1</sup>, G. Di Pietro<sup>1</sup>, E. Vicenzini<sup>1</sup> and D. Toni<sup>1</sup>**

<sup>1</sup>La Sapienza University, Department of Human Neurosciences, Rome, Italy

**Background and Aims:** Posterior circulation stroke cause detection represents a diagnostic challenge in emergency. Vertebral artery (VA) dissection is a frequent cause in young patients.

**Methods:** We describe two cases of posterior circulation stroke, both related to VA dissection, in which ultrasound evaluation with dynamic study, was fundamental for diagnosis.

**Results:** Case 1: 38 yrs old man admitted at the ER for acute onset of severe neck pain, headache, objective vertigo, nausea. Cerebral MRI showed left cerebellum ischemic lesion. Ultrasound revealed right V2 vertebral artery dissection with intramural hematoma and distal post-stenotic flow, that was less identifiable with angioTC.

Case 2: 44 yrs old man admitted at the ER for neck pain, vertigo and left limb paresthesias after head rotation while parking the car in reverse gear. Cerebral MRI showed a left cerebellum ischemic lesion. Both MR and CT angiographies failed to identify vertebral artery dissection. At ultrasound, flow stop in the left VA, only during right neck rotation, was detected while performing transcranial imaging through subnucal approach. Angio-CT with right head rotation confirmed the vertebral artery occlusion at C1-C2 level, without disc herniation or osteophytes. This findings support a Rotational Vertebral Artery Occlusion syndrome with ischemic stroke (Bow Hunter's stroke), probably due to left VA dissection at V3.

**Conclusions:** Accurate ultrasound evaluation of posterior circulation, eventually with dynamic manouvers, have to be considered in the diagnostic work-up of posterior circulation strokes. Bow Hunter's syndrome is a rare cause of vertebrobasilar insufficiency and could be underdiagnosed in clinical practice.

**Trial registration number:** N/A

### AS35-I12

#### REPEATED BRIDGING THERAPY FOR EARLY RECURRENT LARGE VESSEL OCCLUSION ISCHEMIC STROKE: A CASE REPORT

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**Background and Aims:** Bridging therapy (BT) consisting in intravenous thrombolysis (IVT) with rt-PA and endovascular treatment (EVT) is actually considered the best treatment for large vessel occlusion (LVO). In case of early recurrent stroke, the benefits and safety of repeated BT, have not yet been demonstrated.

**Methods:** We present a case of 78-years-old woman with early recurrent LVO ischemic stroke within 20 days.

**Results:** A 78-years-old woman with hypertension and hypercholesterolemia was admitted for right hemiparesis and aphasia (NIHSS 21). Computed tomography angiography (CTA) revealed left M1 occlusion. BT was performed with complete recanalization at 4 hours from the onset and early neurological improvement (NIHSS 13). 24-hours-brain-CT scan showed fronto-insular ischemic lesion. Since a negative extensive diagnostic work-up, clopidogrel was prescribed. At discharge mild aphasia persisted (NIHSS 5). After 20 days, she presented left hemiparesis and neglect (NIHSS 23). CTA showed a right siphon L-occlusion. BT determined again complete recanalization and considerable clinical improvement. 24-hours-brain-CT revealed right fronto-insular and basal ganglia ischemic lesions. At discharge moderate aphasia and left mild hemiparesis (NIHSS 10) were still present. Then oral anticoagulation with Apixaban was started, but only 1-month later AF was detected.

**Conclusions:** Although having a previous stroke within 3 months is still considered a relative contraindication to IVT, repeated systemic thrombolysis has been reported to be safe and efficient. EVT may be a potential option for recurrent strokes. Herein we describe the first report of repeated BT performed in early recurrent LVO ischemic stroke. In properly selected cases repeated BT appears to be safe and effective.

**Trial registration number:** N/A

### AS35-I15

#### CAROTID WEB AND ACUTE ISCHEMIC STROKE: CASE REPORT

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**Background and Aims:** Carotid Web (CW) is a rare variant of fibromuscular dysplasia in which a band of tissue narrows the carotid lumen, and is associated with recurrent ischemic stroke, secondary to blood flow stasis and subsequent embolization. Literature revealed high stroke recurrence rate related to medical treatment whereas carotid stenting seems to be safe and effective in secondary prevention. Nevertheless, evidence and the optimal management is unclear.

**Methods:** Case report

**Results:** A 61 year-old male with previous history of smoking and hypertension treated with doxazosin was admitted in our Comprehensive Stroke Center with acute right hemiparesis, hemihypoesthesia and aphasia (NIHSS 9). Non contrast cranial CT and CT angiography showed ASPECTS 10/10 and distal carotid occlusion. CT perfusion revealed ischemic penumbra. He underwent intravenous fibrinolysis at standard dose and mechanical thrombectomy (TICI 3) with progressive improvement of symptoms. Digital angiography revealed carotid web variant with lumen stenosis of left internal carotid artery (ICA). Prolonged heart rhythm monitoring did not reveal any arrhythmia. Blood tests including thrombophilia studies and ultrasound echocardiography were normal. Elective angioplasty and stenting of ICA was performed satisfactorily followed by dual antiplatelet therapy with aspirin and clopidogrel. Patient was discharged 11 days after symptoms onset with mild distal paresis of right arm. No recurrence was reported.

**Conclusions:** There is an association between carotid artery web and ischemic stroke. Angioplasty and stenting might be safe and feasible for secondary prevention.

**Trial registration number:** N/A

### AS35-I24

#### WHEN THE FREQUENT MEETS THE UNEXPECTED: RECURRENT TIA EVENTS IN A 79-YEARS-OLD MAN WITH CONCOMITANT CEREBRAL VENOUS THROMBOSIS AND ARTERIAL ISCHAEMIC STROKE

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**Background and Aims:** Coexistence of cerebral venous thrombosis (CVT) and arterial ischaemic stroke is exceptional, and in that situation, as post stroke headache is so frequent, the former diagnosis can easily be misdiagnosed.

**Methods:** Case report

**Results:** A 79-year-old man with previous history of recurrent deep venous thrombosis and hypertension, presented with a one-month history of seven transient episodes of sudden onset right distal upper limb weakness and numbness, lasting up to 30minutes; and a few-minutes episode of unbalanced gait and vertigo, preceded, the week before, by transient frontal headaches. Neurological examination, including fundoscopy, was unremarkable. Brain MRI showed acute ischaemia on the left lenticular area. In the following weeks, he reported persistence of the

mild frontal headache. Review of the initial MRI also revealed superior sagittal sinus (SSS) thrombosis; subsequent CT venogram confirmed extensive CVT within the SSS extending to the cortical veins bilaterally and to the left transverse sinus, left sigmoid sinus and left jugular vein. Investigations including autoimmunity and thrombophilia panel, trans-thoracic echocardiogram, 72-hours ECG, total-body CT and PET-FDG were all normal/negative. Anticoagulation was started, with improvement of the clinical symptoms. A 3-months interval MRI revealed partial SSS recanalization.

**Conclusions:** We report a case of recurrent left-hemispheric TIA events initially attributed to the arterial ischemic lesion. The simultaneous presence of CVT, the patient's age, and the history of previous thrombotic events led to the search of occult malignancy, which is so far excluded. No unifying mechanism has so far been found; long term follow-up is planned.

**Trial registration number:** N/A

### AS35-015

#### STREPTOCOCCUS DYSGALACTIAE MENINGITIS PRESENTING AS SPONTANEOUS SUB-ARACHNOID HAEMORRHAGE

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##### Background and Aims:

**Background:** Haemorrhage in bacterial meningitis is < 3%. Meningitis presenting as subarachnoid haemorrhage (SAH) is rare. Meningitis due to Streptococcus (S) dysgalactiae is rare [< 10 cases reported].

**Aim:** To describe first case of S. dysgalactiae meningitis presenting as SAH.

##### Methods: Case Description

**Results:** 62 year gentleman with history of heroin dependence was admitted to psychiatric institute for detoxification, developed progressive drowsiness (2 days) and was referred to our institute. CT brain showed a left sulcal SAH [also noted on subsequent MRI; Fig 1].

Neurological review was sought.

Examination revealed febrile, drowsy patient, signs of meningeal irritation, absence of focal motor/ sensory/ cerebellar signs. Laboratory investigations : neutrophilic leukocytosis and elevated C- reactive protein.

Given the history of substance use, possibility of secondary vasculitis and reversible cerebral vasoconstriction syndrome considered. CT angiogram was normal.



In view of fever/ elevated inflammatory markers, cerebrospinal fluid evaluation done (540 leucocytes : 65% neutrophils; protein 12.6 g/L; glucose 0.1 mmol/L). Blood and CSF cultures positive for Strep, dysgalactiae. Intravenous ceftriaxone 2 gm BD started. Repeat brain imaging (day 5) for persistent drowsiness showed (Fig 1) evidence of ventriculitis, left temporal l hematoma, bilateral infarcts (perforating arteries). Antibiotic was changed to Meropenem, and continued for 2 weeks. Echocardiogram normal. Slow recovery to independent ambulation noted over several weeks.

**Conclusions:** This is the first reported case of Strep dysgalactiae meningitis presenting as spontaneous SAH. Mechanism is likely to be either endothelial dysfunction, cerebral disseminated intravascular coagulation and/ or secondary vasculitis.

**Trial registration number:** NA

### AS35-016

#### DIFFUSION WEIGHTED IMAGING IN ACUTE SPINAL INFARCTS : SUSPECT AND PERFORM

**M. Saini<sup>1</sup> and X.M.S. Neo<sup>2</sup>**

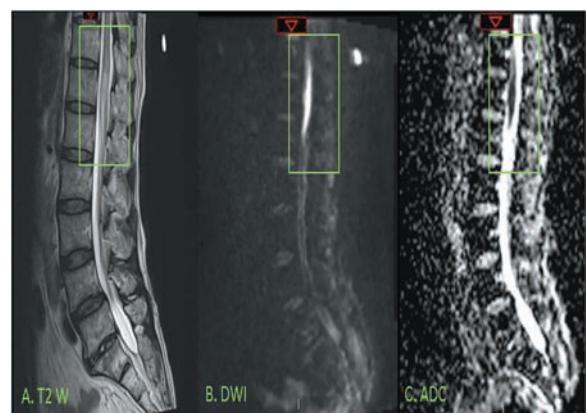
<sup>1</sup>Changi general Hospital, Neurology, singapore, Singapore; <sup>2</sup>National Neuroscience Institute, Neurology, Singapore, Singapore

##### Background and Aims:

**Background:** Spinal Infarcts are < 2% of all strokes. Majority involve the Anterior Spinal Artery territory, conus medullaris infarcts are rare. Spinal imaging may aid in diagnosis.

**Aim:** To underline importance of targeted diffusion weighted imaging (DWI) in spinal stroke.

**Methods:** A rare case of conus infarct is described. 76 year old gentleman with no known past medical issues presented with sudden onset, bilateral foot numbness, bilateral lower limb weakness (over several hours), urinary retention and mild low back pain. Examination revealed symmetrical, lower motor neuron paraparesis, with slightly increased tone at left hip. Ankle jerks and right knee jerk absent; left knee jerk normal with adductor sign. Diffuse sensory loss to all modalities below L1 (right)/L2(left), most severe over L4-S1 regions. Rest neurological exam normal. Systemic exam showed xanthelasma. Syndromic diagnosis was that of an acute myelopathy, at level of conus. Possibility of spinal infarct was considered.



**Results:** MRI spine was diagnostic, consistent with an acute conus infarct (Fig 1). CT Aortogram showed diffuse atherosclerotic changes and ulcerated plaques. Dedicated spinal angiogram was not performed. He was diagnosed with hypertension and hyperlipidemia; amlodipine and statin were prescribed. Mild Improvement in proximal lower limb power noted over first week; currently undergoing rehabilitation

**Conclusions:** A rare case of conus medullaris infarct is described. In patients with high clinical suspicion of vascular myelopathy, dedicated DWI of spinal cord in the early phase aids diagnosis. Management is supportive and includes vascular risk factor management

**Trial registration number:** n/A

Dermatomyositis. Ours would be the first case reported with these characteristics

**Trial registration number:** N/A

## WITHDRAWN

### AS35-002

#### BILATERAL INTRACEREBRAL HEMORRHAGE AS A PRESENTATION OF CENTRAL NERVOUS SYSTEM VASCULITIS IN A PATIENT WITH DERMATOMYOSITIS.

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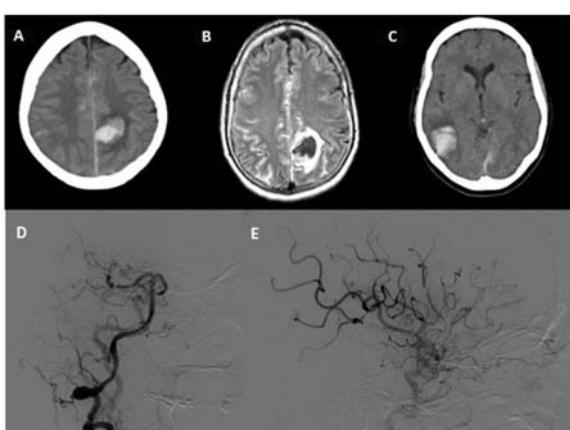
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**Background and Aims:** Intracerebral Hemorrhage (IH) is uncommon in Central Nervous System Vasculitis (CNSV). Relationship between CNSV and Dermatomyositis is scarce.

We aim to describe an exceptional association between IH, CNSV and Dermatomyositis

**Methods:** Review of personal history, complementary tests, treatment and outcome in one year follow-up.

**Results:** A 59-year-old right-handed woman with personal history of refractory Dermatomyositis was admitted to the Emergency Department because of a sudden headache on the left side. Brain computed tomography (CT) showed a left parietal IH. Two days later, she had a new strong headache accompanied with left hemiparesia. A new CT showed a right temporooccipital IH. A Gradient-Echo Magnetic Resonance (MRI) did not show any Amyloid-Beta deposition. Cerebral Angiography offered areas of segmental narrowing in the middle cerebral artery territory bilaterally and in the posterior cerebral artery (P2 segment) bilaterally consistent with vasculitis. Coagulation, autoimmunity, and serology laboratory tests found no relevant alteration. She was treated with methylprednisolone (1g/day bolus for three days), and three 500 mg dose of endovenous cyclofosfamide plus daily oral prednisone. She completely recovered in days and has shown no new neurological or systemic events in a year follow-up. A brain MRI within three months of the beginning found no new radiological findings.



**Conclusions:** CNSV may be a very rare complication of Dermatomyositis. To our knowledge, only nine cases have been reported of this association. In our case, good response to immunosuppressant therapy lets us make a relationship among bilateral IH, CNSV, and

Dermatomyositis. Ours would be the first case reported with these characteristics

**Trial registration number:** N/A

## WITHDRAWN

### AS35-132

#### IODINE CONTRAST EXTRAVASATION ON COMPUTED TOPOGRAPHY POST-THROMBECTOMY MIMICS MAGNETIC RESONANCE HYPERACUTE REPERFUSION MARKER

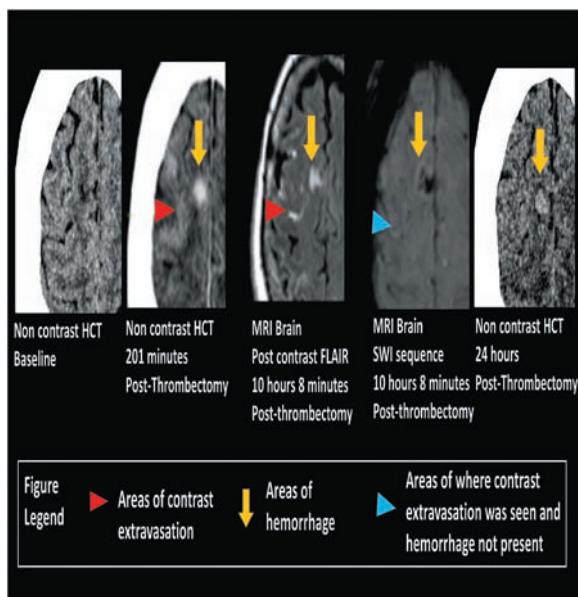
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**Background and Aims:** Hyperacute reperfusion marker (HARM) on post-contrast fluid attenuated inversion recovery (FLAIR) is a marker of blood brain barrier disruption, predictor of hemorrhagic transformation, and poor clinical outcome in ischemic stroke, but requires hyperacute magnetic resonance imaging (MRI) capabilities, so having a comparable computed topography (CT) imaging biomarker would be useful.

**Methods:** A 70 year-old woman with a right middle cerebral artery (MCA) stroke was treated with thrombolysis and thrombectomy for proximal MCA occlusion. The patient's imaging findings (see figure) are described below.

**Results:** Post-thrombectomy non-contrast head CT (HCT) acquired 201 minutes post-procedure secondary to neurologic decline demonstrated hyperdensities within the right frontal lobe and sulci. On the post-gadolinium FLAIR sequence obtained 10 hours later as part of the MR perfusion protocol, hyperintensities were similarly distributed like the hyperdensities seen on the post-thrombectomy non-contrast HCT. Also, these areas of likely iodine-contrast extravasation on the post-thrombectomy non-contrast HCT were not hypointense on the susceptibility weighted imaging (SWI), confirming the areas were not representative of subarachnoid hemorrhage. However, the right frontal lesion was hypointense on SWI, confirming petechial hemorrhage.



**Conclusions:** Although post-thrombectomy contrast extravasation on CT has been described, to our knowledge, this is the first depiction of how it is similarly representative of MRI-HARM. Thus, we may be able to extrapolate what we know about HARM detected on MRI to a CT imaging biomarker that would be much more easily obtainable in most stroke patients. The utility of post-reperfusion CT imaging, or CT-HARM, as an imaging biomarker in ischemic stroke should continue to be investigated.

**Trial registration number:** N/A

#### AS35-058

#### CAROTID ARTERY DISSECTION; AN UNCOMMON PRESENTATION

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**Background and Aims:** Carotid Artery Dissections (CAD) are a common cause for strokes in younger patients<sup>1</sup>. Sports induced CAD especially due to running has been reported as a common cause.<sup>2</sup> There have been case reports of patients presenting with bilateral CAD<sup>3-6</sup> and patients presenting with recurrence of carotid dissection in the same artery<sup>1,7,8</sup>. We present an interesting cause of recurrent carotid dissection in different arteries.

#### Methods:

**Case report:** 49 year old man presented 3 years ago with a sudden onset headache and a popping sound just below his right eye following the completion of a 5km Parkrun. He noted that his right pupil was

smaller than the left. Magnetic Resonance Angiogram (MRA) revealed a right carotid artery dissection. Recently, he re-presented after completing the same Parkrun with a similar headache on the opposite side and noticed that his left pupil was now smaller than his right. Repeat MRA confirmed a dissection of the left carotid artery and a complete resolution of his previous dissection.

**Results:** This is the first case report of recurrent carotid dissections resulting in only a Horner's syndrome after similar physical exertion. The patient was treated conservatively and had no other neurological sequelae on both occasions. Various investigations for connective tissue disorders have been negative and there is no obvious cause for his recurrent dissections. This has resulted in increased patient anxiety regarding physical exertion.

**Conclusions:** This case highlights the need for more research into the cause of CAD in order to provide patients with better advice to prevent recurrent events.

**Trial registration number:** n/a

#### AS35-020

#### PARADOXICAL EMBOLISM DUE TO LARGE AND SERPENTINE THROMBUS IN TRANSIT THROUGH PATENT FORAMEN OVALE: A CASE REPORT

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**Background and Aims:** A thrombus in transit through a patent foramen ovale (PFO) with impending paradoxical embolism is an extremely rare event. Due to its transient nature, it is very difficult to identify the thrombus.

**Methods:** A case report of paradoxical embolism with multiple brain and spleen infarctions in a patient with thrombus straddling the PFO which was diagnosed by echocardiography and treated surgically.

**Results:** A 78-year-old woman came to the emergency department with somnolence, aphasia, right central facial palsy and right hemi-hypoesthesia. Time from symptom onset to arrival to emergency department was 24 hours and NIHSS was 5. Head computed tomography (CT) and magnetic resonance showed lesions suggestive of acute ischemia in both hemispheres and Anglo-CT did not reveal thrombus. Transesophageal and transthoracic echocardiography exhibited a long 13 x 1.5 cm serpentine thrombus accessing the right atrium through the inferior vena cava and extending to the left atrium and left ventricle through a PFO. Lower extremity venous doppler revealed a thrombus in the left femoral and popliteal veins and a spleen infarction was seen in the body-CT.

**Conclusions:** There are few described cases of thrombus in transit through a PFO and there is no medical consensus about the best option for treatment. Surgical removal of the intracardiac thrombus and closure of the PFO was decided in our case with excellent results. Surgery is associated with fewer complications of recurrent embolic events than thrombolysis and anticoagulation, and therefore it appeared to be the best approach in patients who are not at a high surgical risk.

**Trial registration number:** N/A

**AS35-067****CEREBROVASCULAR EVENTS IN 2 PATIENTS WITH WEST-NILE VIRUS BRAIN INFECTION****E. Spina<sup>1</sup>, A. Zini<sup>2</sup>, D. Laterza<sup>3</sup>, G. Bigliardi<sup>3</sup> and L. Picchietto<sup>3</sup>**

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**Background and Aims:** Infection by West Nile Virus has emerged as a public health problem. Neurological manifestation like meningoencephalitis and seizures have been described in up to 25% of cases of WNV-infection

**Methods:** We describe two cases of WNV-related cerebrovascular disease (CDs)

**Results:** Case 1: a 46 year-old patient was admitted with headache, fever and an impaired level of consciousness. Suspecting encephalitis we performed lumbar puncture (LP) finding WNV-RNA copies, reported also in urine and blood test. EEG showed paroxysmal alterations on fronto-temporal right lobe and Venous-MRI showed thrombosis of left transverse-sigmoid sinuses and jugular vein. Conditions improved with anticoagulant and IgIV therapy with full resolution after three months.

Case 2: a 76 year-old male presented diplopia, gait instability, dysarthria and right hemiparesis during fever. LP confirmed encephalitis (pleocytosis, hypoglycorrachia and hyperprotidorrachia) with positivity for WNV-tests. Despite antiviral therapy, the following week he suffered from an occlusion of left MCA with subsequent ischaemic lesion, complicated by hemorrhagic infarction. No embolic sources were founded. After occurrence of pneumonia his condition deteriorated resulting in death.

**Conclusions:** CDs represent first cause of disability and one of the principal causes of death in the world. Bacterial, micotic and viral infections have been demonstrated to potentially cause stroke, through small vessel damage, inflammatory vasculitic mechanism and coagulation alterations. In our two cases cerebrovascular events occurred during acute phase of WNV infection. It suggests that WNV, also in presence of vascular risks, could be a trigger for CDs. Moreover, we observed hemorrhagic complications in both patients, suggesting complex alteration in coagulation patterns.

**Trial registration number:** N/A

**AS35-121****RECURRENT BRAIN EDEMA IN A PATIENT AFFECTED BY CEREBRAL AMYLOID ANGIOPATHY-RELATED INFLAMMATION (CAA-RI)****M. Squitieri<sup>1</sup>, V. Rinnoci<sup>1</sup>, R. Valenti<sup>2</sup>, D. Inzitari<sup>1</sup> and F. Pescini<sup>3</sup>**

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**Background and Aims:** CAA-ri is an unusual form of CAA characterized by an inflammatory response to vascular deposits of  $\beta$ -amyloid.

**Methods:** A 69-year-old woman was referred to our attention for episodes of recurring transient paresthesias lasting 15 minutes, spreading from perioral region to right arm, hemithorax, and leg, followed by headache lasting 30-minutes.

**Results:** MRI scans revealed on FLAIR diffuse hyperintensity of left central sulcus with contrast-enhancement on T1WI; on T2-GRE and SWI cortical/subcortical microbleeds and bilateral hypointensities of parietal sulci were visible. Anti-A $\beta$  autoantibody titer in CSF was increased (91,4 ng/mg). These findings were consistent with CAA-ri. High dose

corticosteroid therapy was administered with subsequent tapering and continued for 8-months. One year later, a severe relapse occurred, characterized by focal neurological symptoms and cognitive impairment. Brain MRI showed subarachnoid hemorrhage, cortical/subcortical vasogenic edema of the left occipital and frontal lobe, right temporal and frontoparietal region. After one month of corticosteroids therapy, improvement of cognitive and focal neurological impairment was obtained. Immunosuppressive therapy with azathioprine and then mycophenolate mofetil was prescribed. Neuropsychological evaluation, however, showed persistence of mild impairment of executive functions, anomia, and a decreased phonemic fluency.

**Conclusions:** CAA-ri is characterized by subacute cognitive decline, headaches, seizures, and stroke-like signs. Neuroradiologic features include vasogenic oedema, sulcal effusions, cortical/subcortical hemorrhages and microbleeds with haemosiderin deposits. In most cases, the inflammation and clinical symptoms improve with corticosteroids with or without immunosuppressive therapy and only a minority of patients relapse, mostly while not taking immunosuppression, as in our patient.

**Trial registration number:** N/A

**AS35-083****CAROTID DISSECTION SECONDARY TO COCAINE: SINGLE CENTRE 12 MONTH EXPERIENCE****M. Strecker<sup>1</sup> and P. Ferdinand<sup>1</sup>**

<sup>1</sup>Royal Stoke Hospital – University Hospitals North Midlands, Stroke Department, Stoke-on-Trent, United Kingdom

**Background and Aims:** Risk factor identification and management are key in strokes affecting the young, whilst illicit drug use represents an important and modifiable risk factor for ischaemic and haemorrhagic stroke. In particular, cocaine represents both a commonly used and aetiiological agent of drug induced stroke with several proposed mechanisms. We present three cases of carotid artery dissection in young chronic cocaine users presenting to Royal Stoke University Hospital within the last 12 months.

**Methods:** Cerebral, vascular and cardiac imaging was reviewed for all patients. Literature relating to cocaine induced carotid artery dissection and strokes and potential mechanisms were reviewed.

**Results:** All cases were identified as having uni/bilateral carotid artery dissection as the primary stroke aetiology in addition to other cocaine associated sequelae ranging from myocardial depression with thrombosis to widespread leukoencephalopathy. Concomitant use of tobacco and alcohol was present in all subjects. Literature review found very few and isolated reports of cocaine related carotid dissection and its causes.

**Conclusions:** Multiple hypotheses exist relating to ischaemic stroke and cocaine use. These include cerebrovascular hypoperfusion related to the vasoconstrictive properties of cocaine, localised vasculitis, vascular apoptosis and cardiac embolization from myocardial depression and thrombus formation. However in relation to carotid dissection the exact pathophysiology remains unclear. Further research is required regarding the exact pathophysiology of cocaine mediated carotid artery dissection and whether in the presented cases there is a common pathway explaining all sequelae or there are several simultaneous mechanisms. This will inform treatment decisions, prognosis and risk of future cerebrovascular events.

**Trial registration number:** N/A

**AS35-082****EXCELLENT OUTCOME AFTER ENDOVASCULAR TREATMENT OF INTERNAL CAROTID ARTERY OCCLUSION.**

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<sup>1</sup>University of Pécs, Stroke Department, Pécs, Hungary; <sup>2</sup>University of Pécs, Department of Anaesthesiology and Intensive Therapy, Pécs, Hungary; <sup>3</sup>University of Pécs, Department of Neurosurgery, Pécs, Hungary

**Background and Aims:** Internal carotid artery (ICA) dissection is a rare but important cause of severe acute ischemic stroke, especially among younger adults. Over the past years, multiple studies on recanalization treatment such as intravenous fibrinolysis alone or combined with endovascular treatment have been performed and high rates of favourable outcomes and reperfusion have been reported.

**Methods:** N/A

**Results:** A 47-year-old female has presented to the emergency department with acute onset left hemiparesis, facial palsy, hemianopsia and right-sided headache (NIHSS: 15). CT-angiography detected ICA occlusion located to the C2 segment, with a maintained flow above the occlusion. CT-perfusion scan (Olea Sphere<sup>®</sup>) showed perfusion deficit across the right hemisphere. In the absence of contraindications, iv. thrombolysis was started with a time window of 1,5 hours. The symptoms showed only moderate improvement, so the patient was referred to endovascular intervention. Intraoperative DSA proved the dissection of the right ICA with moderate lumen stenosis. The distal dissection was covered with a self-expandable stent (LEO+<sup>TM</sup>), the proximal dissection and intimal flap was covered with a Double-Layer Micromesh Stent (Roadsaver<sup>®</sup>). After the successful intervention (TICI3 recanalization) the symptoms disappeared quickly (NIHSS: 1), only a mild headache persisted for 24 hours. Control imaging revealed no ischemic lesion.

**Conclusions:** In the case of ischemic stroke in a young patient ICA dissection should be considered. Patients with persisting moderate-to-severe symptoms after thrombolytic therapy could be candidates for endovascular treatment. Our case showed that complex management of stroke caused by ICA dissection (endovascular treatment after iv. thrombolysis) can result excellent clinical outcomes.

**Trial registration number:** N/A

**AS35-006****A CASE OF DELAYED THROMBECTOMY IN A PATIENT PRESENTING WITH CONVULSION-LIKE MOVEMENTS IN BASILAR ARTERY STROKE**

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**Background and Aims:** A 28-year-old presented with a severe headache, vomiting and blurred vision lasting 10 minutes. This was followed 15 hours later by jerky movements in arms and legs lasting 4 minutes, mimicking generalised-tonic-clonic seizure with residual ataxia and third nerve palsy. Brain imaging using non-contrast CT and CT venogram suggested a basilar artery tip thrombus. Magnetic Resonance Imaging 10 hours following this showed matched restriction-hyperintensity in her cerebellum. She has subtle early changes of restriction diffusion in her midbrain with no corresponding change on T2 FLAIR. She underwent EVT to help prevent further damage to her brain stem. She went on to have posterior fossa oedema and hydrocephalus later that day requiring a posterior craniectomy. She was left with residual weakness (left > right), 3rd cranial nerve palsy and dizziness. She improved and mRS at 90 days was 0.

We review the literature about convulsive-like movements in brainstem stroke and delayed thrombectomy in POCS.

Conclusions Jerky movements in all limbs associated with brainstem lesions are not easily differentiated from convulsions. Unexpected onset and inexperience of the observers limit the characterization of this phenomenon. Convulsive-like movements in brainstem stroke may occur more frequently than reported. Early detection of this motor phenomenon may have practical implications. Data and research on delayed endovascular thrombectomy in POCS remains limited. Case studies have been published which describes favourable prognosis in acute vertebrobasilar occlusion by rapid and complete reperfusion. This would highlight the importance of considering EVT as an option in selected cases

**Methods:**

**Results:**

**Conclusions:**

**Trial registration number:**

**AS35-077****PARADOXICAL EMBOLIC STROKES IN A PATIENT WHO MAY NOT BE CATEGORISED AS A 'YOUNG STROKE' DUE TO PATENT FORAMEN OVALE (PFO)**

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**Background and Aims:** Routine investigations for aetiology of stroke are different for younger patients. An arbitrary age cut off of 50 to 60 years is considered commonly in literature when describing a 'young stroke'. We report the case of a 65 year old woman who presented with multiple embolic infarcts where stroke topography and clinical presentation lead to an aetiological diagnosis of probable PFO.

**Methods:** Case report

**Results:** This woman presented with right dense hemiparesis and aphasia. CT head showed a 'string sign' indicating a proximal left middle cerebral artery thrombus with some early ischaemic changes. A small left basal ganglia infarction was seen on post-thrombolysis CT. She had no pre-existing vascular risk factors or significant family history. On her initial presentation with a right embolic infarct, a full stroke work up including transthoracic echocardiogram (TTE) was unremarkable. Due to the location and the appearance of the thrombus and success of treatment with her second infarct, suspicion was raised about the possibility of a paradoxical venous clot. Again a full stroke work up including biochemical tests, prolonged holter monitoring, carotid ultrasound doppler and TTE were negative. A subsequent focused contrast/bubble echocardiogram revealed a mobile atrial septal aneurysm with shunt on valsava manoeuvre suggestive of a patent foramen ovale (PFO). She is currently being assessed for possible PFO closure.

**Conclusions:** This case demonstrates that age cut off when investigating the cause for acute infarcts are arbitrary and that paradoxical emboli should be considered in patients who present with multiple episodes of stroke regardless of age.

**Trial registration number:** N/A

**AS35-025****GERSTMANN'S SYNDROME; A VERY RARE ENTITY**

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**Background and Aims:** Gerstmann's syndrome is a tetrad of symptoms complex; including agraphia, acalculia, finger agnosia, and right-left disorientation.

**Methods:** In the case studies presented in the literature, it has been reported that Gerstmann Syndrome usually appears as an incomplete tetrad of symptoms or accompanied by cognitive deficits including aphasia, alexia, apraxia and some perceptual disorders.

**Results:** Here, we present the patient with left angular, supramarginal gyrus infarction affecting the parietal lobe. In addition to the symptoms mentioned above, the patient had alexia and anomia aphasia as well.

**Conclusions:** We discussed the clinic appearance and reviewed the current literature.

**Trial registration number:** N/A

## AS35-046

### MYCLOBUTANIL: A POSSIBLE LINK BETWEEN THC OIL CARTRIDGE USE AND RCVS

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#### Background and Aims:

**INTRODUCTION:** Reversible cerebral vasoconstriction syndrome (RCVS) is a vasculopathy characterized by severe headache and segmental narrowing of cerebral arteries, and has been linked to cannabis use. The advent of THC oil cartridges creates exposure to potentially toxic chemicals such as myclobutanil, of which effects on cerebral vasculature are poorly understood.

**Methods:** N/A

**Results:** CASE REPORT: We present a case of a 56-year-old woman with a history of daily cannabis use that developed sudden, severe headache associated with recurrent transient left hemibody paresthesias. She did not have any other risk factors for RCVS. The day prior to her presenting symptoms she used a new THC oil vaporizer involved in a class action lawsuit for containing the pesticide, myclobutanil. Her neurological examination was nonfocal. Noncontrast head CT showed subarachnoid hemorrhage and direct angiography revealed multiple territories of medium vessel focal stenoses. Evaluation for vasculitis was unremarkable. She was started on nimodipine 30 mg every eight hours for two weeks to one month and was advised to stop using her THC cartridge. She was asked to return three months to repeat vessel imaging.

**Conclusions:** DISCUSSION: This case illustrates a potential link between a THC oil cartridge implicated in contamination with myclobutanil, or other unknown chemical contaminants, and RCVS. Complications of RCVS can include ischemic stroke, hemorrhagic stroke, or seizure. Thus, vasoactive substances such as vaporized forms of THC oil as well as possible chemical impurities warrant further investigation in the context of an expanding THC oil market.

**Trial registration number:** N/A

## AS35-084

### IT IS ALL ABOUT TURNING: A CASE OF BOW-HUNTER'S SYNDROME

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**Background and Aims:** Bow Hunter's syndrome is a rare but treatable cause of stroke due to the dynamic rotational steno-occlusion of the vertebral artery (VA) by osteophytes, fibrous bands, or lateral disc herniation. Typically, patients present with posterior circulation transient

ischemic symptoms such as presyncope, syncope, vertigo, diplopia, and horizontal nystagmus, but irreversible deficits including medullary and cerebellar infarctions have also been described.

**Methods:** A 70-years old patient was initially evaluated because light-headedness, sweating, and blurred vision with neck pain. The episode was exacerbated by head rotation to the right. Brain-MRI and CT-scan revealed severe degenerative changes of atlantodens and left atlanto-axial facet joints with foramen magnum stenosis and right rotation of C2 cervical vertebrae. Static vascular imaging as CT-Angiography did not reveal any vertebral arteries abnormalities.

**Results:** Two years later he was admitted to our department for the acute onset of instability and vertigo triggered by head movements. A new brain-MRI revealed the presence of acute bilateral cerebellar ischemic lesions. Dynamic ultrasonography was performed revealing a dynamic occlusion of the left V3 VA at 20° rotation of head to the right, and cerebral angiography confirmed this finding with the final diagnosis of Bow-Hunter's syndrome. Surgical decompression was successfully performed with resolution of left VA rotational occlusion on follow-up ultrasound and angiographic study.

**Conclusions:** Bow Hunter's syndrome is a rare condition that should be bear in mind in the setting of repeated posterior circulation transient ischaemic attack or ischaemic stroke specially if associated with relevant cervical spine abnormalities.

**Trial registration number:** N/A

## AS35-005

### PATHOLOGY OF RETRIEVED THROMBI IN A PATIENT WITH ACUTE ISCHEMIC STROKE DUE TO INFECTIVE ENDOCARDITIS: A CASE REPORT

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**Background and Aims:** Infective endocarditis (IE) is one of the causes of cerebral infarction. Mechanical thrombectomy has been widely used in China for years. However, reports involving retrieved thrombus pathology are somewhat scarce. Here we present a case in which the cause of stroke was confirmed by pathological findings of the retrieved thrombi.

**Methods:** We performed haematoxylin and eosin stain and Gram stain of the thrombi which were retrieved from the occluded intracarotid artery. Clinical information including neuroradiological images were collected.

**Results:** A 33-year male with a history of dilated cardiomyopathy visited the emergency because of sudden onset of left-sided weakness for 14 hours. Mechanical thrombectomy was performed, and the pathological study of the retrieved thrombus demonstrated Gram-staining positive cocci. The patient was combined with fever, septic shock, and acute kidney injury. Ultrasoundcardiography showed vegetation in the left ventricle. Therefore, he was definitely diagnosed as acute ischemic stroke due to infective vegetation embolism.

**Conclusions:** Pathological findings of the retrieved thrombi may contribute to recognizing infective endocarditis in patients with a history of congestive cardiac failure or heart valve disease at early stage.

**Trial registration number:** N/A

**AS35-130****DELAYED ARTERY TO ARTERY EMBOLISM IN A YOUNG PATIENT AS A COMPLICATION OF TRAUMATIC VERTEBRAL ARTERY DISSECTION ASSOCIATED WITH LUPUS ANTICOAGULANT ANTIBODY- CASE REPORT****S. Zikova<sup>1</sup> and F. Adili<sup>2</sup>**<sup>1</sup>City General Hospital “8 th September”, Neurology, Skopje, FYR Macedonia; <sup>2</sup>City General Hospital, Neurology, Skopje, FYR Macedonia

**Background and Aims:** Acute multiple cerebral infarction in young adults due to vertebral artery occlusion as a delayed complication of traumatic vertebral artery dissection (VAD) associated with Lupus anticoagulant antibody ( LA Ab) is very rare but potentially fatal. The LA Ab may play a potential role in traumatic cervicocranialdissection and its complications.

**Methods:** This is a case report of a 28 – year old man who presented with acute occipitomuchal pain and dramatic neurological clinical features. He had a minor car accident 2 weeks before without any injury or symptoms after wards.

**Results:** The clinical examination was confirmed by brain MRI findings with multiple infarctions in left – sided posterior circulation. There was complete occlusion of the left vertebral artery just above its origin till the formation of basilar artery on CT angiography and typical damped flow with high resistance pattern noted in Doppler examination, which correlate with VAD. LA Ab were detected and confirmed on repeated testing. Treatment was initiated with LMWH, antiplatelet and statin. The following neuroimaging showed focal areas of hemorrhagic transformation, thus the antiplatelet therapy was excluded.

**Conclusions:** In this case we presented that VAD and its delayed complications are an important cause of posterior circulation stroke in young adults. There seems to be a correlation between trivial arterial dissection and positive LA Ab. It remains controversial whether the traumatic dissection is really traumatic or there is another precipitating factor.

**Trial registration number:** N/A**Clinical Trial Results – Acute Management – Neither Thrombolysis Nor Thrombectomy****WITHDRAWN**

**Conclusions:** As a word of caution, the results have yet to be adjusted for catchment area changes, new stroke units opening, and changes in population statistics. Nonetheless, our study suggests that stroke is becoming more frequent in younger Australians. Primary and secondary prevention techniques are effective, as results from older shows, but that they need to be carried over to younger at-risk groups too, together with an awareness campaign.

**Trial registration number:** N/A**WITHDRAWN****WITHDRAWN**

**Methods:** Participants with poststroke were randomly assigned to two groups: A, IHT + rehabilitation group; B, rehabilitation group. The Fugl-Meyer motor assessment (FMA) and MMSE were conducted at baseline, end of the 4th week.

**Results:** Among 54 subjects, twenty four males and thirty females, ages from 53 to 74 years old. FMA were improved in two groups after intervention in the end of 4th week, but MMSE were improved in group A, not group B. There were significant differences between group A and group B in MMSE in the end of 4th week ( $P < 0.05$ ). No adverse events occurred during the study.

**Conclusions:** IHT plus rehabilitation exercise could improve cognitive and motor function after intervention in end of 4th week.

**Trial registration number:** N/A

## AS01-025

### ANALYSIS OF STROKE DETECTION IN EMERGENCY COORDINATION CENTERS IN ANDALUCIA

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<sup>1</sup>EPES, EMERGENCY, SEVILLE, Spain; <sup>2</sup>hospital universitario virgen del rocio, neurology, seville, Spain; <sup>3</sup>hospital universitario virgen del rocio, technology, seville, Spain

**Background and Aims:** Early care has been shown to reduce the mortality rate from stroke.

The call to call-Centers is the first step in the acute stroke care. This call is managed by the call center agent, who determines the reason of the call and asks specific questions to recognise stroke.

We propose to compare the results from 2014 and 2018 since the training for call center agents and the triage guide have been updated.

**Aims:** To evaluate the agreement between the reason of the call and the clinical judgment of the emergency teams.

To analyse the stroke pre-warning from the emergency teams**Methods:** Retrospective, descriptive, observational study that includes the stroke cases treated by emergency teams (ICD-9 Diagnosis code 436) from 1-01-2018 until 31-10-18 in Andalucia.

Studied variables were: reason of call, gender, age, pre-warnings and differences among provinces in Andalucia.

**Results:** 2018 Study N 1537 36,24% men average age 67,9 637% women average age 72,9 Identification of the reason of the call as stroke: 50,5% Activated Code Stroke 59,6%

2015 Study N 2462 39,9% men 60,1% women Identification of the reason of the call as stroke: 34,6% Activated Code Stroke 47,3%

**Conclusions:** There has been an increase in Code Stroke activation by emergency teams which has reduced care time until hospital treatment. Call center agents have improved specificity in the use of the triage guide following training.

To emphasize on call centers to reduce time stroke detection time

**Trial registration number:** N/A

## AS01-021

### TO DETERMINE THE FREQUENCY OF LEFT ATRIAL ENLARGEMENT IN DIFFERENT SUBTYPES OF ISCHEMIC STROKE BASED ON TOAST CLASSIFICATION

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**Background and Aims:** The role and basic characteristic of left atrial enlargement in acute cerebral infarction patient is not sufficiently

described in literature, especially the relation between stroke subtype and left atrial enlargement. Hence this study was undertaken to look for the frequency of left atrial enlargement in acute stroke subtypes.

**Methods:** 119 patients with acute ischemic stroke admitted during the study period (June 2016 to March 18) were included. Patient's detailed history and thorough physical examination was performed. Routine blood tests, 12 lead ECG, Trans Thoracic Echocardiography were performed within 24 hours of admission. Using clinical data, radiological images and investigation results, stroke subtype of each patient was determined based TOAST criteria. P wave morphology in lead VI of ECG was evaluated in each patient to look for left atrial enlargement and  $PTFVI > 4,000$  microvolt ms was considered to be left atrial enlargement by ECG voltage criteria.

**Results:** Mean age of male and female stroke patients was  $61.13 \pm 14.51$  years and  $62.11 \pm 13.34$  years respectively. Percentage of stroke due to undermined aetiology was highest (36.4%) followed by cardioembolic stroke (22.1%). Out of 154 patients, 64 (41.5%) had Left atrial enlargement.

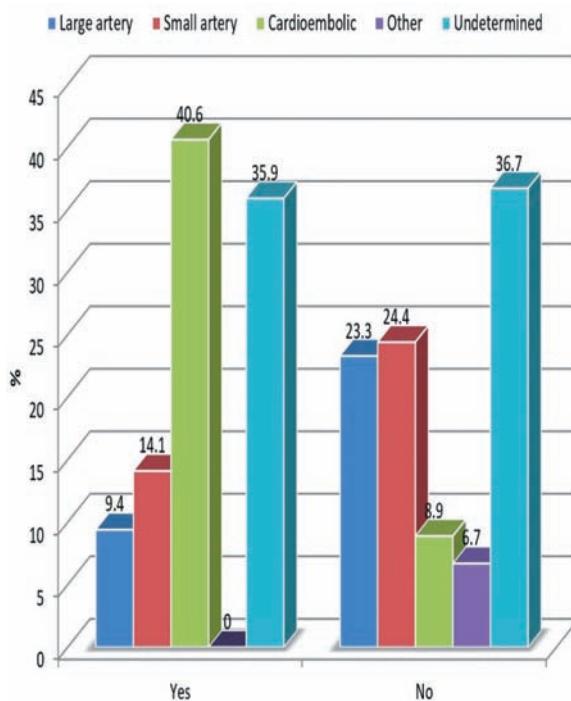


Figure 1- Comparison of LAE among different stroke subtype

**Conclusions:** Second highest frequency of LAE found in undermined group raises the possibility cardiogenic origin of stroke, at least in some of these patients. As these patient would be prone to recurrent stroke, stroke patients of undermined aetiology with left atrial enlargement should be evaluated in detail including more prolonged holter.

**Trial registration number:** N/A

## AS01-023

### A PROSPECTIVE OBSERVATIONAL EXPLORATORY INVESTIGATOR INITIATED STUDY TO EVALUATE THE RISK FACTORS FOR ACUTE STROKE – A MULTI-CENTER STUDY

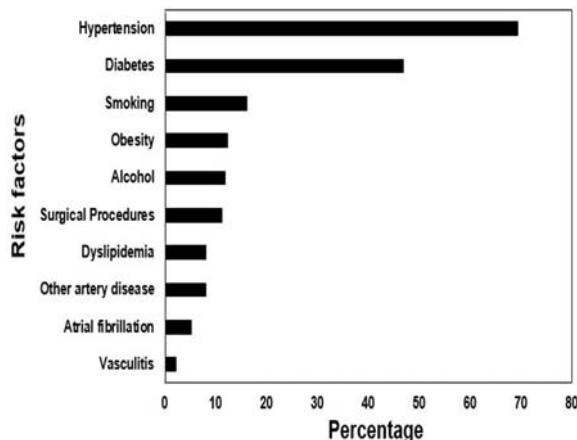
D. Chaudhari<sup>1</sup>, P. Renjen Nath<sup>1</sup> and C.V. S. Ram<sup>2</sup>

<sup>1</sup>Indraprastha Apollo Hospital, Department of Neurosciences, New Delhi, India; <sup>2</sup>Apollo Institute for Blood Pressure Management-Hyderabad, Apollo Blood Pressure Clinics, Hyderabad, India

**Background and Aims:** Stroke is one of the major neurological disorders leading to death and physical disability worldwide accounting for 5.5 million deaths annually. The primary objective of this study was to evaluate the risk factors contributing to acute stroke. The secondary objective was to assess severity of acute stroke using NIH stroke scale and to evaluate new risk factors and any gender specific risk factors.

**Methods:** We studied 526 patients with ischemic and haemorrhagic stroke in subjects seen within 24 hours of onset of symptoms. The NIHSS was calculated for all the subjects. We recorded detailed demographic details, medical history of risk factors for stroke, smoking and alcohol consumption, treatment for stroke (thrombolysis and/or surgical procedures), along with the socioeconomic details and dietary habits.

**Results:** A total of 609 patients were screened and 526 were included in the study, of which, 72.3% were males and 27.7% females. Among the population 75% were above 50 years of age. The mean BMI was  $25.8 \pm 4.3$ . 14.6% of the population were obese. Hypertension and diabetes mellitus were the most common comorbidities observed. The severity of stroke was assessed by NIH Stroke scale (NIHSS) score. Based on severity, 20.5% had mild stroke and 57.4% had stroke of moderate severity. There are no major newer gender based risk factors that could be observed from the study.



**Conclusions:** Hypertension and diabetes mellitus were identified as major risk factors of stroke. The risk factors were correlated with stroke severity as per NIHSS score. Risk factors pattern in stroke and TIA was similar to the published data.

**Trial registration number:** ARI/AS/001-05/16

## AS01-001

### THE CHANGE OF 'SPAGHETTI SIGN' ON FLAIR IMAGES AFTER STA-MCA BYPASS WITH STENO-OCCCLUSIVE DISORDER

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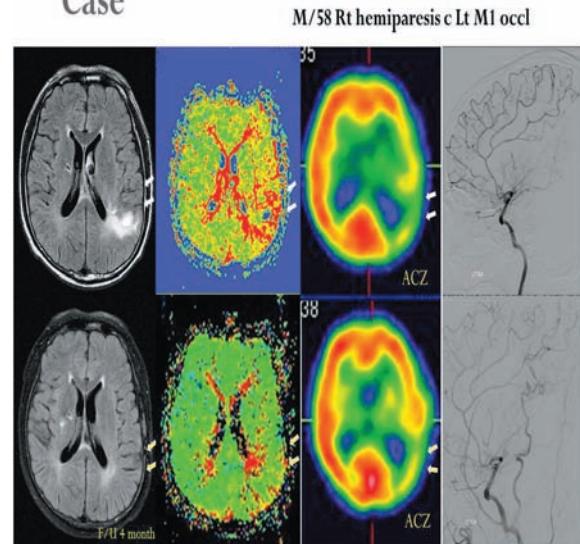
**Background and Aims:** Spaghetti sign, a representative of leptomeningeal vessels on FLAIR were assumed to be explained by slow antegrade or retrograde leptomeningeal collateral flow related to steno-occlusion. The aim of this study was to investigate the correlation between Spaghetti sign and cerebral vascular hemodynamic status and the

effect of recanalization after STA-MCA bypass of in patients with symptomatic steno-occlusive disease of ICA and MCA.

**Methods:** Thirty-two patients with symptomatic ICA and MCA steno-occlusion treated with STA-MCA bypass and underwent pre- and post-operative FLAIR were retrospectively enrolled. The presence of Spaghetti sign on FLAIR was classified as Negative (0), Minimal (1), and Positive (2). Regions were classified into four territories. Correlations between Spaghetti sign on FLAIR and hemodynamic status were measured by MR perfusion and SPECT. The relationship between changes of the Spaghetti sign were examined in affected hemisphere of each patient after successful treatment with STA-MCA bypass.

**Results:** The presence of Spaghetti sign was seen on affected hemispheres in 23 of 32 (72%). In SPECT, CVR in the areas with positive or minimal Spaghetti sign was lower than that in the areas with negative. With F/U FLAIR after 3 to 14 month of surgery, Spaghetti sign decreased or disappeared in 20 (63%). CVR on SPECT and perfusion MRI also demonstrated apparent hemodynamic improvement in areas demonstrating disappearance or decrease of Spaghetti sign after STA-MCA bypass.

## Case



**Conclusions:** This study indicates that STA-MCA bypass was effective for hemodynamic improvement and decreasing Spaghetti sign. Postoperative decrease in Spaghetti sign can be considered as a marker for hemodynamic improvement.

**Trial registration number:** N/A

## AS01-008

### CALCIUM CHANNEL BLOCKERS VERSUS ANGIOTENSIN CONVERTING ENZYME INHIBITORS/ANGIOTENSIN RECEPTOR BLOCKERS TO REDUCE BLOOD PRESSURE VARIABILITY FOLLOWING ISCHAEMIC STROKE – A RANDOMISED FEASIBILITY TRIAL (CAARBS)

**W. Davison<sup>1</sup>, K. Appiah<sup>2</sup>, T. Robinson<sup>2</sup>, P. Rothwell<sup>3</sup> and J. Potter<sup>1</sup>**

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Sciences, Leicester, United Kingdom; <sup>3</sup>University of Oxford, Nuffield Department of Neurosciences, Oxford, United Kingdom

**Background and Aims:** Blood pressure (BP) variability (BPV) is increased in acute ischaemic stroke (IS), is associated with adverse outcomes, and predicts recurrent stroke. However, whether BPV is a therapeutic target in IS has not been prospectively investigated.

**Methods:** Adults with a first episode IS or TIA and BP >130/80mmHg, within seven days of onset, were randomised to a calcium channel blocker (CCB) or angiotensin converting enzyme inhibitor (ACEI)/angiotensin receptor blocker (ARB). BPV from clinic, beat-to-beat, and daytime ambulatory BP measurements was acquired at baseline and three months. The primary objective was assessment of feasibility of recruitment and retention. Secondary objectives were assessment of compliance, safety, and differences in BPV at follow-up.

**Results:** Recruitment ran from 3rd January 2018 to 31st December 2018. 2321 patients were screened, with 14 enrolled (0.6%). Of those not enrolled 2264 (98.1%) were ineligible and 38 (1.7%) declined. Most patients were ineligible due to previous stroke, atrial fibrillation, non-stroke diagnosis, or late presentation. Amendment of the eligibility criteria did not significantly improve recruitment. Treatment compliance was good and BP measurements were well tolerated except ambulatory monitoring. There were no adverse events in either arm. Mean change in SD of beat-to-beat systolic BP at three months was  $-3.8 \pm 2.3\text{mmHg}$  in the CCB arm and  $-2.3 \pm 0.9\text{mmHg}$  in the ACEI/ARB arm.

**Conclusions:** The current trial design was not feasible due to patient ineligibility. However, a possible difference in BPV between trial arms was present, so a further appropriately powered trial with modified eligibility criteria would be valuable.

**Trial registration number:** ISRCTN 10853487

## AS01-011

### DISTINGUISH STABLE AND VULNERABLE ARTERIAL PLAQUES USING ARTERIAL WAVEFORM ANALYSIS

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#### Background and Aims:

**Introduction:** Stroke is the fourth leading cause of death in the UK. The rupturing of unstable plaques, formed by atherosclerosis, is the one of the factors contributing to the stroke event. The percentage of plaque composition plays an important role in the plaque stability and helps determine whether the patients need surgical intervention or not.

**Purpose of the study:** The main aim of this work is to determine the relationship that exists between plaque composition and arterial waveform for distinguishing between stable and vulnerable plaques.

**Methods:** An *in-vitro* experiment representing the arterial system was used to investigate the effect of the composition of the atherosclerosis on the propagation of the arterial waveforms. Artificial plaques with the various percentages of the collagen, soybean oil and calcium were fabricated and implemented into the artificial carotid artery, which is made of the Penrose latex tube. The pulsatile pressure, velocity and arterial vessel wall movement were measured simultaneously proximal to the site of the arterial plaques.

**Results:** It was found that the backward wave intensity in stable plaques have significant reflection in the early systolic period, whereas no backward reflection has been observed in vulnerable plaques.

**Conclusions:** The findings of this study show that the identification of stable and unstable plaques could be distinguished by wave form and this information could be used to differentiate between stable and unstable plaques and guide the vascular surgeons to stratify the atherosclerosis patients for the interventional vascular surgery in the early stage.

**Trial registration number:** N/A

## AS01-015

### REASONS FOR PREHOSPITAL DELAY IN ACUTE ISCHEMIC STROKE: A PROSPECTIVE COHORT STUDY – FINAL RESULTS

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**Background and Aims:** Prehospital delays jeopardize the chances for patients with acute ischemic stroke (AIS) to be treated with recanalization therapies. Population-based education campaigns aiming at reducing prehospital delay are expensive and of questionable benefit. The aim of this study was to understand the reasons leading to prehospital delays in AIS.

**Methods:** We prospectively included patients with AIS (MRI confirmed) admitted to the University Hospital Basel between 2015 and 2017. Trained study personnel interviewed patients or proxies at bedside along a standardized 28-item questionnaire on the prehospital phase. Prehospital delay was defined as delay >4.5 hours between AIS onset and admission to our hospital.

**Results:** Among 337 patients, 140 (42%) had prehospital delay, while 197 (58%) arrived on time. In multivariate analysis, the strongest association with prehospital delay was found for a prehospital visit to the family doctor (OR 3.49, 95%-CI 1.54-7.93, P < 0.01) and lack of knowledge about stroke symptoms (OR 3.98, 95%-CI 2.32-6.72, P < 0.01). Lack of knowledge about stroke was associated with diabetes mellitus (OR 2.28, 95%-CI 1.21-4.27, P = 0.01), but not with a history of stroke (OR 0.62, 95%-CI 0.36-1.08, P = 0.09).

**Conclusions:** In this contemporary cohort, prehospital delay was frequent. Two main risk factors of prehospital delay are modifiable, i.e. prehospital visit to the family doctor and lack of knowledge on stroke. Information campaigns targeting family doctors may contribute reducing prehospital delay. Knowledge on stroke was not higher among patients with history of stroke. Improved information to hospitalized patients with AIS regarding the importance of avoiding prehospital delay in case of a recurrent stroke is needed.

**Trial registration number:** N/A

## AS01-024

### IMPACT OF PRIOR WARFARIN USAGE ON IMMEDIATE ANTICOAGULATION AFTER ATRIAL FIBRILLATION RELATED STROKE : POST HOC ANALYSIS OF TRIPLE AXEL TRIAL

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**Background and Aims:** In atrial fibrillation (AF)-related acute ischemic stroke, rivaroxaban was comparable to warfarin for preventing new ischemic or intracranial hemorrhagic lesions on 4-week magnetic resonance imaging (MRI). We explored whether the effect of rivaroxaban versus warfarin could be modified by warfarin naïvety.

**Methods:** This is a post hoc analysis of Acute Stroke With Xarelto to Reduce Intracranial Hemorrhage, Recurrent Embolic Stroke and Hospital Stay, which was a randomized trial comparing rivaroxaban versus warfarin in patients with AF-related stroke within 5 days. In this study, patients were classified into the warfarin-naïve group and the warfarin-experienced group. The primary endpoint was the composite of new ischemic lesion or new intracranial hemorrhage seen on 4-week MRI. Key secondary end points were new ischemic lesion, new intracranial hemorrhage, and hospitalization length.

**Results:** Of 183 patients included in this study, 107 (58.4%) patients were warfarin-naïve and 75 (41.6%) were warfarin-experienced. For the primary endpoint, there was no significant treatment interaction by warfarin naïvety. However, the effect on the new ischemic lesions was modified by warfarin naïvety ( $p$ -interaction = 0.0422); in the warfarin-naïve group, the rate of new ischemic lesion was lower in the rivaroxaban arm than in the warfarin arm (21.4% vs 39.2%; relative risk, 0.55 [0.30–1.00];  $p < 0.045$ ), whereas, in the warfarin-experienced group, it was comparable between the rivaroxaban and warfarin arms (41.0% vs 30.6%; 1.34 [0.72–2.50];  $p = 0.345$ ).

**Conclusions:** The effect on ischemic lesion recurrence of rivaroxaban versus warfarin were modified by warfarin naïvety, and rivaroxaban appeared better for preventing ischemic lesion recurrence in warfarin-naïve patients.

**Trial registration number:** 183 patients

## AS01-007

### BIFRONTAL INTERHEMISPHERIC APPROACH WITH CUTTING THE SUPERIOR SAGITTAL SINUS FOR DISTAL ANTERIOR CEREBRAL ARTERY ANEURYSMS.

**S. Joo<sup>1</sup>**

<sup>1</sup>Chonnam National University Hospital, Neurosurgery, Gwangju, Republic of Korea

**Background and Aims:** The unilateral interhemispheric approach is a well known operative technique for a distal anterior cerebral artery (DACA) aneurysm. However, there are some risks in the approach, such as postoperative venous infarction due to occasionally sacrificed parasagittal bridging vein or postoperative frontal lobe damage due to retraction force. To overcome the risks, we used bifrontal craniotomy with straight dural incision and cutting of superior sagittal sinus (SSS).

**Methods:** 42 unruptured and 19 ruptured A2 and A3 aneurysm patients who received clipping surgery through bifrontal interhemispheric approach at our institution between March 2007 and December 2017 were reviewed retrospectively. The modified bifrontal interhemispheric approach involve three steps, The first is bifrontal craniotomy of centrobasal portion of the frontal bone, the second is ligation and division of anterior one third superior sagittal sinus and the third is approach to aneurysm via interhemispheric space.

**Results:** At ruptured aneurysm patients, favorable outcome (Glasgow Outcome Scale 4 or 5) at 6 months after primary subarachnoid hemorrhage were shown in 79%, besides all patients with unruptured aneurysm had favorable outcomes. The surgical outcome was strongly related to the preoperative neurologic grade of Hunt and Hess (H-H). 3 patients were poor outcome due to their poor H-H grade on admission (Grade III: 2, IV: 1). In follow up CT scans, venous infarction did not occur in any of our 61 patients.

**Conclusions:** The Modified bifrontal interhemispheric approach might be safe and effective method for treating A2,3 aneurysm with relatively good clinical outcome and no surgical related complication.

**Trial registration number:** N/A

## AS01-014

### PULMONARY COMPUTED TOMOGRAPHY AS A RADIOLOGICAL REFERENCE STANDARD FOR EVALUATING SUSPECTED STROKE-ASSOCIATED PNEUMONIA

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**Background and Aims:** Accurate and timely diagnosis of pneumonia complicating stroke remains challenging. Diagnostic accuracy of Chest X-ray (CXR) in the setting of stroke-associated pneumonia (SAP) is uncertain. Our primary aim was to investigate pulmonary computed tomography (PCT) as a radiological reference standard for evaluating suspected SAP.

**Methods:** Acute stroke (ischaemic or intracerebral haemorrhage) inpatients were recruited within 24 hours of clinically suspected pneumonia and underwent non-contrast PCT within 48 hours of initiating antibiotic treatment. CXR and PCT were anonymised and reported by the study thoracic radiologist. PCT was used as the reference standard for final diagnosis of SAP. Inter-rater reliability of CXR interpretation was evaluated among four stroke physicians.

**Results:** 40 patients with a median age of 78y (range 44y-90y) were included. Median NIHSS was 13 (range 3–31). 87% underwent PCT and all patients underwent at least one CXR. Changes consistent with pneumonia were present in 37% of CXR, but in only 23% of corresponding PCT. PCT was completely normal in 17%. CXR had sensitivity of 37.5%, specificity of 63%, PPV of 23%, NPV of 77%, Odds ratio of 1.02 (95% CI 0.2–5.2) and accuracy of 57% (95% CI 40%–74%). Inter-rater reliability of CXR interpretation for pneumonia between physicians was at best weak ( $k = 0.35$ ).

**Conclusions:** CXR has limited diagnostic accuracy in SAP, with the majority of patients started on antibiotics without evidence of pneumonia on subsequent PCT. PCT is a feasible imaging modality for SAP, which can be applied as a reference standard for evaluation of clinical and biomarker diagnostic SAP algorithms.

**Trial registration number:** NCT03106909

## AS01-005

### SONOTHROMBOLYSIS – A GOOD CHOICE

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**Background and Aims:** Sonothrombolysis (intravenous thrombolysis + TCD or TCCD), presents a promising method for treating the patients with acute cerebral infarction compared to mere intravenous thrombolysis with alteplase from the aspect of safety and therapeutic effect.

**Methods:** The patients who fulfilled criteria were treated with sonothrombolysis or intravenous thrombolysis. The efficacy was being estimated based on the Modified Rankin Scale (mRS) three months after the stroke. A favourable outcome – the mRS values ranging from 0–2. Safety was estimated based on the existence of symptomatic intracerebral hemorrhage. CT with angiography was performed up to 48 hours following

the therapy. If the hemorrhage that could cause the increase in the NIHSS score by  $\geq 4$ , existed, it was considered to be symptomatic.

**Results:** There were 26 patients who were treated with sonothrombolysis and 84 patients who were treated with thrombolysis. The age (66,3 vs 68), initial neurological finding (NIHSS 14,1 vs NIHSS 14,5), did not show statistical differences. The patients who were treated with sonothrombolysis were statistically more often functionally independent relative to the patients treated with thrombolysis (61,5 % vs 39,2% ; OR 2,47; 95% CI: 1.0020 to 6.1022; P = 0.0495). There were no statistically significant differences related to symptomatic intracerebral hemorrhage between the examined groups (8% vs 7,5 %; P = 0.925).

**Conclusions:** Sonothrombolysis is considered to be safe and it increases considerably the percentage of patients that are functionally independent three months following the stroke compared to the patients that were treated only with intravenous thrombolysis.

**Trial registration number:** N/A

## AS01-028

### EARLY ADMINISTRATION OF DESMOPRESSIN AND THROMBOCYTE CONCENTRATES FOR REDUCING HEMATOMA EXPANSION IN PATIENTS WITH INTRACEREBRAL HEMORRHAGE UNDER ANTIPLATELET THERAPY

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**Background and Aims:** Intracerebral hemorrhage (ICH) is the less treatable form of stroke. Here we sought to determine the hemostatic efficacy of platelet transfusion plus desmopressin (DDAVP) in reducing hematoma expansion in patients presenting with spontaneous ICH under antiplatelet treatment (AP-ICH).

**Methods:** We performed a single-center, retrospective, case-control study to identify all patients with AP-ICH, admitted to the Neurosurgical or Neurological Departments of the University Hospital of Tuebingen between 2006 and 2014. Patients were assigned to the treatment or control group based on administration (or not) of combined DDAVP and platelets. The primary outcome was the hematoma expansion from baseline to follow-up cCT scan in the treatment vs. control group. Clinical outcomes were assessed at 90 days with structured telephone interview using the modified Rankin Scale (mRS).

**Results:** From a total of 2,680 ICH patients, 139 patients with AP-ICH fulfilled the inclusion criteria for the study: 67 treated vs. 72 untreated. Treatment with DDAVP and platelets was well tolerated. No significant differences with respect to intracerebral ( $p = 0.284$ ), intraparenchymal ( $p = 0.308$ ) and intraventricular ( $p = 0.270$ ) hemorrhage growth were noted between the two groups (treated vs. controls). No significant differences in poor outcome (mRS scores of 5–6) at Day 90 after the index event were observed between groups ( $p = 0.075$ ).

**Conclusions:** Our results suggest no effect of early hemostatic treatment with DDAVP and platelet infusion in limiting hemorrhage expansion or improving clinical outcome. However, as previous exploratory clinical studies have indicated hemostatic efficacy of DDAVP, larger prospective randomized studies could assess potential effects of different DDAVP administration protocols.

**Trial registration number:** N/A

## WITHDRAWN

## AS01-002

### THE KEEP SIMPLEST STUDY: IMPROVING IN-HOUSE DELAYS AND PERIINTERVENTIONAL MANAGEMENT IN STROKE THROMBECTOMY – A MATCHED PAIR ANALYSIS

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**Background and Aims:** We present a new standard operating procedure (SOP) to reduce in-house delay, standardize periinterventional management and improve patient safety during MT.

**Methods:** Keep Evaluating Protocol Simplification In Managing Periinterventional Light Sedation for Endovascular Stroke Treatment (KEEP SIMPLEST) was a prospective, single-center observational study aimed to compare aspects of periinterventional management in AIS patients treated according to our new SOP using a combination of esketamine and propofol with patients having been randomized into conscious sedation in the Sedation vs. Intubation for Endovascular Stroke Treatment (SIESTA) trial. Primary outcome was early neurological improvement as by 24h-NIHSS, secondary outcomes e.g. were door-to-recanalization, recanalization grade, conversion rate and mRS at 3 months.

**Results:** Door-to-recanalization time (128.6 +/- 69.47 vs. 156.8 +/- 75.91 min; p = 0.02), mean duration of MT (92.01 +/- 52 vs. 131.9 +/-

64.03 min;  $p < 0.001$ ), door-to-first angiographic image (51.61  $\pm$  31.7 vs. 64.23  $\pm$  21.53 min;  $p = 0.003$ ) and CT-to-first angiographic image time (31.61  $\pm$  20.6 vs. 44.61  $\pm$  19.3 min;  $p < 0.001$ ) were significantly shorter in the group treated under the new SOP. There were no differences in early neurological improvement, mRS at 3 months or other secondary outcomes between the groups. Conversion rates of CS to GA were similar in both groups.

**Conclusions:** An SOP using a novel sedation regimen and optimization of equipment and procedures directed at a leaner, more integrative and compact periinterventional management can reduce in-house treatment delays significantly in stroke patients receiving thrombectomy in light sedation and demonstrated the safety and feasibility of our improved approach.

**Trial registration number:** N/A

## AS01-029

### MULTIPLE CEREBRAL ANEURYSMS ON SINGLE PARENT ARTERY

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**Background and Aims:** Multiple cerebral aneurysms reportedly account for 14–33% of all cerebral aneurysms. However, multiple separate aneurysms on single parent artery are uncommon. The majority of these are found on middle cerebral artery (MCA). Multiple aneurysms arising from anterior communicating artery (ACoA) are rare. We report 10 cases of multiple aneurysms developed separately on single artery and describe angiographic and operative findings of these lesions.

**Methods:** Among 249 patients of cerebral aneurysms operated in our hospital for recent 3 years, 10 had multiple aneurysms on single parent artery. **Results:** Among 10 cases, 8 were diagnosed preoperatively and the two cases was found intraoperatively. Four were found on MCA bifurcation, two on M2 and four on ACoA. All separate aneurysms developed on single parent artery were treated successfully with multiple clipping.

**Conclusions:** Multiple cerebral aneurysms, developed separately on single parent artery, are uncommon. Furthermore, those arising from ACoA are very rare. Despite the advanced technology in radiological examinations, multiple cerebral aneurysms may not be detected on pre-operative study only. Close proximity or smaller size of the lesion may be responsible for the preoperative false negative angiographic findings

**Trial registration number:** N/A

## AS01-020

### CLINICAL ECONOMIC EVALUATION OF POST-STROKE REHABILITATION AT THE ACUTE STAGE IN TERTIARY HOSPITAL

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**Background and Aims:** To investigate the effect of rehabilitation on functional recovery of patients with stroke in the acute stage of in tertiary hospital and analyze the related clinical economics.

**Methods:** 50 cases of stroke patients with hemiplegia at the Department of Neurology were randomly divided into rehabilitation group and control group. Medications were performed in all patients of two groups following the rule of symptomatic treatment, the rehabilitation group received extra rehabilitation treatment. Each patient was assessed using the Barthel Index (BI), Berg balance scale (BBS), U. S. National Institutes

of Health Stroke Scale (NIHSS) before and after the treatment. Hospital costs were compared between the two groups for evaluate the cost-effectiveness.

**Results:** compared with the control group, Barthel, Berg, NIHSS scores of the rehabilitation group were significant improved ( $P < 0.05$ ); the total cost of rehabilitation group was an average of  $15132.02 \pm 2815.66$  RMB, higher than that of the control group  $13323.10 \pm 2341.02$  ( $P < 0.05$ ). But the cost-effectiveness analysis revealed that elevating one point in Barthel and Berg score or decreasing one point in NIHSS costed an average of 1200.95 RMB, 1136.04 RMB and 7005.57 RMB in rehabilitation group respectively, while the control group costed an average of 1753.04, 1800.42 and 12336.21 RMB ( $P < 0.05$ ).

**Conclusions:** The acute rehabilitation shows convincing and promising effects on the functional recovery of post-stroke patients. What is more important, clearly it has better cost-effectiveness from the perspective of clinical economics.

**Trial registration number:** ChiCTR1800020017

## AS01-017

### PROGNOSTIC SIGNIFICANCE OF EARLY POST-STROKE DISABILITY ACCORDING TO PRE-MORBID FUNCTIONAL STATUS

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**Background and Aims:** To determine associations between disability at 7 days post-stroke and 90 day outcomes according to pre-morbid functional status.

**Methods:** Post-hoc analysis of the Head Positioning in acute Stroke Trial (HeadPoST), a pragmatic, international, cluster crossover randomised trial of 11,094 patients with acute stroke. Increased disability after stroke was calculated as the difference between scores at 7 days and pre-morbid estimates on the modified Rankin scale (mRS). Outcome was ordinal 90-day mRS score. Associations of  $\Delta$ mRS and outcome were determined by ordinal, logistic regression, hierarchical, mixed models with fixed randomized intervention, fixed period, random cluster, and

random cluster-period effects, adjusted for age, sex, risk factors, and stroke type and severity.

**Results:** Of the 8285 patients included in these analyses, 3222 (38.9%) were women (mean [SD] age 68 [13] years] and 1984 (24%) had mRS  $\geq 2$ . Compared with patient with  $\Delta$  mRS 0, greater  $\Delta$ mRS was associated with greater odds of a poor outcome at 90 days (reference  $\Delta$ mRS 0, adjusted odds ratios for  $\Delta$ mRS 1: 1.50 [95% confidence interval 1.34-1.67],  $\Delta$ mRS 2: 2.25 [1.98-2.56], and  $\Delta$ mRS  $\geq 3$ : 4.37 [3.73-5.12] [ $P$  trend  $< 0.0001$ ]). Although patients with pre-morbid disability were less likely to have further poststroke disability, the odds of poor outcome was greater in those patients 1.73 (1.54-1.95) compared to those without 1.60 (1.52-1.69) ( $P$  interaction  $< 0.0001$ ).

**Conclusions:** Increased disability between baseline and 7 days after stroke is associated with worse 90-day outcome independently of stroke severity; this association is stronger with greater pre-morbid disability.

**Trial registration number:** NCT02162017

## AS01-03I

### THE CLINICAL EFFICACY OF CEREBROLYSIN IN ISCHEMIC STROKE PATIENTS WITH PRE-STROKE MILD COGNITIVE IMPAIRMENT: A PILOT STUDY

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**Background and Aims:** Assessment of cognitive improvement after Cerebrolysin® treatment in ischemic stroke patients who suffered from mild cognitive impairment before stroke

**Methods:** This study had a randomized, placebo-controlled, double-blind design. Patients were randomized within 24 hours post-stroke to either intravenous placebo therapy ( $n = 19$ ) or Cerebrolysin 40 ml per day ( $n = 20$ ) for 21 days. Both groups received standard stroke treatment and concomitant treatment for comorbid conditions. Endpoints were MoCA and ARAT scales evaluated three months after discharge. The statistical process was carried out by non-parametric methods with the software Statistica 13.0 (Dell Inc.) based on the LOCF population.

**Results:** The total number of patients included was 39. The average NIHSS score at time of admission was  $9.4 \pm 0.2$  points. Discharge time was  $22.3 \pm 0.3$  days post stroke. At study endpoint patients in the Cerebrolysin group had improved in the MoCA from  $23.8 \pm 0.2$  at baseline to  $25.2 \pm 0.1$  compared to placebo patients who improved from  $23.6 \pm 0.2$  at baseline to  $24.1 \pm 0.1$ , a significant group difference ( $p < 0.001$ ). In the ARAT, Cerebrolysin treated patients improved from  $29.9 \pm 0.2$  at baseline to  $39.6 \pm 0.4$  as compared to placebo patients who improved from  $34.2 \pm 0.7$  to  $38.6 \pm 0.3$  points, a significant group difference ( $p < 0.05$ ).

**Conclusions:** Cerebrolysin has a beneficial effect on functional and cognitive performance of mildly cognitive impaired patients who suffered from ischemic stroke. Cerebrolysin was safe and well tolerated

**Trial registration number:** N/A

## AS01-012

### ADOPTING A PATIENT-CENTRED APPROACH IN ACUTE STROKE TRIALS WITH USE OF A UTILITY-WEIGHTED MODIFIED RANKIN SCALE

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**Background and Aims:** We aimed to map functional outcome and health-related quality of life (HRQoL) to derive a utility weighted outcome measure and use it as an endpoint to test the efficacy of interventions in acute stroke trials.

**Methods:** We calculated utility-weighted mRS (UW-mRS) scores using pooled data from 5 international trials (INTERACT, ENCHANTED, HeadPoST, SCAST and ATTEND) and our results were externally validated using data from COSSACS. UW-mRS was derived using ordinary least squares regression with mRS as a discrete ordinal explanatory dummy variable and HRQoL by EuroQol 5-dimensional questionnaire as a continuous response variable. We used a linear regression model to assess differences in mean UW-mRS scores between two intervention groups.

**Results:** UW-mRS scores derived from 19338 patients with acute stroke were 0.96, 0.92, 0.75, 0.58, 0.32, -0.093 for mRS scores of 0, 1, 2, 3, 4, and 5, respectively. Both UW-mRS and ordinal mRS were statistically significant in INTERACT ( $P = 0.04$  and  $P = 0.02$  for UW-mRS and ordinal mRS, respectively) and ENCHANTED ( $0.04$ ,  $< 0.0001$ ). In HeadPoST (0.84, 0.41), SCAST (0.12, 0.22), ATTEND (0.42, 0.29) and COSSACS (0.77, 0.95), both the UW-mRS and ordinal mRS captured the divergent treatment effects by showing neutral results.

**Conclusions:** Use of UW-mRS as an outcome measure has similar statistical efficiency to ordinal analysis of the mRS. Greater improvements in HRQoL are observed where there is favourable shift from higher levels of disability (mRS scores 3-5); interventions that achieve such a shift therefore have the greatest potential to benefit to stroke survivors' HRQoL.

**Trial registration number:** N/A

## AS01-016

### CLINICAL ANALYSIS OF DOUBLE-STENT THROMBECTOMY

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**Background and Aims:** To discuss the safety and efficacy of double-stent (DS) thrombectomy for acute occlusion of the internal carotid artery (ICA) bifurcation.

**Methods:** Patients with cerebral infarction who underwent thrombus aspiration within 6 hours of presenting to the Fifth People's Hospital of Chengdu from June 5, 2008 to December 2018 were included ( $n = 11$ ). All the cerebral infarctions were at the end of the ICA. Revascularization was performed using a "Y" DS in parallel or in series (Solitaire FR+trevo). Patients' demographic and clinical data, National Institutes of Health Stroke Scale (NIHSS) score, modified Rankin Scale (mRS) score, and imaging data summaries were collected. Therapeutic effects and patient prognoses were analyzed.

**Results:** Ten patients underwent revascularization using a DS after a single stent procedure and had coincident aspiration failure three times; one patient underwent a DS stent procedure. Thrombolysis in cerebral infarction grades were 3 and 2b in eight and three patients, respectively. At 24 h, 7 days, and 4 weeks after surgery, median NIHSS scores were 11, 5, and 1, respectively. Two patients developed asymptomatic cerebral hemorrhage within 7 postoperative days, and 1 patient developed symptomatic cerebral hemorrhage and died 24 h postoperatively. Eight patients completed a 90-day follow-up with median NIHSS and mRS scores of 1 each.

**Conclusions:** For acute occlusion of the end of the ICA bifurcation, DS-assisted thrombectomy is feasible, safe, and effective for better prognosis. Large-sample, multicenter studies are required to confirm this result.

**Trial registration number:** N/A

#### AS01-027

#### STROKE DETECTION BY WEARABLE ACCELEROMETERS –PROOF OF CONCEPT OF A STROKE ALARM

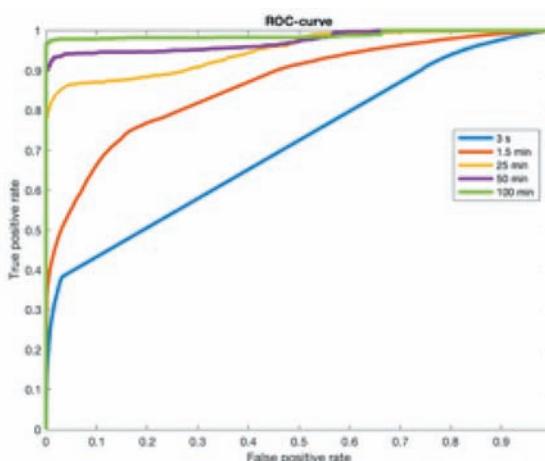
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**Background and Aims:** Recent advances in stroke treatment has provided effective tools to successfully treat ischemic stroke, but still the most common patient is the one not treated due to late arrival to hospital. Early detection may improve treatment outcome and facilitate expansion of reperfusion treatment to a larger portion of stroke patients. This prospective study was conducted to assess the capability to detect stroke within clinically relevant times by using bilateral bracelet accelerometers.

**Methods:** Motion data were collected by wearable 3-axis bracelet accelerometer for 24 hours on 30 stroke patients with unilateral arm motor impairment and 30 healthy subjects. Accelerometer data were analysed using machine-learning algorithms.

**Results:** The sensitivity and specificity for detection of stroke-affected arms are shown by the Receiver Operating Characteristic (ROC) curves by analysing periods between 3 seconds up to 100 minutes. The Area Under the Curve (AUC) increased from 0.7136 for 3s analysis, 0.9490 for 25 minutes, and 0.9881 for 100 minutes.



**Conclusions:** The 3-axis bracelet accelerometer shows a high detection rate with a low false positives rate at time-samples less than 30 minutes, thereby providing a wearable easy-to-use stroke detection system. We suggest that such a stroke alarm may be reasonable and cost-effective to ensure early detection in the event of a stroke in high-risk patients with recent TIA, stroke or atrial fibrillation.

**Trial registration number:** N/A

#### Clinical Trial Results – Acute Management – Thrombolysis or Thrombectomy

#### AS02-063

#### STROKE SHORT TERM OUTCOME IN PATIENTS WHO RECEIVED INTRA-ARTERIAL THROMBOLYSIS THERAPY

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**Background and Aims:** To study the dynamics of the neurological status in patients who received intra-arterial thrombolysis therapy.

**Methods:** 75 patients with acute stroke included to the study. All patients were admitted hospital during the first days of disease onset. The main group included 41 patients hospitalized within six-hour therapeutic window, which underwent selective thrombolytic therapy.

**Results:** In 41% of patients in main group, there was a significant neurological recovery, which manifested by decrease NIHSS total score by 4 or more points. Significant relationship was found between the initial mRs score and development of HT in patients of main group ( $r = 0.4$ ;  $p = 0.009$ ; sensitivity 81.25%, specificity 60.0%). Despite the close reliable relationship between development of HT and mRs score, the latter had no effect on the development of symptomatic HT ( $p = 1.000$ ). Also, significant relationship was found between the mRs score and clinical outcome by day 21 ( $r = 0.46$ ;  $p = 0.003$ ). Patients of main group with general score for ASPECTS < 7 (in 11 (26.8%) out of 16) significantly more often ( $p = 0.04$ ) had poor outcomes by 21 days than in patients with a total score > 7 on this scale (7 (17.1%) out of 25). Sensitivity and specificity of scores for ASPECTS < 7 with respect to unfavorable outcomes were 68.75% and 72.0%, respectively.

**Conclusions:** Intra-arterial thrombolytic therapy in first 6 hours after development of stroke is a safe and highly effective method of treatment and significantly increases the number of patients with good functional outcomes (compared to patients without thrombolysis;  $p < 0.01$ ).

**Trial registration number:** N/A

#### AS02-026

#### ENDOVASCULAR EQUIPOISE SHIFT DURING A PHASE III RANDOMIZED CLINICAL TRIAL OF SONOTHROMBOLYSIS FOR ACUTE ISCHEMIC STROKE

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**Background and Aims:** Several centers stopped recruitment of patients into CLOTBUST-ER trial (NCT01098981) due to equipoise shift preferring endovascular treatment that lead to decline in the rate of overall enrollment and heterogeneity of patient recruitment among centers. This finding prompted the Steering Committee to perform a post-hoc analysis aiming to exclude subjects recruited at centers where endovascular treatment became available and decline was noted in balanced randomization between sonothrombolysis and ongoing endovascular trials.

**Methods:** The primary efficacy outcome was three-month functional improvement assessed by modified-Rankin-Scale (mRS) scores in patients treated with tissue-plasminogen-activator (tPA) within 3h ("US" outcome) and 4.5h ("Global" outcome). From a total of 676 participants randomized in CLOTBUST-ER trial we identified 52 patients from 7 centers with equipoise shift.

**Results:** Post-hoc sensitivity analysis in the intention-to-treat population showed a significant ( $p < 0.01$ ) interaction of centers with equipoise shift on the association between sonothrombolysis and three-month functional outcome [adjusted common Odds Ratio (cOR) for Global outcome in centers with equipoise shift: 0.22, 95%CI:0.06-0.75;  $p = 0.02$ ; adjusted cOR for Global outcome in centers without shift: 1.20, 95%CI:0.89-1.62;  $p = 0.24$ ]. After excluding centers with equipoise shift, patients randomized to sonothrombolysis had higher odds of three-month functional independence (mRS-scores 0-2) compared to patients treated with tPA only (adjusted OR: 1.53; 95%CI:1.01-2.31;  $p = 0.04$  & adjusted OR: 1.47; 95%CI:1.02-2.13;  $p = 0.04$  for patients randomized within 3 and 4.5h).

**Conclusions:** Our experience in CLOTBUST-ER indicates that the increasing implementation of endovascular therapies across major academic stroke centers raises significant challenges for clinical trials aiming to test non-interventional or adjuvant reperfusion strategies.

Trial registration number: NCT01098981

## AS02-021

### MECHANICAL THROMBECTOMY IN TREATMENT OF ACUTE ISCHEMIC STROKE- INITIAL EXPERIENCE IN BULGARIA,

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**Background and Aims:** Our aim is proving efficiency of the method for achieving long term reperfusion in treating strokes in acute phase. Publishing statistical data of the initial results in Bulgaria.

**Methods:** The endovascular protocol in University Hospital "St. Anna" includes:

1. Sedation or anesthesia
2. 8 or 9 fr. Leading balloon catheter
3. 5 or 6 fr. Distal access catheter
4. Microcatheter and guidewire, which passes through the thrombus.
5. Supraselective angiography and subsequent mechanical thromectomy
6. After procedure patients stay in Intensive Care Clinic for 24 hours.
7. Next day CT till 24 hours.
8. Double antiagregant therapy and statin for at least 3 months

**Results:** Average number of runs has been 2.3. In 41 cases we achieved satisfactory reperfusion (84%). In 15 patients the outcome was lethal (31%). In 3 of them the cause of death was decompensated end stage heart failure – the average ejection fraction was 24%. 3 died with brain edema, 4 had intracerebral hemorrhage, 2 had pneumonia and 3 of the patients had developed sepsis and septic shock. The average NIHSS at discharge was 6 points. 23 patients were discharged with none or mild disability defined as mRS 0-2 (47%). 11 of them had not any neurological deficiency (22%).

	IMS III (N=629)	SYNTHESIS (N=362)	MR RESCUE (N=118)	MR CLEAN (N=500)	St.Anna (N=36)
Technique:	MERCII	IA-tPA and thromb-fragmentation	MERCII	Stent-Retrievers	Save - techniques
<b>Main vessel occlusion (ICA, M1):</b>	33%	34%	81%	86%	94%
<b>Recanalisation (TICI 2b/3):</b>	44%	N/A.	27%	59%	79%
<b>Good outcome (mRS 0-2):</b>	43%	42%	13%	33%	47%
<b>Secondary ICH:</b>	6%	6%	5%	8%	8%
<b>90-days mortality:</b>	19%	8%	19%	21%	35%

**Conclusions:** Mechanical thrombectomy results in better reperfusion of main brain vessels (ICA, MCA M1 and BA) compared to fibrinolytic therapy. Long term outcomes are also good. In follow-ups we have not registered re-stroke. End results are non-inferior and in some aspects are relevant to leading international centers.

Trial registration number: N/A

## AS02-044

### IS IT POSSIBLE TO PREDICT THE OUTCOME OF ENDOVASCULAR THROMBECTOMY FOR HYPERDENSE MIDDLE CEREBRAL ARTERY SIGN AT THE TIME OF FIRST ADMISSION?

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**Background and Aims:** The hyperdense middle cerebral artery sign (HMCAS) on admission non-contrast CT (NCCT) is a well-characterized phenomenon in acute ischemic stroke. The HMCAS is associated with poorer clinical outcome. The purpose of this study is to determine the impact of HMCAS on the outcome of patients underwent endovascular thrombectomy

**Methods:** A retrospective analysis of prospectively collective database included 136 consecutive patients with anterior circulation acute ischemic stroke who underwent endovascular thrombectomy between January 2012 and May 2017. We collected the demographics, and clinical and brain imaging as well as functional and imaging outcomes data at baseline. Patients were divided into two groups with hyperdense artery sign and those without the sign. Poor outcome was defined as a modified Rankin Scale (mRS) score  $\geq 3$  at three months follow-up.

**Results:** There were 136 patients, 50.7 % of them were women. The median age was 59.1 years ( $\pm 11.3$ ). 93 of 136 patients had HMCAS (% 68.4). There were no differences in basic demographics, clinical characteristics, and vascular risk factors between the two groups, however, tobacco use is more common in patients with HMCAS ( $p < 0.05$ ). Patients with HMCAS had more collateral embolism during the procedure (9.7%) compared patients without HMCAS (0 %) ( $p = 0.057$ ).

**Conclusions:** In our study, we demonstrated that the presence of HMCAS on baseline CT was not useful in predicting good clinical

outcome in patients who underwent endovascular treatment, however, the presence of HMCAS is related to more collateral embolism during the procedure. Different endovascular strategies may be applied in these patients.

**Trial registration number:** N/A

## AS02-036

### BODYWEIGHT AND RATES OF ICH ACCORDING TO ALTEPLASE DOSE IN PATIENTS ON PRIOR ANTIPLATELET THERAPY: ENCHANTED TRIAL RESULTS

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**Background and Aims:** Patients on prior antiplatelet therapy (APT) are at increased risk of intracerebral haemorrhage (ICH) after thrombolysis treatment. We examined the association of bodyweight on outcomes in acute ischaemic stroke (AIS) patients on prior APT by use of low- (0.6mg/kg) vs. standard-dose (0.9mg/kg) alteplase in the international, Enhanced Control of Hypertension and Thrombolysis Stroke Study (ENCHANTED).

**Methods:** Post-hoc analysis of 752 participants on prior APT, categorised by bodyweight (kg) quartiles: 38–59 (n = 143), 60–69 (n = 196), 70–79 (n = 196), and 80–130 (n = 217). Primary outcome was death at 90 days, assessed in logistic regression models with data presented as odds ratios (OR) and 95% confidence intervals (CI).

**Results:** Participants with lower bodyweight tended to be older, female, Asian, and with lower Glasgow coma scale score, compared to higher bodyweight. After adjusting for confounders, higher bodyweight was associated with increased ICH risk although no significant statistically, and with reduced risk of death in the standard-dose group.

Bodyweight	Low dose Outcomes	Standard dose Outcomes	P interaction
	ICH	ICH	
60-69 Vs. 38-59	0.62 (0.18-2.07), 0.44	2.64 (0.87-8.03), 0.09	0.98
70-79 Vs. 38-59	0.95 (0.3-3.07), 0.93	1.62 (0.48-5.51), 0.44	
80-130 Vs. 38-59	0.71 (0.21-2.38), 0.58	1.57 (0.45-5.49), 0.48	
	Death day 90	Death day 90	
60-69 Vs. 38-59	0.49 (0.16-1.49), 0.21	0.42 (0.17-1.02), 0.05	0.14
70-79 Vs. 38-59	1.06 (0.38-3.02), 0.91	0.4 (0.16-1.01), 0.05	
80-130 Vs. 38-59	0.83 (0.28-2.4), 0.73	0.6 (0.24-1.49), 0.27	

**Conclusions:** Standard-dose alteplase has a higher risk of death in thrombolysed AIS patients with low body weight.

**Trial registration number:** NCT01422616

## AS02-053

### NEED TO FOCUS ON STRIATOCAPSULAR INFARCTS: IMPACT OF CST ABNORMALITIES EARLY AFTER MECHANICAL THROMBECTOMY OF MIDDLE CEREBRAL ARTERY OCCLUSIONS

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**Background and Aims:** Decreases of fiber integrity of the corticospinal tract (CST) after occlusions of the middle cerebral artery (MCA) are described before, especially in the subacute and chronic phase. They are known to correlate to poor motor outcome. Until now, there is no study that has focused on the new entity of striatocapsular infarcts and the impact of their acute CST alterations.

**Methods:** In the acute phase (day 3) after mechanical recanalization of MCA occlusions 80 patients were examined with diffusion tensor imaging and the CST was reconstructed by probabilistic fibertracking. FAindex within the posterior limb of the Capsula interna (Clp) as well as peduncle (PED) was calculated and correlated to clinical parameters (NIHSS/MRS-Score). Subgroup analyses focused on striatocapsular infarcts (n = 26) versus peripheral infarction (n = 54).

**Results:** FAindex of the CST within Clp and PED is significantly reduced in the acute stroke phase (see figure). It is correlated to poor functional outcome (NIHSS at discharge:  $r = -0.3$ ;  $p = 0.009$ / MRS90d:  $r = -0.27$ ;  $p = 0.04$ ), especially in the subgroup of peripheral infarcts ( $r = -0.36$ - $0.39$ ;  $p = 0.007$ / $0.021$ ). There is no significant correlation for the striatocapsular infarcts ( $r = -0.17$ - $0.16$ ;  $p = 0.44$ / $0.5$ ).

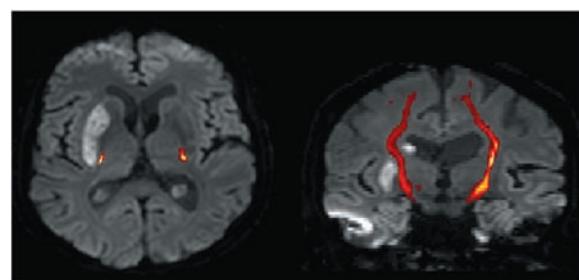


Figure: An example of a patient three days after mechanical recanalization of a right MCA occlusion and striatocapsular infarct. The CST on the healthy side (left) shows higher connectivity values (yellow) than on the affected side (increasing connectivity values from red to yellow).

**Conclusions:** The known predictive value of structural CST abnormalities after MCA occlusions can be shown in an early stage after mechanical recanalization, especially for peripheral infarcts. However, it is absent for the recently emerging entity of striatocapsular infarcts, whose impaired CST integrity requires further and longitudinal exploration.

**Trial registration number:** N/A

**AS02-061**

## **WORKFLOWS AND TIMELINES OF MECHANICAL THROMBECTOMY FOR ACUTE ISCHAEMIC STROKE IN A HIGH VOLUME STROKE CENTRE: COMPARISON OF REAL-LIFE DATA TO TRIAL AND GUIDELINES TARGETS**

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**Background and Aims:** Randomised trials have indicated that mechanical thrombectomy (MT) is a future-guiding treatment modality up to 24 hours after onset of acute ischemic stroke. However to achieve good clinical outcomes, management needs to be well co-ordinated.

This study aims to audit workflows and timelines involved with endovascular treatment at the Klinikum Kassel (KK), a German high volume stroke centre, in order to analyse whether standards are in accordance with guidelines and in-house targets.

**Methods:** In this on-going study, patients receiving MT between 04/2018 and 03/2019 will be evaluated. We analysed the MT scheme timelines, comparing real treatment times with the findings of the HERMES trials and guidelines. Parameters indicative of time-efficiency were the door-to-needle, door-to-groin, onset-to-groin and onset-to-recanalisation times. Further, management times of Mothership (MS) and Drip&Ship (DS) patients will be compared.

**Results:** At the time of the first interim analysis (10/2018) a total of 54 patients were enrolled. Door-to-needle (M:36min, IQR:29-49min) and door-to-groin (M:77min; IQR:56-93min) times met the guidelines, however KK standards (30 min and 60 min, respectively) were not met in the majority of patients. Onset-to-groin (M:165min; IQR:34-217min) and onset-to-recanalisation (M:206min; IQR:168-265min) times were found to be more time-efficient than HERMES results. MS management resulted in earlier recanalisation compared to DS (Onset-to-recanalisation: MS:190min; DS:272min).

**Conclusions:** Timelines were in accordance with national and international guidelines and more time-efficient than the findings of the HERMES group, nonetheless we would aim for even shorter times in our stroke centre. Further the MS modality proved to be more effective than the DS concept.

**Trial registration number:** N/A

**AS02-054**

## **THE CORRELATION OF THE FINAL INFARCT VOLUME MEASUREMENT BETWEEN NCCT AND MRI DWI IN ACUTE STROKE PATIENTS AFTER MECHANICAL THROMBECTOMY**

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**Background and Aims:** The final size of ischemia in acute stroke patients on NCCT is besides NIHSS and successful recanalization an important predictor of good clinical outcome. In our study we perform a follow up imaging (NCCT and MRI) 24–72 hours after stroke onset to evaluate the size and ischemic lesion volume (ILV).

The first aim of study is to find correlation of the final ILV (ml) measured by eASPECT software (Brainomix Ltd.) on NCCT and ILV on MRI/DWI

measured by radiologist 24–72 hours after mechanical thrombectomy (MT). The second aim of study is to compare ASPECT-score of the final infarct between NCCT and DWI/MR.

**Methods:** All consecutive patients after MT were examined 24–72 hours after stroke onset on NCCT and MRI. The both examinations were done within 30 minutes. The statistical significance was assessed by the Kruskal-Wallis test.

**Results:** During the period 05–12/2018 40 patients were included to study. 4 patients were excluded due to haemorrhage after MT. Mean age was 69.8 ( $\pm$  10.8) and 63.9% were men. Baseline NIHSS median was 16 (4–20). TICI 2–3 was 34(94,4%) and TICI 0–1 was 2(5,6%). NIHSS on 7th day median was 2(0–32). The final median ILV on NCCT was 26ml (7–163), on MRI/DWI was median 14ml (0–276). The median eAspect score was 8 on NCCT and 8 on MRI/DWI. The difference between the measured volumes and ASPECT score were not statistically significant by Kruskal Wallis test ( $p = 0.05$ ).

**Conclusions:** We found excellent correlation of final ILV between NCCT and MRI/DWI. Automatic eASPECT-software is reliable tool for final ILV measurement on NCCT 24–72 hours after MT.

**Trial registration number:** N/A

**AS02-034**

## **YIELD OF EARLY VENOUS FILLING FOR PREDICTING REPERFUSION HEMORRHAGE AFTER MECHANICAL THROMBECTOMY TREATMENT FOR ANTERIOR CIRCULATION PROXIMAL OCCLUSION STROKES**

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**Background and Aims:** Any degree reperfusion hemorrhage (RH) may occur in up to 40% after endovascular mechanical thrombectomy (EVT) for proximal occlusion in ischemic strokes. Angiographic cerebral early venous filling (EVF) is associated to irreversible brain stroke damage and higher risk of endovascular treatment RH and symptomatic brain parenchymal hematomas post EVT.

**Aim:** Assess the yield of EVF in predicting RH post EVT.

**Methods:** EVT performed for anterior circulation proximal occlusion that led to reperfusion score of Thrombolysis in Cerebral Infarction (TICI) over 1 between December 2014 and June 2018 were included. EVF was defined as contrast opacification of any cerebral vein before the late arterial phase of post-EVT DSA after internal carotid artery injection. Post procedure RH was defined according to Heit's criteria.  $\chi^2$  was used as the statistic test.

**Results:** 102 patients were included. RH was present on control imaging in 31 patients (30%). EVF was significantly associated with RH ( $\chi^2 = 3,973 > 3,84$ ,  $p < 0,05$ ) and found in 9 patients with RH (29%) and in 9 patients without RH (12%). Sensitivity and specificity of EVF for RH were respectively of 30% and 87% with a 74% negative predictive value of EVF for RH.

**Conclusions:** EVF has a low sensitivity but high specificity and negative predictive value for RH. EVF should be taken into account for blood-pressure and anticoagulation management post EVT.

**Trial registration number:** N/A

**AS02-057****IMPACT OF GLYCEMIA LEVELS WITHIN FIRST 48 HOURS AFTER MECHANICAL THROMBECTOMY ON CLINICAL OUTCOME IN ACUTE ISCHEMIC STROKE PATIENTS**

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**Background and Aims:** Different factors may have an impact on clinical outcome after mechanical thrombectomy (MT) in acute ischemic stroke (AIS) and we aimed to evaluate the impact of glycemia (GLY) levels in the first 48 hours after MT.

**Methods:** Consecutive AIS patients treated with MT were enrolled in the retrospective bi-center study. Neurological deficit was assessed with National Institutes of Health Stroke Scale (NIHSS) and clinical outcome after 3 months with modified Rankin scale (mRS) with a score 0–2 for good outcome. GLY levels were collected as three routine samples done daily within first 48 hours after MT.

**Results:** Completed GLY levels were collected in 690 consecutive patients treated with MT (350 males, mean age  $71 \pm 12$  years). Median of admission NIHSS was 17 points and 88% of patients had AIS in anterior circulation. Recanalization (TICI 2b-3) was achieved in 551 (79.9%) of patients and SICH in 35 (5%) patients. Patients with mRS 0–2 had lower median of GLY in the within 48 hours compared to those with poor outcome (6.5 vs. 7.3 mmol/l,  $p < 0.0001$ ). Similar difference was found in patients with known diabetes mellitus (8.0 vs. 10.0 mmol/l,  $p < 0.0001$ ) and without diabetes (6.4vs. 6.8 mmol/l,  $p < 0.0001$ ). Logistic regression analysis showed a median of GLY ( $p = 0.0001$ ; OR: 0.839, 95% CI: 0.767-0.918) as a predictor of good clinical outcome after MT.

**Conclusions:** Lowering of GLY within the first 48 hours after MT seems to may have a positive impact on clinical outcome in treated patients.

**Trial registration number:** N/A

**AS02-009****SIGNAL INTENSITY IN FLUID-ATTENUATED INVERSION RECOVERY (FLAIR) AND TREATMENT EFFECTS IN THE WAKE-UP TRIAL**

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**Background and Aims:** Signal intensity of stroke lesions in fluid-attenuated inversion recovery (FLAIR-SI) magnetic resonance imaging is associated with time since stroke onset with higher intensities signifying longer time intervals. Based on visual assessment of FLAIR imaging data, patients with stroke of unknown time of symptom onset can be selected for treatment with alteplase safely and effectively as shown in the WAKE-UP trial. In this subgroup analysis, we investigate if quantitatively measured FLAIR-SI is a relevant modifier of treatment effect in WAKE-UP.

**Methods:** FLAIR-SI of stroke lesions was measured relative to signal intensity in a mirrored region in the contralateral hemisphere. The relationship between FLAIR-SI and treatment effect was analysed by binary logistic regression using favourable outcome (mRS 0–1) as dependent variable. All models were adjusted for treatment (alteplase or placebo), NIHSS at symptom onset and stroke lesion volume.

**Results:** FLAIR-SI was successfully quantified in stroke lesions of 433 patients (of 503 patients included in WAKE-UP). Mean FLAIR-SI was 1.06 (SD 0.09). We detected no significant interaction between treatment and FLAIR-SI ( $p = 0.34$ ) in relation to favourable clinical outcome (mRS 0–1) although there appeared to be a moderate, non-significant trend for a decreasing treatment effect with increase of FLAIR-SI.

**Conclusions:** In patients in whom no marked parenchymal FLAIR hyperintensity was detected by visual judgement in WAKE-UP, quantified FLAIR signal intensity of stroke lesions did not significantly modify treatment effect of intravenous thrombolysis.

**Trial registration number:** Efficacy and Safety of MRI-based Thrombolysis in Wake-up Stroke (WAKE-UP)  
ClinicalTrials.gov identifier (NCT number): NCT01525290

**AS02-059****THROMBECTOMY IN ANDALUCIA USING ASPIRATION (TRIANA) VS STANDARD STENTREIEVER: EFFECTIVENESS OF ENDOVASCULAR THERAPY FOR STROKE**

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**Background and Aims:** Although mechanical thrombectomy with stentriever is the first choice for endovascular treatment of acute ischemic stroke (AIS) with large vessel occlusion (LVO), other devices may be reasonable according to the guidelines. Therefore, we compare the

efficacy of Direct Aspiration First Pass Technique (ADAPT) vs stentriever, in order to be able to adjust to the resources of our health system.

**Methods:** We design a multicenter, prospective, non-randomized study in patients with anterior AIS, LVO and less than 8 hours of evolution treated with endovascular rescue techniques: ADAPT using SOFIA® catheter in comparison with the stent retriever system. Baseline characteristics, procedural features, and clinical results were collected during 2017–2018.

**Results:** Of 532 patients (mean age 68.4, 42.9% women), 370 (69.5%) were treated with ADAPT and 162 (30.5%) with stentriever as first choice. For primary outcome, the proportion of patients with successful revascularization was 93.5% (n = 345) in ADAPT vs 80.2% (n = 130) in stentriever ( $p = 0.003$ ). Using only ADAPT, the rate of recanalization TICI2b-3 was 73.8% (n = 283). Rescue treatment was used in 87 patients (27.2%) in the aspiration group and 7 patients (4.3%) in stentriever ( $p < 0.001$ ). Median revascularization attempts were 1 (IQR: 1–2) in ADAPT and 2 (IQR: 2–3) in stentriever ( $P < 0.0001$ ). ADAPT first option achieved shorter puncture-recanalization times:  $40 \pm 41$  vs  $74 \pm 46$  min ( $p < 0.01$ ). The rate of independence (mRS 0–2) at 3 months was 63.7% in ADAPT vs 57.9% in stentriever group ( $p = 0.08$ ).

**Conclusions:** Although further randomized clinical trials are needed, ADAPT could be more effective, and shorten times and attempts of the procedure.

**Trial registration number:** ClinicalTrials.gov Identifier: NCT03407092

## AS02-029

### EFICACY AND SAFETY OF RECOMBINANT TISSUE PLASMINOGEN ACTIVATOR R (TPA) IN ACUTE ISCHEMIC STROKE DUE TO SMALL VESSEL VERSUS LARGE VESSEL DISEASES

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**Background and Aims:** Background Acute ischaemic stroke accounts for approximately 80% of all strokes and intravenous alteplase is the only (FDA) approved thrombolytic agent for the treatment of acute ischaemic stroke

Aim to evaluate the efficacy and safety of thrombolysis with intravenous recombinant human tissue plasminogen activator r (TPA) for ischemic stroke in small and large vessel diseases  
**Methods:** a cross sectional study of total of 50 patients whose having either small or large vessel diseases and received IV r (TPA)

Patients were recruited from stroke unite at Al Ain hospital United Arab Emirates

**Results:** Small vessel disease was associated with a better outcome than large vessel disease with no mortality recorded among them and 3 patients died among large vessel diseases, there was positive correlation between post TPA bleeding and NIHSS at onset and NIHSS after 24 hours after treatment in large vessel group as p value was 0.05 and 0.000 respectively. There was strong positive correlation between the occurrence of post r TPA bleed and mRS at 3month as r value is 0.578 and (p value = 0.000). In large vessel group there was statistical significance between NIHSS at onset and favorable outcome and there was a strong positive correlation with statistically high significance between the degree of ICA stenosis in the large vessel disease group and mRS at 3 month as p value was 0.003

**Conclusions:** Conclusion

Small vessel disease after IV thrombolysis have more often a good outcome, do not have higher risk of post rTPA bleeding and have low mortality than large vessel diseases

**Trial registration number:** N/A

## AS02-002

### THE PREDICTIVE VALUE OF THRIVE SCORE FOR OUTCOMES OF PATIENTS WITH ACUTE BASILAR ARTERY OCCLUSION TREATED BY THROMBECTOMY

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**Background and Aims:** Patients with basilar artery occlusion still have poor outcomes after revascularization. Based several trials, THRIVE score has been shown to predict outcomes after endovascular therapy (ET) in acute stroke patients. We attempted to evaluate the value of THRIVE score in predicting outcomes of acute stroke patients with basilar artery occlusion.

**Methods:** We retrospected patients with cerebral infarction of the basilar artery occlusion from May 2014 to August 2018. All patients had good revascularization (TICI=2b or 3) after thrombectomy. According to the outcomes of patients at three months, the patients were divided into groups with good outcomes and poor outcomes (MRS> 2). We observed the baseline status and major adverse complications during hospitalization.

**Results:** 68 patients were included in our study. Univariate analysis showed that NIHSS score was significantly higher in patients with poor outcome than patients with good outcome ( $P = 0.000$ ). And THRIVE score was also significant higher in patients with poor outcome than patients with good outcome ( $P = 0.000$ ). Multivariate regression analysis showed that THRIVE score was independent predictor of poor prognosis ( $P = 0.000$ ) and mortality. The ROC curve was drawn to compare THRIVE score with NIHSS score for the predictive value, the results showed that the predictive value of THRIVE score for poor prognosis was higher than NIHSS score.

**Conclusions:** THRIVE score was negatively correlated to good outcomes by patients with basilar artery occlusion who were treated by thrombectomy using Solitaire AB stent. THRIVE score strongly predicts good outcomes in these patients than NIHSS score.

**Trial registration number:** N

## AS02-049

### TRANSFER VERSUS DIRECT ENDOVASCULAR THERAPY IN A NATIONWIDE REGISTRY: THE NATIONAL ACUTE STROKE ISRAELI REVASCULARIZATION (NASIS-REVASC) REGISTRY

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**Background and Aims:** Arrival of patients to endovascular capable centers must be rapid, since delays hamper time-sensitive stroke treatments. We aimed to assess in a nationwide registry time-to-treatment among patients with emergent large vessel occlusion (ELVO) directly admitted (direct-EVT) versus transferred to endovascular capable centers (transfer-EVT).

**Methods:** Clinical and radiological data of consecutive, prospectively enrolled patients, with ELVO treated with endovascular therapy (EVT) included in the National Acute Stroke Israeli Revascularization (NASIS-REVASC) registry in 6 comprehensive stroke centers were analyzed. Stroke subtypes were categorized according to TOAST criteria.

Neurological deficits assessed using the NIH stroke scale (NIHSS), vessel recanalization using the final thrombolysis in cerebral infarction (TICI) scale, and functional outcome using the modified Rankin scale (mRS). Excellent outcome was defined as a mRS≤1 at hospital discharge and 90 days post-stroke.

**Results:** Among 272 patients treated with EVT (with or without t-PA) 201 were direct-EVT and 71 transfer-EVT. Time of symptom onset to groin puncture was 230 [IQR 150, 325] in direct-EVT vs. 320 [IQR 273–388] in transfer EVT patients ( $p < 0.001$ ) and time to groin puncture was <4.5 hrs in 63% of direct-EVT vs. 24% of transfer-EVT;  $p < 0.001$ ). Excellent outcome at hospital discharge and 3 months were (21% vs. 16%,  $p = 0.45$  and 42% vs. 33%,  $p = 0.45$ ) respectively.

**Conclusions:** Transfer-EVT was associated in a nationwide registry with prolonged time of symptom onset to groin puncture. These findings emphasize the need for efficient protocols for inter-facility transfer as well as for selecting patients shipped directly to endovascular capable centers.

**Trial registration number:** N/A

## AS02-050

### THE ISRAEL EMS STROKE PRE-NOTIFICATION SMARTPHONE APP A NEW TOOL TO INVESTIGATE PREHOSPITAL TRIAGE ACCURACY

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**Background and Aims:** The Face Arm Speech Test (FAST) is the the most important stroke triage tool today for Emergency Medical Services (EMS). But it is unclear what is the contribution of each part of FAST to identify stroke in the prehospital setting, and if other parameters could be of help to improve the triage of paramedics. We attempted to investigate the FAST triage accuracy by using the newly developed Stroke Pre-notification Smartphone App (SPSA) of the Israeli national EMS.

**Methods:** We analyzed retrospectively our institutional stroke registry between 07/2016 07/2017 for all patients arriving for suspected stroke to our hospital. We compared, in all patient arriving with prior use of SPSA, the accuracy of clinical parameters like Mean Arterial Pressure (MAP), pulse, breathing, forced eye deviation and each part of the FAST to be able to distinguish between AS patients and those with other final diagnosis.

**Results:** During the analyzed time period 478 patients were admitted to our hospital with AS. 114 Patients were admitted with suspected AS using the SPSA. Only 50%(n = 57) were finally diagnosed as AS patients. MAP ( $p = 0.003$ ), Arm Weakness ( $p = 0.004$ ), Speech ( $p = 0.0016$ ) difficulties were found to be able to distinguish between the AS patients and the AS mimickers. Face Asymmetry and forced eye deviation were not helpful to differentiate between AS and other conditions.

**Conclusions:** The use of SPSA can investigate triage accuracy of the classical FAST triage system and each component, and shows the need of subtracting and adding other clinical features to make the prehospital stroke triage more accurate.

**Trial registration number:** N/A

## AS02-027

### DOES PRE-TREATMENT WITH ANTIPLATELETS AFFECT THE OUTCOMES OF INTRAVENOUS THROMBOLYSIS?

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**Background and Aims:** Prestroke antiplatelet therapy, particularly dual (any two agents) therapy, increases intracerebral haemorrhage (ICH) risk after thrombolysis. We investigated outcomes in patients thrombolysed with alteplase or tenecteplase on prior antiplatelet therapy.

**Methods:** We undertook pooled data of three trials comparing tenecteplase with alteplase, using binary logistic regression to compare the effects of prior antiplatelet use (none, single, or dual).on favourable (mRS 0–2) or poor (mRS 5–6) day 90 modified Rankin Scale (mRS), 24h NIHSS improvement ( $\geq 8$  or = 0–1), ICH and symptomatic ICH (SICH) incidence.

**Results:** Of 291 patients, 135 were on no antiplatelet, 117 on single, and 19 on dual therapy; 4 were on warfarin. More patients on dual therapy had SICH and mRS 5–6 (Table). Adjusting for onset-to-treatment time, age and baseline NIHSS, odds of mRS 5–6 were non-significantly higher with single (OR 1.25, 95% CI 0.45–3.47) and dual (OR 1.98, [0.31–12.6]) therapy compared with none, as were odds of SICH (single: OR 3.99 [0.43–36.8]; dual: OR 4.21 [0.20–88.8]). There was no interaction between antiplatelet therapy and thrombolytic agent for any outcome.

Antiplatelet therapy	Tenecteplase			Alteplase		
	None n = 90	Single n = 72	Dual n = 13	None n = 47	Single n = 46	Dual n = 6
SICH (n,%)	3(3.3)	2(2.8)	3(23.1)	1(2.1)	5(10.9)	1(16.7)
mRS 0–1 at 90 d (n,%)	39 (43.3)	31(43.1)	3(23.1)	17(36.7)	11(23.9)	2(33.3)
mRS 5–6 at 90 d (n,%)	11(12.2)	15(20.8)	5(38.5)	9(19.1)	13(28.3)	3(50)

**Conclusions:** Small numbers on prior dual antiplatelet therapy limit interpretation, but non-significantly higher odds and incidence of both SICH and mRS 5–6 with dual antiplatelet agents support the need for further investigation.

**Trial registration number:** N/A

**AS02-051**

## FUTILE RECANALIZATION IN NONAGENARIANS UNDERGOING ENDOVASCULAR TREATMENT FOR ACUTE ISCHEMIC STROKE

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**Background and Aims:** Futile recanalization, defined as lack of clinical benefit despite angiographic recanalization, is an important limitation of endovascular treatment for acute ischemic stroke (AIS). Data on this topic in nonagenarians, who are increasingly being admitted to our hospitals, is scarce.

**Methods:** Retrospective observational study with data collection from Belgian, Swiss, Canadian comprehensive stroke centers and Swedish National database (EVAS). All patients with AIS were eligible if aged  $\geq 90$  years and treated with EVT  $\pm$  pre-treatment with intravenous thrombolysis (IVT). Data on recanalization (mTICI), functional outcome (mRS at 3 months) and clinical response (delta mRS) was collected. Near complete or complete recanalization (mTICI 2b-3) was observed in relation to functional outcome at 3 months and classified as "meaningful" (mRS 0-2) or "futile" (mRS 3-6) recanalization.

**Results:** Retrospective inclusion of 112 nonagenarians (mean age 93.3  $\pm$  2.5y; 76.8% women; pre-mRS  $\leq 2$  in 69.4%). Combined data on mTICI, pre- and post-mRS was available in 58 patients. Successful recanalization (mTICI  $\geq 2b$ ) was achieved in 75.9%. Good functional outcome (mRS  $\leq 2$ ) was seen in 17.0% and 3-months mortality was 60.3%. Clinical response, measured by delta mRS, was better in the group with successful compared to unsuccessful recanalization [2.8  $\pm$  1.6 vs. 3.9  $\pm$  1.2 (mean  $\pm$  SD)]. Nonetheless, meaningful recanalization was low (18.2%), especially with respect to 75% of patients having a pre-stroke mRS  $\leq 2$ . Independent predictors of futile recanalization will be identified through multivariate analysis.

**Conclusions:** A substantial proportion of nonagenarians shows futile recanalization in EVT for AIS. Treatment decisions should be made on case-by-case evaluation, keeping in mind limited chances of favorable outcome and high risk of mortality.

**Trial registration number:** N/A

**AS02-024**

## CEREBRAL HAEMODYNAMIC IN STROKE THROMBOLYSIS (CHIST) STUDY

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**Background and Aims:** Approximately 50% of acute ischaemic stroke (AIS) patients receiving intravenous thrombolysis (IV rtPA) have successful recanalization of the occluded intracranial arteries. Understanding how cerebral autoregulation (CA), and other haemodynamic parameters, are affected in AIS patients, particularly during IV rtPA, may provide information about their association with reperfusion injury or improvements in outcome.

**Methods:** Cerebral blood velocity (CBV, Transcranial Doppler), beat-to-beat blood pressure (BP, Finometer) and end-tidal carbon dioxide (ETCO<sub>2</sub>, capnography) were recorded in eleven participants (5 female, age 68  $\pm$  11 years) during and immediately after IV rtPA and at 3 further visits (123  $\pm$  38 mins; 23.9  $\pm$  2.6 hrs; 18.1  $\pm$  7 days and 89.6  $\pm$  4.2 days of stroke symptom onset), respectively.

**Results:** BP ( $p=0.03$ ) and heart rate ( $p < 0.005$ ) reduction were observed across four visits. ETCO<sub>2</sub> demonstrated a significant increment post 24 hours of stroke symptoms onset ( $p = 0.034$ ). CBV did not demonstrate any significant differences in overall temporal patterns across four visits, nor between hemispheric values. Affected hemisphere (AH) demonstrated a reduction in CA (ARI index) during IV rtPA (5.45  $\pm$  2.65 to 4.48  $\pm$  2.82,  $p = 0.04$ ) which increased immediately after completion. Three participants had impaired AH ARI ( $< 4$ ) at first visit, all of them have improved AH ARI ( $> 4$ ) and Modified Rankin Scale  $\leq 1$  at visit 4. No differences were observed between both hemispheres ARI values across all visits.

**Conclusions:** Worsening dynamic CA during IV rtPA suggests closer BP monitoring during this critical stage is needed to prevent further ischaemia or hyperperfusion. Future investigations will look at the application of such knowledge within personalised AIS care to best facilitate recovery.

**Trial registration number:** NCT 02928926

**AS02-012**

## EARLY NEUROLOGICAL DETERIORATION AFTER INTRAVENOUS THROMBOLYSIS IN ACUTE ISCHEMIC STROKE: PREVALENCE, PREDICTORS, AND PROGNOSIS

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**Background and Aims:** In acute ischemic stroke, patients may deteriorate early after administration of intravenous (IV) thrombolysis. We evaluated the prevalence, predictors, and 3-month outcomes of acute stroke patients who had early deterioration after receiving IV thrombolysis.

**Methods:** Data were collected prospectively on 192 patients with intravenous thrombolysis after ischemic stroke. NIHSS scores were measured at admission and at 24 hours after intravenous rt-PA therapy. Early neurological deterioration (END) is defined as a four-point or greater increase in the NIHSS score within the first 24 hours from the NIHSS score just before thrombolysis. Modified Rankin scores (mRS) at 3 months were collected by phone-calls.

**Results:** END was observed in 30 patients (15.6%) and was independently associated with old age (OR 1.121, 95% CI 1.052-1.194,  $P < 0.001$ ), higher initial NIHSS (OR 1.210, 95% CI 1.032-1.418,  $P = 0.019$ ), and onset-needle time (OR 1.010, 95% CI 1.001-1.020,  $P = 0.033$ ) on multivariate analysis. Intracranial hemorrhage (OR 5.144, 95% CI 1.053-25.118,  $P = 0.043$ ) and malignant ischemic stroke (OR 6.992, 95% CI 1.252-39.032,  $P = 0.027$ ) occurred more in patients with END than other patients. At 3 months, no patients with END had a modified Rankin Scale (mRS) score of 0-1. END was associated with death and dependency (mRS 3-6,  $P < 0.001$ ) and death ( $P < 0.001$ ), at 3 months.

**Conclusions:** Old age, higher baseline NIHSS score, and prolonged onset-needle time were independently associated with END. END was strongly predictive of 3-month poor outcome after rt-PA therapy.

**Trial registration number:** N/A

## AS02-037

### INTRAVENOUS ALTEPLASE TREATMENT IN PATIENTS $\geq 80$ YEARS OF AGE AFTER ACUTE ISCHEMIC STROKE

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**Background and Aims:** Risks and benefits of intravenous alteplase for stroke in patients  $\geq 80$  years old are controversial. We evaluated the efficacy and complication in thrombolysed patients  $\geq 80$  years compared with their younger counterparts.

**Methods:** We collected prospectively patients who were treated with standard-dose intravenous alteplase for acute ischemic stroke within 4.5 hours of onset. The co-primary endpoints were the rate of functional independence at 90 days (a score of 0-2 on the modified Rankin Scale) and symptomatic intracranial hemorrhage (according to ECASS III criteria).

**Results:** A total of 192 patients were enrolled with 30 were  $\geq 80$  years old. The elderly group had more severe strokes (median NIHSS is 14 versus 11), a larger proportion of female (80% versus 38.3%) and higher systolic blood pressure at admission ( $154.93 \pm 23.64$  versus  $143.11 \pm 26.27$ ). No difference in the rate of functional independence at 90 days was observed (46.2% versus 72%, 95% CI, P = 0.09). Those aged  $\geq 80$  years had a statistically higher symptomatic intracranial hemorrhage incidence (16.7% versus 6.8%, 95% CI, P = 0.035). Elderly patients demonstrated a longer hospital stay (14 days versus 6 days, 95% CI, P < 0.05) and increased mortality at 3 months (23.1% versus 8%, 95% CI, P = 0.019).

**Conclusions:** This study involving Asian patients showed that patients aged  $\geq 80$  could benefit from standard-dose alteplase after acute ischemic stroke. There was a significant increase in symptomatic intracerebral hemorrhage, hospital stay, and death of those patients. Low-dose alteplase should be considered in Asian patients  $\geq 80$  years to decrease hemorrhagic risk.

**Trial registration number:** N/A

## AS02-047

### INFLUENCE OF WHITE BLOOD CELL COUNT ON OUTCOME FOR THROMBOLYSIS-TREATED ACUTE ISCHEMIC STROKE ENCHANTED (ENHANCED CONTROL OF HYPERTENSION AND THROMBOLYSIS STROKE STUDY) POST HOC ANALYSIS

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**Background and Aims:** Increased inflammatory reaction can aggravate brain injury after acute ischemic stroke, but the clinical effect of such response is not fully understood. The aim of this study was to determine

associations of peripheral white blood cell (WBC) count on clinical outcome among participants of the ENCHANTED study.

**Methods:** The ENCHANTED study, an international, multicenter, randomized controlled trial where patients with acute ischemic stroke were randomized to low-dose (0.6 mg/kg) or standard-dose (0.9 mg/kg) IV alteplase. Blood samples were collected on admission and WBC count was measured at local laboratories. The primary outcome was death or disability, defined by scores 3–6 on the modified Rankin Scale at 90 days. Secondary outcomes included ordinal mRS shift, fatal intracerebral hemorrhage (ICH) by various standard criteria. Associations of baseline WBC count and outcomes were evaluated in logistic regression models.

**Results:** There were 3179 participants with relevant data who were classified into quartiles of WBC counts ( $\leq 6.30$ ,  $6.31\text{--}7.82$ ,  $7.83\text{--}9.80$ , and  $\geq 9.81 \times 10^9/\text{L}$ , respectively). Increased WBC count was associated with younger age, elevated NIHSS scores, less antithrombotic used, elevated heart rate, elevated fever treated, stroke severity. Risks of death or major disability at 90 days increased progressively with higher WBC count: frequencies of 30.4%, 34.7%, 39.1% and 44.8% for quartile groups, respectively (P <.0001 for trend). After adjustment for baseline clinical and imaging variables, the association between WBC count and primary outcome was still significant (P <.0001 for trend).

**Conclusions:** Elevated WBC count on admission may be an independent prognostic predictor in patients with Acute Ischemic Stroke, but this requires further evaluation in a prospective cohort study.

**Trial registration number:** no

## AS02-076

### PRIMARY IA-THROMBOLYSIS FOR NONLVO STROKE DIRECTLY TRANSFERRED WITHIN 6 HOUR OF ONSET TO CSC.

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**Background and Aims:** Direct transfer to angio-suite (DTAS) of patients with suspected (LVO) ischemic stroke selected before hospital admission may reduce the times and improve the outcomes of endovascular treatment (EVT). However, some transferred cases discovered to be Non-LVOs so the Mechanical thrombectomy will not be the treatment of choice. Aim: is to show the efficacy and safety of IA-thrombolysis for direct transferred Non-LVO strokes within 6 hour from onset

**Methods:** between 2016–2018, 125 suspected LVO stroke was directly transferred to our CSC for MT based on LVO scales. 33 cases (26.4%) discovered to be non LVOs with onset of >4 hrs and <6 hours. All cases received IA-thrombolysis. We compared clinical and radiological outcomes of patients treated with TNK to those treated with other alteplase. Primary outcome measures were favorable functional outcome at 30 days, and rate of intracranial hemorrhage (ICH). Early neurological improvement, angiographic recanalization, and mortality at 30 days were additional outcome measures.

**Results:** We identified 33 patients (mean age  $67 \pm 15$  years, 54 were women). twenty-three patients received IA TNK, 10 received alteplase. Stroke severity was similar among the two groups. No difference between the groups was found in the secondary outcome measures and ICH. TICI 2b or 3 was achieved in 22 cases (66.7%). Borderline statistical significance was seen toward favorable functional outcome at 1 month in the TNK-treated patients.

**Conclusions:** Our study demonstrates that administration of IA thrombolysis in Non LVO acute stroke is safe and results in rates of favorable outcomes.

**Trial registration number:** N/A

**AS02-022**
**CLINICIAN BEHAVIOUR CHANGE IN THE EMERGENCY DEPARTMENT (T<sup>3</sup> TRIAL) – FINDINGS FROM A MIXED METHODS PROCESS EVALUATION**

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**Background and Aims:** To achieve optimal outcomes for patients with acute stroke, evidence-based management in the emergency department (ED) is essential. A multidisciplinary, multifaceted protocol-based intervention implemented in Australian EDs (T<sup>3</sup> trial) had no significant effect on patient outcomes or the delivery of clinical care. A mixed-methods process evaluation was conducted to identify contextual and clinician-level factors that influenced protocol uptake.

**Methods:** Behaviour change strategies were developed based on the Theoretical Domains Framework (TDF) and Behaviour Change Wheel, to address priority barriers identified from expert panel ratings. Quantitative and qualitative data were collected pre-implementation from a web-based survey of influential barriers completed by a purposive sample of expert clinicians (n = 17), and post-implementation from interviews (n = 28) of ED and stroke clinicians from intervention sites and site study co-ordinators. Quantitative data were analysed descriptively and qualitative data thematically summarised. Results were triangulated to aid interpretation.

**Results:** Three main findings emerged: i) ED clinicians did not regard stroke management as ‘our business’; ii) implementation was difficult to achieve alongside the ED priorities of triage and assessment resulting in adaptations and non-adherence to protocol elements; iii) the evidence supporting tPA, hyperglycaemia and fever management was frequently challenged and this mitigated against implementation of all protocol elements.

**Conclusions:** A theoretically designed evidence-based intervention to improve stroke care in the ED was unable to overcome organisational and individual barriers identified pre-implementation through a systematic and rigorous process. These findings demonstrate the importance of rigorously testing new interventions and behaviour change theories, particularly in complex clinical settings.

**Trial registration number:** ACTRN12614000939695.

**AS02-007**
**OUTCOME, EFFICACY AND SAFETY OF ENDOVASCULAR THROMBECTOMY IN ISCHEMIC STROKE ACCORDING TO TIME TO REPERFUSION: DATA FROM A MULTICENTER REGISTRY.**

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**Background and Aims:** In mechanical thrombectomy (MT) of anterior circulation acute ischemic stroke (AIS), data indicates a decline of treatment effect with increasing time from symptom onset to treatment. However, the magnitude of the decline will depend on the clinical setting and imaging selection. Aims of this study were (1) to evaluate the clinical effect of time to reperfusion (TTR) and (2) to assess the safety and technical efficacy of MT according to strata of TTR.

**Methods:** Using the retrospective multicenter BEYOND-SWIFT registry data (NCT03496064), we compared safety and efficacy of MT in 1461 patients between TTR strata of 0–180 minutes (n = 192), 180–360 minutes (n = 876) and >360 minutes (n = 393). Clinical effect of TTR was evaluated using multivariable logistic regression analyses adjusting for prespecified confounders (aOR and 95% confidence intervals, 95%-CI). Primary outcome was good functional outcome (modified Rankin Scale: mRS 0–2) at day 90.

**Results:** Every hour delay in TTR was a significant factor related to mRS 0–2 (aOR 0.933, 95%-CI 0.887 – 0.981, P = 0.007) with an estimated 1.5% decreased probability per hour delay of reperfusion, mRS 0–1 (aOR 0.929, 95%-CI 0.877 – 0.985, P = 0.013) and mRS 0–3 (aOR 0.955, 95%-CI 0.911 – 1.000, P = 0.049). Patients with late TTR had lower rates of successful and excellent reperfusion, higher complication rate and number of passes.

**Conclusions:** TTR is an independent factor related to long-term functional outcome. With increasing TTR, procedures become technically less effective and more prone to complications. Efforts should be made to shorten TTR through optimized pre- and in-hospital pathways.

**Trial registration number:** NCT03496064

**WITHDRAWN**

Endovascular thrombectomy is an effective for patients with cardioembolic ischemic stroke with good collateral blood flow to the ischemic area of the brain.

**Trial registration number:** N/A

## AS02-065

### CEREBROLYSIN AFTER THROMBOLYSIS: IS THE POSITIVE TREND SUSTAINABLE?

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#### Background and Aims:

**Aim:** To compare the clinical benefit of early ( $\leq 1$  h) and late (22–24 h) initiation of Cerebrolysin treatment in thrombolysed stroke patients

**Methods:** In this retrospective study Cerebrolysin was administered either one ( $n = 47$ ) or 22–24 ( $n = 60$ ) hours after thrombolysis; both groups were compared to a control group treated with rt-PA only ( $n = 220$ ). The dosage regimen for Cerebrolysin was 30 mL daily for 5 days followed by 20 mL daily for two to ten consecutive days. Concomitant early mobilization and rehabilitation therapy was performed in all patients. Efficacy was assessed by mRS at day 90.

**Results:** The percentage of patients with an mRS score 0 – 2 at day 90 was 66% in the Cerebrolysin group with early initiation, 60% in the Cerebrolysin group with late initiation, and 50% in the control group (rt-PA only). Mean 3-month mRS was  $1,43 \pm 1,17$  in the 1-hour group compare to  $1,97 \pm 1,06$  in the 22–24-hour group ( $p = 0,0205$ ). Both group demonstrate significant differences in comparison to controls, rt-PA only ( $2,55 \pm 1,84$ ,  $p = 0,0003$  and  $p = 0,0247$ , respectively).

**Conclusions:** This study showed a clear clinical advantage of starting Cerebrolysin treatment within one hour after thrombolysis. Furthermore, this therapy was safe and well tolerated. These results should be confirmed in larger randomized, controlled studies.

**Trial registration number:** N/A

## AS02-066

### THE RESULTS OF ENDOVASCULAR TREATMENT OF CARDIOEMBOLIC ACUTE STROKE DEPENDING ON THE DEGREE OF COLLATERALIZATION OF BLOOD FLOW TO THE BRAIN

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**Background and Aims:** Mechanical thrombectomy is being considered to improve the rate and speed of recanalization. Our study evaluated the blood flow of the brain on a scale ACG (American Society of Interventional and Therapeutic Neuroradiology collateral grading) for patients with cardioembolic acute stroke underwent endovascular thrombectomy. We used TICI (thrombolysis in cerebral infarction scale) to estimate value revascularization cerebral artery.

**Methods:** The study included 34 patients with atrial fibrillation. Two groups were identified according to the degree of collateralization of the brain, estimated on the ACG. The first group consisted 10 patients (mean age 75,7; NIHSS  $15 \pm 5,9$ ) with ACG 0–2 degree collateral blood flow. The average time "symptom-puncture" was 208.5min. The second group consisted 24 patients (mean age 75,8; NIHSS  $12,7 \pm 5,3$ ) with ACG 3–4 degree, and the average time "symptom-puncture" was 297min.

**Results:** Blood flow rate on the TICI: in the first group before thrombectomy was  $0,1 \pm 0,2$ , after revascularization was  $2,2 \pm 0,6$ ; in the second group before thrombectomy was  $0,4 \pm 0,9$ , after  $2,4 \pm 0,9$ . After thrombectomy the NIHSS scale averaged in the first group  $13,6 \pm 7,2$ , in the second group  $9,6 \pm 6,7$ ; mRS in the first group was  $4,6 \pm 2,0$ , in the second group  $2,4 \pm 1,8$ . patients (mean age 75,8; NIHSS  $12,7 \pm 5,3$ ) with ACG 3–4 degree, and the average time "symptom-puncture" was 297min. ate value revascularization cerebral artery.

**Conclusions:** There is a tendency to better functional clinical outcome in patients in the second group with ACG 3–4 collateral blood flow.

## AS02-039

### ADAPT TECHNIQUE IN ISCHEMIC STROKE TREATMENT OF M2 MIDDLE CEREBRAL ARTERY (MCA) OCCLUSIONS IN COMPARISON TO M1 OCCLUSIONS: POST HOC ANALYSIS OF THE PROMISE STUDY

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**Background and Aims:** While the benefits of thrombectomy for treatment of Acute Ischemic Stroke (AIS) for proximal large vessel occlusion (LVO) have been established, few studies have evaluated aspiration of more distal occlusions. This post hoc analysis of the PROMISE study was performed to analyze the safety and efficacy of larger bore aspiration catheters (ACE 68, ACE 64) for thrombectomy in M1 and M2 occlusions.

**Methods:** PROMISE was a prospective multicenter study of 204 patients treated with ACE68/ACE64 catheters for anterior circulation LVO AIS. Clinical and angiographic outcomes, complications, and mortality in M1 and M2 occlusions were compared. Associations of covariates with functional independence (Day-90 mRS 0–2) or mTICI 2b-3 reperfusion were determined by univariate and multivariate model analyses.

**Results:** There was no significant difference between M1 ( $n = 124$ ) and M2 ( $n = 37$ ) occlusions with regards to baseline characteristics, post procedure mTICI 2b-3 reperfusion (93% vs. 92%,  $p = 1.0$ ), functional independence (57% vs. 70%,  $p = 0.18$ ), symptomatic intracranial hemorrhage (1.6% vs. 2.7%,  $p = 0.55$ ), device-related serious adverse events (SAE) at 24 hours (1.6% vs. 0.0%,  $p = 1.00$ ), device- or procedure-related SAE at 30 days (4.0% vs. 8.1%,  $p = 0.39$ ), or mortality at 90 days (6.6% vs. 2.7%,  $p = 0.69$ ). M1 vs. M2 occlusion location was not a significant predictor of functional independence in both univariate (OR 0.561,  $p = 0.15$ ) or multivariate (OR 0.591,  $p = 0.31$ ) analysis.

**Conclusions:** Our post hoc analysis suggests that use of larger bore aspiration catheters for frontline aspiration thrombectomy of M2 occlusions is as safe and effective as for M1 occlusions.

**Trial registration number:** NCT02678169

## AS02-014

### SAFETY AND EFFICACY OF INTRAVENOUS TPA IN PATIENTS WITH MILD STROKE

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**Background and Aims:** Mild stroke (NIHSS 0–4) accounts approximately for one third of patients that present in three hours after onset. About 30% of patients, who are considered having mild stroke, suffer from clearly disabling deficits at 90 days. Although prior major trials of tPA included patients with low NIHSS scores, the safety and efficacy of tPA in such patients are still controversial.

**Aims:** To evaluate the efficacy and safety of tPA in mild stroke in the first 4.5 hours.

**Methods:** Prospective case series study in 50 mild stroke patients who were admitted in People's hospital 115 and University Medical Center in 4.5 hours from the symptoms onset between November 2017 and July 2018. Favorable outcome (mRS of 0–1) at 90 days, symptomatic intracerebral hemorrhage, mortalities of all causes at 90 days were evaluated to determine the association with tPA treatment.

**Results:** tPA was administered to 27 of 50 patients (54%). 73 % of patients in the tPA group vs 63.2% in the untreated group achieved a favorable outcome at 90 days ( $p = 0.48; 95\%$ ). The incidence of symptomatic intracerebral hemorrhage according to SITS-MOST's criteria and the mortality rate was not different between the two groups- (0% in both groups); (3.7% vs 4.3%;  $p = 1$ ; 95%). Multivariable logistic regression analysis of favorable outcome revealed that the significant independent factors were age of 70 or older (OR, 0.125; 95%, 0.026 – 0.591); History of diabetes (OR, 0.066; 95% CI, 0.006 – 0.795).

**Conclusions:** tPA treatment can be safe and has effective trend in patients with mild stroke

**Trial registration number:** N/A

## AS02-023

### BRIDGING THERAPY AND DIRECT THROMBECTOMY FOR ACUTE ISCHEMIC STROKE: A PROSPECTIVE COHORT STUDY

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**BRIDGING THERAPY AND DIRECT THROMBECTOMY FOR ACUTE ISCHEMIC STROKE: A PROSPECTIVE COHORT STUDY**

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**Background and Aims:** It remains controversial if intravenous thrombolysis (IVT) prior to mechanical thrombectomy (MTE) is superior to MTE alone in patients with acute ischemic stroke caused by large vessel

occlusion. In this study, we compare functional outcomes, death, reperfusion, and intracranial hemorrhage in two groups

**Methods:** From September 2017 to July 2018, patients with acute large artery occlusion within the anterior cerebral circulation eligible for MTE with or without prior IVT were included in a prospective cohort study. A mRS score of 0–2 was considered as good functional outcome at 90 days. Successful reperfusion was defined as a Thrombolysis in Cerebral Infarction (TICI) scale 2b–3

**Results:** Of the 124 patients included, 56 (45,2%) received bridging therapy, 68 (54,8%) received direct thrombectomy. The difference was no statistically significant in onset-to-groin time (median, 270 vs 371 min;  $P = 0,09$ ), ASPECTS (median, 9 vs 10;  $P = 0,69$ ), good collateral status (87,5% vs 77,9%;  $P = 0,16$ ). Functional independence (mRS 0–2) and mortality at 90 days did not differ significantly (58,9 vs 75%,  $P = 0,057$ ; 14,3% (8/56) vs 7,4% (5/68),  $P = 0,25$ ; respectively). Successful reperfusion rate was highly significant in bridging therapy group (87,5 vs 72,1%;  $P = 0,036$ ). There were no significant difference in rates of parenchymal hematoma type 2 (2/56 vs 2/68,  $P = 1,00$ )

**Conclusions:** These data suggest that bridging therapy has higher significant successful reperfusion rate, however the difference was no statistically significant in functional independence, mortality, or rate of parenchymal hematoma type 2. Further studies are needed to confirm our findings

**Trial registration number:** N/A

## AS02-010

### ASSOCIATION BETWEEN RENAL DYSFUNCTION AND CLINICAL OUTCOMES AFTER MECHANICAL THROMBECTOMY IN ACUTE ISCHEMIC STROKE

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**Background and Aims:** For acute ischemic stroke (AIS) patient receiving mechanical thrombectomy (MT), renal dysfunction was an independent risk factor of contrast-induced nephropathy which may affect clinical outcomes. However, the influence of renal function on stroke outcomes was still controversial. We aimed to investigate the association between renal function and outcomes of MT in AIS.

**Methods:** All consecutive stroke patients receiving MT were included in the prospective stroke registry in Nanjing First Hospital from April 2015 to August 2018. Baseline estimated glomerular filtration rate (eGFR) was measured by CKD Epidemiology Collaboration equation (CKD-EPI). Renal dysfunction was defined as eGFR < 60 and was further categorized into G3a (45–59) and G3b-5 ( $\leq 44$ ) ml/min/1.73 m<sup>2</sup>. Multivariate logistic regression analysis was performed to evaluate the association between eGFR and symptomatic intracranial hemorrhage (sICH), 3-month death and poor functional outcome (modified Rankin Scale 3–6) at 3 months.

**Results:** A total of 290 patients were included in the study. 66 (22.8%) patients had renal dysfunction, 42 (14.5%) were G3a, 24 (8.3%) were G3b-5. Renal dysfunction was associated with sICH (21.5% vs. 8.6%,  $p = 0.004$ ), 3-month death (32.8% vs. 18.8%,  $p = 0.019$ ) and poor functional outcome (72.3% vs. 58.1%,  $p = 0.039$ ). After adjusted by demographic and clinical risk factors, renal dysfunction was associated with sICH (OR = 2.54, 95% CI = 1.13–5.70,  $p = 0.024$ ) and 3-month death (G3b-5, OR = 2.74, 95% CI = 1.02–7.32,  $p = 0.044$ ). However, it was not associated with poor functional outcome (OR = 0.75, 95% CI = 0.37–1.51,  $p = 0.42$ ).

**Conclusions:** For AIS patients receiving MT, renal dysfunction increased the risk of sICH and 3-month death, however it was not associated with poor functional outcome.

**Trial registration number:** N/A

**AS02-015****THROMBOLYSIS WITH TENECTEPLASE COMPARED TO ALTEPLASE 3–4.5 HOURS AFTER ACUTE ISCHEMIC STROKE**

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**Background and Aims:** Thrombolysis with alteplase has beneficial effect on outcome and is safe within 4.5 hours (h), but the effect diminishes with increasing time from stroke onset to start of treatment. In this study, the aim was to compare the efficacy and safety of tenecteplase and alteplase in patients treated 3–4.5 h after ischemic stroke.

**Methods:** The data are from a prespecified substudy of patients included in The Norwegian Tenecteplase Stroke Trial (NOR-TEST) which was a multicenter randomized controlled trial conducted in 13 stroke units in Norway.

**Results:** In the intention-to-treat analysis 60 (57%) of 105 patients that received tenecteplase and 47 (53%) of 89 patients in the alteplase group reached good functional outcome (mRS 0–1) at three months (OR 1.19, 95% CI 0.68–2.10). The rates of intracranial hemorrhage in the first 48 hours were 5.7% in the tenecteplase group and 6.7% in the alteplase group (OR 0.84, 95% CI 0.26–2.70). At 3 months, mortality was 5.7% (6 of 105) and 4.5% (4 of 89). After excluding stroke mimics and patients with mRS > 1 before stroke, 71 patients remained in the tenecteplase group and 56 patients in the alteplase group. The proportion of patients with good functional outcome was 61% in the tenecteplase group and 57% in the alteplase group (OR 1.24, 95% CI 0.65–2.37).

**Conclusions:** Tenecteplase is at least as effective as alteplase to achieve good clinical outcome in patients with mild strokes treated between 3 and 4.5 h after ischemic stroke.

**Trial registration number:** NCT01949948.

**AS02-043****EFFECT OF TPA ADMINISTRATION PRIOR TO ASPIRATION THROMBECTOMY IN ANTERIOR CIRCULATION LVO: A PROMISE STUDY POST HOC ANALYSIS**

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**Background and Aims:** The PROMISE study investigated safety and efficacy of large bore reperfusion catheters in patients with AIS from anterior circulation LVO treated with ADAPT as frontline treatment. This post hoc analysis examines the effect of pre-procedural IV-tPA on functional clinical outcome.

**Methods:** PROMISE was a prospective, single-arm, multicenter study. Inclusion criteria were anterior circulation LVO within 6 hours of ictus; NIHSS ≥ 2; CT-ASPECTS ≥ 6. To investigate the effect of pre-procedure IV-tPA on functional independence (Day 90 mRS 0–2), univariate and multivariate (adjusting for baseline differences) analyses were performed. The effect of tPA was also listed by occlusion location.

**Results:** PROMISE enrolled 204 patients (median age 74[IQR 65–80]) across 20 European centers. Prior to procedure, 61.8% had IV rtPA. In both univariate (OR 2.327, p < 0.01) and adjusted multivariate model analysis (OR 2.243, p = 0.02), tPA was a significant predictor of day 90 mRS 0–2.

In patients given tPA compared to those without, Day 90 mRS 0–2 was observed in 68.9% vs 48.7% (p < 0.01), and post-procedure mTICI 2b-3 rate was 92.1% vs 94.9% (p = 0.44). By location, the percentage of patients with day 90 mRS 0–2 in the tPA (n = 126) and no-tPA (n = 78) groups was as follows: 78.9% vs. 52.2% ICA-T, 67.0% vs. 47.3% MCA, 63.3% vs 45.2% M1, and 79.2% vs 53.8% M2.

**Conclusions:** In this post hoc analysis of the PROMISE study, pre-procedure IV-tPA was a significant predictor of good functional outcomes but not of mTICI 2b-3.

**Trial registration number:** NCT02678169

**AS02-069****CENTRAL RETINAL ARTERY OCCLUSION TREATED WITH INTRAVENOUS THROMBOLYSIS**

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**Background and Aims:** Central retinal artery occlusion (CRAO) is a medical emergency that, if not treated, may result in irreversible loss of vision due to retinal ischemia. CRAO is considered an equivalent of an acute ischemic stroke. Current literature indicates that patient with CRAO may benefit from intravenous thrombolysis (IVT). There is no consensus on the time window to establish reperfusion to save vision. The aim of the study was to identify patients who could benefit from IVT.

**Methods:** Multiple comprehensive stroke centers retrospective study analyzing data of patients with CRAO treated with IVT from January 2014 to December 2018. Good outcome was defined as full restoration of vision at 30 days. Following indicators of good clinical outcome were assessed: time to IVT, the presence of vascular risk factors, etiology of CRAO, initial changes on eye fundus and visual acuity.

**Results:** 17 patients, 59% men, mean age 69 (34–83), were included. Mean time from onset to IVT was 361 minutes (100–860, SD 240). 4 patients (23.5%) were treated within 4.5 hours, 2 of them (11.6%) recovered completely (treated 262 and 100 minutes after the occlusion). Etiology was large vessel disease in both cases, and they had no ischemic changes on eye fundus at admission. Partial recovery of vision at 30 days was observed in 13 patients (76.5%).

**Conclusions:** Patients with acute reperfusion within 4.5 hours and no ischemic changes on eye fundus had a good visual outcome in our study. CRAO is an emergency that has a time-sensitive outcome similar to ischemic stroke.

**Trial registration number:** N/A

**AS02-062****PRIMARY ASPIRATION CLOT INGESTION FOR MIDDLE CEREBRAL ARTERY OCCLUSION (PACMAN): A RANDOMIZED CONTROLLED STUDY OF TWO ASPIRATION TECHNIQUES.**

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**Background and Aims:** A Direct Aspiration first Pass Technique (ADAPT) is an effective method to perform mechanical thrombectomy. Anyway, the technique is still evolving.

We evaluated two aspiration modalities to assess their impact on reperfusion rates and clinical outcomes and also described the PACMAN technique performed at our institution.

**Methods:** Between January and November 2018, all patients with an isolated middle cerebral artery occlusion (M1 segment) treated with the ADAPT-PACMAN at our institution were enrolled in the study.

Participants were randomly assigned to receive ADAPT performed either with a 60cc syringe versus aspiration pump.

The primary outcome was the rate of successful reperfusion (mTICI 2b or 3).

We also compared the modified Rankin scale (mRS) at 90 days and procedural details (timing, number of passages).

**Results:** We did not observe any significant correlation between procedural TICI score and aspiration techniques (RR:2.06; 95%CI:1.6-2.6; P = 0.8). We report a median of 1 revascularization passage (SD = 0.9, range = 1-5) in the syringe group and 2 (SD = 1.5, range = 1-7) in the pump group; TICI 3 score was obtained at first-attempt recanalization in 67.6% and 45.7% of cases.

The rate of functional independence at 90 days (mRS≤2) was higher in syringe group (61.8% vs.48.6%, p = 39).

Stent-retriever were used in 2.9% vs.14.3%.

Symptomatic intracerebral hemorrhage occurred in 10.1% of participants, without differences among aspiration techniques (P = 0.73).

**Conclusions:** Our study shows that syringe alone is non-inferior to the aspiration pump to obtain successful complete recanalization of M1-MCA occlusions and may reduce procedural costs.

The PACMAN technique seems to increase the rate of first-attempt recanalization using the ADAPT.

**Trial registration number:** N/A

## AS02-025

### SMOKING PARADOX REVISITED: CURRENT SMOKING DOES NOT MODIFY TREATMENT EFFECT OF THROMBOLYSIS IN MRI-SELECTED PATIENTS WITH ACUTE ISCHEMIC STROKE AND UNKNOWN TIME OF SYMPTOM ONSET

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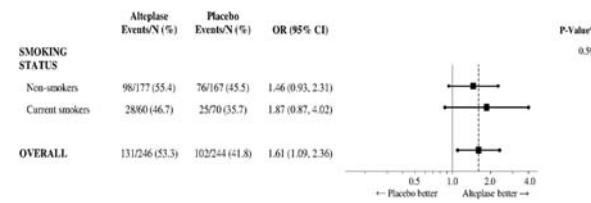
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**Background and Aims:** Patients with acute ischemic stroke (AIS) who are smokers may have a better prognosis after intravenous thrombolysis (IVT) than non-smokers. However, the evidence for this so-called smoking paradox is inconsistent and data analyzing the impact of smoking on the treatment effect of IVT are lacking.

**Methods:** We performed a subgroup analysis of the WAKE-UP trial that randomized AIS patients with unknown time of symptom onset who had a diffusion-weighted imaging/fluid attenuation recovery imaging (DWI/FLAIR) mismatch to either IVT or placebo. Patients were categorized as current smokers or non-smokers (including former smokers and never-smokers). Baseline demographic and clinical characteristics as well as clinical and imaging follow-up data were analyzed according to smoking status.

**Results:** Non-smokers were younger ( $60.1 \pm 13.0$  vs  $67.2 \pm 10.3$  years;  $p < 0.001$ ) and less often had arterial hypertension (44.4% vs 56.7%;  $p = 0.02$ ) or atrial fibrillation (3.8% vs 15%;  $p < 0.001$ ). Baseline severity did not differ between groups, but current smokers had a trend towards more severe strokes (National Institutes of Health Stroke Scale score >10 in 27.1% vs 19.5%;  $p = 0.08$ ). The treatment effect of IVT was not different between current smokers and non-smokers ( $p$ -value for interaction: 0.59). In univariate analysis, the median modified Rankin scale score at 90 days was higher in the current-smokers group (1 [1 – 3] vs 2 [1 – 3],  $p = 0.047$ ), but did not differ significantly after adjustment for age and baseline stroke severity.



**Conclusions:** In patients with mild to moderate AIS and unknown time of symptom onset with DWI/FLAIR mismatch, current smoking did not modify the treatment effect of IVT.

**Trial registration number:** NCT01525290

## AS02-006

### THE ROLE OF ASPECTS IN PATIENT SELECTION FOR ENDOVASCULAR THERAPY – CTA SOURCE IMAGES VERSUS NONCONTRAST CT

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**Background and Aims:** We aimed to evaluate the association between pre-treatment Alberta Stroke Programme Early CT Score (ASPECTs) on CT angiography source images (CTA-SI) and post-treatment clinical and radiological outcomes in acute stroke patients treated with endovascular therapy (ET).

**Methods:** Patients with proximal artery occlusion in the anterior circulation and treated with ET successfully were enrolled in the study. The

association between both scores along with final infarct and outcome were analyzed.

**Results:** CTA-SI ASPECTs was better correlated with final infarct than NCCT ASPECTs. In univariate analyzes, factors associated with good outcome were age, baseline NIHSS score, and presence of diabetes mellitus. On the other hand, when an analysis differentiating patients by age was performed, the patients below 60 years of age had significantly better outcomes despite having higher baseline NIHSS scores. Finally, in multivariate analyzes, only age and baseline NIHSS score were found to be independent predictors of good outcome. Both scoring modalities were not found to be independent predictors of good outcome.

**Conclusions:** Although CTA-SI ASPECTs in patient selection for ET seems to be more useful than NCCT ASPECTs, outcomes are changeable for the younger population who could continue their lives with mild or no deficits despite having a relatively low initial ASPECTs. Thus, it is reasonable to rearrange ET triage criteria and treatment targets by age groups and younger patients who are still able to benefit from treatment will not be excluded from the ET protocol.

**Trial registration number:** N/A

## AS02-017

### SEVERE LEUKOARAIOSIS IS AN INDEPENDENT PREDICTOR OF POOR OUTCOME IN ACUTE STROKE PATIENTS UNDERWENT THROMBECTOMY

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**Background and Aims:** The aim of the study was to evaluate whether severe leukoaraiosis (LA) is associated with poor outcome in acute stroke patients treated with endovascular therapy (ET).

**Methods:** We analyzed the data of anterior circulation stroke patients treated with ET at our stroke center, 2012 to 2018, retrospectively. LA was scored according to the van Swieten scale (VSS) on computed tomography and dichotomized into absent or moderate versus severe LA. The Modified Rankin scale (mRS) score at 90 days was used to assess the outcomes and a mRS score of 3–6 was defined as a ‘poor outcome’.

**Results:** Of 139 patients, 15 (10.8 %) showed severe LA of deep white matter (VSS>4) on CT. Severe LA was more frequent in women ( $p=0.027$ ) and elderly patients ( $p=0.001$ ). Patients with severe LA had higher baseline diastolic blood pressures ( $p=0.004$ ) and they were more likely to have a history of hypertension ( $p=0.020$ ), hyperlipidemia ( $p=0.036$ ), previous stroke ( $p=0.025$ ) and, atrial fibrillation ( $p=0.007$ ). Additionally, in patients with severe LA, successful recanalization (TICI 2b-3) rate was lower ( $p=0.031$ ) whereas futile recanalization rate and mRS scores at 90 days were higher ( $p=0.077$  and  $p=0.002$ , respectively). In multivariate analyses, age and severe LA were found to be independent predictors of poor outcome ( $p=0.038$  and  $p=0.017$ , respectively).

**Conclusions:** Severe LA is an independent predictor of poor outcome in acute stroke patients treated with ET. Therefore, the clinician should be cautious about the decision of ET in elderly patients with severe LA.

**Trial registration number:** N/A

## AS02-060

### RANDOMIZED CLINICAL TRIAL OF SAFETY AND FEASIBILITY OF EARLY INTENSIVE BLOOD PRESSURE LOWERING IN THROMBOLYSED ACUTE ISCHEMIC STROKE PATIENTS AND ASSESSED USING CT PERfusion IMAGING

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**Background and Aims:** Uncertainty persists over optimal management of blood-pressure (BP) in the early phase of acute ischemic stroke (AIS). Tight control of BP may reduce cerebral blood flow (CBF) while elevated BP may increase risk of symptomatic intracranial hemorrhage (SICH). We aimed to determine the safety and effects of intensive BP lowering on CBF, SICH and functional outcome in thrombolysed AIS patients.

**Methods:** In a randomized controlled trial, AIS patients with systolic BP 160–180mmHg were randomized to early intensive (systolic BP 140–160mmHg) or guideline-based BP management (systolic BP 160–180mmHg) during first 72-hours. All subjects underwent CT perfusion at baseline, 24 and 72-hours to evaluate cerebral hemodynamics. Clinical outcome was assessed with dichotomized modified Rankin scale (0–1 as excellent outcome versus scores 2–6 as poor outcome) at 90 days and SICH.

**Results:** 54 patients were randomized to early intensive BP lowering (26) or guideline-based BP management (28). Intensive BP arm had lower average systolic BP over 72-hours compared to standard therapy ( $145.0 \pm 11.1$  vs.  $151.9 \pm 12.7$ mmHg;  $p=0.049$ ). Except for more male patients (76.0% vs. 46.4%;  $p=0.016$ ) in intensive BP-lowering arm and lower prevalence of atrial fibrillation (4.0% vs. 25.9%;  $p=0.029$ ), there were no significant differences in age, laboratory findings, cardiovascular risk factors and CT-ASPECTS between the 2 arms. Despite intensive BP lowering, there was no significant difference in cerebral perfusion parameters across serial CT perfusion scans, functional outcome at 90 days or SICH between the 2 arms.

**Conclusions:** In the early phase, intensive BP lowering appears feasible and safe in thrombolysed AIS patients.

**Trial registration number:** NCT03443596

## AS02-075

### ENDOVASCULAR THROMBECTOMY FOR PATIENTS WITH LOW NIHSS: INSIGHTS FROM AN INTERNATIONAL MULTIDISCIPLINARY SURVEY

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**Background and Aims:** Up to 30% of acute ischemic stroke patients with mild clinical deficits (NIHSS  $\leq 5$ ) have large vessel occlusion (LVO). These patients were underrepresented in the recent endovascular trials. The role of EVT remains poorly defined in this population.

**Methods:** Using an international web-based survey, we asked practitioners regarding their EVT practices in patients with low NIHSS using the following scenario: A 76-year-old women with mild hemiparesis and aphasia presenting within 3 hours from symptom onset with NIHSS at admission of 2, ASPECTS of 10 on CT and a MI occlusion on CT angiography.

**Results:** 273 participants from 33 countries were allocated to this scenario (mean age 44.5 years, 84.6% male, 54.2% neurologists, 30.8% neuro-interventionists, 11% neurosurgeons, 4% others). More respondents (60.1%) favoured EVT with or without IVT vs. 31.9% who chose IVT-alone vs. 8.1% who chose antithrombotics. Respondents favouring EVT were practicing in higher volume thrombectomy centers (92.2 vs 57.9 thrombectomies per year;  $P = 0.015$ ). Participants age, sex, discipline, hospital setting (teaching vs non-teaching) and experience had no influence on decision to offer EVT.

**Conclusions:** EVT appears to be favoured approach to treat LVOs in patients with mild clinical deficits, especially among practitioners from high volume centres.

Trial registration number: N/A

## AS02-020

### COLLATERAL STATUS IS NOT ASSOCIATED WITH CLINICAL OUTCOME IN ENDOVASCULAR THERAPY FOR PATIENTS WITH INTRACRANIAL ATHEROSCLEROTIC-RELATED OCCLUSION

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**Background and Aims:** The collateral circulation is an important determinant of clinical outcome in the reperfusion therapy of anterior circulation major artery occlusion. We aim to investigate relationship between collateral status and outcome of endovascular therapy for acute Intracranial atherosclerosis-related occlusion (ICAS-O).

**Methods:** We enrolled 405 patients (January 2011 to May 2016) from three comprehensive stroke centers in Korea who received endovascular therapy for acute ischemic stroke (AIS) caused by anterior circulation large arterial occlusions. Underlying ICAS-O was identified in 73 patients and embolic occlusion (Embo-O) was identified in 332 patients. CTA collateral pattern were evaluated and categorized into two groups by ASITN score: absent/poor collaterals (CTA collateral score 0–1) versus

moderate/good collateral score (CTA collateral score 2–4). Outcome was determined by the modified Rankin Scale (mRS) at 3 months and was grouped as either good (mRS 0–2) or poor (mRS 3–6).

**Results:** Good outcome was no difference between the ICAS-O group (45.2%) and Embolic-O group (45.2% vs 56.2%,  $P = 0.684$ ). Age, ASITN score and NIHSS score were significantly lower in ICAS-O group and onset to puncture time was significantly longer in ICAS-O group. In multivariate analysis, young age and low NIHSS score were associated with good outcome in ICAS-O group.

**Conclusions:** Collateral status was associated with a good outcome in Embolic-O group of acute ischemic stroke. However, the association has not been confirmed in ICAS-O group.

Trial registration number: N/A

## AS02-048

### THROMBOLYSIS IN STROKE WITH UNKNOWN ONSET BASED ON NON-CONTRAST CT (TRUST CT). AN INTERNATIONAL, MULTICENTER, REGISTRY-BASED STUDY

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**Background and Aims:** Intravenous thrombolysis in wake-up stroke (WUS) or stroke with unknown onset (SUO) has been recently proven to be safe and effective using magnetic resonance imaging (MRI) for patient selection. However, in most of the thrombolytic hospitals worldwide MRI is not available. We hypothesize that pragmatic non-contrast computed tomography (NCCT)-based WUS/SUO thrombolysis may be feasible and safe.

**Methods:** TRUST-CT (NCT03634748) was an international multicenter registry-based study. WUS/SUO patients undergoing NCCT-based thrombolysis with NIHSS  $\geq 4$  and initial ASPECTS  $\geq 7$  were included and compared to propensity score matched non-thrombolyzed WUS/SUO controls. Primary endpoint was symptomatic intracranial hemorrhage (ICH) according to ECASS3 criteria; secondary endpoints included 24-hour NIHSS change of  $\geq 4$  and modified Rankin Score (mRS) at 90 days.

**Results:** 117 patients with NCCT-based WUS/SUO thrombolysis (IVT) were included. As compared to 110 controls, the median admission NIHSS was 10 and 9, respectively, and the median ASPECTS was 10 in both groups. 29 (24.8%) IVT patients underwent additional embolectomy. 4 (3.4 %) IVT patients and 0 controls suffered symptomatic ICH. A decrease of  $\geq 4$  NIHSS points was observed in 63 (53.8 %) IVT patients as compared to 28 (25.5%) patients in the control group ( $p = 0.001$ ). 65 (55.6%) IVT patients and 46 (41.8%) controls achieved mRS 0 to 2 at 90 days ( $p = 0.03$ ).

**Conclusions:** NCCT-based thrombolysis in WUS/SUO seems feasible and safe and may be effective. Randomized prospective comparisons with MR-based approaches are warranted.

Trial registration number: NCT03634748

**AS02-033****COLLATERAL FLOW STATUS AND THE EFFECT OF RECANALIZATION THERAPIES ON CLINICAL OUTCOME IN ISCHEMIC STROKE PATIENTS****H. Thi Bich Nguyen<sup>1</sup>, T. Huy Nguyen<sup>1</sup>, T. Quoc Nguyen<sup>1</sup>,****H. Quoc Huynh<sup>1</sup> and B. Nguyen Pham<sup>1</sup>**<sup>1</sup>People 115 Hospital, Cerebrovascular Disease Department, Ho Chi Minh, Vietnam

**Background and Aims:** Collateral circulation plays a vital role in sustaining blood flow to the ischemic areas in ischemic stroke or transient ischemic attack. We investigated the association between collateral flow assessed on baseline CT Angiography and predicted outcome at 3 months in acute stroke patients.

**Methods:** A prospective, cohort study of patients with acute stroke from People 115 Hospital, Vietnam. Among 429 patients treated with recanalization therapies in acute stage, we identified 166 patients with large vessel occlusion in both anterior and posterior circulation from September 2017 to July 2018. Besides clinical data, we accessed collateral flow (CF) on CTA (mCTA collateral score) and the degree of reperfusion after recanalization on angiography.

**Results:** Among 166 patients, 88 patients were endovascular therapy alone, 78 patients were treated with combined intravenous thrombolysis and endovascular therapy (mean age,  $61.6 \pm 14.3$  years; median NIHSS score, 14; median door to groin time, 124). In 3 groups (CF poor, intermediate, good), TICI 2b–3 recanalization was achieved in 68.7%, 71.8% and 80.1% respectively ( $p = 0.384$ ); mRS 0–1 at 90 days achieved in 24.2%, 39.5% and 55% respectively ( $p = 0.007$ ). A good CF status was revealed to have a beneficial effect on favourable functional outcome (mRS 0–2,  $p = 0.015$ ) compared with poor CF.

**Conclusions:** Patients with good or intermediate collaterals on CTA benefit from recanalization therapy, whereas patients with poor collaterals don't benefit from treatment. CTA-collaterals are thus well suited for patient selection in endovascular therapy.

**Trial registration number:** N/A**AS02-052****COMPARE SAFETY AND OUTCOME AFTER RECANALIZATION BETWEEN SUBTYPES IN STROKE : LARGE ARTERY ATHEROSCLEROSIS AND CARDIOEMBOLISM****H. Thi Bich Nguyen<sup>1</sup>, T. Huy Nguyen<sup>1</sup>, T. Quoc Nguyen<sup>1</sup> and B. Nguyen Pham<sup>1</sup>**<sup>1</sup>People 115 Hospital, Cerebrovascular Disease Department, Ho Chi Minh, Vietnam

**Background and Aims:** This study was conducted to analyze the outcomes and complications between two stroke subtypes (TOAST classification) large artery atherosclerosis and cardioembolism after recanalization.

**Methods:** A prospective, cohort study of patients with acute stroke from People 115 Hospital, Viet Nam. Among 429 patients treated with recanalized therapies in acute stage, we identified 158 patients who had large vessel occlusion in both anterior and posterior circulation, classified to 2 stroke subtypes cardioembolism (CE) and large artery atherosclerosis (LAA) from September 2017 to July 2018. We evaluated mRS follow up at 90 days and intracranial hemorrhage rate between 2 subtypes.

**Results:** Of the 158 patients, 102 had large artery atherosclerosis and 56 had cardioembolism (mean age, 62; median NIHSS score, 14). CE group had female rate higher than LAA group (53.8% vs 32.1%,  $p = 0.008$ ). Besides, smoking rate was higher in LAA group (29.1% vs 11.5%,  $p =$

0.014). The incidence of intracranial hemorrhage classified PH (ECASS definition) after recanalization in CE group was higher than that in LAA group (21.2% vs 6.6%,  $p = 0.007$ ). Favourable outcome at 3 months (mRS 0–2) in LAA group was higher compared to CE group (67.9% vs 48.1%,  $p = 0.041$ ), while mortality in CE group was higher than other (23.5% vs 12.5%,  $p = 0.092$ ).

**Conclusions:** Cardioembolism was associated with a significantly higher rate of parenchymal hemorrhage after acute treatment and lower rate of favourable outcome (mRS 0–2) compared to LAA subtype.

**Trial registration number:** N/A**AS02-046****THE ENHANCED CONTROL OF HYPERTENSION AND THROMBOLYSIS STROKE STUDY (ENCHANTED) BLOOD PRESSURE (BP) ARM: REGIONAL DIFFERENCES IN BLOOD PRESSURE MANAGEMENT****X. Wang<sup>1</sup>, T. Robinson<sup>2</sup>, J. Chalmers<sup>1</sup> and C. Anderson<sup>1</sup>**<sup>1</sup>The George Institute for Global Health, Neurological and Mental Health department, Sydney, Australia; <sup>2</sup>University of Leicester, Department of Cardiovascular Sciences, Leicester, United Kingdom

**Background and Aims:** Results from large-scale epidemiological studies mark significant variation in hypertension management at the country level and variation in management within countries. Given that an elevated blood pressure (BP) accounts for about two-thirds of strokes worldwide, it is of great importance to understand the regional differences in BP management after acute ischemic stroke (AIS) in the hospital setting.

**Methods:** The Enhanced Control of Hypertension and Thrombolysis Stroke Study (ENCHANTED) BP arm compared a strategy of intensive (systolic BP [SBP] 130–140mmHg) versus guideline-recommended (SBP < 180mmHg) BP lowering in 2227 thrombolysis-treated AIS patients for superiority with respect to shift ('improvement') in 90-day modified Rankin score and the key safety outcome of any symptomatic intracerebral hemorrhage. The main results will be presented at the International Stroke Conference in February 2019. ENCHANTED recruited patients from 110 hospitals in 15 countries. Descriptive statistics will be provided by region, country, and hospitals.

**Results:** Data on differences in BP at stroke onset, BP management strategy, BP lowering agents used, achieved BP during the acute phase will be report.

**Conclusions:** N/A**Trial registration number:** N/A**AS02-004****STROKE: AN EVALUATION OF THROMBECTOMY IN THE AGEING BRAIN – [INCLUDING] WHERE IV THROMBOLYSIS FAILS OR IS CONTRAINDICATED (STABILISE)****P. White<sup>1</sup>, G. Ford<sup>2</sup>, B. Gregson<sup>1</sup>, A. Cora<sup>1</sup>, R. Francis<sup>1</sup>; Stabilise Investigators**<sup>1</sup>Newcastle University, Stroke Research Group Institute of Neuroscience, Newcastle, United Kingdom; <sup>2</sup>Oxford AHSN, Oxford AHSN, Oxford, United Kingdom

**Background and Aims:** STABILISE investigates two novel thrombectomy devices (ERIC™ and SOFIA™) with design features favourable to accessing distal/tortuous vessels and retrieving longer clots. Tortuous vessels are more common in elderly and long clots are more prevalent in those failing to respond to IVT – both groups generally under-represented in thrombectomy trials to date.

Aims are to confirm feasibility, safety, technical efficacy of ERIC/SOFIA devices in heterogeneous population. Results will inform design of phase 3 trial.

**Methods:** Phase 2 RCT (PROBE design). Patients randomised 2:1 into investigational arm (thrombectomy using SOFIA &/or ERIC devices) compared with standard thrombectomy arm (any other CE marked thrombectomy device).

Patients  $\geq 18$  years with AIS due to an angiographic (CTA or MRA) confirmed LVO.

Core lab assessment- using modified extended TICI (2C) scale- blinded to patient allocation, of anonymised thrombectomy procedure DSA images will be primary efficacy endpoint of the trial.

Functional outcome assessment will be by standard Rankin score questionnaire completed by patient/carer at 90 and 365 days. Trial participants also blinded to trial allocation.

**Results:** STABILISE recruited 67 patients by end of planned recruitment period in 4 UK centres.

Primary outcome is angiographic by blinded core lab assessment. This completes in December 2018.

However, 1 year clinical follow-up completes in late January 2019, so primary trial results will not be presented until ESOC. Secondary endpoints presented to include 90/365 day outcome by independent mRS assessment, procedural safety.

**Conclusions:** STABILISE has demonstrated feasibility of multicentre device focussed RCT in the thrombectomy field

Additional conclusions based on final trial results will be presented.

**Trial registration number:** ISRCTN 15698516

## AS02-001

### HYPERTENSE SIGNALS ON ARTERIAL SPIN-LABELED IMAGING AS A PREDICTOR FOR FAVORABLE OUTCOME AFTER LATE TIME WINDOW THROMBECTOMY

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**Background and Aims:** In patients with cerebral large vessel occlusion (LVO), selection of patients with eligibility for thrombectomy is important. We have used magnetic resonance (MR) imaging, including arterial spin-labeled (ASL), to select patients with eligibility for thrombectomy. We could detect hyperintense signals (HIS) on MR-ASL, and it might indicate presence of leptomeningeal collaterals. We speculated that this sign might be associated with favorable outcome after successful recanalization.

**Methods:** We studied whether HIS on MR-ASL was useful to predict favorable outcome in patients with LVO after successful recanalization. We compared factors, including MR-ASL findings, between favorable and unfavorable outcome groups. Furthermore, we divided therapeutic time window into early and late phases; within 6 hours, and over 6 hours from onset. We also investigated factors associated with outcome at each therapeutic time windows.

**Results:** Presence of HIS on MR-ASL was significantly frequent (70.0 % v. s. 27.3 %,  $p = 0.049$ ) and an independent factor for favorable outcome at late time window treatments (95% confidence interval; 1.33-89.12, odds ratio; 10.88,  $p = 0.026$ ). At early time window, procedure time less than 55 minutes was an independent factor for favorable outcome.

**Conclusions:** HIS on MR-ASL might be a predictor for favorable outcome and it could be a good parameter to select patients with eligibility for thrombectomy at late time window treatments. Procedure time might be important for patients who were treated at early time window.

**Trial registration number:** N/A

## AS02-005

### HIGH WHITE BLOOD CELL COUNT IS A RISK FACTOR FOR CONTRAST-INDUCED NEPHROPATHY FOLLOWING MECHANICAL THROMBECTOMY

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**Background and Aims:** The aim of this study was to investigate the incidence and risk factors of contrast-induced nephropathy (CIN) following mechanical thrombectomy.

**Methods:** We examined 80 consecutive patients who underwent mechanical thrombectomies from January 2014 to March 2018, excluding three patients on hemodialysis. The patients' clinical backgrounds, treatments, and clinical prognoses were analyzed. CIN was defined as an increase in serum creatinine level  $\geq 44.2 \mu\text{mol/L}$  (0.5 mg/dL) or 25% above baseline in the 72 hours after exposure to the contrast medium.

**Results:** The incidence of CIN was 8.8% (7/80). We found a significantly higher CIN incidence in patients with severe renal hypofunction (50.0%) than in those with moderate-to-mild renal hypofunction (10.3%) or normal renal function (6.1%,  $p < 0.01$ ). Based on creatinine clearance, an estimated glomerular filtration rate  $< 30 \text{ mL/min}/1.73 \text{ m}^2$  is considered to indicate severe renal hypofunction,  $30\text{--}59 \text{ mL/min}/1.73 \text{ m}^2$  moderate-to-mild renal hypofunction, and  $\geq 60 \text{ mL/min}/1.73 \text{ m}^2$  normal renal function. On univariate analysis, white blood cell (WBC) count differed significantly between the groups with and without CIN. On multivariate analysis, high WBC count ( $\geq 9,700 / \mu\text{L}$ , odds ratio, 11.90; 95% confidence interval, 1.22-117;  $p < 0.033$ ) was an independent risk factor for CIN.

**Conclusions:** This study found that the incidence of CIN was 8.8% following mechanical thrombectomy in patients with acute ischemic stroke. Severe renal hypofunction and higher WBC counts were associated with an increased risk of CIN.

**Trial registration number:** N/A

## AS02-030

### ALTEPLASE IN ACUTE ISCHEMIC STROKE WITHIN 3–4.5 HOURS AFTER STROKE ONSET: RESULTS FROM A MULTICENTER, SINGLE-ARM TRIAL IN CHINA

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**Background and Aims:** To evaluate the efficacy and safety for alteplase in Chinese patients with acute ischemic stroke (AIS) within 3–4.5 hr after onset in a multicenter, single-arm trial.

**Methods:** AIS patients within 3–4.5 hr after symptoms onset otherwise fulfilling current Chinese alteplase label selection criteria received 0.9 mg/Kg i.v. of alteplase. The primary efficacy endpoint was defined as favourable outcome (modified Rankin Scale [mRS] 0–1) at 3 months. The primary safety endpoint was symptomatic intracranial haemorrhage (sICH) according to the European Cooperative Acute Stroke Study III (ECASS III) criteria.

**Results:** Between Dec 2016 and Dec 2017, 120 patients (96 males) were enrolled and treated from 11 sites in China. The mean age was 61.1 ( $\pm 10.9$ ) years, most of the patients had mild-to-moderate stroke with

a median baseline NIHSS score of 6. Median time from onset to needle was 3 hr 54 min. The primary efficacy endpoint was achieved in 63.3% of patients (95% CI: 54.4-71.4%) and was statistically significantly higher than the predefined threshold of 40% ( $p < 0.0001$ ). Three (2.5%; 95% CI: 0.5-7.1%) patients had sICH, 2 of whom died from the event; 4 non-sICH deaths were reported within 3 months.

**Conclusions:** Alteplase is effective and well tolerated in Chinese AIS patients within 3-4.5 hr after onset.

**Trial registration number:** NCT02930837

## AS02-058

### PREDICTORS OF POOR OUTCOME AFTER THROMBECTOMY IN ACUTE ISCHEMIC STROKE PATIENTS

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**Background and Aims:** Timely and effective recanalization of the occluded vessel is of importance for acute ischemic stroke patients. However, Successful recanalization (SR) is not always associated with good prognosis. We aimed to explore predictive factors of poor outcome of successful recanalization after thrombectomy in patients with acute anterior circulation large-vessel occlusion.

**Methods:** Between January 2016 and October 2018, the eligible patients with SR were retrospectively enrolled. Poor outcome was defined as modified Rankin Scale (mRS) of 3 to 6 at 90 days. We used univariate and multivariate logistic regression analysis to explore risk factors of poor outcome.

**Results:** We enrolled 76 patients with SR (mean age:  $64.34 \pm 14.90$ , 46 males). The proportion of patients with poor outcome was 57.9% (44/76). The multivariable logistic regression showed systolic blood pressure (SBP) (OR, 1.03; 95% CI, 1.00-1.07;  $P = 0.041$ ), baseline National Institutes of Health Stroke Scale (NIHSS) score (OR, 1.17; 95% CI, 1.04-1.31;  $P = 0.007$ ), and blood glucose levels (OR, 1.80; 95% CI, 1.09-2.96;  $P = 0.022$ ) were the predictive factors of poor outcome, while baseline Alberta Stroke Program Early CT Score (ASPECTS) was the protective factor. (OR, 0.49; 95% CI, 0.33-0.73;  $P < 0.001$ ).

**Conclusions:** High SBP, high NIHSS, high blood glucose and low ASPECTS were associated with poor outcome despite successful recanalization after thrombectomy in patients with acute ischemic stroke. Further large sample studies are needed to confirm these findings.

**Trial registration number:** N/A

## Clinical Trial Results – Prevention

### AS03-030

### DESCRIPTIVE STUDY OF 514 INTRACEREBRAL HEMORRHAGES IN A THIRD LEVEL HOSPITAL

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**Background and Aims:** Intracranial hemorrhage represent 25% of cerebral vascular events, and analyzing them is an important issue due to their high morbimortality.

**Methods:** In this retrospective study, we analysed 514 patients with intracerebral hemorrhage that were treated in our hospital between 2008 and 2018. We collected epidemiological variables, risk factors and performed a descriptive study in order to characterize them.

**Results:** 61% of our patients were men, and the median age was 73 years. Hypertension was present in 68.1% of cases, and it turned out

to be the only cardiovascular risk factor in most cases. 22.7 % of them had known atrial fibrillation, 25.3 % were under antiaggregant therapy and 15.8 % were anticoagulated before the event.

The median of initial NIHSS was 10, and the median of systolic blood pressure 156 mmHg. According to criteria SICH score, CT angiography was performed in 45.7 % of the patients in Emergency. Most bleeding were located in basal ganglia, and the most frequent etiology was the hypertensive one.

Mortality rate was 13 %. Among the patients who survived, 52.8 % were released from the hospital. After correlating death with different risk factors we observed that mortality was greater among patients with atrial fibrillation and in those already under anticoagulation and anti-aggregation treatment.

**Conclusions:** According to our study, the most frequent location of ICH was basal ganglia, and hypertension the most common cause. Prognosis might be influenced by proper management and monitoring in a specialized unit as the one we have in our hospital.

**Trial registration number:** N/A

### AS03-016

### DURAL ARTERIOVENOUS FISTULAE AFTER CEREBRAL VENOUS THROMBOSIS (CVT). RESULTS FROM A RANDOMIZED CONTROLLED TRIAL OF DABIGATRAN ETEXILATE VERSUS DOSE-ADJUSTED WARFARIN IN PATIENTS WITH CVT

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**Background and Aims:** The frequency of dural arteriovenous fistulae (DAVF) after cerebral venous thrombosis (CVT) has not been systematically studied.

**Methods:** RE-SPECT CVT (ClinicalTrials.gov number: NCT02913326) was a phase III, prospective, randomized, parallel-group, open-label, multicentre, exploratory trial with blinded endpoint adjudication. We enrolled patients with acute CVT after 5-15 days of treatment with heparin. Patients were allocated to dabigatran 150 mg twice daily or dose-adjusted warfarin, for a treatment period of 24 weeks. A standardized MR protocol including time-of-flight MR angiography, 3D phase contrast venography and 3D contrast enhanced MR venography was obtained at the end of the treatment period. In a substudy of the trial, the development of DAVF was assessed by two blinded adjudicators.

**Results:** 120 CVT patients (mean age 45.2 years, 66 women) were randomised. Development of DAVF was evaluated in 112 patients, 57 allocated to dabigatran and 55 to warfarin. Imaging from 3 of 112 patients was not evaluable. A DAVF (Borden I) was found in one patient (0.9%), allocated to warfarin, but in hindsight this DAVF was already present at baseline. The fistula was asymptomatic and did not present with haemorrhage at baseline or during the trial.

**Conclusions:** In the RE-SPECT CVT sample, despite systematic imaging, we found no new DAVFs six months after CVT

**Trial registration number:** Clinicaltrials.gov: NCT02913326

## AS03-022

### THE DOSE-RESPONSE OF AEROBIC EXERCISE AFTER STROKE ON CARDIORESPIRATORY FITNESS: A PHASE I DOSE-ESCALATION TRIAL

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**Background and Aims:** The optimal exercise dose to increase cardiorespiratory fitness after stroke is unclear. Doses lower than current guidelines recommend may be effective. We aimed to determine the tolerability and dose-response of low doses of aerobic exercise using a dose-escalation study design, and to assess the effectiveness of low-dose exercise (< 25min/session) on cardiorespiratory fitness ( $\text{VO}_{2\text{peak}}$ ) and walking ability.

**Methods:** 20 participants ( $n = 5$  per cohort) received home-based, individualised telehealth-supervised aerobic exercise 3 d/week at moderate-vigorous intensity (55–85% $\text{HR}_{\text{max}}$ ) for 8-weeks. Session duration increased by 5min/dose from 10min (Dose 1) to 25min (Dose 4). Doses were deemed tolerable and escalated if less than one-third of participants in a cohort reached the dose-limiting threshold. Doses were deemed effective if more than two-thirds of participants in a cohort increased  $\text{VO}_{2\text{peak}} \geq$  the minimum response criteria of 2mL/kg/min, measured during fitness assessments.

**Results:** All doses were tolerable.  $\text{VO}_{2\text{peak}}$  increases of  $\geq 2\text{mL/kg/min}$  occurred for 1/5 participants (Dose 1), 2/5 participants (Dose 2), 3/5 participants (Dose 3), and 2/5 participants (Dose 4).  $\text{VO}_{2\text{peak}}$  increased by 11% (Dose 1), 13% (Dose 2), 19% (Dose 3) and 6% (Dose 4). When data from all doses were combined improvements were seen in  $\text{VO}_{2\text{peak}}$  (mean 1.9mL/kg/min, 95% CI 0.7 to 3.2) and 6-minute walk test distance (mean 25m, 95% CI 8 to 40).

**Conclusions:** Low doses of supervised home-based moderate to vigorous aerobic exercise increased cardiorespiratory fitness and walking capacity of ambulant stroke survivors. A Phase II trial of low-dose aerobic exercise is warranted.

**Trial registration number:** ANZCTR Trial ID: ACTRN12617000460303

## WITHDRAWN

## AS03-007

### NEUROLOGICAL CARE UNIT AND STROKE UNIT: PREVALENCE OF DELIRIUM AND INTERVENTION STRATEGIES

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**Background and Aims:** Delirium is a common complication in the setting of critically ill patient care. In this context patients with primarily neurological pathologies present a very special patient collective, as the acute onset of neurological symptoms and possible preexisting neurological deficits can make delirium detection challenging. Medical staff, working in the setting of neurocritically ill patients care, frequently report about facing delirium and its associated complications, so a closer look is needed.

This study aimed to quantify the prevalence of delirium and to evaluate the effectiveness of non-pharmacological intervention strategies in the neurological intensive care unit and the stroke unit at the University of Saarland.

**Methods:** This study used a prospective cohort design with a total study period of six months, separated into two phases. All consecutive patients in the Stroke Unit and Intensive Care Unit ( $n = 417$ ) were evaluated for Delirium using the Confusion Assessment Method for ICU (CAM-ICU) in combination with the Richmond Agitation Scale Score (RASS). Standardized screening was carried out three times every day. In the first part of the study prevalence of delirium was assessed in 209 patients. In the second part of the study a multi-component prevention program was implemented on both units and another 208 patients were evaluated.

**Results:** Analysis of the control group showed 57 patients (30,6%) with delirium positive testing, while 129 patients (69,4%) always showed a negative result. In the intervention group 61 patients (31,8%) were tested positive and 131 patients (68,2%) never showed delirium.

**Conclusions:** There is no significantly difference between the two groups.

**Trial registration number:** N/A

### AS03-013

#### REAL WORLD RIVAROXABAN AND APIXABAN LEVELS IN ASIAN PATIENTS WITH ATRIAL FIBRILLATION

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**Background and Aims:** We aims to measure the plasma levels of rivaroxaban and apixaban among Asian atrial fibrillation patients and compare the results with clinical trials.

**Methods:** Patients aged more than 20 years, and were ordered rivaroxaban or apixaban for more than 7 days were enrolled to collect both peak and trough levels.

**Results:** A total of 178 patients were enrolled, including 73 patients took rivaroxaban (15 mg daily, 34 patients; 10 mg daily, 39 patients) and 105 patients took apixaban (5 mg BID, 44 patients; 2.5 mg BID, 61 patients). Patients in the apixaban group had worse kidney function (serum creatinine,  $1.2 \pm 0.5$  versus  $1.0 \pm 0.3$  mg/dL,  $p = 0.02$ ) and higher percentage to be ordered inappropriately adjusted dose comparing to the rivaroxaban group (37.5 versus 22.5%,  $p = 0.046$ ). The proportions of self-reported good adherence were similar between these two groups (84.9% versus 74.3%,  $p = 0.097$ ). The percentages of drug level within the expected range from clinical trials were significantly higher in apixaban group than in rivaroxaban group, either for trough (85.7 versus 71.2 %,  $p = 0.023$ ) or peak level (85.6 versus 29.0 %,  $p < 0.001$ ). Furthermore, after adjusting age, sex, kidney function, appropriate dose and adherence, patients in rivaroxaban group still had lower potential to have peak and trough fell within the expected drug levels (hazard ratio for peak, 0.084, 95% confidence interval [CI] = 0.04-0.18,  $p < 0.001$ ; trough, 0.359, 95% CI = 0.16-0.81,  $p = 0.014$ ).

**Conclusions:** Our real-world data suggested that Asian patients under rivaroxaban therapy were more prevalent to had suboptimal drug levels comparing to those with apixaban, especially for peak level.

**Trial registration number:** NTUH-REC No: 201704065RINB

### AS03-001

#### CANCER AND ANTITHROMBOTIC TREATMENT WITH RIVAROXABAN VERSUS ASPIRIN IN THE NAVIGATE ESUS TRIAL

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**Background and Aims:** Cancer in ischemic stroke patients is associated with an increased risk of thrombosis as well as bleeding under antithrombotic treatment. We investigated the frequency of cancer and distribution of outcome events during aspirin and rivaroxaban treatment among participants in NAVIGATE ESUS randomized controlled trial.

**Methods:** Patients reported having a history of cancer at time of study entry. During a mean follow-up of 11 months, the effects of aspirin and rivaroxaban treatment in the incidence of recurrent ischemic stroke, major bleeding, and all-cause mortality were compared between patients with cancer and without cancer.

**Results:** Among 7213 randomized patients, 543 (7.5%) reported a history of cancer. Of all patients, 3609 were randomized to rivaroxaban (254 [7.0%] with cancer) and 3604 to aspirin (289 [8.0%] with cancer). Annual rate of recurrent ischemic stroke was 4.5% in non-cancer patients in rivaroxaban and 4.6% in aspirin arms (HR 0.98 [95% CI 0.78-1.24]), whereas in cancer patients the recurrent ischemic stroke rate was 7.7% in rivaroxaban and 5.4% in aspirin arms (HR 95% CI 1.43 [0.71-2.87]). In cancer patients, the annual rate of major bleeds favored aspirin similarly to overall trial population (HR 2.57 [95% CI 0.67-9.96],  $p$  for interaction 0.95). All-cause mortality was similar in cancer and non-cancer patients.

**Conclusions:** Our exploratory analyses show that patients with ESUS and a history of cancer had similar rates of recurrent ischemic strokes and all-cause mortality during aspirin and rivaroxaban treatments and that aspirin was safer than rivaroxaban in cancer patients regarding major bleeds.

**Trial registration number:** NCT02313909

### AS03-002

#### STUDY OF INTENSIVE LIPID-LOWERING EFFECT BY PCSK9 INHIBITORS; SIGNAL CHANGE OF CAROTID PLAQUE ON MRI

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**Background and Aims:** We reported that a sharp decline of plasma low-density lipoprotein cholesterol (LDL-C) above 50 mg/dL by additional lipid-lowering (ALL) therapy significantly reduced new ischemic lesions on diffusion-weighted imaging after carotid artery stenting (CAS) (*J Stroke Cerebrovasc Dis*. 2018 Mar; 27(3): 764-770). We consider the optimal period of ALL therapy that causes qualitative change in carotid plaque, leading to perform CAS safely.

**Methods:** 1. Exploration of study methodology; We determine the prospective study method based on the case in our previous study with literature reviews.

2. Prospective study; In 10 patients with asymptomatic cervical carotid stenosis (40-79%), proprotein convertasesubtilisin/kexin type 9 inhibitors are administrated in addition to the maximum tolerable dose of statin. The plaque-to-muscle signal intensity ratio on magnetic resonance imaging (MRI) are evaluated 1, 2and 3 months later.

**Results:** 1. We clarified carotid plaque signal change on a three-dimensional T1-weighted turbo-spin-echo MRI as some references demonstrated previously. We established the prospective study design shown in Method 2.

2. From August 2017 to December 2018, 10 patients were enrolled. The LDL-C value was significantly decreased from the baseline to 1 month ( $97.7 \pm 5.75$  mg/dL,  $22.5 \pm 4.27$  mg/dL, respectively,  $p < 0.001$ , paired t-

test). The signal intensity ratio showed a significant decrease in a month ( $p = 0.048$ ), but not from 1 to 2 months and from 2 to 3 months.

**Conclusions:** We demonstrated a qualitative change of carotid plaque on MRI in 1 month after ALL therapy. The most appropriate period of ALL therapy before CAS might be from 1 to 2 months.

**Trial registration number:** UMIN000028006

## WITHDRAWN

**Methods:** The validation data set consisted of 239 nondiabetic patients with a minor ischemic stroke or TIA and IGT (2-hour post-load glucose levels between 7.8 and 11.0 mmol/l). The outcome was persistent versus normalized IGT, based on repeated oral glucose tolerance test after a median of 46 days. The discriminative ability of the existing model was calculated with the area under the ROC curve (AUC). The newly developed model was internally validated with bootstrap resampling, and externally validated in the development population of the existing model.

**Results:** Hundred eighteen of 239 patients (49%) had P-IGT. The existing model, with the predictors age, current smoking, statin use, triglyceride, hypertension, history of cardiovascular diseases, body mass index (BMI) and fasting plasma glucose performed poorly with an AUC of 0.517. The newly developed model included BMI, hypertension, statin use, atrial fibrillation, 2-hour post-load glucose levels and HbA1c, and predicted P-IGT more accurately (internally validated AUC 0.692, externally validated AUC 0.710).

**Conclusions:** This prediction model with simple clinical variables can be used to predict P-IGT in patients with IGT directly after minor stroke or TIA, and may be useful to optimize secondary prevention.

**Trial registration number:** NL 38294.078.12

## AS03-015

### RE-SPECT ESUS®, A STUDY OF DABIGATRAN VERSUS ACETYLSALICYLIC ACID FOR STROKE PREVENTION IN PATIENTS WITH EMBOLIC STROKE OF UNDETERMINED SOURCE: BASELINE PREDICTORS OF RECURRENT STROKE

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**Background and Aims:** In the Randomized, double-blind, Evaluation in secondary Stroke Prevention comparing the EfficaCy and safety of the oral Thrombin inhibitor dabigatran versus acetylsalicylic acid (ASA) in patients with Embolic Stroke of Undetermined Source (RE-SPECT ESUS®) trial, dabigatran was not superior to ASA for reduction of recurrent stroke. We aimed to identify clinical predictors of recurrent stroke.

**Methods:** 5390 patients with ESUS were randomly assigned to dabigatran or ASA. Median follow-up was 19 months (observation period 0.5–3.5 years). The primary efficacy outcome was time to first recurrent stroke. For this analysis, the study population was pooled (independent of treatment assignment). Clinical predictors of recurrent stroke were identified using Cox proportional hazards regression modelling. Univariate predictors with  $p < 0.1$  were selected as well as predictors from the multivariate backward selection ( $p < 0.1$ ).

**Results:** Baseline patient characteristics that were associated with recurrent stroke in univariate analyses include male sex, age  $\geq 75$ , CHA2DS2-VASc score  $\geq 4$ , prior stroke or TIA, PPI at baseline, CrCl  $< 50$  mL/min. The Table shows the results of multivariate analyses.

**Conclusions:** In line with previous evidence, several risk factors were identified as being independent predictors of recurrent stroke at the time

## AS03-021

### PREDICTION OF PERSISTENTLY IMPAIRED GLUCOSE TOLERANCE IN PATIENTS WITH MINOR ISCHEMIC STROKE OR TRANSIENT ISCHEMIC ATTACK

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**Background and Aims:** Persistent impaired glucose tolerance (P-IGT) increases the risk of recurrence of stroke, other cardiovascular diseases and unfavorable outcome after stroke. However, in many patients IGT returns to normal after stroke. Previously, a prediction model was developed to identify patients at risk of P-IGT. This study aims to externally validate this model, and, if necessary, improve the model in an independent data set.

of index stroke: CHA<sub>2</sub>DS<sub>2</sub>-VASc score ≥4, CrCl <50 mL/min and a history of prior stroke/TIA. In addition, male sex was also identified as predictive for recurrent stroke.

**Table:** Predictors of recurrent stroke

	Univariable HR (95% CI)	p value	Multivariable HR (95% CI)	p value
Prior stroke or TIA* (yes vs no)	2.35 (1.90, 2.90)	<0.0001	2.27 (1.83, 2.81)	<0.0001
Renal function* (CrCl <50 vs ≥50 mL/min)	2.07 (1.56, 2.74)	<0.0001	1.67 (1.22, 2.29)	0.0014
Baseline CHA <sub>2</sub> DS <sub>2</sub> -VASc score		0.0118		0.0014
4 vs 2–3	1.50 (1.13, 2.00)	0.0052	1.59 (1.19, 2.13)	0.0019
≥5 vs 2–3	1.45 (1.08, 1.95)	0.0130	1.70 (1.25, 2.32)	0.0008
Gender (male vs female)	1.43 (1.15, 1.78)	0.0015	1.59 (1.26, 2.00)	<0.0001
PPI at baseline (yes vs no)	1.22 (0.99, 1.50)	0.0659	1.21 (0.98, 1.50)	0.0714
Age* (≥75 vs <75 years)	1.52 (1.22, 1.91)	0.0003	1.09 (0.82, 1.45)	0.5364
Treatment (dabigatran vs ASA)	0.85 (0.69, 1.03)	0.1028	0.83 (0.68, 1.02)	0.0797

Variables with p <0.1 in the univariate analysis and selected in the multivariate analysis are shown. Other variables in the univariate analyses with p <0.1 were time from index stroke to randomization, previous myocardial infarction, coronary artery disease, diabetes, patent foramen ovale, left ventricular ejection fraction ≤40%. In the multivariate model, predictors with p <0.1 were selected via backward selection. Patients with missing categories in any variable are not considered in the multivariate analysis.

\*Age, renal impairment and prior stroke or TIA were kept in the multivariate model by definition.

ASA, acetylsalicylic acid; CI, confidence interval; CrCl, creatinine clearance; HR, hazard ratio; PPI, proton pump inhibitor; TIA, transient ischaemic attack.

**Trial registration number:** NCT02239120

## AS03-019

### HUNTING FOR THE UNDERLYING CAUSES AND LINKS: ATRIAL FIBRILLATION IN CRYPTOGENIC STROKE AND TIA – THE NORDIC ATRIAL FIBRILLATION AND STROKE STUDY (NOR-FIB)

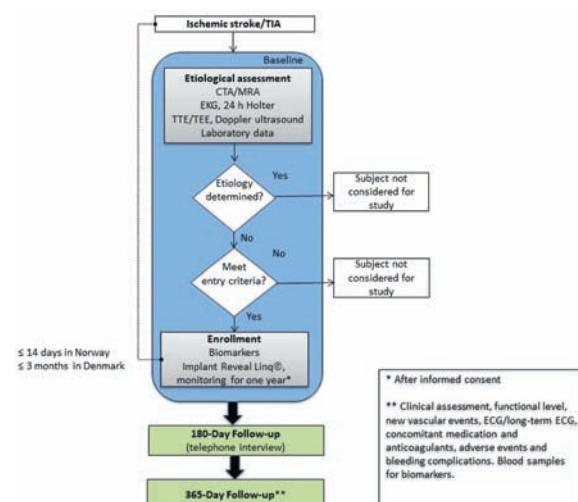
B. Ratajczak-Tretel<sup>1,2</sup>, A. Lambert Tancin<sup>1,2</sup>, B. Halvorsen<sup>2,3</sup>, E. Sandset Charlotte<sup>4</sup>, H. Ihle-Hansen<sup>5</sup>, T. Truelsen Clement<sup>6</sup>, K. Ægidius<sup>7</sup>, H. Tobro<sup>8</sup>, S. Krogseth<sup>9</sup>, H. Ihle-Hansen<sup>10</sup>, C. Kruuse<sup>11</sup>, K. Arntzen<sup>12</sup>, G. Eldøen<sup>13</sup>, A. Gulsvik<sup>14</sup>, M. Kurz<sup>15</sup>, M. Rezai<sup>15</sup>, J. Sørmark<sup>16</sup>, S. Ingebrigtsen<sup>17</sup>, D. Atar<sup>2,18</sup> and A. Aamodt Hege<sup>4</sup>

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**Background and Aims:** A significant proportion of ischemic stroke and transient ischemic attack (TIA) caused by underlying AF is still erroneously classified etiologically as cryptogenic, because standard cardiac rhythm monitoring is often insufficient in detecting paroxysmal AF. Data from randomized controlled trials and clinical practice show that prolonged cardiac rhythm monitoring detects paroxysmal AF in up to 25% of patients with cryptogenic ischemic events. However, long-term rhythm monitoring is still expensive, and there is a need to identify biomarkers that can be used for better selection of patients where the probability of detecting AF is highest.

**Methods:** NOR-FIB is an international, prospective, multicenter, observational study designed to evaluate the occurrence of occult AF in cryptogenic stroke and TIA. Patients with cryptogenic stroke and TIA from the Nordic countries are included and have the Medtronic Reveal LINQ® Insertable cardiac monitor implanted for 12 months for AF detection. Blood samples for the analysis of biomarkers predicting AF are taken at inclusion and at 12 months follow-up. If AF is detected, treatment with anticoagulant is started. Estimated number of patients to be included in the study is 500.



**Results:** By December 2018 the total number of patients included in participating centers is 129. AF or atrial flutter has been detected in 34 patients, resulting in detection rate of 26 %. The pilot study has identified biomarkers that seem to be useful for the detection of AF in cryptogenic stroke and TIA.

**Conclusions:** Updated interim analysis focused on cardiac rhythm analysis of included patients will be presented.

**Trial registration number:** NCT02937077  
EudraCT 2018-002298-23

**AS03-031**

**RE-SPECT ESUS, A STUDY OF DABIGATRAN ETEXILATE VERSUS ACETYLSALICYLIC ACID FOR STROKE PREVENTION IN PATIENTS WITH EMBOLIC STROKE OF UNDETERMINED SOURCE: EAST ASIAN SUBGROUP ANALYSIS**

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**Background and Aims:** In the Randomized, double-blind, Evaluation in secondary Stroke Prevention comparing the Efficacy and safety of the oral Thrombin inhibitor dabigatran etexilate versus acetylsalicylic acid in patients with Embolic Stroke of Undetermined Source (RE-SPECT ESUS) trial, dabigatran was not superior to acetylsalicylic acid (ASA) for the prevention of recurrent stroke. Our prespecified subgroup analysis evaluated results in patients enrolled in East Asia.

**Methods:** Overall, 5390 patients diagnosed with ESUS (564 centres; 42 countries) were randomly assigned to dabigatran (150mg or 110mg twice daily) or ASA and followed up for 0.5–3.5 years. The primary efficacy outcome was time to recurrent stroke. A Cox proportional hazards regression model was used for the analysis of outcomes.

**Results:** Out of 5390 participants, 988 patients were randomized in East Asia (Japan 599, Korea 187, China 109, Taiwan 93). Mean age was 65.3 years, 31.6% were women and the median duration of follow-up was 18.8 months. Efficacy and safety results are shown in the table. The hazard ratios for recurrent stroke and major bleeding (dabigatran vs ASA) were 0.65 (95% CI, 0.41–1.03) and 1.19 (95% CI 0.62–2.30), respectively.

**Conclusions:** In patients with ESUS in East Asia, dabigatran was not superior to ASA in preventing recurrent stroke and did not significantly increase the risk of major bleeding, reflecting the pattern of results observed in the overall study population.

Table: Efficacy (randomized set) and safety (treatment set) outcomes of patients in East Asia

	Dabigatran (n = 491), n (%/yr)	ASA (n = 497), n (%/yr)	HR (95% CI)
Recurrent stroke	30 (3.9)	48 (6.2)	0.65 (0.41–1.03)
Ischaemic stroke	29 (3.7)	47 (6.1)	0.64 (0.41–1.02)
Composite of non-fatal stroke, non-fatal MI or cardiovascular death	34 (4.4)	49 (6.3)	0.72 (0.47–1.12)
	Dabigatran (n = 488), n (%/yr)	ASA (n = 496), n (%/yr)	HR (95% CI)
Major bleed	19 (2.9)	17 (2.6)	1.19 (0.62–2.30)
Intracranial bleed	8 (1.2)	9 (1.4)	0.94 (0.36–2.45)

All events were confirmed by adjudication.

Covariates in the Cox model are age (< or ≥ 75 years), renal impairment (creatinine clearance < or ≥ 50 mL/min) and prior stroke or transient ischaemic attack (yes or no).

ASA, acetylsalicylic acid; CI, confidence interval; HR, hazard ratio; MI, myocardial infarction; NE, not estimable.

Trial registration number: NCT02239120

**WITHDRAWN****AS03-027**

**PLAQUE FEATURES AND VASCULAR GEOMETRY IN BASILAR ARTERY ATHEROSCLEROSIS**

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<sup>1</sup>Shanghai General Hospital, Neurology, Shanghai, China

**Background and Aims:** Disturbed flow caused by mechanical forces of blood flow is associated with the focal distribution of atherosclerotic plaque. We hypothesized that basilar artery geometry may be related to plaque location and burden.

**Methods:** All patients hospitalized with ischemic stroke and intracranial large artery atherosclerotic disease were enrolled from March 2017 to October 2017. MR angiography and high-resolution black-blood MRI (HR-BBMRI) were performed in seven-days after symptom onset. Basilar plaques were defined on HR-BBMRI cross sections as focal vessel wall thickenings at sites of maximal lumen narrowing compared with sections immediately above or below those sites. Vascular characteristics of basilar artery and plaque features were measured. The relationship of vascular geometry and plaque were assessed.

**Results:** Sixty-seven patients (39 with and 28 without basilar artery plaque) were analyzed. In the tortuous basilar artery, plaques preferred to be formed at the inner arc than the outer arc (27/39, 69% vs. 12/39, 31%). Basilar artery (BA) with plaque had a greater vascular tortuosity ( $112.8 \pm 10.3$  vs  $107 \pm 4.6$ ;  $P = 0.034$ ) and tended to appear positive remodeling (19/39, 49%) in comparison with negative (13/39, 33%) and intermediate (7/39, 18%) remodeling. In addition, apparent plaque had

greater plaque enhancement (14/21, 67% vs 5/18, 28%;  $P = 0.017$ ) and plaque burden ( $0.76 \pm 0.15$  vs.  $0.70 \pm 0.09$ ;  $P = 0.036$ ) compared with minimal plaque.

**Conclusions:** We conclude that (1) Plaques are more likely to form at the inner arc of tortuous basilar artery. (2) Basilar artery with plaques tends to have greater vascular tortuosity and develop positive remodeling.

**Trial registration number:** N/A

### AS03-006

#### RELATIONSHIP BETWEEN REGIONAL BLOOD FLOW BEFORE AND AFTER CAROTID ARTERY STENTING AND RELATIONSHIP BETWEEN COGNITIVE FUNCTION BEFORE AND AFTER IT

**Y. Wang<sup>1</sup> and W. Pian<sup>1</sup>**

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**Background and Aims:** Currently, asymptomatic carotid artery stenosis (aCAS) is established as an independent risk factor for cognitive impairment. Carotid artery stenting (CAS) is one of the treatment methods for moderate to severe aCAS cases. Studies on CAS and cognitive function have yielded controversial results. Therefore, our study aims to provide a comparative analysis of cognitive function before and after CAS in aCAS patients. We also analyse there regional blood flow before and after CAS, to precisely understand relationship between them in such patients. Furthermore, this study will provide a basis for patient selection whether going CAS therapy in future.

**Methods:** Twenty aCAS patients underwent angiography or other non-invasive examination and those with 50–99% of internal CAS were recruited. The subjects' demographic data, vital signs, and medical history were collected. Additionally, we conducted the Montreal Cognitive Assessment and computed tomography perfusion scans before and after 6 months of CAS.

**Results:** At the 6-month follow-up, the relative cerebral blood flow, relative cerebral blood volume, relative mean transit time, and relative peak time were improved in the aCAS patients. However, the patients' cognitive function did not change after 6 months of CAS treatment.

**Conclusions:** CAS may improve the regional blood flow in aCAS patients but not the cognitive function, suggesting the need for more clinical research.

**Trial registration number:** N/A

### AS03-011

#### EFFICACY OF RECANALISATION IN PATIENTS WITH CHRONIC OCCLUSION IN THE MIDDLE CEREBRAL ARTERY

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**Background and Aims:** Patients with chronic middle cerebral artery occlusion may be asymptomatic or mild symptoms, but severe cerebral infarction may occur in the future. This study evaluated the safety and efficacy of interventional recanalisation in patients with chronic middle cerebral artery (MCA) occlusion, which causes chronic symptomatic cerebral infarction.

**Methods:** Twenty-two patients with MCA occlusion that led to chronic symptomatic cerebral infarction were admitted at the Chengdu Fifth People's Hospital from June 2017 to September 2018. In all patients, a large area of hypoperfusion in the MCA area was noted on computed

tomography (CT) perfusion imaging. Regular drug treatment was ineffective in all the patients. The patients' clinical and imaging data, including general condition, past history, treatment status, and prognosis, were analysed. Therapeutic effects and complications were also analysed.

**Results:** Of the 22 subjects, 20 underwent successful revascularisation; their thrombolysis in cerebral infarction score was 3. No patient had postoperative intracranial haemorrhage. No complications were noted during the perioperative period. After 90 days' follow-up, no patient had cerebral infarction or any other cerebrovascular disease. The modified Rankin Scale score was less than 2 in all patients.

**Conclusions:** If regular drug treatment is ineffective for patients with chronic symptomatic cerebral infarction caused by MCA occlusion with a large area of hypoperfusion in the MCA area confirmed via CT perfusion imaging, interventional recanalisation may be safe and effective. Large sample-size clinical trials are needed to confirm this result.

**Trial registration number:** N/A

### AS03-005

#### IS POST-STROKE ATRIAL FIBRILLATION MORE LIKELY A CAUSE OR CONSEQUENCE OF ISCHEMIC STROKE? INSIGHTS FROM LONG-TERM CONTINUOUS ARRHYTHMIA MONITORING

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<sup>2</sup>University of Western Ontario, Neurology, London, Canada

**Background and Aims:** Continuous arrhythmia monitoring following ischemic stroke identifies atrial fibrillation (AF) in a high proportion of patients. Due to the absence of pre-stroke arrhythmia monitoring in most patients, it is unclear whether post-stroke AF suggests a cause or effect relationship to the index event.

**Methods:** Data from the Optum<sup>®</sup> EHR de-identified database between 2007–2017 were linked to the Medtronic CareLink database of cardiovascular implantable electronic devices (CIED) capable of continuous AF monitoring. Patients had  $\geq 1$  year of device data both pre- and post-ischemic stroke. We quantified the percentage of ischemic stroke patients who had AF ( $\geq 6$  minutes on any day) detected within the year following their stroke and calculated the percentage of these patients with AF present or absent in the year preceding their stroke.

**Results:** Among 347 CIED patients (age  $72.8 \pm 10.8$ , 64% male) with ischemic stroke, 150 (43.2%) had AF detected in the following year. Among these, 115 (76.7%) also had AF detected in the year preceding the ischemic stroke, suggesting that AF may have caused the index event. In contrast, 35 (23.3%) did not have AF detected in the preceding year, suggesting that the AF could be a consequence of the index event or newly developed and unrelated to the index event.

**Conclusions:** AF detected post-stroke is 3x more likely to indicate that AF was also present prior to the stroke. Regardless of whether post-stroke AF suggests a cause or effect relationship to the index stroke, detection of post-stroke AF and treatment with oral anticoagulation is critical for recurrent stroke prevention.

**Trial registration number:** N/A

## Clinical Trial Results – Rehabilitation & Recovery

### AS04-029

#### IMPACT OF MINDFULNESS AND PSYCHO-EDUCATIONAL INTERVENTIONS ON THE QUALITY OF LIFE OF STROKE PATIENTS

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##### Background and Aims:

**Background:** Strokes influence negatively the quality of life (QOL) of patients both in physical and psychological-cognitive domains. Therefore, interventions aimed at improving QOL in these patients are needed.

**Aims:** To assess the impact of a cognitive-behavioral intervention based on mindfulness and psycho-educational therapy on the QOL of stroke patients.

**Methods:** Pilot study with 7 patients with a previous stroke, a reliable caregiver and a modified Rankin score  $</= 2$ . Eight sessions of 2 hours based on cognitive-behavioral (including mindfulness) and psychoeducational approaches were performed once a week for 2 months. The patients were instructed to practice daily for the entire study period. Two validated questionnaires, the neuro-QoL (quality of life in neurological disorders) and patient-reported outcomes measurement information system (PROMIS) were given at the beginning of the study and 3 months later.

**Results:** 4 women and 3 men (age 44–74) with 3 posterior and 4 anterior circulation strokes were studied and considered useful the intervention. All showed significant physical and cognitive disability combined with anxiety, depression, pain and social difficulties. After the intervention 5 patients had improved in at least one of the domains whereas 2 had not improved in any of them despite considering useful the intervention. Cognitive domains improved the most, followed by social role and physical domain.

**Conclusions:** This intervention was useful as it helped the patients face their symptoms in a more positive manner and improved their anxiety and worrisome about cognitive dysfunction. This resulted in an improvement of their overall QOL, particularly in cognitive domains.

**Trial registration number:** N/A

### AS04-051

#### DOES A STROKE IN THE DOMINANT LEFT HEMISPHERE IMPEDE THE POTENTIAL BENEFITS OF LOCOMOTOR REHABILITATION?

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**Background and Aims:** Locomotion is crucial for daily living and is often impaired in stroke survivors. Although intensive rehabilitation can improve walking impairment, many continue to experience locomotor impairment. For individuals with left hemispheric strokes, this limitation may be a consequence of impaired motor planning ability. Herein, we investigate whether stroke patients with left hemispheric lesions (LHL) would have greater difficulty performing backward locomotor treadmill

training (BLT), a task requiring proficient motor planning, compared to stroke survivors with right hemispheric lesions (RHL).

**Methods:** In this retrospective observational study, 23 right-handed chronic stroke survivors with left ( $n = 10$ ) or right ( $n = 13$ ) hemispheric stroke underwent six sessions of BLT. The primary endpoints were: 1) improvement in backward walking step length (affected leg) during training (BWSL), and 2) post-training changes in overground walking speed, relative to baseline ( $\Delta 10MWT-fast$ ).

**Results:** There were no significant baseline differences in BWSL ( $p = 0.1454$ ) or walking speed ( $p = 0.6053$ ). Participants with LHL demonstrated less improvement in BWSL, over six training sessions, compared to individuals with RHL,  $10.33 \pm 5.15\text{cm}$  and  $16.75 \pm 6.49\text{ cm}$ , respectively (ANOVA,  $p = 0.0001$ ). In addition, while both groups reached the minimal critical important difference threshold for overground walking recovery in stroke ( $\Delta 10MWT = 0.16\text{ m/s}$ ) over six BLT sessions, the LHL group trended towards less improvement ( $0.199 \pm 0.057\text{m/s}$ ), compared to the RHL group ( $0.369 \pm 0.064\text{ m/s}$ ), ( $t$ -test,  $p = 0.0736$ ).

**Conclusions:** Our findings support the model that motor planning may be impaired in individuals with left hemispheric stroke, hindering the effects of locomotor rehabilitation. Well powered, prospective studies are needed to validate these preliminary findings.

**Trial registration number:** N/A

### AS04-011

#### SOCIETAL REINTEGRATION THROUGH ENHANCED INPATIENT NEUROREHABILITATION: EVIDENCE FROM 39 PATIENTS WITH CHRONIC LOW-FUNCTIONING STROKE

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**Background and Aims:** In many countries, inpatient rehabilitation for stroke is only funded for a limited period of time post incidence. For those with the poorest recovery trajectory, transfer into a nursing home is often the consequence. For both, individuals and social care funders, this is the least desired outcome. The P.A.N. Centre for Long-Term Rehabilitation, a specialised inpatient unit, located in Berlin, Germany, has been developed to further the rehabilitation of this particular patient group with the aim to obtain the skills necessary to allow transfer to home or, if needed, a form of assisted living within the community.

**Methods:** The P.A.N. concept comprises a 24-hour setting; the maximum stay is 18 months. Patients receive 12.5 hours of medical and neuropsychological treatments per week (including physio-, occupational and speech therapy). The remaining time is occupied with activities promoting independence and social participation.

**Results:** We report 39 chronic patients aged  $45.38 \pm 9.21$  years ( $M \pm SD$ ). After  $16.51 \pm 6.72$  months ( $M \pm SD$ ) only 7 of these patients were discharged into inpatient settings (3 in nursing homes). The vast majority of patients (32; 82%) returned home or to assisted living within the community. Rehabilitation outcome, measured through the Early Rehabilitation Barthel Index significantly increased from  $34.49 \pm 41.85$  at admission to  $58.85 \pm 42.54$  ( $M \pm SD$ ) at discharge ( $p < 0.001$ ).

**Conclusions:** Our results prove the efficacy of the P.A.N. concept and its immense capacity in enabling to independent living with the most severe consequences of stroke.

**Trial registration number:** N/A

**AS04-013****SPASTICITY-REDUCING HAND SURGERY:  
IMPROVED FUNCTION, ACTIVITY AND  
PATIENTS' SATISFACTION AT ONE-YEAR  
FOLLOW-UP**

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**Background and Aims:** We evaluated if spasticity-reducing surgery in the upper extremity could improve motor function, fulfill patient's specific goals and influence performance of daily activities in patients with muscle over-activity.

**Methods:** Thirty consecutive patients with spasticity due to stroke and other CNS injuries were included.

Before surgery the patients' clinical problems related to spasticity were defined and motor function and activity assessed. Each patient's potential to comply with the post-surgical rehabilitation procedure was estimated and the intensity level chosen (low, moderate or high).

Surgery mainly comprised lengthening of tendons and release of muscles. Physiotherapy, occupational therapy, wrapping and application of orthoses started the first post-operative day. Patients were taught a home-training program. One week of intensive in-hospital rehabilitation followed 2–3 weeks after surgery and a new home-training program was designed.

General hand function (usefulness) and pain were evaluated using the VAS scale (0–10), spasticity using the Modified Ashworth Scale (0–5) and activity by Canadian Occupational Performance Measure (performance and satisfaction mean values). Wilcoxon signed rank test was used.

**Results:** At one year follow-up general hand function increased (2.1 vs. 4.2;  $p < 0.001$ ), pain decreased (3.0 vs. 1.7;  $p < 0.05$ ), and spasticity decreased (3.5 vs. 2.1;  $p < 0.001$ ). Both activity measures: performance and satisfaction improved (2.0 vs. 5.5;  $p < 0.01$  and 1.9 vs. 5.5;  $p < 0.01$ ).

**Conclusions:** Hand surgery combined with comprehensive rehabilitation is a therapeutic option to reduce muscle over-activity, improve hand function, reduce pain, and promote patient ability for arm-hand activities and satisfaction in daily life in patients with disabling spasticity.

**Trial registration number:** N/A

**WITHDRAWN****SPASTICITY-REDUCING HAND SURGERY:  
IMPROVED FUNCTION, ACTIVITY AND  
PATIENTS' SATISFACTION AT ONE-YEAR  
FOLLOW-UP**

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**Background and Aims:** We evaluated if spasticity-reducing surgery in the upper extremity could improve motor function, fulfill patient's specific goals and influence performance of daily activities in patients with muscle over-activity.

**Methods:** Thirty consecutive patients with spasticity due to stroke and other CNS injuries were included.

Before surgery the patients' clinical problems related to spasticity were defined and motor function and activity assessed. Each patient's potential to comply with the post-surgical rehabilitation procedure was estimated and the intensity level chosen (low, moderate or high).

Surgery mainly comprised lengthening of tendons and release of muscles. Physiotherapy, occupational therapy, wrapping and application of orthoses started the first post-operative day. Patients were taught a home-training program. One week of intensive in-hospital rehabilitation followed 2–3 weeks after surgery and a new home-training program was designed.

General hand function (usefulness) and pain were evaluated using the VAS scale (0–10), spasticity using the Modified Ashworth Scale (0–5) and activity by Canadian Occupational Performance Measure (performance and satisfaction mean values). Wilcoxon signed rank test was used.

**Results:** At one year follow-up general hand function increased (2.1 vs. 4.2;  $p < 0.001$ ), pain decreased (3.0 vs. 1.7;  $p < 0.05$ ), and spasticity decreased (3.5 vs. 2.1;  $p < 0.001$ ). Both activity measures: performance and satisfaction improved (2.0 vs. 5.5;  $p < 0.01$  and 1.9 vs. 5.5;  $p < 0.01$ ).

**Conclusions:** Hand surgery combined with comprehensive rehabilitation is a therapeutic option to reduce muscle over-activity, improve hand function, reduce pain, and promote patient ability for arm-hand activities and satisfaction in daily life in patients with disabling spasticity.

**Trial registration number:** N/A

**WITHDRAWN****AS04-049****IMPROVEMENT OF REHABILITATION  
SERVICES – TELEREHABILITATION:  
UNDERSTANDING THE CONSTRAINTS AND  
FACILITATORS TO BETTER DEFEAT  
CLINICIANS' RETICENCE**

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**Background and Aims:** A large proportion of people having suffered a stroke do not have access to outpatient rehabilitation. In-home telerehabilitation was thus proposed as an alternative solution. These remote interventions present a challenge from a technical and clinical point of view, for both patients and clinicians. The objectives are to evaluate satisfaction, as well as facilitators and barriers for the implementation of telerehabilitation in public health establishments targeted by clinicians (physiotherapists, occupational/speech therapists) and present possible solutions.

**Methods:** Satisfaction was assessed at the end of the intervention by the Healthcare Satisfaction Questionnaire and an online survey. Barriers/facilitators were identified by individual interviews. Descriptive and qualitative analyses were done.

**Results:** Eleven patients (aged  $66 \pm 15$  years) were included in the project, and 153 sessions were conducted. Patients' and clinicians' global satisfaction of rehabilitation services received was 86%, and 65%, respectively. The main advantage mentioned by patients was to receive services without having to travel or requiring professionals to come to their home. For the clinicians, the main obstacle was to provide treatment without "hands-on" therapy or face to face intervention. Identified facilitators were: 1) having a super-user clinician trained to solve technological problems, 2) having sensors for security purposes, and 3) having additional cameras to evaluate specific activities. The clinicians suggested having a clinical mentor available to teach how to provide tele-treatment (e.g verbal instructions, exercises replacing face to face intervention).

**Conclusions:** For clinicians to use telerehabilitation, adequate support is needed to support change in practice and promote patients' and clinicians' satisfaction.

**Trial registration number:** NA

**WITHDRAWN**

( $P < 0.05$ ) than baseline, but there was no difference compared with usual group. At 90-day follow-up, all patients in the REX group recovered the ability of walking independently. In usual group, one patient died, two patients were lost to follow-up, two patients (40%) recovered the ability of walking independently (vs REX group,  $P < 0.05$ ).

**Conclusions:** Acute stroke patients with severe paralysis wearing REX exoskeleton robot may accelerate the recovery of independent walking ability and improve patient's long-term outcome.

**Trial registration number:** N/A

#### AS04-039

### STUDY ON THE CURATIVE EFFECTS OF LABIAL PRONUNCIATION TRAINING FOR DYSARTHRIA AFTER STROKE

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**Background and Aims:** Explore the curative effect of labial pronunciation training on the basis of conventional speech therapy on dysarthria after stroke.

**Methods:** 20 patients with dysarthria after stroke were selected and randomly divided into two groups. The control group was treated with conventional speech therapy, while the experimental group was treated with labial pronunciation training on the basis of conventional speech therapy. Conventional speech therapy for two groups were 20min per time, labial pronunciation was training 10 minutes, Both groups were 5 times a week for 4 weeks. Therapist carried on face to face in a quiet and stable environment. Using spss20.0 for statistical analysis, significance levels were set at  $P < 0.05$ .

**Results:** 1. there was lower in the score of the modified Frenchay articulation disorder rating scale than before and the control group, and the difference was statistically significant ( $p < 0.01$ ).

2. the number of "a" items of the experimental group were more than before and the control group ( $p < 0.01$ ,  $p < 0.05$ ).

3. the reflex function, the lip movement, the throat movement scores of the experimental group were lower than before ( $p < 0.01$ ) and the score of the respiratory function and lip movement of the experimental group were lower than control group ( $p < 0.05$ ).

4. the MMSE scores of both groups were higher than before ( $p < 0.01$ ).

**Conclusions:** Labial pronunciation training can help improving the articulation function after stroke, and the articulation function may be related to the cognitive function.

**Trial registration number:** ChiCTR1800020017

#### AS04-012

### REX LOWER LIMB EXOSKELETON ROBOT IMPROVED SEVERE PARALYTIC STROKE PATIENT'S LONG TERM OUTCOME

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**Background and Aims:** Impaired gait after stroke remains a challenge. We investigated the effect of REX exoskeleton robot (Rex Bionics Plc. New Zealand) for gait training in acute stroke patients with severe paralysis.

**Methods:** Stroke patients with severe hemiplegia (lower limb strength was no more than Grade 2 in Manual Muscle Test) enrolled. They were assigned to receive usual rehabilitation alone ( $n=5$ ) or REX adjuvant walk exercise in addition to usual care ( $n=5$ ). REX training time per session was 20 minutes, twice a day, lasted 4 weeks. After then, all of them continued to do usual rehabilitation. Assessment at baseline and at the endpoint of 4 weeks training consisted of the Manual Muscle Test (MMT), Fugl-meyer lower limb movement, Berg balance, Functional Ambulation Categories (FAC), Brunnstrom stage (Brs), IOMW. The independent walking ability were evaluated 3 months later.

**Results:** The median time from stroke to inclusion was 30 days (range 13 to 38). Only in REX group, the MMT, Fugl-meyer lower limb movement, Berg balance, and FAC walking function all had a significant improvement

#### AS04-026

### CLINICAL IMPACT OF A PERSONALIZED ECOLOGICALLY VALID VIRTUAL REALITY SYSTEM IN COGNITIVE REHABILITATION: A RANDOMIZED CONTROLLED TRIAL WITH CHRONIC STROKE PATIENTS

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**Background and Aims:** Cognitive impairments after stroke are not always given sufficient attention despite its impact in activities of daily

living (ADL's). Current cognitive rehabilitation methods mostly rely on paper-and-pencil tasks targeting isolated domains, which is not consistent with everyday-life. Besides limited ecological-validity, these tasks are not accessible to patients whose dominant arm is paretic. Virtual Reality (VR) has shown to be a solution for the development of accessible and ecologically-valid systems. Many tools were developed, however, most of the times they lack personalization and clinical validation.

**Methods:** Reh@City VR tool integrates adaptive cognitive tasks in ADL's simulations (calculations at the bank, action sequencing at home, newspaper information recall) to be solved through an accessible interface. We have performed a trial with 42 stroke patients comparing Reh@City (14 participants), a content equivalent paper-and-pencil Task Generator (TG) (18 participants) and standard occupational therapy (OT) (10 participants). The intervention comprised 12 sessions of 30 minutes, three times per-week and all patients went through neuropsychological assessment pre and post-intervention.

**Results:** A within-group analysis revealed that the Reh@City group significantly improved in general cognitive functioning, attention, visuospatial ability and executive functioning, verbal memory, processing speed, self-reported memory, and self-perceived cognitive deficits impact. The TG group improved in orientation, verbal and visual memory and processing speed. The OT group only improved in visual memory. Reh@City was also superior between-groups in general cognitive functioning, visuospatial ability and executive functioning and self-reported memory.

**Conclusions:** Reh@City clinical impact was superior to paper-and-pencil and OT interventions in the rehabilitation of cognitive deficits after stroke.

**Trial registration number:** NCT02857803

## AS04-027

### A PILOT STUDY OF A GROUP-BASED HEALTH EDUCATIONAL INTERVENTION TO IMPROVE EMOTIONAL WELL-BEING AND QUALITY OF LIFE AFTER STROKE: PRELIMINARY RESULTS

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**Background and Aims:** Emotional changes including depression and anxiety are frequent after stroke but data on preventive interventions are scarce.

The overall aim of this study is to reduce health-related anxiety and depression in stroke patients of working age by a group-based health educational intervention. This study explores whether the intervention improves patients' emotional scores and examines patient participation as well as evaluation.

**Methods:** A prospective, single center, open intervention study with patient reported outcome measures (group-based health education) in patients of working age with transitory ischemic attack (TIA) or minor stroke.

Population: inclusion cohort aged 18–65 years with TIA or minor stroke admitted in 2018–2019 to Bispebjerg University Hospital.

Patients complete questionnaires (depression, anxiety, health related fear, and quality of life) one week before and one week after the intervention and provide evaluation of the programme after the intervention.

**Results:** Of 28 patients included (17/28 women, median age 54 years), 18/28 attended the health education programme; 4/28 had a history of depression/anxiety. Before intervention 13/28 reported no signs of depression compared to 10/18 after intervention, moderate to severe depression was reported before by 7/28 after by 3/18. Anxiety was reported by 3/28 before and 0/18 after. 1/10 patients not attending reported depression and anxiety.

**Conclusions:** We plan to complete the health intervention programme with 100 patients and explore the reasons for not attending.

**Trial registration number:** N/A

## AS04-053

### OPTIMIZING PATIENT'S ADHERENCE TO STROKE REHABILITATION TREATMENT: RESULTS OF A TELEREHABILITATION PILOT TRIAL

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**Background and Aims:** Even when travel is not a barrier, adherence to rehabilitation treatments has been shown to be suboptimal. As a result, many patients refuse their rehabilitation treatments outright or decrease the duration and/or frequency of their treatments over time. Telerehabilitation, which refers to the use of telecommunication technologies to provide long-distance rehabilitative services, has been proposed as a mean of addressing these barriers. We pilot-tested a telerehabilitation platform to determine whether it could meet patients' and professionals' needs and expectations and to explore key contextual factors related to the optimization of patient's adherence to stroke rehabilitation plan.

**Methods:** Implementation process was documented. Group and individual interviews were conducted. Validated questionnaires were administered pre- and post-intervention to summarize patients' clinical progress.

**Results:** 2 rehabilitation teams (21 professionals and managers) and 13 patients were recruited. On average, 2.1 hours of teletreatment/patient/week were provided, which represented >80% of the patients' treatment plan. Clinicians reported a higher dose of treatment, improved adherence to treatment plan, as well as more frequent interactions with the patients than standard care. Despite a certain degree of initial apprehension, the telerehabilitation solution was positively received by patients. They described the services as adapted to their medical condition, focused on their needs, and without inconsistencies. Patients' clinical progress will be presented.

**Conclusions:** Telerehabilitation can facilitate an intensive rehabilitation program and contribute to increase the treatment dose, while matching the patient/family condition, situation and expectations. Robust data validating the hypothesis that telerehabilitation is efficacious because it increases patient's adherence to treatment plan is warranted.

**Trial registration number:** N/A

## AS04-028

### CORE-STABILITY EXERCISES IMPROVE GAIT PATTERN AFTER STROKE. A RANDOMIZED CONTROL TRIAL PROTOCOL

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**Background and Aims:**

**Background:** Stroke is an acute neurological disease caused by an interruption in blood supply in the brain. There is a need of a global approach, starting in the acute phase, and emphasizing in early rehabilitation. Stroke can cause different problems. Difficulty in walking it's one of the motor impairments and it causes disability. One of the physiotherapy objectives is to improve gait autonomy. Core -stability exercises improve trunk

control which is important to maintain balance in a standing and a sitting position.

**Aim:** To study the effectiveness of a physiotherapy standard treatment against a treatment based in core-stability exercises added to physiotherapy standard treatment.

**Methods:** Randomized clinical trial of stroke patients, every patient will do 1 hour per day of physiotherapy, 5 days per week in 5 weeks. There are two groups one control which they are going to do standard physiotherapy treatment and the experimental group who are going to do 30 minutes of core-stability exercises and 30 minutes of standard physiotherapy treatment.

**Results:** this study will provide data about the effectiveness of core-stability exercises added to a physiotherapy standard treatment.

**Conclusions:** no conclusions are available, is an ongoing protocol.

**Trial registration number:** N/A

## AS04-032

### EASILY CONDUCTED TESTS DURING THE FIRST WEEK POST-STROKE CAN AID THE PREDICTION OF ARM FUNCTIONING AT 6 MONTHS

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**Background and Aims:** In clinical practice, prediction of the affected arm functioning after stroke needs to be based on easily conducted and meaningful factors. Several clinical tests have been proposed; further validation of their predictive value is needed.

**Aim:** To examine the individual value of clinical tests as early predictors of arm functioning.

**Methods:** We performed a secondary analysis of merged data (n = 223) from two independent cohorts. The candidate predictors were six individual motor items and the sensory function measured during the first week post-stroke using the Fugl-Meyer Assessment of Upper Extremity (FMA-UE). For each predictor, we calculated the odds ratio (OR) of achieving two levels of a favorable 6-month outcome:  $\geq 32$  and  $\geq 58$  points on the motor part of FMA-UE (FMA-UE-motor).

**Results:** Patients with full function on motor items were at least 5.7 (shoulder abduction) to 36.8 (elbow extension) times more likely to achieve a FMA-UE-motor  $\geq 58$  compared with those with absent function. Having partial elbow extension, pronation/supination, dorsiflexion and grasping ability were likewise associated with a FMA-UE-motor  $\geq 58$  with OR from 2.2 (elbow extension) to 19 (dorsiflexion). Patients with partial shoulder abduction were at least 7.3 times more likely to reach a FMA-UE-motor  $\geq 32$ . Intact sensory function was among the weakest predictors of both outcome levels.

**Conclusions:** This study confirmed that some motor and intact sensory arm function early post-stroke were associated with a favorable 6-month outcome in patients with moderately impaired arm function and mild-to-moderate stroke. When only partial motor function was present, wrist dorsiflexion was the strongest predictor of a FMA-UE-motor  $\geq 58$ .

**Trial registration number:** ClinicalTrials.gov: NCT02250365, NCT01115348

## AS04-033

### FEASIBILITY OF APPLYING NON-INVASIVE BRAIN STIMULATION TO INDUCE RECOVERY FROM NEGLECT

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**Background and Aims:** Up to 80% of people who experience a right hemisphere stroke suffer from neglect, which is debilitating, impedes rehabilitation and strongly predicts poor recovery. Behavioural training and transcranial direct current stimulation have been successful in the rehabilitation of motor functions after stroke, and here we assessed the feasibility of these interventions for ameliorating neglect.

**Methods:** Transcranial direct current stimulation (tDCS) and behavioural training were applied alone, or in combination, in a prospective, randomised, controlled trial. Patients with confirmed neglect at  $>4$  weeks post stroke were allocated randomly to 10 sessions of 15 minutes each of 1 mA constant tDCS, 10 sessions of rod lifting with the unaffected hand, both interventions, or a control task. A convenience sample of 60 patients was planned. Primary outcomes were recruitment and retention rates, with secondary outcome measures the effect size and variance of neglect scores and activities of daily living, assessed directly after the interventions and at 6 months follow up.

**Results:** Of 4311 patients admitted with confirmed strokes across 4 hospital sites, 288 were screened, with 24 randomised. Most exclusions (91/288) were due to medical comorbidities preventing patients' attendance of 10 hospital-based intervention sessions. 21/24 patients completed the interventions and 14/24 attended 6 month follow up. There were no tDCS related SAEs.

**Conclusions:** Despite being conducted at a high-volume stroke centre, < 10% of screened patients were eligible for the trial protocol, predominantly due to medical comorbidities. Future studies of tDCS, either with or without behavioural training, should consider length and location of the interventions.

**Trial registration number:** NCT02401724

## AS04-030

### HEALTH-RELATED QUALITY OF LIFE AT 3 AND 12 MONTHS POST-STROKE IN A DANISH AND NORTH NORWEGIAN COHORT: A COMPARATIVE LONGITUDINAL STUDY WITH THE QOLIBRI-OS

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**Background and Aims:** Subacute rehabilitation is more centralized and better organized in Denmark than in North of Norway. Main aims are to compare health-related quality of life between a North Norwegian and a Central Danish stroke cohort, and to assess changes from 3 to 12 months after stroke.

**Methods:** First-ever stroke survivors were consecutively enrolled at stroke units. The 6-items Quality of Life after Brain Injury-Overall Scale (QOLIBRI-OS) was filled in by 169 Norwegian patients, age  $70 \pm 12$  years and 135 Danish patients, age  $67 \pm 12$  years ( $p = 0.06$ ). Possible scale score 0–100.

Baseline measures were from the National Stroke registries. Baseline Scandinavian Stroke Scale was similar in the two samples ( $p = 0.11$ ).

**Results:** Total QOLIBRI-OS differed significantly between the countries at 3 and 12 months post stroke in favor of the Norwegian participants. At 12 months mean score in Norway was 71.9 (SD 20.3) versus Denmark 65.9 (SD 23.4), mean difference 6.0, 95% CI of the difference 1.1–10.9,  $p < 0.05$ , small effect size. Single-items showed better Norwegian scores at 3 and 12 months for ‘satisfaction with cognition’, ‘emotional status’, and ‘ability to perform daily activities’. Scores for ‘satisfaction with physical function’, personal life and social relationship’, and ‘current situation and future prospects’, were not different. There were no significant within-country-changes from 3 to 12 months

**Conclusions:** A small difference in quality of life in favor of Norwegian stroke survivor’s was found, despite apparently better organized subacute stroke rehabilitation in Denmark. Preliminary results will be analyzed further with predictor analyses and evaluation against EQ-5D.

**Trial registration number:** NCT02311426

## WITHDRAWN

expand this study to contemplate more variables and develop specific actions to humanize care.

**Trial registration number:** N/A

## AS04-019

### CONTRALATERAL BRAIN ATROPHY IN CONSERVATIVELY TREATED PRIMARY INTRACEREBRAL HEMORRHAGE

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**Background and Aims:** Brain volume loss after various cerebrovascular accident (CVA) and traumatic brain injury (TBI) is a recent issue. In patients with intracerebral hemorrhage (ICH), loss of brain volume can occurs in the ipsilateral hemisphere of the hematoma. But contralateral hemispheric volume change after ICH is not well known. The present study aimed to investigate contralateral brain volume changes in patients with ICH who were not undergoing surgery.

**Methods:** Total 2213 patients with ICH admitted our hospital between January 2010 and December 2017, 46 patients without surgical intervention were included in the present study. We measured contralateral hemispheric brain volume at axial brain computed tomography (CT) images at the time of onset and 12months after attack. We analyzed the relationship between various factors and volume changes of contralateral hemisphere.

**Results:** There were average volume ratio decreases of 3.16% ( $P = 0.001$ ). In univariate and multivariate logistic regression models, there is no significant factors associated with a contralateral brain volume loss. Kruskal-Wallis test and Mann-whitney test shows no statistically significance ( $P\text{-value} = 0.824$ ,  $P\text{-value} = 0.122$ ) between ICH volume groups.

**Conclusions:** Contralateral parenchymal volumes were significantly decreased at the follow-up brain CT scans and these morphological changes may offer important clinical information on the remote effects and symptoms in the course of ICH treatment. However, further investigations of brain injury, including cerebrospinal fluid studies for inflammatory markers and novel neuroimaging techniques, would be required in future studies in order to find out the precise mechanisms responsible for these volume changes.

**Trial registration number:** N/A

## WITHDRAWN

plasticity using functional near-infrared spectroscopy (fNIRS) in stroke patients.

**Methods:** Twenty stroke patients participated in this single-blind, randomized cross-over study. Four conditions were randomly applied with 24 hours of washout period between each condition: dual-site anodal stimulation over the bihemispheric primary leg motor area (M<sub>I</sub>leg) and supplementary motor area (SMA); anodal stimulation over the ipsilesional M<sub>I</sub>leg and SMA; anodal stimulation over the contralateral M<sub>I</sub>leg and SMA; sham stimulation. Two battery-driven stimulators were used with 2 mA direct current in each anode. During the 30 minutes of stimulation, subjects took rest in the early and late 10 minutes and walking on a treadmill in the middle 10 minutes. The hemodynamic responses were recorded by an fNIRS system at before and after the intervention. Pearson correlation coefficient was generated from oxyhemoglobin signals.

**Results:** To confirm the changes of the connectivity after tDCS stimulation compared with the sham stimulation, the network change was investigated by thresholding based on the correlation coefficient value of 0.6. The network changes after dual-site stimulation was noticeable compared to single or sham stimulation conditions. Connectivity between sensorimotor-related areas such as M<sub>I</sub>leg, SMA, and primary sensory motor cortex was increased after dual-site stimulation.

**Conclusions:** This study implies dual-site tDCS may enhance the neuro-modulation effect in the gait-related motor network compared to the conventional single-site stimulation in stroke patients.

This study was supported by KHIDI (HI17C1501) and NRF (NRF-2017R1A2A1A05000730, NRF-2017M3A9G5083690).

**Trial registration number:** N/A

## AS04-007

### A MULTICENTER STUDY IN SEVEN COUNTRIES ON LONGITUDINAL OUTCOMES IN PERSONS WITH STROKE, THE SIN STROKE STUDY

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**Background and Aims:** Walking on even surface and stair walking capacity are prerequisites for Independence referred to as primary goals in rehabilitation after stroke.

The aim of this study was to investigate to what extent walking and stair-climbing capacity in persons with stroke may differ in different countries and specialized rehabilitation clinics.

**Methods:** The design was a prospective, descriptive study of the specialized rehabilitation of stroke patients in rehabilitation institutions in Norway, China, the United States, Russia, Israel, Palestine and Sweden. Patients with a primary diagnosis of stroke attending an institution for specialized rehabilitation were enrolled. The primary outcome measures Barthel Index (BI) item 9 and 10, the Functional Independence Measure (FIM) item 12 and 13 were performed on admission, 18–22 days into rehabilitation, at discharge, 6 and 12 months post discharge.

**Results:** There were significant differences in walking and stair climbing capacity in the repeated measurements analysis from baseline to 6 months between centers. Explanatory factors for differences were time between debut to admission, time of exercises, amount of exercise provision, as well as length of stay in the rehabilitation unit.

**Conclusions:** The varied models and content of specialized rehabilitation significantly influence the outcomes of walking and stair climbing capacity within the rehabilitation period and this is maintained at 6 and 12 months post discharge.

**Trial registration number:** NCT01732679

## WITHDRAWN

## WITHDRAWN

Social problem questionnaire (SPQ) respectively. The relationship and association between different variables was assessed using Pearson's correlation and Chi-square test respectively.

**Results:** Majority of Hausa women who suffered stroke reported adequate level of social support (60.8%), with fairly low levels of social constraints in both the Total Family Stress (91.9%) and Non-Child Related stress (90.5%) domains of the SPQ. None of the participants' socio-demographic features had a significant relationship or association with either social support or social constraints ( $p > 0.05$ ). Rather, an inverse relationship exists between social support and social constraints.

**Conclusions:** The outcome of this study suggests that adequate levels of social support results in reduced levels of social constraints following stroke.

**Trial registration number:** N/A

## WITHDRAWN

## WITHDRAWN

## WITHDRAWN

1st — the main (15 patients) receiving basic therapy (memantine) together with neuropsychological training; 2nd – comparative group (15 people.) Received only basic therapy (memantine).

Psychological training consisted of psychotherapy course from 6 to 10 sessions of 9 exercises for cognitive brain stimulation. For verification of neuropsychological disorders, the Luria and Khachinsky scales were used.

**Results:** According to Hachinski Ischaemic Score 10.7 points was observed in 10% patients; from 11 to 14 points – 25%; 15 to 17 – 65% of patients. Analysis of the neuropsychological spectrum showed according to neuropsychological testing by Luria aphasia was found in 65.5% of patients; alexis at 51.7%; agraphia at 25.3%; akakuliya 49.5%; agnosia at 44.9%; apraxia in 39.8 patients. After a psychological training the main group performance has improved by 1.5 times ( $p \geq 0.05$ ); in the control group to 0.5 times ( $p \geq 0.05$ ).

**Conclusions:** With the help of basic therapy in psychological care can lead to more effective treatment of dementia

**Trial registration number:** Neuropsychological rehabilitation was carried out by means of psychological training.

## AS04-052

### VIRTUAL REALITY FOR UPPER-LIMB REHABILITATION IN PERUVIAN STROKE PATIENTS: RESULTS FROM A SINGLE ARM TRIAL

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#### Background and Aims:

**Background:** Upper-limb recovery in stroke patients demands for intensive rehabilitation to be achieved. Yet lack of patient motivation and the overwhelmed professional workforce in Peru prevent patients from optimal recovery. Videogames can overcome these problems as they provide entertaining environments. Thus, we have developed a virtual reality game for upper-limb activities to be tested in stroke patients.

**Objective:** To measure the change on upper-limb skills in stroke patients after using a wearable device with a virtual reality game designed for task-specific exercises.

**Methods:** Single-arm pilot trial conducted at a local hospital in Lima, Peru. 10 patients with at least 6 months after the stroke episode were screened for eligibility. Patients received two months (3 times per week) of 45-minute sessions of hospital inpatient rehabilitation plus the video-game for 45 minutes extra. Videogame activities included gardening activities performed with shoulder, elbow and wrist movements using a wireless suit with motion sensors. Main outcome was upper-limb function as measured by the Fugl-Meyer test (Upper extremity domain).

**Results:** Six participant out of the nine eligible finished the intervention. Mean age was 68.7 years and 5/6 were men. Upper limb scores did not vary significantly from baseline (Mean score:  $60.0 \pm 3.6$  vs  $60.0 \pm 4.3$ , respectively).

**Conclusions:** Our results show no variation in upper limb skills after using a videogame designed for rehabilitation. Main hypothesis for this is that patients already had a high score (60 out of 66) and thus, were not able to improve much more in two months of intervention.

**Trial registration number:** N/A

## AS04-054

### COMBINED NEUROPSYCHOLOGICAL, NEUROPHYSIOLOGICAL AND PSYCHOPHYSIOLOGICAL ASSESSMENT OF THE EFFECTS OF N-PEP-12 ON NEURORECOVERY IN PATIENTS AFTER ISCHEMIC STROKE

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**Background and Aims:** Cognitive impairment is a common consequence of patients with stroke, regardless of severity, with significant implications on quality of life. Vascular cognitive impairment describes a spectrum of cognitive disorders ranging from mild cognitive impairment to dementia, with implications for almost all cognitive domains and behavior. There is increasing evidence to suggest the disproportionate impairment of executive dysfunction. We investigate the effects of N-Pep-12 treatment on the neuro recovery of patients with post-stroke cognitive impairment. N-Pep-12 is a proprietary, peptide-based agent that has been shown to exert neuroprotective and pro-cognitive effects in experimental studies as well as in earlier clinical studies in patients suffering from age-related cognitive deficits.

**Methods:** This exploratory, prospective, randomized, single-blind, controlled, phase IV study will use a multidimensional approach to combine neuropsychological outcome scales, neurophysiological investigations (qEEG), psychophysiological investigations (eye-tracking), and clinical parameters. Patient inclusion is restricted to stroke that is ischemic in origin, supratentorial, and radiologically confirmed (CT or MRI), with an onset between 30–120 days before screening, no significant pre-stroke disability, no 3-month history of stroke and age between 18–80.

**Results:** One hundred twenty stroke patients will be enrolled in the study by April 2019. Topline results will be available.

**Conclusions:** A critical advantage of N-PEP-12 is its dosage form. The compound is available as film-coated tablets or capsules, significantly more accessible than intravenous alternatives. N-Pep-12 has been shown to significantly improve memory impairment in older adults with subjective memory complaints. Results of this trial will be extensively discussed and evaluated after completion.

**Trial registration number:** In processing at ISRCTN

## AS04-042

### CLIC: A CLOUD SYSTEM FOR STROKE FOLLOW-UP

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**B. Pacifico<sup>1</sup>, R. Bisogno<sup>1</sup>, I. Passero<sup>2</sup> and C. D'Ambrosio<sup>3</sup>**  
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**Background and Aims:** The CLIC project aims at designing, developing and operating an information system for the Stroke Unit of University Hospital of Salerno. CLIC system automates the follow-up of patients affected by stroke and their subsequent transfers to associated rehabilitation facilities.

**Methods:** The project has led to the development of a cloud platform that optimizes the work of the medical and para-medical staff, improves their relations with patient families and prevents every problem of post-ischemic administration phases.

CLIC supports the compilation of the evaluation reports according to the ICF specifications, NHISS, Barthel Index, Rankin, Doss, Ellm, Cirs, Mmse and Trunk Control Test. CLIC memorizes all the investigations executed in the patient medical record, organizes the transfer to the rehabilitation facility, and finally registers the resignation of patient, which marks the end of the healing process.

The system allows doctors, due to their role in the Rehabilitation Follow-Up, to access all information on patient's clinic history, to promptly know the results of the exams and book others, and to know and book the availability of beds at the rehabilitation facilities.

**Results:** One year after the operative adoption of CLIC, the data collected and elaborated and the impacts of the system on stroke follow-up workflow are presented and discussed.

**Conclusions:** The CLIC system and the associated workflows have been evaluated in a formal statistical comparison test and compared with the past follow-up practices. Basing on field observations collected (like time of Stroke unit hospitalization), the evaluation clearly stated the improvements introduced by the adoption of the system.

**Trial registration number:** 250

## WITHDRAWN

### AS04-021

## REHABILITATION OF BALANCE AND GAIT FUNCTIONS AFTER POST-STROKE ATACTIC SYNDROME

**V. Ondar<sup>1</sup>, S. Ismailova<sup>1</sup>, S. Subocheva<sup>1</sup>, M. Abroskina<sup>1</sup> and S. Prokopenko<sup>1</sup>**

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**Background and Aims:** The abstract covers a method of balance correction with application of platforms with biological feedback (BF), an original method of balance correction MAPS-I based on activation of anticipatory synergies and a proprietary method of stato-locomotor function correction based on activation of the vestibular analyzer and postural synergies by means of shifting the centre of gravity of patient in the vertical plane.

Our aim was to assess efficiency of the proprietary method based on dosed centre-of-gravity shifting in the vertical plane.

**Methods:** A total of 90 patients with post-stroke ataxia were enrolled in the study. Group 1 ( $n=30$ ) was treated with application of the proprietary method, Group 2 ( $n=30$ ) received treatment by means of the MAPS-I method and Group 3 ( $n=30$ ) underwent balance correction via BF equipment.

All patients underwent computer stabilometry (CS), "Laser analyzer of kinematic gait parameters" (LA-I), balance and gait assessment using Berg Balance Scale (BBS), ICARS and Dynamic Gait Index (DGI) prior to and after the course of treatment.

**Results:** Significant decrease in main CS and LA-I values and improvement in indices of DGI and BBS functional scales after treatment was revealed.

**Conclusions:** The proprietary method of balance and gait functions correction makes it possible to improve standing and gait balance and can be recommended for complex restorative treatment of patients after stroke.

**Trial registration number:** N/A

### AS04-046

## NEUROAID EARLY POST STROKE: PRELIMINARY RESULTS OF POLISH-SLOVAK STUDY

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**Background and Aims:** Treatments for stroke are limited. NurAiD II (MLC 901) is a combination of natural products that has been used to improve recovery after ischemic stroke. The aim of this study was to assess the safety and potential efficacy of NurAiD II in the early stage after stroke, not later than six months after stroke. Two Polish and six Slovak investigators has been involved in this study.

**Methods:** The NeuroAiD Safe Treatment (NeST) Registry (clinicaltrials.gov NCT02536079) is a product registry provides information on the use and safety of NeuroAiD in clinical practice. We analysed anonymised information of ischemic injury from Poland and Slovakia that was included in the NeST Registry ([www.neuroaid.com/en/nest/main/index](http://www.neuroaid.com/en/nest/main/index)). Patients consented are prospectively entered using online forms for baseline and subsequent visits. Data collected includes demographics, diagnosis, medical history, modified Rankin Score (mRS), Glasgow Coma Scale (GCS), National Institute of Health Stroke Scale (NIHSS), compliance and side effects.

**Results:** Forty-two patients from Slovakia and Poland were included with mean age of  $62.54 \pm 11.22$  years, with 21 (50.00%) women. The mean number of days where NurAiD II was started was  $97.98 \pm 159.25$  days

since the time of stroke onset. Median NIHSS for the patients was 7.5 (1–26) at baseline (B), 6.0 (0–19) at M (month) 1, 4.5 (0–16) at M2 and 3 (0–15) at M3. After three month the mRS was improving over time. There were no side effects reported. Two patients were lost of follow-up.

**Conclusions:** NurAiD II was safe in ischemic stroke. The improvement of neurological and functional measures has been observed.

**Trial registration number:** N/A

## AS04-055

### POST-STROKE FATIGUE – CLIENTS PERSPECTIVE ON NATURE-BASED REHABILITATION

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**Background and Aims:** It is estimated that up-to 75% of individuals suffer from fatigue after stroke. Post-stroke-fatigue contributes to disability and reduced quality of life. Currently, there is neither sufficient evidence on the efficacy of any intervention for post-stroke fatigue nor how the patients perceive the interventions. The objective of the study was to examine the clients' experience of post-stroke nature-based rehabilitation.

**Methods:** An interview was conducted included 27 informants, who voluntary participated in a semi-structured interview. The informants were identified among those who participated in a two-armed randomized controlled prospective trial, with 101 individuals included thereof 51 were randomized to the nature-based intervention (ClinicalTrial.gov identifier: NCT02435043). The intervention was performed in enriched garden environment, supported by a multimodal rehabilitation team. The intervention was performed as a group therapy of eight persons, lasting for ten weeks, two days/week, each day session lasting three and a half hours. The interviews were recorded, transcribed and analyzed according to Interpretive Phenomenological Analyses. The study was approved by the regional ethical committee in Lunds (Dnr 2012/352).

**Results:** Two subordinate themes emerged 1) *Salutogenic environment supporting mental recovery*, with the subthemes a) tranquility, b) permisiveness and 2) *Fascination as a motivation for physical activities*, with the subthemes a) free play and b) exploration. The results indicate that nature-based rehabilitation can promote both perceived fatigue recovery and promote engagement in physical activities otherwise not undertaken.

**Conclusions:** The results highlight important aspects on how nature can support post-stroke fatigue recovery and how these can be implemented for further develop successful rehabilitation programs.

**Trial registration number:** N/A

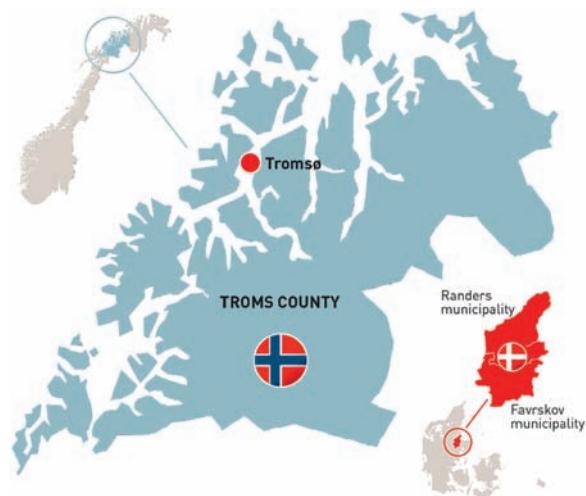
## AS04-016

### RECOVERY AND QUALITY OF LIFE FOLLOWING STROKE IN DENMARK AND NORWAY: A QUALITATIVE COMPARATIVE ANALYSIS

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**Background and Aims:** Previous studies have shown reductions in quality of life after stroke and variations between European countries. This study aims to explore and compare quality of life and recovery processes in regions of North Norway and Central Denmark. Geographically, different regions in North Norway are very dissimilar to Denmark, with large areas and scattered settlements.



**Methods:** We performed individual in-depth interviews with 11 stroke survivors twelve months after stroke onset. Phenomenological perspectives and an inductive approach shaped the interview process and the processing of data. Theory of embodiment enlightened the perspective on quality of life and recovery

**Results:** We found that quality of life was closely related to the individuals' reconstruction of the embodied self: how they made sense of the world and what they thought of themselves. We identified three intertwined and negotiating processes: a familiar self, an unfamiliar self, and recovery of self. Factors such as enriching social relations, successful return to work, and continuity and presence in professional support during the recovery process influenced quality of life positively. Fatigue and sustained reduced function hindered participation in meaningful activities and negatively affected quality of life

**Conclusions:** There was a difference between the two countries in descriptions of continuity and support in the professional follow-up during the recovery process, influencing the degree of encouragement in reconstructing the embodied self – and consequently quality of life. Reconstruction of the embodied self is a way of understanding stroke survivors in the recovery process and is of clinical value in stroke rehabilitation

**Trial registration number:** ClinicalTrials.gov Identifier: NCT02369055

**AS04-056****SELF-PERCEIVED IMPACT OF STROKE:  
A 5-YEAR FOLLOW-UP**

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**Background and Aims:** Persons with stroke suffer the consequences of stroke, physical, cognitive and psychological, even long after stroke onset and it can potentially restrict their participation and quality of life. Longitudinal long-term follow-up studies that follow persons using the same questionnaires are rare. The purpose of this study is to investigate different aspects of self-perceived impact of stroke one and five years after stroke with a focus on self-perceived participation.

**Methods:** In this longitudinal study, persons with first time stroke and impaired upper extremity function included in Stroke Arm Longitudinal study at University of Gothenburg study (SALGOT), Sweden in 2009–2010 were followed at one and five years post stroke. Stroke Impact Scale, the Impact on Participation and Autonomy and the European Quality of Life 5 dimensions were questionnaires used; face-to-face interviews at 1 year, and mail survey at 5 years. Non-parametric methods were used and changes over time was calculated.

**Results:** A total of 45 participants responded at both time points. Generally the consequences of stroke were more explicit after five years; strength, emotion and participation were the most affected areas. Furthermore, the participants experienced restrictions in social life and autonomy indoors. Stroke severity was moderately correlated to quality of life measured by EQ5D.

**Conclusions:** It seems as if the perceived impact of stroke becomes more prominent as time goes on, with emotion and participation being some of the most affected areas. This study highlights the need of continuous support over time for persons with stroke.

**Trial registration number:** N/A

differences in outcome considering mortality rate, and lower mRS in favour of Cerebrolysin group, without any differences in complications rate. In mRS after 90 days – good outcome was observed in 67% of cerebrolysin patients in comparing with 37% of patients in control group.

**Conclusions:** based on the first results, Cerebrolysin could be considered as safe for the patients with acute stroke after thrombolytic therapy with or without thrombectomy, and there is certain benefit in 90 days outcome in cerebrolysin patients group.

**Trial registration number:** N/A

**WITHDRAWN****AS04-060****POSSIBLE SYNERGISTIC EFFECT OF  
THROMBOLYTIC THERAPY WITH ALTEPLASE  
AND SYSTEMIC CEREBROLYSINE IN THE  
ACUTE STROKE PATIENTS**

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**Background and Aims:**

**Introduction:** Thrombolytic therapy with rtPA, remains a “golden standard” for treating acute ischaemic stroke (AIS). In clinical setting, though, thrombolytic treatment results in recanalisation in only 30% of patients, and in some of them increases risk of serious complications. Cerebrolysin however, showed several levels of neuroprotection after thrombolysis.

**Methods:**

**Materials and methods:** We performed a prospective study on patients with acute ischemic stroke after thrombolytic therapy with or without endovascular recanalization therapy, without clinical improvement in the first 24 hours. The patients were divided in two groups – study group of patients who received Cerebrolysin during at least 14 and no longer than 21 days, and a control group. Patients in both group had baseline NIHSS of >8. We compared outcome after 7 days of treatment (NIHSS), by discharge and after 90 days (mRS).

**Results:** We included all together 15 patients in Cerebrolysin group, and 17 matched controls, last patient being enrolled on 16. January 2019. Interim analysis of 9 study patients and 11 control patients showed some

**AS04-005****RELATIONSHIP AMONG AEROBIC CAPACITY,  
WALKING ABILITY, AND COGNITION IN  
PATIENTS WITH SUBACUTE MILD STROKE**

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<sup>3</sup>Dermatology and Venereology- and Department of Clinical and Experimental Medicine-, Dermatology and Venereology- and Department of Clinical and Experimental Medicine-, Linköping, Sweden

**Background and Aims:** Developing better stroke rehabilitation approaches requires an understanding of how different functions and

activities relate to each other. The aim of the present study was to determine the relationship among aerobic capacity, walking ability and cognition in patients with subacute mild stroke.

**Methods:** Cross-sectional analysis. Patients (n = 53), age  $\geq 50$  years, mild stroke, evaluated 118 days (mean) post stroke. Aerobic capacity was measured with the standard ergometer exercise stress test (peak work rate), walking ability with the 6-minute walk test (6MWT), and cognition with the Neurobehavioral Cognitive Status Examination (NCSE). Relationships were investigated with Pearson correlations. Multiple linear regression was performed to identify the association between aerobic capacity (dependent variable) and 6MWT and cognitive function variables (independent variables). Variables with correlation  $P < .10$  were included in the regression analysis.

**Results:** Aerobic capacity correlated significantly ( $P < .05$ ) with age, sex, 6MWT, NCSE Construction and NCSE Judgment. The strength of the associations as analyzed with Pearson correlation coefficients ( $r$ ) was low for age (-.41), moderate for sex and 6MWT (-.52 and .55, respectively), and low for NCSE Construction and NCSE Judgment (.31 and .30, respectively). On multiple regression, aerobic capacity was associated with age, sex, 6MWT, NCSE Naming, and NCSE Judgment but not with NCSE Construction ( $P = .380$ ). The proportion of variation (adjusted R<sup>2</sup>) in the dependent variable explained by the model was .57.

**Conclusions:** Age, sex, walking ability, and cognition are associated with aerobic capacity in patients with subacute mild stroke. The result implicate that 6MWT may be useful to monitor aerobic capacity in subacute mild stroke.

Trial registration number: NCT02107768.

## AS04-025

### THE GUGGING SWALLOWING SCREEN (GUSS) RECOMMENDS A SIMILAR DIET AS THE FIBEROPTIC ENDOSCOPIC EVALUATION OF SWALLOWING (FEES) FOR SEVERE STROKES WHEN COUGHING IS EVALUATED CRITICALLY

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**Background and Aims:** Dysphagia is a common complication after stroke. Early assessment of swallowing can prevent severe consequences such as aspiration pneumonia. The Gugging Swallowing Screen (GUSS), a valid and widely-used bedside-screen, has been criticised to overestimate the necessity of nasogastric tubes (NGT) compared to fiberoptic endoscopic evaluation of swallowing (FEES) in severe stroke patients. This cross-sectional study compares the diet recommendations of GUSS and FEES as well as the actually implemented diet in severe stroke patients and investigates if they differ because of the items "vigilance" and "voluntary cough" in the GUSS-pretest.

**Methods:** The diet-recommendations given by FEES, GUSS and the actually implemented diet were compared for 20 patients with severe acute stroke (National Institute of Health Stroke Scale [NIHSS]  $\geq 15$ ).

**Results:** The GUSS recommended nothing per os (NPO) for all severe strokes; in 50% of these, FEES recommended equally NPO. For the other ten patients, the FEES recommended a less strict level-I diet. This diet was implemented in five cases, all other patients received NPO. Eleven out of 15 patients with NPO showed insufficient vigilance whereas all five patients with level-I diet were awake ( $p = 0.004$ ). Only 1/15 (7%) patients administered to NPO could cough voluntary compared to 2/5 (40%) with diet level-I ( $p = 0.071$ ).

**Conclusions:** GUSS is a suitable diagnostic-tool for dysphagia in severe stroke patients. In clinical practice, the decision for NPO is based on vigilance but not on the ability of voluntary coughing. The additional use of FEES may prevent NGT in severe stroke with good vigilance.

Trial registration number: N/A

## AS04-017

### LEVODOPA TREATMENT IN ACUTE ISCHEMIC STROKE. AN OPEN LABEL SAFETY AND EFFICACY STUDY

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**Background and Aims:** Acute ischemic stroke results in functional impairment and disability of the patients. The objective of the present study is to evaluate safety and efficacy of levodopa, a well-known medicine used for decades for the treatment of movement disorders.

**Methods:** Thirty patients, of acute ischemic stroke, beyond the window for thrombolysis and endovascular re canalization, with a NIHSS of 6–23 were enrolled in our study at our center. Levodopa (50 /200) was administered to 15 patients followed by physiotherapy after 45 minutes for three months. Rest of the 15 patients received conservative management, out of which 14 completed the study.

**Results:** The NIHSS was assessed at days 30 and 90 and mRS at day 90. The mean difference in NIHSS at day 30 between the two arms was 2.2 (p 0.015) and the mean difference in NIHSS at day 90 was 3.86 (p 0.015). The mean difference in mRS at day 90 was 1.42 (p 0.00001). The effect size of levodopa treatment in acute ischemic stroke is 0.68, 1.415 and 2.944, for assessments of NIHSS at days 30, 90 and mRS at day 90 respectively. There were no adverse effects of levodopa treatment.

**Conclusions:** There is a difference of about 4 points in NIHSS and 1.42 in mRS at day 90, favoring administration of levodopa, which appears to be efficacious and safe in treatment of acute ischemic stroke. Further studies are required to assess efficacy and role of levodopa in stroke rehabilitation and functional improvement.

Trial registration number: N/A

## AS04-023

### MOTOR LEARNING IN ACUTE STROKE

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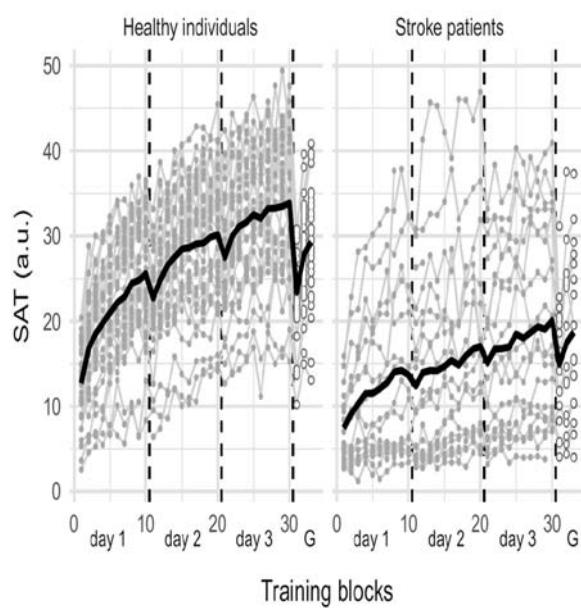
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**Background and Aims:** The acute phase (1–7 days post-stroke) is characterized by an enhancement of neural plasticity which supports rapid motor recovery. However, it is currently unknown whether (sub) acute stroke patients can acquire new motor skills with their paretic upper limb (UL). This issue is critical because motor skill learning is a key component for post-stroke neurorehabilitation. The first aim of this study is to explore whether acute stroke patients can learn a new motor skill with the paretic UL on a neurorehabilitation robot (REAPlan<sup>®</sup>, AXINESIS, Belgium), compared to healthy individuals (HI). The second aim is to explore the impact of the lesion size and localization on motor skill learning in acute stroke patients through Voxel-based Lesion Symptom Mapping (VLSM).

**Methods:** 19 acute stroke patients and 34 HI completed a 3-consecutive-days protocol. Patients were included 1 to 4 days post-stroke. Participants achieved a motor skill learning task (CIRCUIT) involving a speed/accuracy trade-off (SAT), with their paretic UL on the REAplan®. Furthermore, the patients underwent motor control measures and a High-Resolution 3D brain MRI to perform VLSM.

**Results:** Most of the acute stroke patients were able to improve and retain from day to day a new SAT motor skill with their paretic UL. Furthermore, their performance were similar to that observed in HI. The VLSM results will be presented during the conference.

**Fig1 : Evolution of the SAT (a.u.: arbitrary unit) on Day 1, Day 2 and Day 3 and NewCircuit.**



**Conclusions:** Performance of acute stroke patients were similar to that observed in HI suggesting that the patients learned a new motor skill on top of spontaneous recovery.

**Trial registration number:** NCT01519843

## WITHDRAWN

### AS04-043

#### DIFFERENCE OF THREE-DIMENSIONAL GAIT ANALYSIS BETWEEN ELDERLY PATIENTS WITH NORMAL PRESSURE HYDROCEPHALUS AND PATIENTS WITH HEMIPLEGIA AFTER STROKE

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<sup>1</sup>Huadong Hospital Affiliation To Fudan University, Department of Rehabilitation Medicine, Shanghai, China

**Background and Aims:** To study the difference in gait parameters between the elderly patients with normal pressure hydrocephalus and patients with hemiplegia after stroke by 3-dimensional motion analysis system.

**Methods:** 3-dimensional gait data of 9 elderly patients with NPH and 8 patients with hemiplegia after stroke were collected and the difference between the 2 gaits was analyzed.

**Results:** Compared with the stroke patients, the patients with NPH showed smaller stride ( $P < 0.05$ ) and decreased total gait cycle time, support phase, swing phase time ( $P < 0.05$ ), the maximal extension angle of the hip joint, the maximum abduction angle and the sagittal ROM of hip reduced significantly ( $P < 0.05$ ), the knee angles of initial contact reduced significantly ( $P < 0.05$ ), while the maximum abduction angle of knee and the maximum external rotation angle of knee and the frontal ROM of knee increased significantly ( $P < 0.05$ ); in dynamic parameters, the patients with stroke showed greater vertical force peak ( $P < 0.05$ ) and the peak value of the abduction of the knee joint ( $P < 0.05$ ). The peak value of the plantar flexion torques and the peak value of the varus torques were significantly lower than those of the elderly patients with NPH( $P < 0.05$ ).

**Conclusions:** Differences of three-dimensional gait analysis between elderly patients with NPH and patients with hemiplegia after stroke mainly exist in temporal-spatial parameters and kinematic parameters of the hip and knee, while in kinematic parameters, for patients with stroke, the bilateral gait abnormality, abnormality of temporal-spatial parameters and the difference of ankle joint torque may be the cause for imbalances and high occurrence of fall.

**Trial registration number:** ChiCTR1800020017

## Cognition and Vascular Cognitive Impairment

### AS26-022

#### GOOD MODIFIED RANKIN SCALE COULD PREDICT NORMAL COGNITION FUNCTION STATUS AMONG HEMORRHAGE STROKE SURVIVORS: RESULTS FROM CLEAR III AND MISTIE III TRIALS

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**Background and Aims:** We examined whether good functional outcome (modified Rankin Scale (mRS)) assessed at day 30 (D30) could predict normal cognition function (Mini-Mental State Examination (MMSE)) at days 180 (D180) and 365 (D365).

**Methods:** 732 survivors in the MISTIE-III and CLEAR-III trials were analyzed. Patients were followed for one-year, MMSE (normal ≥24) and mRS (good 0–3) at D30, D180 and D365. Multivariate logistic regression (MLR) estimated the relationship between good D30 mRS and normal D180 or D365 MMSE, adjusting for age, ICH location, ICH hemisphere and total blood burden (stability ICH plus IVH).

**Results:** The odds of normal D180 MMSE were >6 times higher for patients with good D30 mRS versus poor D30 mRS (OR [95% CI] = 6.47 [3.86, 10.83]). The odds of normal D365 MMSE were almost 5-times higher for patients with good D30 mRS versus poor D30 mRS (OR [95% CI] = 4.75[2.78, 8.15]). MLR: D30 good mRS (AOR [95% CI] = 4.43[2.46, 7.96], p < 0.001), age (AOR [95% CI] = 0.96[0.94, 0.97], p < 0.001), deep location (AOR [95% CI] = 0.56[0.36, 0.86], p = 0.009), left hemisphere (AOR [95% CI] = 0.19[0.13, 0.27], p < 0.001), and total blood burden (AOR [95% CI] = 0.97[0.96, 0.98], p < 0.001) were significantly associated with normal D180 MMSE. MLR: D30 good mRS (AOR [95% CI] = 3.05[1.65, 5.63], p < 0.001), age (AOR [95% CI] = 0.96 [0.94, 0.98], p < 0.001), deep location (AOR [95% CI] = 0.48[0.36, 0.86], p = 0.001), left hemisphere (AOR [95% CI] = 0.20[0.13, 0.29], p < 0.001), and total blood burden (AOR [95% CI] = 0.98[0.97, 0.99], p < 0.001) were significantly associated with normal D365 MMSE.

**Conclusions:** Good functional outcome (mRS) at D30 is predictive of normal cognition status (MMSE) at D180 and D365 post-stroke.

**Trial registration number:** N/A

### AS26-023

#### GOOD EXTENDED GLASGOW COMA SCALE PREDICTS NORMAL COGNITION FUNCTION STATUS AMONG HEMORRHAGE STROKE SURVIVORS: CLEAR III AND MISTIE III TRIALS RESULTS

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**Background and Aims:** Good functional outcome, measured by extended Glasgow Coma Scale (GOSE) scores assessed at day 30 were examined whether it could predict normal cognition function, measured by Mini-Mental State Examination (MMSE) at day 365.

**Methods:** 732 survivors in the MISTIE III and CLEAR III trials were analyzed. The patients were followed for one-year with MMSE and GOSE collected at day 30 (D30), 180 (D180) and 365 (D365). Good GOSE was defined as 4–8 and normal MMSE > = 24. Multivariate logistic regression (MLR) was used to estimate the relationship between good D30 GOSE and normal D365 MMSE, adjusting for age, any ICH location, ICH hemisphere and total blood burden, measured as stability ICH plus IVH.

**Results:** The odds of normal D365 MMSE were almost 3 times higher for patients with good D30 GOSE as compared those with poor D30 GOSE (OR [95% CI] = 3.65 [2.12, 6.31]). In MLR model, D30 good GOSE (AOR [95% CI] = 2.29 [1.25, 4.21], p = 0.007), age (AOR [95% CI] = 0.96 [0.94, 0.98], p < 0.001), deep location (AOR [95% CI] = 0.43 [0.27, 0.68], p = 0.001), left hemisphere (AOR [95% CI] = 0.21 [0.14, 0.30], p < 0.001), and total blood burden (AOR [95% CI] = 0.98 [0.97, 0.99], p < 0.001) were significantly associated with normal D365 MMSE. Similar results hold for predicting normal D180 MMSE using good D30 GOSE.

**Conclusions:** Good functional outcome at D30 as measured by GOSE is predictive of normal cognition status as measured by MMSE at D180 and D365 post-stroke.

**Trial registration number:** N/A

## WITHDRAWN

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**Background and Aims:** The PRISMS trial did not find evidence that IV alteplase, compared with oral aspirin, reduces functional disability in acute cerebral ischemia (ACI) patients presenting with mild, non-disabling deficits, albeit in an underpowered sample due to early termination of the study. In this analysis we investigated the relationship of cognitive impairment to disability and to alteplase treatment in the PRISMS cohort.

**Methods:** PRISMS enrolled ACI patients with NIHSS 0–5, without clearly-disabling deficits at presentation, and without pre-stroke disability. Patients underwent 90d global disability (mRS) and cognitive tests (Table). We examined the association of cognitive performance with disability (90d mRS 0–1 vs ≥2) and with treatment (alteplase vs aspirin), excluding patients with final diagnosis of ACI mimic.

**Results:** Among 273 patients with final diagnosis of ACI, 79.1% had disability-free outcome. Compared with disabled patients, disability-free patients showed better performance on cognitive tests assessing language, visuospatial reasoning, and verbal memory, but not attention. No association between treatment arm and cognitive outcomes was observed, with the exception of digit span forward which showed a slight difference favoring the aspirin group.

**Conclusions:** Cognitive impairment in language, visuospatial, and memory function appears to be associated with disabled long-term outcome among minor deficit ACI patients. No association between alteplase treatment arm and favorable cognitive result was observed with any test. Further multivariable modeling will be provided at the presentation.

## AS26-038

### COGNITIVE PREDICTORS OF MEMORY IMPAIRMENT AFTER STROKE

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**Background and Aims:** Memory impairments are common after stroke and can have significant functional and prognostic implications, but the underlying mechanisms are not well understood. We hypothesized that recall and recognition memory after stroke will be differentially influenced by impairments in other cognitive domains, including executive functions and processing speed.

**Methods:** We retrospectively analysed the performance of 198 stroke patients on the 5-word memory subtest of the MoCA (MoCA-Mem). Patients recalled the words without prompts ('free-recall') and then with multiple-choice ('recognition'). Using multiple linear regression, we investigated the association between MoCA-Mem performance and performance on 1) the other MoCA subtests, and 2) neuropsychology assessment of executive functions, processing speed and language. We also examined the positive and negative predictive value (PPV and NPV) of the MoCA-Mem for predicting impairment based on neuropsychology assessment of memory.

**Results:** Of the 198 patients, 89% failed on the MoCA-Mem free-recall while 30% failed on recognition. Of the other MoCA subtests, performance on the executive domain was the only significant predictor of free-recall, while none were predictive of recognition. On neuropsychology assessment, executive function and processing speed was predictive of free-recall while language impairment was predictive of recognition. Using performance on neuropsychology assessment as the criteria, MoCA-Mem free-recall had good NPV (90.91%) but very poor PPV (42.68%) while recognition had both moderate NPV (70.83%) and PPV (71.43%).

**Conclusions:** Recall and recognition memory impairment after stroke likely arise from separable cognitive processes. Our findings suggest that recognition memory tests may be more useful when assessing memory impairment after stroke.

Trial registration number: n/a

## AS26-034

### COGNITIVE IMPAIRMENT MAY BE ASSOCIATED WITH FUNCTIONAL DEPENDENCE AFTER MILD STROKE: A PRISMS TRIAL EXPLORATORY ANALYSIS

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Table: Cognitive scores in PRISMS population by mRS category and by alteplase treatment group assignment

Cognitive test	Published normal age-adjusted mean (SD)	90d mRS 0–1 (mean (SD) N=216)	90d mRS ≥2 (mean (SD) N=57)	Unadjusted difference (95% CI)	IV alteplase + aspirin placebo (mean (SD) N=138)	IV alteplase placebo + aspirin (mean (SD) N=135)	Unadjusted difference (95% CI)
Animal Naming (total unique animals named)	17.6 (4.7)	17.4 (4.89)	13.9 (5.94)	<b>3.50 [1.58, 5.42]</b>	16.5 (5.19)	16.8 (5.44)	-0.31 (-1.73, 1.11)
Controlled Word Association (total acceptable words in 1 min)	12.7 (4.3)	10.9 (4.57)	9.2 (4.60)	<b>1.71 [0.18, 3.23]</b>	10.0 (4.57)	11.1 (4.62)	-1.15 (-2.38, 0.08)
Digit Symbol Coding (total correct symbols)	48.2 (7.0)	52.2 (28.3)	43.4 (24.5)	8.86 (-1.50, 19.22)	47.8 (26.9)	53.7 (28.5)	-6.13 (-14.15, 1.89)
Logical Verbal Learning Test (total recall)	21.2 (5.4)	21.4 (5.64)	18.6 (6.40)	<b>2.80 [0.87, 4.73]</b>	20.9 (6.25)	20.8 (5.54)	0.09 (-1.50, 1.67)
Boston Naming (total number correct)	14.1 (1.1)	13.8 (2.37)	12.9 (2.33)	<b>0.91 [0.10, 1.72]</b>	13.9 (2.48)	13.4 (2.27)	0.50 (-0.16, 1.15)
Digit Span Forward (score)	8.4 (2.0)	9.3 (2.87)	8.8 (3.08)	0.48 (-0.53, 1.49)	8.7 (2.72)	9.7 (3.03)	-0.99 (-1.80, 0.18)
Digit Span Backward (score)	5.7 (2.1)	5.6 (2.31)	4.9 (2.63)	0.72 (-0.11, 1.54)	5.2 (2.26)	5.7 (2.50)	-0.53 (-1.20, 0.13)
Benton Line Orientation (total number correct)	23.3 (men) 21.1 (women)	21.9 (8.74)	17.9 (9.19)	<b>3.99 [0.64, 7.33]</b>	20.1 (8.84)	22.1 (9.00)	-1.99 (-4.69, 0.72)

Summaries were based on patients with available assessments.

Trial registration number: N/A

## AS26-037

### ACE- INHIBITION ON REVERSIBILITY OF ALTERATIONS IN ARTERIAL WALL AND COGNITIVE PERFORMANCE ASSOCIATED WITH EARLY HYPERTENSION

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**Background and Aims:** The hypertension is not only a stroke risk factor but impairs the vascular elasticity and cognitive function. However, the reversibility induced by antihypertensive agents of early alterations in vascular and cognitive function is under investigated. In this follow-up study we evaluated the influence of 3-month angiotensin-converting enzyme (ACE) inhibition on the morphological and functional changes of arterial wall and cognitive performance in thirty newly diagnosed primer hypertensive patients.

**Methods:** Common carotid intima-media thickness (IMT) and brachial artery flow mediated dilatation (FMD) were detected by ultrasonography. Arterial stiffness indicated by augmentation index (Alx) and pulse wave velocity (PWV) were assessed by arteriograph. Parameters of cognitive function were determined by neuropsychological examination.

**Results:** Executive function overall score was significantly higher at 3-month follow-up compared to baseline (0.233 (0.447) vs. 0.038 (0.936);  $p = 0.001$ ). 3-month ACE inhibition could not reach a significant level in the improvement of IMT, FMD, Alx and PWV values. Significant negative associations were revealed between IMT and complex attention ( $p = 0.0008$ ,  $r = -0.598$ ), executive function ( $p = 0.0005$ ,  $r = -0.617$ ) and immediate memory ( $p = 0.026$ ,  $r = -0.420$ ) overall scores at follow-up. Alx had significant negative correlations with complex attention ( $p = 0.001$ ,  $r = -0.568$ ), executive function ( $p = 0.046$ ,  $r = -0.374$ ), and immediate memory ( $p = 0.005$ ,  $r = -0.507$ ). PWV related significantly and negatively with complex attention ( $p = 0.007$ ,  $r = -0.490$ ).<sup>1</sup>

**Conclusions:** Early three months CE therapy already improve the cognition. Early ACE inhibition results in the reversal of initial impairments of cognitive function associated with hypertension.

**Trial registration number:** G. Richter research grant and MTA-DE Neurodegenerative and Cerebrovascular Research Group

## AS26-017

### SOCIAL COGNITION IMPAIRMENTS ARE ASSOCIATED WITH BEHAVIOURAL CHANGES IN THE LONG TERM AFTER STROKE

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**Background and Aims:** Behavioural changes after stroke might be explained by social cognition impairments. The aim of this study was to investigate whether performances on social cognition tests (including emotion recognition, Theory-of-Mind (ToM), empathy and behaviour regulation) were associated with behavioural deficits (as measured by proxy ratings) in a group of patients with relatively mild stroke.

**Methods:** Prospective cohort study in which 119 patients underwent neuropsychological assessment with tests for social cognition (emotion recognition, ToM, empathy, and behaviour regulation) 3–4 years post-stroke. Test scores were compared with scores of 50 healthy controls. Behavioural problems were assessed with the Dysexecutive Questionnaire (DEX) self rating and proxy rating scales. Pearson correlations were used to determine the relationship between the social cognition measures and DEX scores.

**Results:** Patients performed significantly worse on emotion recognition, ToM and behaviour regulation tests than controls. Mean DEX-self score did not differ significantly from the mean DEX-proxy score. DEX-proxy ratings correlated with tests for emotion recognition, empathy, and behaviour regulation (lower scores on these items were associated with more problems on the DEX-proxy scale).

**Conclusions:** Social cognition impairments are present in the long-term after stroke, even in minor stroke patients. Most of these impairments were associated with a broad range of behavioural problems as rated by proxies. This strengthens the proposal that social cognition impairments are part of the underlying mechanism of behavioural change. Since tests for social cognition can be administered in an early stage, this would allow for timely identification of patients at risk for behavioural problems in the long-term.

**Trial registration number:** N/A

## AS26-040

### NEUROPSYCHOLOGICAL ASSESSMENT OF COGNITIVE IMPAIRMENT BEFORE AND AFTER SPONTANEOUS INTRACEREBRAL HAEMORRHAGE: A SYSTEMATIC REVIEW

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**Background and Aims:** There is increasing interest in understanding cognitive dysfunction before and after Intracerebral haemorrhage (ICH), given the higher prevalence of dementia reported (ranging from 5% to 44%) for this stroke type. Much of the evidence to date examining cognitive impairment associated with cerebrovascular disease has tended to focus more on ischaemic stroke. The aim of this review was to identify and quantify studies that focused on cognitive dysfunction pre- and post ICH.

**Methods:** A systematic search was conducted using databases PubMed, PsycINFO, CINAHL, Cochrane and SCOPUS to identify studies that exclusively assessed cognitive function pre- and post ICH. Studies were included in the review if used a measure of global cognition and/or a neuropsychological battery to assess cognitive function. Nineteen studies were deemed relevant for inclusion, where  $n = 8$  studies examined cognitive impairment pre-ICH and  $n = 11$  studies post ICH.

**Results:** There was wide variation across all studies regarding cohort sizes, ICH location ratio, neuropsychological and/or cognitive assessment in terms of measures or tools used, heterogeneous timing of assessment post the ICH index and type of study design. Prevalence of cognitive impairment pre-ICH ranged between 9%-29% and post ICH between 37%-88%. Predictive factors identified for pre- and post ICH were previous stroke, ICH volume and location, and markers of cerebral amyloid angiopathy (CAA). The most common cognitive domains affected post ICH were information processing speed, executive function, memory, language and visuo-spatial abilities.

**Conclusions:** Cognitive impairment and dementia affected almost one-third of patients examined, whether assessing cognitive functioning either pre- or post ICH.

**Trial registration number:** N/A

## AS26-041

### ASSOCIATIONS BETWEEN PHYSICAL ACTIVITY, SEDENTARY BEHAVIOUR AND COGNITIVE FUNCTION FOLLOWING SELF-REPORTED STROKE: A CROSS-SECTIONAL ANALYSIS OF UK BIOBANK (N = 8776)

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**Background and Aims:** Evidence suggests that cognitive function is positively associated with physical activity and negatively with sedentary behaviour. We aimed to investigate these associations in a sample of stroke survivors, who are at a higher risk of both limited physical activity and cognitive decline.

**Methods:** Data from UK Biobank participants with self-reported stroke ( $N = 8776$ ). In a series of regression models, we assessed cross-sectional associations of self-reported physical activity time in minutes (walking; moderate; vigorous) and sedentary behaviour time in hours (computer use; driving; watching TV) with performance on cognitive tasks: reaction time, verbal-numerical reasoning, visual memory and prospective (future) memory. We controlled for demographics, health-, lifestyle-, and stroke-related factors. We adjusted significance thresholds using the False Discovery Rate method.

**Results:** After including all potential confounders, we found better performance on reaction time (standardised beta = -0.07, 95% CI:-0.10 to -0.04), verbal-numerical reasoning (standardised beta = 0.08, 95% CI:0.04 to 0.12) and prospective memory tasks (OR = 1.25, 95% CI:1.06 to 1.48) with computer use. Driving and watching TV were associated with worse scores on the verbal-numerical reasoning task (standardised beta = -0.06, 95% CI:-0.10 to -0.01; standardised beta = -0.08, 95% CI:-0.11 to -0.04; respectively). No associations with measures of physical activity remained significant after adjusting for all covariates.

**Conclusions:** We found very weak task-specific associations with measures of sedentary behaviour. Our results suggest the relationships between sedentary behaviour, physical activity and cognition are complex. Associations between physical activity and cognition may be mediated through health improvements, while the relationship between sedentary behaviours and cognition may depend on how cognitively demanding the behaviour is.

**Trial registration number:** N/A

## WITHDRAWN

### AS26-043

## REAL WORLD FEASIBILITY OF BRIEF COGNITIVE SCREENS ON A HYPER-ACUTE STROKE UNIT: AN EXPLORATION OF 'UNTESTABLE' PATIENTS

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**Background and Aims:** Early cognitive screening is recommended by stroke clinical guidelines worldwide. Previous studies have demonstrated issues with full completion of screening tests, especially in the hyperacute period. Feasibility research relying on informed consent for data usage may not truly reflect reality. Our aim was to examine feasibility of five brief cognitive screens and explore reasons for 'untestability' in a real-world sample.

**Methods:** Routine clinical data was collected for consecutive admissions to the hyper-acute stroke unit of the Glasgow Royal Infirmary during 4 waves of recruitment between May 2016-August 2018. The cognitive assessment (including questions to score AMT-4, GP-cog, mini-cog, 2 shortened forms of the Montreal Cognitive Assessment (MoCA)) was attempted during the first week of admission. Patients were classified as partially untestable (where at least one item was incomplete) and fully untestable (where assessment was not attempted and/or no questions answered).

**Results:** Of 704 patients consecutively assessed (mean age:69.1), 120 (17%) were classed as fully untestable on all brief screens, 44(6%) classed as partially untestable (Table 1 for reasons). In the fully untestable group 37% had total anterior circulation syndrome, versus 5% in the partially untestable group. Clock-draw (a feature of GP-cog, mini-cog, short-form MoCA's) was the most problematic item in the partially untestable group and not completed by 41/44(93%). AMT-4 had the highest completion rate in the full sample (571/704,81%).

TABLE 1. Reasons for Fully/Partially Untestable

Total 164/704	Neurological deterioration/ Medically unwell	Aphasia	English limited	Declined	Acute confusion/ distressed/ delirium	Limb weakness	Deaf/blind or visual problem due to stroke	Dementia	No reason recorded
Fully untestable (n=120)	61	20	3	3	10	N/A	1	5	17
Partially untestable (n=44)	2	13	1	7	5	9	3	N/A	4

**Conclusions:** Our research confirms that many patients are untestable even with the shortest cognitive screens. Where possible researchers should make full use of incomplete participant data rather than applying a complete-case analysis approach.

**Trial registration number:** N/A

**AS26-036**

**ASSOCIATIONS BETWEEN MILD COGNITIVE IMPAIRMENT AND VASCULAR BRAIN LESIONS IN PATIENTS WITH ATRIAL FIBRILLATION. PRELIMINARY DATA FROM THE STRAT-AF STUDY**

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**STRAT-AF Study**

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**Background and Aims:** Atrial fibrillation (AF) and cognitive decline are associated, despite stroke. Cerebral small vessel disease (SVD) may be involved in such association. Our aims were to: 1) describe the prevalence of mild cognitive impairment (MCI) and of vascular brain lesions (SVD and non-SVD) in a cohort of elderly patients with AF; 2) assess the association between brain lesions and cognitive impairment.

**Methods:** STRAT-AF Study is an ongoing observational study evaluating the role of biological markers for cerebral bleeding risk stratification in patients with AF on oral anticoagulants. MCI was diagnosed according to the comprehensive neuropsychological battery (abnormal test >/= 1). On brain MR, visual rating was used to assess the presence of non-lacunar infarcts and signs of SVD.

**Results:** Among the 127 enrolled patients (mean age  $77.5 \pm 6.5$ ; F:34%), white matter hyperintensities were detected in nearly all the patients (93%), lacunar infarcts in 29%, CMB in 32%, cSS in 6%, PVS (>20) in 52%, severe atrophy in 62% of patients. Non-lacunar infarcts were present in 24 patients (19%). MCI was diagnosed in 59 patients (46.5%). On univariate regression analyses, the only brain lesions associated with MCI were CMBs [OR(95%CI) = 3.9(1.3-11.7) and non-lacunar infarcts[OR (95%CI) = 3.5(1.3-9.2)]. In multivariate regression analysis, adjusting for age, sex and education, both types of lesions retained an independent effect [OR(95%CI) = 4.1(1.3-12.7) for CMB and OR(95%CI) = 3.0(1.1-8.2) for non-lacunar infarcts].

**Conclusions:** In our cohort of elderly patients with AF on oral anti-coagulants, MCI is frequent. Non-lacunar infarcts and CMBs are the only vascular lesions that retain an independent association with MCI.

Trial registration number: N/A

**AS26-044**

**ASSOCIATION BETWEEN FATIGUE AND COGNITIVE FUNCTIONS AT 6 MONTHS IN ISCHEMIC STROKE PATIENTS TREATED WITH ACUTE REVASCULARISATION THERAPY**

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**Background and Aims:** Fatigue is among the most prevalent symptoms after stroke, and it is now recognized as an important issue in patients with improved functional recovery thanks to better acute management. Because of limited knowledge on this topic, we aimed to determine the associations between fatigue and cognitive functions at 6 months in ischemic stroke patients.

**Methods:** Forty six patients with first-ever ischemic stroke treated with acute revascularisation therapy were included in the stroke unit of Dijon, France. At 6 months, we performed clinical examination, evaluation of post-stroke fatigue with the Fatigue Severity Scale (FSS), assessment of anxiety/depression using the HAD scale, and a comprehensive neuropsychological evaluation. Patients with significant fatigue (FFS score >4) were compared to patients without fatigue.

**Results:** In our cohort, 35% patients reported significant post-stroke fatigue at 6 months. Patients with fatigue had a greater prevalence of depression, and higher mRs scores. Concerning neuropsychological evaluation, only deficit on divided attention was more frequent in the fatigue group (75% versus 32%, p = 0.032), even in a subgroup of non-depressed patients.

**Conclusions:** Our study suggests that a deficit on divided attention is more frequent in patients with post-stroke fatigue. Further studies are needed to evaluate whether cognitive rehabilitation strategies may have an impact on fatigue.

Trial registration number: N/A

**AS26-013**

**PREVALENCE AND SUB-CLASSIFICATION OF COGNITIVE IMPAIRMENTS POST-STROKE AND PREDICTORS FOR FAVORABLE COGNITIVE OUTCOME. A SEVEN YEAR FOLLOW-UP STUDY**

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**Background and Aims:** Knowledge of the burden and development of post-stroke cognitive impairments in the years after the first event are limited. We aimed to assess the prevalence and sub-classification of mild cognitive impairment (MCI) and dementia seven years after first ever stroke or transient ischemic attack (TIA) and identify predictors for favorable cognitive outcome.

**Methods:** During 2007 and 2008, 227 patients with first-ever stroke or TIA without preexisting cognitive impairment (CI), were included. After seven years, survivors were invited to a follow-up. Transitions of cognitive status from one to seven years were recorded with diagnoses of MCI or dementia and etiologic sub-classification based on clinical cognitive profile, MRI findings and biomarkers at both time points. Favorable outcome was defined as normal cognitive function or MCI with exclusion of those who had progression from normal to MCI.

**Results:** After seven years, 109 patients completed follow-up of whom 40 (37%) were diagnosed with MCI and 24 (22%) with dementia. Of the 64 patients diagnosed with CI, nine were sub-classified with degenerative cognitive disease, 13 with vascular disease and 42 had mixed cognitive disease. In all, 65 patients had favorable outcome. In the multivariable logistic regression analysis, lower age and absence of medial temporal

lobe atrophy on MRI at 12 months were independently associated with favorable outcome, adjusted odds ratio (95% confidence interval) 0.94 (0.90-0.98) and 0.55 (0.35-0.98), respectively.

**Conclusions:** 60% of stroke survivors have a favorable cognitive outcome. Lower age and absence of markers of neurodegenerative pathology on MRI were associated with favorable outcome.

**Trial registration number:** NCT00506818

## WITHDRAWN

### AS26-003

#### EXTRA AND TRANSCRANIAL COLOR-CODED SONOGRAPHY DATA IN PATIENTS WITH LEFT INTERNAL CAROTID ARTERY, AND/OR LEFT MIDDLE CEREBRAL ARTERY STENOSIS OR OCCLUSION AND VASCULAR APHASIAS

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**Background and Aims:** Large artery disease (LAD) is presumed in aphasics with ischemic stroke and significant stenosis (>50%) or occlusion of the ipsilateral ICA/MCA. However, only scarce data exist on the distribution of the steno-occlusive diseases in aphasics.

The aim of our study was to investigate the role of Transcranial Color Coded Sonography (TCCS) in determination of abnormalities affecting intracranial, and/or extracranial arteries in aphasics with acute ischemic stroke.

**Methods:** A total of 200 patients with a first acute ischemic stroke (LAD) and aphasia were selected between January 2012 and October 2018. Their language function was evaluated by means of the Romanian modified version of the Western Aphasia Battery. They received MRI, MR-A, TTE, extracranial color Doppler sonography (ECDS) and TCCS examinations in the first 12 hours of stroke onset. There were no brain DWI/MRI findings of an earlier stroke.

**Results:** The main aphasic syndrome at admission was Broca's aphasia (62%). In 140 cases (70%) the lesions were located at classical language centers. Sonographic results were: 85 patients (42.5%) with no changes in the intracranial hemodynamics, and 115 cases (57.5%) with the following changes: a) 41 patients (20.5%) with MCA, siphon or terminal ICA (CI) stenosis/ occlusions; b) 74 patients (37%) with hypo perfusion of the left MCA; 39 of them had a severe stenosis/or occlusion of the extracranial ipsilateral ICA, with collateral circulation.

**Conclusions:** TCSS was a reliable method for the evaluation of the intracranial ICA and MCA stenosis/occlusion and helped identify the intracranial hemodynamic impairment in the extracranial ICA diseases causing post-stroke aphasia.

**Trial registration number:** N/A

### AS26-012

#### PREDICTORS OF INITIAL APHASIA SEVERITY AFTER FIRST EVER ACUTE STROKE: AN OBSERVATIONAL STUDY FROM KOLKATA, INDIA

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**Background and Aims:** Contemporary studies have highlighted initial severity of aphasia as an important determinant of aphasia recovery. Objective of our study was to explore the predictors of initial aphasia severity after stroke.

**Methods:** Bengali version of western aphasia battery (WAB), a validated scale, was used for language assessment. All patients underwent language examination during first week following stroke. Severity was assessed by calculating aphasia quotient (AQ) and taking into account the severity scale as in WAB. Lesion assessment was done by using Magnetic resonance imaging (3T) for ischemic stroke (if not contraindicated) and computed tomography for hemorrhagic stroke. Demographic factors (age, gender and

number of years of formal education), lesion-related factors (type of stroke, lesion volume, cortical versus sub-cortical location and site of lesion) and initial aphasia type were independent variables while initial severity of aphasia (non-severe, AQ = 50 or more; severe, AQ < 50) was dependant variable. Appropriate statistical tests were performed for data analysis.

**Results:** Among 515 screened cases of first-ever acute stroke, 208 presented aphasia. On univariate analysis the following factors were associated with higher initial severity- hemorrhagic stroke ( $p = 0.000$ ); larger volume of lesion ( $p = 0.000$ ); cortico-subcortical mixed lesion ( $p = 0.000$ ) and non-fluent type of aphasia ( $p = 0.000$ ). In binary logistic regression most robust predictors of higher severity were- higher volume of lesion ( $p = 0.000$ , OR = 1.651); hemorrhagic stroke ( $p = 0.004$ , OR = 11.987) and non-fluent aphasia ( $p = 0.012$ , OR = 4.796). The overall predictive value of the regression model was found 90.4%.

**Conclusions:** The most important determinants of initial severity of post-stroke aphasia in our sample were lesion-related factors and non-fluent type of aphasia.

**Trial registration number:** N/A

## AS26-021

### SEVERE AORTIC STENOSIS IS NOT ASSOCIATED WITH IMPAIRED CEREBRAL BLOOD FLOW AFFECTING NEUROCOGNITION

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**Background and Aims:** We wanted to determine whether severe aortic stenosis (AS) is associated with altered cerebral hemodynamics and neurocognitive impairment. AS causes the left ventricle to exert higher systolic pressure to overcome resistance from the valve, leading to heart failure, and decline in cardiac output and ejection fraction. There has been no direct measurement of cerebral blood flow (CBF) nor the impact of CBF on neurocognition in AS.

**Methods:** Data came from 31 patients with AS with planned valve replacement. We used transcranial Doppler to assess bilateral mean flow velocity (MFV) and vasomotor reactivity (VMR) in the middle cerebral artery, defining abnormal MFV as <30mmHg and abnormal VMR as <2% based on previous data. Our neurocognitive battery assessed memory, language, attention, visual-spatial skills and executive function. Impairment was <1.5 SD's below normative mean.

**Results:** The mean age was 79 years, 64%M, and the mean gradient was 44.24mmHg across the valve. The average MFV was 42.63mmHg (SD = 10.87), the average VMR was 2.82% (SD = 3.79), and the mean cognitive composite score was -0.30 (SD = 0.86) below the normative mean (average). Of the 5 with abnormal MFV, the mean cognitive score was 0.02 SDs above the mean, and of the 15 with abnormal VMR, the mean cognitive score was -0.30 SDs below the normative mean, reflecting average (normal) cognitive function.

**Conclusions:** There was loss of cerebrovascular reserve with AS, increasing stroke risk, but less impact than previously assumed on mean flow velocity in the cerebral circulation and little effect of cerebral blood flow on neurocognition in these patients.

**Trial registration number:** N/A

## AS26-015

### THE NEUROAD II (MLC901) IN VASCULAR COGNITIVE IMPAIRMENT STUDY (NEURITES): PRELIMINARY RESULTS

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**Background and Aims:** NEURITES is a 24-week, multi-center, double-blind, randomized, placebo-controlled phase II study of NeuroAiD II in patients with vascular cognitive impairment not demented (CIND). The primary objective was to evaluate the comparative change from baseline with MLC901 and placebo on executive function in VCIND patients as measured by Verbal Fluency (VF) and Color Trails Test (CTT) I & 2.

**Methods:** Male and female subjects were eligible if they fulfilled the following inclusion criteria: age 55–85 years, Modified Rankin Score  $\leq 3$  (mRS), diagnosis of CIND due to cerebrovascular disease, cognitive impairment documented by neuropsychological evaluation within 12 months of index stroke/Transient Ischemic attack, not demented by DSM-IV criteria. MLC901 or matching placebo was administered for 24 weeks along with standard post-stroke care.

**Results:** NEURITES randomized 103 subjects: placebo ( $n = 46$ ) and MLC901 ( $n = 57$ ) with a mean age of  $68.3 \pm 8.4$  years; 38.8% of whom were female. At week 12, statistical significance was observed with CTT-2 (change of score from baseline of  $-1.8 \pm 22.3$  Vs  $-12.7 \pm 32.3$ ,  $P = 0.05$ ) between Placebo and MLC901 but this was not significant at Week 24. There was no significant difference in VF or the CTT-I. The number of patients experiencing Serious Adverse Events (SAE) were 6(13%) compared to 13(22.8%, 1 possibly related),  $P = 0.30$ , in Placebo and MLC901 respectively.

**Conclusions:** MLC901 demonstrated safety and early improvement in cognitive outcomes as compared to placebo. A larger trial will be required to further confirm these findings.

**Trial registration number:** Clinicaltrials.gov-NCT01847924

## AS26-020

### CLINICAL AND RADIOLOGICAL CHARACTERIZATION OF DEPRESSION AND APATHY FINDINGS AFTER STROKE

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**Background and Aims:** Acute ischemic stroke (AIS) treatment is evolving and as lethality decreases the proportion of survivors with cognitive sequels is increasing. Studies show a high prevalence of poststroke neuropsychiatric disorders (NPD), with negative impact on quality of life, greater risk of institutionalization and death. Post-stroke apathy (PSA) and depression (PSD), as hallmarks of poststroke NPD are frequently underdiagnosed. We aim to evaluate the frequency of PSA and PSD, their clinical features and neuroimaging findings, as well as the occurrence of associated cognitive impairment.

**Methods:** cross-sectional study gathering post stroke adult patients, from a tertiary neurovascular outpatient cohort. All patients underwent

standardized clinical evaluation, based on predefined protocol, including MEEM, MINI, mRS, NIHSS, Apathy scale. MRI markers of small vessels and cortical atrophy were analysed.

**Results:** Seventy-one patients were included, 15(21.1%) showed signs of apathy and 28(39.4%) depression. The PSA and PSD median NIHSS was 2. There was no difference between groups in relation to mRS, score of the NIHSS, etiological classification, occurrence of dementia and Small Vessel Disease (SVD) loan score. Individuals with Mild Cognitive Impairment (MCI) presented depression in 75% of cases, which was the most frequent NPD in these individuals ( $p = 0.02$ ).

**Conclusions:** Poststroke PSA and PSD have high prevalence and are independent of the type of stroke and degree of motor or functional impairment. There was a correlation between the MCI and diagnosis of depression, which points out the importance of depressive episode scrutiny in patients with poststroke cognitive loss.

**Trial registration number:** N/A

## AS26-019

### DOES SEASON AFFECT TELEPHONE COGNITIVE SCREENING PERFORMANCE IN OLDER SUBJECTS?

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**Background and Aims:** Cognitive screening tools, such as the MoCA and TICS-M, are commonly used in patients with TIA and stroke, both in research studies and in clinical practice. However, short-term changes could be influenced by seasonal variation in performance, with impaired performance in Winter/Spring (Jan-June) months reported on more detailed cognitive testing. We determined whether time of year affects the results of more limited telephone cognitive testing in older individuals at risk of stroke.

**Methods:** Older subjects ( $\geq 70$  years) with hypertension enrolled in an ongoing trial of blood pressure lowering completed serial telephone cognitive assessments (T-MoCA; TICS-M) six months apart. The difference between baseline and six month scores was compared for baseline assessments in Winter/Spring (Jan-June) versus Summer/Autumn (July-Dec) after adjustment for age, sex and level of education

**Results:** Among 711 (78.0%) participants who had baseline and 6 month assessments in different seasons, a lower baseline cognitive score was associated with male gender, low education and increasing age (T-MOCA – all  $p < 0.001$ , TICS-M – all  $p < 0.001$ ). On repeat testing after 6 months subjects tested at baseline in Winter/Spring showed improvement on testing in Summer/Autumn (mean difference in score: T-MOCA +0.95; TICS-M +0.70), whereas no significant improvement was seen in those first tested in Summer/Autumn (T-MOCA +0.56; TICS-M +0.13): difference in change (T-MoCA –  $p = 0.007$ ; TICS-M –  $p = 0.037$ ).

**Conclusions:** Season does appear to affect the results of telephone cognitive screening in older subjects. Trials and other studies involving repeat testing should ensure that this potential bias is considered in design and analysis.

**Trial registration number:** N/A

## AS26-031

### PROJECTING THE INCIDENCE OF POST-STROKE COGNITIVE IMPAIRMENT AND DEMENTIA IN THE IRISH POPULATION AGED 40+ YEARS FROM 2015–2025

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**Background and Aims:** Post-stroke cognitive impairment (PSCI) is a common consequence of stroke, leading to reduced quality of life and increased care needs. The aim was to apply estimates of PSCI incidence to the Irish population and project the number with PSCI in the population in 2025.

**Methods:** We developed a Markov model to estimate future incidence of PSCI in the population aged 40–89 years living in Ireland up to 2025. Population data, estimates and projections to 2025 were obtained from the Central Statistics Office. Age and sex specific stroke incidence was estimated using 2015 hospital discharge data ( $n = 6,155$ ). Transition probabilities across five health states defined by cognitive impairment, physical disability, dementia and death were estimated using data from stroke survivors in the English Longitudinal Study on Ageing ( $n = 279$ ). An annual stroke recurrence risk of 3% was assumed.

**Results:** The Irish population aged 40–89 years in 2015–2025 ( $n = 2.8m$ ), are projected to have a cumulative incidence of stroke of approximately 2.5% by 2025 ( $n = 71.4k$ ). Of these, approximately 21.4% are estimated to have died due to stroke ( $n = 15.2k$ ), and 24.8% to have died of another cause ( $n = 17.7k$ ). Of the survivors ( $n = 38.4k$ ), approximately 47.7% are predicted to have cognitive impairment without dementia ( $n = 18.3k$ ), and 15.1% to have dementia ( $n = 5.8k$ ).

**Conclusions:** In 2025, almost two thirds of Irish people who have survived a stroke in the preceding 10 years will have cognitive impairment. The model will be developed further to include a probabilistic sensitivity analysis and an economic evaluation of alternative strategies for stroke management, including cognitive rehabilitation.

**Trial registration number:** N/A

## AS26-030

### ASSOCIATIONS BETWEEN HOMOCYSTEINE, FOLATE, VITAMIN B12, AND COGNITIVE DOMAINS IN A CONVALESCENT POST STROKE POPULATION

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**Background and Aims:**

**Background:** Population based studies have shown that levels of homocysteine (Hcy), folate or vitamin B12 affect cognition. The studies that examine Hcy in post-stroke groups have produced conflicting results. Therefore, we aim to determine if levels of homocysteine, folate and vitamin B12 have an association with cognition in convalescent Singaporean stroke patients.

**Methods:** 708 consenting patients (33% female, 81% Chinese, 10% Malay and 9% Indian) with both baseline fasting blood and neuropsychological

evaluation at a mean of 5.2 months post-stroke were included. Plasma levels of Hcy and serum levels of B12 and folate were measured. Independent associations (standardized  $\beta$ ) were determined in multiple linear regression models that simultaneously controlled for potential confounders.

**Results:** Patients in the higher quartiles of Hcy measurement were significantly more likely to be male, older, less educated, have hypertension, have previous history of vascular events, and have lower levels of vitamin B-12 and folate. Hcy was significantly inversely correlated with folate ( $r = -0.246$ ,  $p < 0.001$ ), and with vitamin B-12 ( $r = -0.248$ ,  $p < 0.001$ ). Vitamin B-12 was significantly correlated with folate levels ( $r = 0.138$ ,  $p < 0.001$ ). High levels of Hcy affected general cognition and attention while high levels of vitamin B-12 and folate were protective for short-term memory, executive functioning and visuospatial performance. These associations were independent of confounding factors, in particular interactions between Hcy, folate and vitamin B-12 as well as interactions between demographic information, risk factors and Hcy, folate and vitamin B-12.

**Conclusions:** Homocysteine, vitamin B12 and folate affect different sub-domains of cognition in convalescent post-stroke patients.

**Trial registration number:** N/A

## AS26-009

### NONFOCAL TRANSIENT NEUROLOGICAL ATTACKS ARE RELATED TO COGNITIVE IMPAIRMENT IN PATIENTS WITH HEART FAILURE

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**Background and Aims:** Nonfocal transient neurological attacks (TNAs) are associated with an increased risk of future dementia. However, whether nonfocal TNAs are also associated with concurrent cognitive impairment has not been investigated. Patients with heart failure are at risk of cerebral hypoperfusion, which probably plays a role in the etiology of nonfocal TNAs. We studied the relation between nonfocal TNAs and cognitive functioning in these patients.

**Methods:** We performed neuropsychological testing in all patients with heart failure enrolled in the Heart Brain Connection study. We assessed global cognition, attention-psychomotor speed, executive functioning, memory and language. Patients were interviewed with a standardized questionnaire about the occurrence of the following nonfocal TNAs in the preceding six months: unsteadiness, bilateral weakness, blurred vision, unconsciousness, paresthesias, nonrotatory dizziness, amnesia and confusion. We studied associations between nonfocal TNAs and cognitive functioning with linear and logistic regression analyses, adjusted for sex, age and education.

**Results:** Thirty-seven (23%) of 158 patients (mean age 70 years, 67% men) experienced  $\geq 1$  nonfocal TNAs. Impairment in  $\geq 1$  cognitive domains was more frequent in patients with than without nonfocal TNAs (41% vs. 18%; adjusted odds ratio 4.6, 95%-confidence interval 1.8-11.8). Patients with nonfocal TNAs performed significantly worse than patients without nonfocal TNAs on global cognition, attention-psychomotor speed, memory and language. These relations were independent of NYHA classification, left ventricular ejection fraction and cardiac

output. Excluding patients with brain infarction on MRI, or previous stroke or TIA did not change the results.

**Conclusions:** Nonfocal TNAs are associated with cognitive impairment in patients with heart failure.

**Trial registration number:** N/A

## AS26-039

### ENLARGING THE TRANSIENT GLOBAL AMNESIA SPECTRUM: VASCULAR AND OTHER ATYPICAL TRIGGERS AND MANIFESTATIONS

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**Background and Aims:** Transient global amnesia (TGA) represents a benign syndrome usually easily distinguishable from stroke. It is often accompanied by an isolated hippocampus punctate lesion on diffusion-weighted imaging (HPDL). We report 13 unusual “TGA” cases associated with unusual triggers (such as acute strokes) or clinical aspects (such as focal neurological signs, or absence of amnestic manifestations).

**Methods:** Over 12-years, our comprehensive stroke center prospectively collected patients with clinically and/or radiologically defined TGA with A) acute vascular lesions, B) other neurological triggers, and C) unusual neurological manifestations. They were analysed and grouped to redefine an enlarged “TGA spectrum”.

**Results:** We identified in group A) 5 patients with typical TGA (4 with HPDL) and radiological evidence of recent ischemic or haemorrhagic brain lesions (acute convexity subarachnoid hemorrhage, lenticular hemorrhage, 3 ischemic MCA strokes), B) 4 patients with typical TGA (3 with HPDL) plus other transient neurological signs (aphasia, behavioural problems, minor lateralizing sensory-motor deficits), and C) 4 patients with HPDL but without clinical amnesia (but acute aphasia, minor lateralizing sensory-motor deficit, focal seizures with loss of awareness from anti-CASPR-2 encephalitis, and convulsive peri-coital syncope).

**Conclusions:** TGA can be triggered by acute vascular and other neurological events. Furthermore, TGA may present with additional focal neurological signs, or as HPDL with a non-amnestic syndrome. Therefore, TGA may better be considered as a “TGA spectrum”, with clinical and/or radiological manifestations being the common expression of acute stress to the brain.

**Trial registration number:** N/A

## WITHDRAWN

impairment, cerebrovascular risk factors, previous strokes, neurological conditions, and neuroimaging patterns as well as behavioral and psychological aspects.

**Methods:** The study has adopted experimental clinical research the subject is stroke patients from 20 to 70 year old. And there are 35 stroke patients and 35 matched control group (Healthy group). While hospitalized, all the patients underwent a daily clinical examination comprising the Canadian Neurological Scale (CNS) (Coté, et.al), brain CT and/or MRI, and examinations capable of detecting etiopathogenetic causes of stroke. After a 3- 6 month period after stroke onset, all the patients completed NIMHANS Neuropsychological Battery by Shobini L. Rao, et. al. For the Behavioral assessment: Daily activities (Barthel), Dispositional Optimism (Scheier, M. F. et.al), Depression (Beck et.al, 1988) and Resilience (Wagnild and Young).

**Results:** The results found that the stroke patients performed worse than the controls. Cognitive impairment was more closely associated with reduced performance of daily activities than with motor deficits. In the psychological aspects stroke patients have scored very less in optimism and resilience and found high in depression.

**Conclusions:** This study concluded that the stroke patients had differences based on their case history, cognition, cerebrovascular conditions, previous strokes, neurological conditions, and neuroimaging patterns as well as behavioral and psychological aspects.

**Trial registration number:** N/A

## AS26-024

### PEAK WIDTH OF SKELETONIZED MEAN DIFFUSIVITY: A NOVEL BIOMARKER OF CEREBRAL AMYLOID ANGIOPATHY

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**Background and Aims:** Cerebral amyloid angiopathy (CAA) is increasingly recognized as a major cause of vascular cognitive impairment. We investigated whether Peak width of skeletonized mean diffusivity (PSMD), a novel marker of small vessel disease (SVD), is associated with CAA-related cognitive impairment and other imaging markers of CAA.

**Methods:** We analyzed cognitive function, PSMD and conventional MRI markers of SVD in 25 patients with probable CAA and mild cognitive impairment (CAA-MCI), and 63 patients with MCI not attributed to CAA (non CAA-MCI). We compared PSMD between subjects with CAA-MCI and non CAA-MCI, and explored its associations with cognitive function and conventional markers of SVD.

**Results:** PSMD was increased in patients with CAA-MCI ( $8.6 \pm 3.3 \times 10^{-4} \text{ mm}^2/\text{s}$ ) compared to participants with non CAA-MCI ( $7.0 \pm 2.8 \times 10^{-4} \text{ mm}^2/\text{s}$ ;  $p = 0.046$ ). Higher PSMD was correlated with age ( $r = 0.47$ ;  $p = 0.008$ ), total brain volume ( $r = -0.49$ ;  $p = 0.006$ ) and cerebral microbleeds count ( $r = 0.45$ ;  $p = 0.012$ ) in patients with CAA-MCI, but not in patients with non CAA-MCI. Among patients with CAA-MCI, increased PSMD was independently associated with worse performances in attention ( $B = -0.11$  [95% confidence interval  $-0.23 - 0.00$ ];  $p = 0.04$ ), but not in executive function, processing speed or memory, after adjusting for other MRI markers of SVD.

**Conclusions:** Our findings suggest that PSMD could be a marker of CAA and may reflect burden of CAA-related SVD. Longitudinal studies

should explore whether PSMD is associated with cognitive decline in CAA.

**Trial registration number:** N/A

## AS26-016

### COGNITIVE FUNCTIONS ONE YEAR AFTER CAROTID ENDARTERECTOMY – A PROSPECTIVE STUDY

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**Background and Aims:** The effect of carotid endarterectomy (CEA) on cognitive functions is debatable. Study aims to assess changes in cognitive functions after CEA.

**Methods:** Self-sufficient patients with carotid stenosis  $>70\%$  indicated to CEA were included to the study. Physical, neurological and cognitive functions examinations including Addenbrooke's Cognitive Examination-Revised (ACE-R), Mini-Mental State Examination (MMSE), Clock Drawing Test (CDT), Speech Fluency Test (SFT) were performed prior to CEA, 24h, 30 days and 1 year after CEA. Brain magnetic resonance (MR) was performed prior to and 24h after CEA. Changes in cognitive tests 24h, 30 days, 1 year after CEA, influence of age, gender, side and degree of carotid stenosis, vascular risk factors, stroke or transient ischemic attack (TIA) prior to CEA, vascular complications (TIA, stroke, new brain infarction on control MR) on changes in cognitive functions were statistically evaluated.

**Results:** Totally 645 patients (448 males, mean age  $69.0 \pm 7.7$  years, 281 symptomatic stenoses) were included during 34 months. Stroke/TIA occurred in 32 (5%) patients within 30 days after CEA. New brain infarction on control MR was detected in 33 (14%) out of 235 patients. Improvement in cognitive tests after 30 days/1 year were 3.8/2.73 points in ACE-R, 0.8/0.6 points in MMSE, 0.2/0.2 points in CDT and 0.3/0.5 points in SFT ( $p < 0.05$  in all cases). Cognitive improvement was not dependent on age, gender, symptomatic stenosis, vascular risk factors, neither vascular complications after CEA.

**Conclusions:** CEA leads to improvement in cognitive functions 30 days and 1 year after surgery. Supported by MHCR grant 17-31016A.

**Trial registration number:** N/A

## AS26-001

### TOWARDS A DEFINITION OF VASCULAR COGNITIVE IMPAIRMENT IN THE INDIAN POPULATION- COMMUNITY BASED STUDY OF CORRELATION OF COGNITIVE SCORES AND MRI FEATURES IN MAHARASHTRA, INDIA

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**Background:** The definition of VCI in India is confounded by lack of normative data on cognition, vascular risk factors and imaging data on volumes and vascular changes.

**Aims:** To correlate cognitive scores (obtained using a validated Marathi version of Kolkata Cognitive Battery- KCB), in selected Maharashtra rural and urban communities, with MRI brain variables.

**Methods:** We studied 250 individuals without pre-existing neuropsychiatric conditions aged  $\geq 40$  years. Cognition was operationally classified as High (KCB > 100), Moderate (81–100), Low (< 81). MRI data included Fazeka's scale for white matter hyperintensities on Flair and T2 images, and Pasquier scale for global cortical atrophy (GCA) in multiple regions. SPSS was used for analysis.

**Results:** Our study group included 78 (31.2%) rural and 172 (68.8%) urban residents (114 women), average age 52 years. 183/250 (73.2%) had five years or less schooling. 91 (80%) women were housewives and 87 (64%) men were semiskilled laborers. There was an upward trend in grade 3 GCA with increasing age (40–49: Gr0 53.5% Gr3 0%, 50–59: Gr0 43.6% Gr3 0%, 60–69: Gr0 38.5% Gr3 2.6%, 70+: Gr0 15.8% Gr3 5.3%). Similar trends (though not as marked) were observed with periventricular and deep white matter hyperintensities. KCB scores were < 81 in 130/250 (52%), with frequency of low scores trending upward with increasing age. Multiple linear regression showed GCA to be a significant predictor of low cognition scores ( $B = -4.82$ , 95CI -9.45 to -0.18,  $p < 0.05$ ) after adjusting for age, sex, education and comorbidities.

**Conclusions:** The baseline data obtained of KCB scores and MRI variables can guide VCI definition in Indian population.

**Trial registration number:** NA

## AS26-002

### EVALUATION OF COGNITIVE FUNCTIONS IN AN AGE-STRATIFIED MANNER IN A 'NORMAL' INDIAN POPULATION AND CORRELATION WITH MRI VOLUMETRY- TOWARDS A DEFINITION OF VASCULAR COGNITIVE IMPAIRMENT

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**Background and Aims:** 'Normative' Indian data on age-stratified cognitive scores in correlation with vascular risk factors and MRI data, is needed for defining Vascular cognitive impairment (VCI).

To establish normative community data for age-stratified cognitive scores (over 40 years), in correlation with vascular risk factors and MRI findings of atrophy, lacunes, microbleeds, and volumetry including White matter hyperintensities volume (WMHV).

**Methods:** 2561 subjects were studied, after excluding persons with previous strokes or dementia, using validated Marathi translations of Kolkata cognitive battery (KCB) and Geriatric depression scores (GDS). Those with GDS < 9 were stratified for age and cognitive scores (1961 persons), and 10% from each subgroup were randomly selected for MRI brain (3 D Flair sag, T2 Axial, SWI axial, Diffusion axial, T13D, volumetry).

**Results:** The KCB scores showed significant decline with age ( $p < .001$ ), with rising depression scores ( $p < .001$ ), and lower years of education ( $p < .01$ ).

MRI correlations: Delayed word recognition task and total hippocampal volumes showed a minor but statistically significant positive correlation. (Spearman's coefficient 0.153.  $P < 0.05$ ). Visuoconstructional ability and WMHV showed no correlation.

Age and periventricular WMHV overall, and in each gender, showed significant positive correlation ((Spearman's rho = 467,  $p < .001$ )).

KCB score and WMHV showed a small, but significant negative correlation (Spearman's rho = 467,  $p < .001$ ).

KCB scores showed no correlation with total and white plus grey matter brain volumes.

**Conclusions:** This baseline data, and particularly the correlation of KCB scores with WMHV and age, could guide definition of VCI in India.

**Trial registration number:** NA

## AS26-010

### EFFECT OF HYPERTENSION AND DIABETES MELLITUS ON WHITE MATTER CHANGES IN MRI BRAIN: COMPARATIVE STUDY BETWEEN PATIENTS WITH ALZHEIMER'S DISEASE AND AN AGE-MATCHED CONTROL GROUP

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**Background and Aims:** White matter hyperintensities (WMH) on MRI brain in periventricular and deep white matter regions are commonly seen in cognitively normal older persons and in AD patients.

**Aims:** To compare presence and severity of WMHs in AD patients and cognitively normal control group, and evaluate effect of Hypertension and Diabetes on WMHs.

**Methods:** Thirty four patients with AD, and age and gender matched control group of 24 persons with MMSE over 27/30, were studied. Vascular risk factors, MMSE and MRI brain were assessed in all. Fazeka's and Pasquier grading of WMH and atrophy were done. Periventricular WMHs (PVWMH) and Deep WMH (DWMH) were assessed separately.

**Results:** Overall, Periventricular WMHs of grade 2 and over were seen in 19/34 patients, and in 7/24 controls ( $P$  value 0.044). Significantly higher grades of PVWMHs were seen in hypertensives vs non-hypertensives in the case group ( $P$  0.027), and in women compared to men. In control group, hypertension had no effect on severity of PVWMHs. Among both Diabetics and non-diabetics, no difference in PVWMHs was found between case and control groups. DWMHs were, conversely, seen only in control group. Overall, over 25% of cognitively normal older persons had WM hyperintensities of grade 2 and over ; 55% of AD patients had PVWMH of Gd 2 or over, and no DWMHs

**Conclusions:** This study showed that over a quarter of cognitively normal, older Indian persons had WM hyperintensities of grade 2 and over on MRI brain. WMHs had no specific association with AD.

**Trial registration number:** N/A

## AS26-032

### TRANSCRANIAL DOPPLER ULTRASOUND IN VASCULAR COGNITIVE IMPAIRMENT- NO DEMENTIA

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**Background and Aims:**

**Background:** although cerebral white matter lesions (WMLs) are considered as a risk factor for vascular dementia, data on their impact on cerebral hemodynamic are scarce. We test and compare Transcranial Doppler (TCD) features in WMLs patients with or without associated cognitive impairment.

**Methods:** a sample of non-demented elderly patients with WMLs were consecutively recruited. Mean blood flow velocity (MBFV), pulsatility index (PI), peak systolic blood flow velocity (PSV), end-diastolic blood flow velocity (EDV), and resistivity index (RI) were recorded from the middle cerebral artery bilaterally. Global cognitive functioning, frontal lobe abilities, functional status, mood evaluation and WMLs severity were also assessed.

**Results:** 161 patients satisfying the clinical criteria for vascular cognitive impairment-no dementia (VCI-ND) were age-matched with 97 controls with WMLs but without any cognitive deficit. Compared to controls, VCI-ND patients exhibited a decrease of MBFV and EDV, as well as an increase of PI, RI, and PSV. Moreover, a significant correlation between all TCD parameters and severity of executive dysfunction was observed, whereas PI, RI, and EDV significantly correlated with WMLs load and MBFV was independently associated to depressive symptoms.

**Conclusions:** VCI-ND showed a hemodynamic pattern of cerebral hypoperfusion and enhanced vascular resistances. These changes may be considered as the TCD correlate of VCI-ND due to microcirculation pathology. TCD provided useful indexes of occurrence and severity of small-vessel disease and executive dysfunction in elderly patients at risk for future dementia.

**Trial registration number:** N/A

## AS26-005

### RELATIONSHIP BETWEEN WHITE MATTER MICROSTRUCTURE CHANGES AND EXECUTIVE FUNCTION IN PATIENTS WITH WHITE MATTER HYPERINTENSITIES: A DIFFUSION TENSOR IMAGING STUDY

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**Background and Aims:** Using diffusion tensor imaging (DTI) to explore the microstructural changes of white matter in patients with white matter hyperintensities (WMHs), analyzed the correlation between these changes with cognitive impairments especially executive function.

**Methods:** Collected cases by imaging and divided them into two groups: WMH and normal. then used Montreal Cognitive Assessment and Clinical Dementia Rating scales divided them into four groups: Normal Control (NC), WMH-cognitive normal (WMH-CN), WMH-Vascular Cognitive Impairment of None Dementia (WMH-VCIND) and WMH-Vascular Dementia (WMH-VAD). Then tested them with executive function scales and performed the fluid attenuated inversion recovery sequence MRI and DTI. In the end, discussed the microstructural changes of white matter of WMHs and the correlation between these changes with executive impairment.

**Results:** The executive function of WMHs cases was significantly lower than that of the NC group; the fractional anisotropy (FA) value statistically decreased at bilateral posterior portion of the internal capsule crystalline part, the left side of the posterior limb of internal capsule and the overall left lateralization, while mean diffusivity (MD) value statistically increased at bilateral inferior frontal occipital tract, inferior longitudinal fasciculus and other regions. Finally, the FA and/or MD values of the ROIs of the corpus callosum, the superior longitudinal fasciculus, the inferior frontal occipital fasciculus, the cingulate and the external capsule were significantly correlated with the executive function.

**Conclusions:** The microstructural of white matter in cases with WMHs were changed, and the more severe the executive function, the more serious the destruction of white matter microstructure.

**Trial registration number:** N/A

## AS26-007

### ABNORMAL INTRINSIC FUNCTIONAL CONNECTIVITY IN WHITE MATTER LESIONS: A TRIPLE NETWORK MODEL STUDY

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**Background and Aims:** White matter lesions (WMLs) is considered to induce abnormal intrinsic functional connectivity (FC). In the study, we used the triple network model to investigate the change of FC in WMLs with different cognitive state patients.

**Methods:** 83 subjects were divided into four groups based on their clinical diagnosis: WMLs -normal cognitive group, WMLs with MCI group, WMLs with VD group and control group. All subjects were assessed using Mini Mental State Exam (MMSE) and Clinical Dementia Rating (CDR) to determine their cognitive state. Resting-state functional MRI (rs-fMRI) data were acquired with a SIMENS 3T MRI scanner. The triple network model include default-mode network (DMN), salience networks (SN) and central executive network (CEN), these networks and FC were processed with Independent Components Analysis (ICA) and ROI based analysis using REST toolbox.

**Results:** The FC between SN and DMN was negatively correlated; the significant difference areas were in bilateral prefrontal cortex, ventromedial prefrontal cortex among the four groups. The FC between SN and CEN was positively correlated; the significant difference areas were in bilateral dorsolateral prefrontal cortex, bilateral ventrolateral prefrontal cortex, bilateral supplementary motor areas (SMA), bilateral inferior parietal lobule. The FC intranetwork in SN was positively correlated; the significant difference areas were in anterior cingulated cortex and right frontoinsular cortex.

**Conclusions:** The results show that the network (DMN) inversely related to SN characterizes the damage mechanism of cognitive impairment of WMLs, while the network positively related to SN (including CEN and SN internal) characterizes the compensation mechanism.

**Trial registration number:** N/A

## WITHDRAWN

**Results:** We found serum TFF3 were significantly decreased in PSCIND group than NCI and HC groups. Interestingly, patients in PSCIND group with lowest quartile of TFF3 levels ( $< 15.62 \text{ mmol/L}$ ) had a significantly reduction in the left fronto-temporo-insular cortex, right temporo-insular cortex and right caudate nucleus volume and a prominent lower MMSE and MoCA scores. In addition, in PSCIND group, we found a positive relationship between serum TFF3 levels and the GMV of the left fronto-temporo-insular cortex, right temporo-insular cortex and right caudate nucleus, as well as the severity of cognitive impairment.

**Conclusions:** Our present study suggested that low serum TFF3 levels may be involved in the neuroanatomical correlates of post-stroke patients with cognitive dysfunction and could be served as a potential peripheral predictor for cognitive dysfunction in post-stroke patients.

**Trial registration number:** N/A

## Diagnosis – Investigation of Stroke Etiology

### AS15-021

#### NORWEGIAN MICROEMBOLI IN ACUTE STROKE STUDY (NOR-MASS), METHODS

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**Background and Aims:** The cause of ischemic stroke remains unknown in 25–40% of cases despite extensive diagnostic investigation. Most of these cryptogenic strokes are thought to be embolic even in the absence of a definite embolic source. Circulating microemboli (CME) are clinically silent, but indicate active embolization and are associated with increased risk of recurrent stroke and worse clinical outcome. Transcranial Doppler monitoring (TCDM) is the only available method for detecting CME in vivo. New equipment enables prolonged monitoring with less patient discomfort. We aim to assess the usefulness of prolonged, ambulatory TCDM in acute stroke diagnostics.

**Methods:** NOR-MASS is a prospective observational study of unselected patients with acute stroke or TIA. Patients  $> 18$  years of age with symptom onset  $< 24$  hours before admission are eligible, and all stroke subtypes, severities and vascular distributions are accepted. Bilateral, stationary TCDM is performed for one hour, followed by unilateral Doppler Holter monitoring for 2 hours. Unilateral monitoring is repeated 18–36 hours and 48–72 hours after symptom onset. All patients go through diagnostic stroke work-up according to Standard Operating Procedures. Endpoints are prevalence and frequency of CME in the acute phase of stroke, MRI DWI lesions, persistence of CME over time and recurrence of stroke/TIA at 3 months and 1 year.

**Results:** 14 patients are included by January 21st 2019.

**Conclusions:** This study may reduce the frequency of cryptogenic stroke and improve individualized treatment.

**Trial registration number:** NCT03543319

### AS15-057

#### CODE STROKE: DISTINGUISHING STROKE-MIMICS FROM CEREBROVASCULAR DISEASE USING THE NIHSS SCALE

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**Background and Aims:** Stroke-mimics (SM) are usually difficult to diagnose in emergency setting (up to 20% of potential strokes). Thus, some SM are misdiagnosed and treated with intravenous thrombolysis. Our aim was to evaluate TM-score (TeleStroke mimic score) and clinical features of NIHSS to improve discrimination of SM from cerebrovascular disease (CVD).

**Methods:** We included 165 patients (82 SM, 83 haemorrhagic/ischaemic CVD, paired by initial NIHSS-score from a sample of 453 code-strokes) attended in a tertiary referral hospital. Data was recorded prospectively from May/2014 to February/2017. TM-score and NIHSS items were evaluated and logistic regression was made to find the best predictors of SM.

**Results:** CVD were older and had higher rates of vascular risk factors. Mean NIHSS in SM was 4.3. Thrombolysis was administered in 20.5% of CVD vs 6% SM. Forty-two percent of SM had  $< 15$  points in TM-score, while 78% of CVD had  $> 15$ . ROC curve of TM-score was 0.66 (0.58–0.75,  $p < 0.001$ ). Between NIHSS items, disturbance in level of consciousness (LOC) and LOC questions were significantly associated to SM (OR 6.39 [1.1–36.7], OR 5.63 [2.0–15.3]). Contrarily, visual loss and facial palsy were negatively associated to SM (OR 0.31 [0.1–0.94], OR 0.28 [0.1–0.6]). With this NIHSS model, ROC curve was 0.73 (0.66–0.81,  $p < 0.001$ ). Motor symptoms and aphasia did not improve discrimination of SM.

**Conclusions:** TM-score helps to identify stroke mimics, but clinical findings in NIHSS items such as decrease of LOC despite low NIHSS and the absence of visual loss can also be used in SM diagnosis, improving selection for acute stroke treatment.

**Trial registration number:** N/A

### AS15-032

#### CORNEAL CONFOCAL MICROSCOPY: A SURROGATE IMAGING BIOMARKER FOR WHITE MATTER HYPERINTENSITIES IN PATIENTS WITH ISCHEMIC STROKE

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**Background and Aims:** The presence of white matter hyperintensities (WMH) on MRI imaging confers an increased risk of stroke, dementia and death. Corneal confocal microscopy (CCM) can detect nerve injury non-invasively and may be a useful surrogate marker for WMH. We aim to determine whether corneal nerve pathology identified using CCM is associated with the presence of WMH in patients with acute ischemic stroke.

**Methods:**

**Design:** Prospective cohort study in individuals with acute ischemic stroke.

**Setting and Participants:** 196 patients with acute ischemic stroke underwent neurological examination, MRI brain imaging and CCM.

**Main outcomes and measures:** Participants underwent blinded quantification of WMH and corneal nerve fiber density (CNFD), corneal nerve branch density (CNBD) and corneal nerve fibre length (CNFL).

**Results:** The prevalence of hypertension [ $p = 0.013$ ] was significantly higher and CNFD [ $p = 0.031$ ] was significantly lower in patients with WMH compared to those without WMH. CNFD and CNFL were significantly lower in patients with DM without WMH [ $p = 0.008$ ,  $p = 0.019$ ] and in patients with DM and WMH [ $p = 0.042$ ,  $p = 0.024$ ] compared to patients without DM or WMH, respectively. In a multivariate model a

one-unit decrease in the CNFD increased the risk of WMH by 5%, after adjusting for age, DM, gender, dyslipidemia, metabolic syndrome, smoking and HbA1c. DM was associated with a decrease in all CCM parameters, but was not a significant independent predictor of WMH.

**Conclusions:** CCM demonstrates corneal nerve pathology, which is associated with the presence of WMH in participants with acute ischemic stroke. CCM may act as a surrogate-imaging biomarker for WMH.

**Trial registration number:** N/A

## AS15-071

### INTERNAL CAROTID ARTERY INTIMA MEDIA THICKENING AND OCCLUSION IN ANTIPHOSPHOLIPID SYNDROME

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**Background:** Antiphospholipid syndrome (APLS) is associated with increased intima media thickness and premature atherosclerosis of the carotid arteries.

**Aims:** To share an atypical presentation of stroke.

**Methods:** Case report

**Results:** A 46-year-old man with a past medical history of hypertension presented to the emergency department with severe anhedonia, apathy and confusion. His initial head CT scan was normal. Metabolic and infectious work up, including CSF analysis, were unremarkable. A brain MRI showed acute infarction in bilateral globus pallidus, left caudate, bilateral centrum semiovale and left frontal lobe cortex. A CT angiogram of the head and neck revealed complete occlusion of the right internal carotid artery (ICA) and severe stenosis of the left ICA, just distal to the bulb bilaterally. It also showed increased thickening of the left bulb wall. Hypercoagulable work up was significant for laboratory evidence of APLS. Despite intensive medical treatment, the patient deteriorated quickly with massive anterior circulation territory stroke and transtentorial herniation.

**Conclusions:** Bilateral globus pallidus lesions can mimic frontal lobe syndrome causing severe apathy and anhedonia, previously described as pure psychic akinesia. The basal ganglia is a highly metabolically active area, making it very susceptible to hypoxemia. APLS is associated with premature atherosclerosis and intima media thickening of the carotid arteries which can reduce blood flow and increase the risk of stroke. Medical management of APLS involves anticoagulation as well as controlling the other risk factors for stroke.

**Trial registration number:** N/A

## WITHDRAWN

## AS15-070

### THE SMASH-U CLASSIFICATION SYSTEM IN A BRAZILIAN SERIES OF HEMORRHAGIC STROKE

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**Background and Aims:** Hemorrhagic stroke (HS) comprises between 10 and 20% of all cerebrovascular events. HS etiologic classification has an important role upon prognosis and management. The goal of our investigation was to provide new data about HS etiology in a Brazilian series of patients evaluated in a tertiary academic hospital using the SMASH-U classification system.

**Methods:** Our study took place in a Brazilian academic stroke center. We evaluated patients with HS followed in our outpatient clinic from January/2015 to April/2018 using the SMASH-U scale (SS). This acronym SMASH-U stands for S for structural lesions, M for medications related, A for amyloid angiopathy, S for systemic diseases, H for hypertension and U for undetermined. The modified Rankin scale (mRS) was used to evaluate clinical outcomes according to HS etiology and was dichotomized into 0–2 (functional independence) and 3–6 (functional dependence or death).

**Results:** We evaluated medical records of 70 patients classified as HS. A total of 18 (25%) patients had structural lesions, 4 (5%) had medications related HS, 6 (8%) amyloid angiopathy, 2 (2.7%) systemic diseases, 26 (22%) hypertensive HS and 14 (19.4%) an undetermined etiology. Patients with structural lesions had a higher frequency of functional independence when compared to the other groups.

**Table 1 – SMASH-U Outcome**

SMASH-U	MRS		P Value
	0 - 2	3 - 6	
Structural lesions	15	3	0,050
Medications related	2	2	0,539
Amyloid angiopathy	3	3	0,445
Systemic diseases	1	1	0,668
Hypertension	16	10	0,712
Undetermined	8	6	0,532

Table 1: Clinical outcomes according to SMASH-U etiology for hemorrhagic stroke. mRS: modified rankin scale.

**Conclusions:** Our study was the first in Brazil to evaluate HS etiologic classification using a standardized classification system (SMASH-U). Although with several limitations, including survival bias and a small number of patients, we concluded that etiologic classification seems to influence prognosis and its importance should not be underestimated in patients with HS.

**Trial registration number:** N/A

## AS15-061

### RELATIONSHIP BETWEEN THE DIMENSION OF PATENT FORAMEN OVALE (PFO) AND ACUTE CEREBRAL ISCHEMIC LESION VOLUME IN YOUNG PATIENTS WITH CRYPTOGENIC ISCHEMIC STROKE

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**Background and Aims:** Due to the high incidence of PFO in cryptogenic strokes (50%), defining a stroke as PFO-related is a challenge. Literature suggests that large shunts confer higher risk, and that large cerebral ischemic lesions are thought to be atypical.

We aimed to study the relation between PFO size and acute cerebral ischemic lesion volume in young patients with cryptogenic stroke.

**Methods:** In 20 patients aged < 55 years with cryptogenic stroke and PFO we studied:

- length of PFO and maximum separation between septum primum and secundum through transesophageal images (Horos software).

- Cerebral lesion volume using MRI-FLAIR sequences (multi vendor Olea Sphere 3.0 software) excluding patients submitted to revascularization that could affect final lesion size.

Pearson correlation used to evaluate the association between single dimensions of PFO and lesion volume. Multiple logistic regression performed using PFO dimensions as predictive variable and lesion volume as dependent variable.

Figure 2: PFO dimension, echocardiographic image

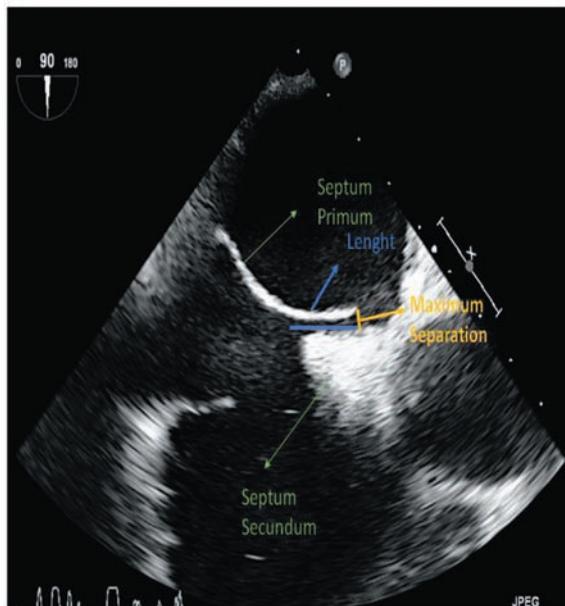
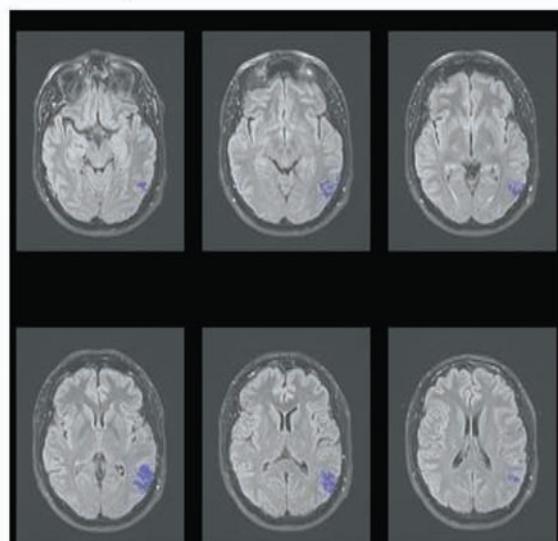


Figure 1: cerebral ischemic lesion volume measurement (multi vendor Olea Sphere 3.0 software)



Categories	Series	volume (cc)
Recent lesion	FLAIR	6.06

**Results:** We found a direct significant correlation between lesion volume and maximum PFO separation ( $p = 0.047$ ), and a trend towards inverse correlation with PFO length ( $p = 0.603$ ). Multiple logistic regression showed that lesion volume is directly dependent on maximum separation (coeff. 2,536,  $p = 0.006$ ) and inversely on length of PFO (coeff.-0.837;  $p = 0.057$ ).

**Conclusions:** The direct correlation between maximum separation and lesion volume suggests that PFO-related pathogenesis is possible also for small PFO and large lesions. The trend towards inverse correlation between PFO length and lesion volume suggests a 'filter-like' action of longer tunnel on larger emboli. If confirmed, these correlations may be included in a score to define pathogenic role of PFO.

**Trial registration number:** N/A

**Conclusions:** Bilateral stroke disease was associated with AF detection on ICM in patients with cryptogenic stroke or ESUS. Larger size cohorts may need to be examined to validate our findings.

**Trial registration number:** N/A

## WITHDRAWN

## WITHDRAWN

## AS15-068

### CLINICAL VARIABLES RELATED TO DIFFUSION-WEIGHTED MAGNETIC RESONANCE IMAGING FINDINGS IN ISCHAEMIC STROKE AND TRANSIENT ISCHAEMIC ACCIDENT

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**Background and Aims:** Brain diffusion-weighted (DWI) magnetic resonance imaging (MRI) is the most sensitive radiological test for early detection of ischaemic stroke. Occasionally, patients with a clinical diagnosis of stroke show no radiological abnormalities. False negatives at DWI in stroke arise within a few hours of onset. Brainstem and cerebellar lesions and lacunar strokes are relevant causes of negative DWI, even reaching 50% according to reported series. The aim of our study is to know whether there are clinical variables related to normal or abnormal DWI.

**Methods:** A cross-sectional study was performed on patients who were admitted to our Stroke Unit between November 2017 and October 2018 with a clinical diagnosis of ischaemic stroke (IS) or transient ischaemic attack (TIA). Sociodemographic, clinical, blood test, CT scan and MRI variables were analysed.

**Results:** A sample of 306 patients (mean age:  $72.6 \pm 13.1$  years old) was analysed. DWI was negative on 120 patients (39.2%). Positive correlation was found between a greater probability of abnormal DWI and the presence of atrial fibrillation, vascular occlusion at CT angiography, motor and cranial nerves impairment, dysarthria, and NIHSS score  $\geq 4$  after 24 hours. Duration of symptoms under 1 hour was significantly related to normal DWI. No differences were found regarding sociodemographic data, hypertension and other clinical variables.

**Conclusions:** There are significantly related variables to DWI findings in patients with IS and TIA, defining a subgroup of patients in which a normal DWI might be anticipated.

**Trial registration number:** N/A

## AS15-018

### THE IMPACT OF CANCER ON ACUTE STROKE- PROGNOSIS AND DIAGNOSTIC CLUES

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**Background and Aims:** Cancer and Stroke are not uncommonly seen concomitantly on stroke units. We aimed to characterise the stroke inpatient population for incidence of cancer, and explore an opportunity to screen for occult cancer.

**Methods:** Data on all patients admitted to a university hospital with confirmed stroke were retrospectively analysed (24-month period); creating a cohort of patients with diagnosis of any cancer (CS). An unmatched comparison group was collected of cancer-free stroke patients (NCS). Vascular risk factors, imaging and blood results were recorded. Active cancer was defined as a new or recurrent diagnosis within one year of stroke diagnosis.

**Results:** Of 1,365 stroke admissions, 8% (108) had concomitant cancer, 16.7% newly diagnosed. 56.5% (61/108) of CS patients died within 2 years of stroke, with 29.6% (32/108) dying during stroke admission – compared to 13.0% of NCS patients (14/108,  $p = 0.003$ ). CS patients were more likely to be discharged to a care home (29.9%, 32/107) versus NCS (9.6%, 10/104,  $p < 0.001$ ).

CS patients demonstrated multi-territory infarction on brain imaging in 22.7% (20/88); more commonly than NCS at 9.4% (9/96):  $p = 0.01$ .

Admission blood results were abnormal in CS, Table I: \*Median (25–75%IQR)

	CS N = 68	NCS N = 48	p-value
White Cell Count $10^9/L$	10.5 (7.7–14.6)*	7.9 (6.7–10.6)*	0.006
C-reactive protein mg/L	32 (16–90)*	5 (0–36)*	0.0003
Haemoglobin g/L	119 (107.5–135)*	128 (118–144)*	0.06

**Conclusions:** Stroke with cancer is associated with higher rates of disability and mortality, and occult cancer should be ruled out in the setting of multi-territory infarction or elevated C-reactive protein.

**Trial registration number:** N/A

## AS15-077

### CRYPTOGENIC STROKE AND ASYMPTOMATIC ATRIAL FIBRILLATION: ROLE OF INSERTABLE CARDIAC MONITORS IN A REAL WORLD POPULATION

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**Background and Aims:** The incidence of atrial fibrillation (AF) in cryptogenic stroke (CS) patients has been studied in carefully controlled clinical trials, but real-world data are limited. We investigated the incidence of AF in clinical practice among a cohort of 60 patients with an insertable cardiac monitor (ICM) placed for AF detection following CS.

**Methods:** Patients admitted to our Stroke Unit with CS were included in the study; they received an ICM and were monitored for up to 2 years for the purpose of AF detection. All detected AF episodes ( $\geq 30$  sec) were considered.

**Results:** From March 2016 to January 2019, 60 patients (mean age  $67 \pm 12$  years, 67% male) received an ICM to detect AF after a CS. No patients were lost to follow-up. AF was detected in 18 patients (30%, AF group mean age  $70 \pm 11$  years, 67% male) after a mean time of 8 months ranging from 30 days to 14 months after CS. In these patients anticoagulant treatment was prescribed and nobody had a further stroke.

**Conclusions:** AF episodes were detected via continuous monitoring with ICMs in almost 1 of every 3 CS patients (30%). AF after CS was asymptomatic and paroxysmal and thus unlikely to be detected by strategies based on intermittent short-term recordings. ICMs should therefore be part of daily practice in the evaluation of CS patients.

**Trial registration number:** N/A

## AS15-059

### SEX AND AGE DIFFERENCES IN TRADITIONAL AND NON-TRADITIONAL ACUTE STROKE SYMPTOMS – A PROSPECTIVE CROSS-SECTIONAL STUDY

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**Background and Aims:** Patients with acute stroke not only present with traditional, but also non-traditional symptoms which may be overlooked in the acute situation. Sex and age may, just as in myocardial infarcts impact the presentation of acute stroke symptoms. We aimed to explore differences in patient reported traditional and non-traditional symptoms according to sex and age.

**Methods:** In a single-center prospective cross-sectional study, we identified patient reported traditional (BEFAST) and non-traditional symptoms in acute stroke. We analysed odds of each symptom according to sex and age by multivariable logistic regression adjusted for age (included as a continuous variable), sex, stroke severity, stroke localisation, and comorbidities.

**Results:** In total, 231 patients with acute stroke (mean age 71 years [SD 11], 46% women) were included. There was no significant difference between women and men in any of the traditional and non-traditional symptoms. With each year increase in age, visual disturbances (traditional symptom) (OR 0.96, 95% CI [0.94;0.99]), headache (OR 0.96, 95% CI [0.93;0.99]), and sensibility disorders (non-traditional symptoms) (OR 0.94, 95% CI [0.92;0.98]) were less reported.

**Conclusions:** In patients with acute stroke, there was no difference between women and men in the presentation of traditional and non-traditional symptoms. With increasing age, visual disturbances, a traditional symptom, and headache and sensibility disorders, non-traditional symptoms, were less frequently reported which may be taken into account when evaluating stroke symptoms in younger patients.

**Trial registration number:** N/A

## AS15-026

### GIANT CELL ARTERITIS AMONG PATIENTS WITH VERTEBROBASILAR STROKE: WHEN TO SUSPECT?

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<sup>2</sup>University Hospital of Alexandria, Department of Neurology, Alexandria, Egypt; <sup>3</sup>Kantonsspital St. Gallen, Neurology, St. Gallen, Switzerland

**Background and Aims:** Stroke may occur in patients with giant cell arteritis (GCA), whereby the vertebrobasilar (VB) territory is affected in nearly 75% of these cases. Because the underlying etiology is not identified in one-fourth of strokepatients and GCA is rarely thought about as a causative etiology for VB-stroke, we conducted a pilot study to screen for a concomitant GCA among these patients.

**Methods:** In 65 consecutive patients with VB-stroke, we screened for elevated erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), hemoglobin level as well as for the presence of halo sign of the temporal and vertebral artery using ultrasound.

**Results:** In the present cohort, two patients (3.1%) suffered from GCA. They were older in age (median 85 versus 69 years, p = 0.02), had significantly increased ESR and CRP-levels as well as lower serum hemoglobin levels in comparison to patients without GCA (median 75 versus 11 mm in the first hour, p = 0.001; 0.25 versus 3.84 mg/dl, p = 0.01, 10.4 versus 14.6 mg/dl, p = 0.003, respectively). The two GCA-patients had multiple vascular stenoses and/or occlusions in the VB-territory compared to only five patients (7.9%) without GCA (p = 0.01).

**Conclusions:** Among patients with VB-stroke, screening for GCA might help to detect the underlying stroke etiology, especially when other causes were excluded. Older age, anemia and multiple vascular stenoses/occlusions in the VB-territory might be red flags raising suspicion for a concomitant GCA in patients with VB-stroke but otherwise undetermined etiology. Larger studies are needed to confirm these findings.

**Trial registration number:** N/A

## AS15-035

### PREDICTORS OF SUBOPTIMAL GLYCEMIC CONTROL BEFORE ISCHEMIC STROKE: A PROSPECTIVE MULTICENTER TRIAL

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**Background and Aims:** Diabetes mellitus is a major modifiable risk factor for ischemic stroke. Impaired glycemic control at the time of admission is known to be associated with unfavorable outcome. In this study, we assessed factors that were related to disturbed blood glucose regulation prior to stroke among patients admitted with ischemic stroke.

**Methods:** We conducted a prospective and observational study in three tertiary academic centers. In 787 patients with acute ischemic stroke, clinical and demographic data, and admission blood glucose and HbA1c levels were collected. Multivariate analyses were performed to determine clinical features related elevated HbA1c levels ( $\geq 7\%$ ) at the time of admission.

**Results:** Among 787 patients, 36% had prior and 7.6% had newly diagnosed diabetes mellitus. The median (IQR) admission blood glucose was 113 (98–136) mg/dl in non-diabetics and 170 (128–245) mg/dl in diabetics. In 65% of diabetics, HbA1c levels were higher than 7%. Factors that were independently related to uncontrolled diabetes included younger age (p = 0.004), lower education level (p = 0.016), and absence of atrial fibrillation (p = 0.018).

**Conclusions:** Our results revealed that almost 1 of every 10 patients with ischemic stroke have newly diagnosed diabetes. On the other hand, blood glucose control is mostly sub-optimal in diabetic patients at the time of stroke onset. Strategies to increase patient awareness among diabetic patients, especially in high risk-populations such as young and those with lower education levels, might have positive implications in controlling complications related to diabetes mellitus, including stroke.

**Trial registration number:** N/A

## WITHDRAWN

**AS15-056****NEUTROPHIL RATIO IS ASSOCIATED WITH CRYPTOGENIC STROKE IN PATIENTS WITH ACUTE ISCHEMIC STROKE AND ACTIVE CANCER****M.Y. Eun<sup>1</sup> and J. Hwang<sup>1</sup>**<sup>1</sup>School of Medicine, Kyungpook National University Chilgok Hospital, Neurology, Daegu, Republic of Korea

**Background and Aims:** Cryptogenic stroke is relatively common in patients with active cancer. We aimed to evaluate the association between neutrophil ratio and cryptogenic stroke in patients with acute ischemic stroke and active cancer.

**Methods:** A retrospective study was conducted at Kyungbook National University Chilgok Hospital, which is a university hospital with comprehensive stroke and cancer centers. We included patients with acute ischemic stroke and active cancer between January 2016 and September 2018. Cryptogenic stroke was defined as a cerebral infarction not attributed to a definite source of cardioembolism, large-vessel atherosclerosis, or small-vessel disease according to The Trial of Org 10172 in Acute Stroke Treatment. We assessed the association of neutrophil ratio with cryptogenic stroke.

**Results:** Among 51 enrolled patients, cryptogenic stroke developed in 22 patients. In univariate analyses revealed that neutrophil ratio (OR 1.05; 95% CI 1.01-1.10) and systemic metastasis (OR 4.82; 95% CI 1.39-16.66) were associated with increased risk of cryptogenic stroke. Neutrophil ratio independently predicted cryptogenic stroke after adjustment of age, sex, and systemic metastasis.

**Conclusions:** This study demonstrated that high level of neutrophil ratio was associated with cryptogenic stroke in patients with acute ischemic stroke and active cancer. Further large prospective studies are warranted.

**Trial registration number:** N/A**AS15-065****EVALUATION OF INCIDENCE OF PAROXYSMAL ATRIAL FIBRILLATION (VA.LIN.FA STUDY) IN SUBJECTS WITH RECENT CRYPTOGENIC ISCHEMIC STROKE**

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**Background and Aims:** cryptogenic ischemic strokes (IS) are thought to comprise about 25% of all IS. There is evidence that most cryptogenic strokes are thromboembolic and paroxysmal AF may play a role in most of them. NUUBO WEARABLE (NW) is a not implantable device that allows prolonged, not invasive ECG monitoring. Its efficacy in finding paroxysmal AF after IS is not fully known. Aim of our study is to evaluate the incidence of paroxysmal AF in a consecutive sample of subjects with cryptogenic IS, by means of NW.

**Methods:** the study involved patients with embolic strokes of undetermined source, defined as not- lacunar IS without evidence of stenosis >50% in the artery supplying the ischemic territory nor of cardiac sources of embolism. All patients underwent 30-days ECG monitoring by NW, starting within 15 days after stroke onset.

**Results:** from June until December 2018 we included 15 patients. The device was usually well tolerated (only one patient stopped the monitoring before time). Mean CHA2DS2-VASc score was: 3 (+ 1 s.d.). ECG tracing usually allowed a correct interpretation (in two

patient it was not clear enough to be analyzed). The mean analyzable time of registration was 339 hours. We found two brief period of AF (15 seconds each) in one patient out of 12 (8%).

**Conclusions:** NW is a useful and reliable tool for not invasive, prolonged ECG monitoring in patients with recent IS. Its efficacy in finding paroxysmal AF will be evaluated along the continuation of the study.

**Trial registration number:** N/A**AS15-016****CARDIOMYOPATHIES AS CAUSE OF ISCHEMIC STROKE: A CARDIAC MAGNETIC RESONANCE IMAGING STUDY**

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<sup>3</sup>Hospital Beatriz Angelo, Neurology, Loures, Portugal

**Background and Aims:** Cardiomyopathies may be a cause of ischemic stroke in adults currently classified as having strokes of undetermined etiology. Cardiac Magnetic Resonance Imaging (CMR) has diagnostic utility in the assessment of cardiomyopathies that may not be detected by echocardiography.

We aimed to determine if CMR could be useful to identify previous undiagnosed cardiomyopathies in a cohort of patients with ischemic stroke and to determine the type and frequency of these cardiomyopathies.

**Methods:** We prospectively included a consecutive sample of ischemic stroke patients with standard etiological evaluation. Patients with structural changes on echocardiography considered as causal for stroke in TOAST classification were excluded. A 3-Tesla CMR was performed. We compared the frequency of the found cardiomyopathies with reference values for the general population.

**Results:** One hundred and thirty two patients were included with a mean age of 68.4 years. In 7 patients, CMR identified a cardiomyopathy-frequency of 5.3% 95%CI (2.59-10.54%). Four patients had a hypertrophic cardiomyopathy, 2 restrictive cardiomyopathy and 1 non-compaction cardiomyopathy. Six of these patients had had a diagnosis of undetermined stroke and one of cardioembolic stroke (AF) at hospital discharge (non-compaction). We found a higher frequency of hypertrophic cardiomyopathy in the entire cohort and in the undetermined cause group than in the general population (3.03% and 5.81% versus 0.2% respectively, p = 0.001 and p < 0.001). The frequency of non-compaction cardiomyopathy was also higher in our cohort (0.76% vs 0.05% respectively, p < 0.001).

**Conclusions:** Although rare, cardiomyopathies should be considered as a possible cause of ischemic stroke classified as of undetermined etiology after standard evaluation

**Trial registration number:** N/A**AS15-046****COCAINE RELATED STROKES: CASE SERIES OF A TERTIARY BRAZILIAN HOSPITAL**

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**Background and Aims:** cocaine use is associated with acute/chronic cardiovascular toxicity leading to stroke. We report a series of cocaine

related strokes treated in an academic tertiary hospital, illustrating a large spectrum of stroke mechanisms.

**Methods:** we reviewed cocaine related strokes admitted to our department during 2018.

**Results:**

**Cases:** 1. Male, 52 years, long-time cocaine user, manifested headache, disorientation and aphasia, NIHSS = 7. Brain CT showed infarctions at right PCA and left MCA territories. CTA demonstrated diffuse arterial irregularities with multiple segmental stenosis, CSF showed increased cellularity and hyperproteinorraquia, compatible with cerebral vasculitis. He received intravenous prednisolone. 2. Male, 40 years, Glasgow coma scale (GCS) 8, miotic and poorly reactive pupils and convergent strabismus, NIHSS 34. Brain-CT showed ischemia at left CPA territory and CTA demonstrated multiple and diffuse irregularities. Inflammatory CSF and arteriography compatible with vasculitis; toxicological urine test positive for cocaine metabolites. He was treated with intravenous prednisolone with normal CSF control, but able to move only his head and left hand. 3. Male, 44 years, woke up after a cocaine abusing night with right upper limb monoparesis, progressing to aphasia, right hemiparesis and hypoesthesia, entering the hospital with GCS = 9 and NIHSS = 21. Exams evidenced left hyperdense MCA sign, ASPECTS 3 and tandem occlusion. Ecocardiography exams identified acute cardiac dysfunction suggestive of cardioembolic stroke. He underwent decompressive craniectomy and went home restricted to bed with NIHSS = 16.

**Conclusions:** cocaine use causes stroke due to numerous cardiovascular complications. The management of cocaine related stroke may vary according to the putative stroke mechanism.

**Trial registration number:** N/A

### AS15-033

#### CLINICAL FEATURES OF EMBOLIC STROKE OF UNDETERMINED SOURCE WITH OR WITHOUT SIGNIFICANT PATENT FORAMEN OVALE

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<sup>5</sup>National Cerebral and Cardiovascular Center, Cerebrovascular Medicine, 5-7-1- Fujishirirodai-Suita-shi-Osaka, Japan

**Background and Aims:** Large randomized control trials have established the efficacy of the patent foramen ovale (PFO) closure than anti-platelet therapy for preventing recurrent stroke in patients with cryptogenic stroke aged <= 60 years. However, clinical characteristics of the acute embolic stroke of undetermined source (ESUS) with or without significant PFO (SPFO) remain unclear.

**Methods:** Of 4169 patients with acute stroke admitted to our stroke center within 7 days of onset between 2011 and 2017, we enrolled 431 ESUS cases (10.3%) examined with transesophageal echocardiography (TEE). We defined SPFO when (1) >26 bubbles flowed into the left atrium through the PFO in the contrast TEE, or (2) PFO was accompanied by an atrial septal aneurysm. We assessed clinical characteristics in each group with or without SPFO.

**Results:** The mean age of the study cohort was  $70.9 \pm 12.5$  years (male, 61.7%). SPFO were detected in 80 cases (18.6%). Patient with and without SPFO exhibited significant differences in age (mean: 73.9 vs. 70.8;  $P = 0.049$ ), deep vein thrombosis (DVT; 17.5% vs. 2.5%,  $P < 0.0001$ ), and current smoking (13.8% vs. 24.8%;  $P = 0.003$ ).

**Conclusions:** ESUS patients with SPFO are older, smoke less, and have more comorbid DVT than those without SPFO. Hence, searching for SPFO and DVT is imperative even in ESUS patients aged >60 years despite the established efficacy of PFO closure in relatively younger patients.

**Trial registration number:** N/A

### AS15-078

#### MULTITERRITORIAL CRYPTOGENIC ISCHEMIC STROKE. DESCRIPTION OF A SINGLE CENTER REGISTRY

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**Background and Aims:** Description of a prospective registry of patients with acute multiterritorial cryptogenic ischemic stroke studied in our hospital between January-2018 and January 2019

**Methods:** Prospective registry of acute multiterritorial ischemic stroke. We excluded patients with previously known AF, with AF or other plausible etiologies detected during a complete standard etiologic investigation (blood tests, MRI, MRA/CTA, TT-echocardiogram and 24–48h cardiac rhythm monitoring). A more thorough research was then performed with a stepwise approach that included neoplasm biomarkers, thromophilic state study, whole-body-CT scan and prolonged heart rhythm monitoring with ILR.

**Results:** 40 multi-territory ischemic strokes were identified. 12 patients with multiterritorial ischemic stroke were excluded due to known AF ( $n = 5$ ), bilateral critical ICA stenosis ( $n = 1$ ) or AF detected in primary study ( $n = 6$ ). 28 patients (7.53%) met inclusion criteria (mean age: 73.13 years, 53.57% women). 5 had suffered a previous stroke and 8 were already under antiplatelet therapy. Regarding MRI, all except 2 patients had a 2-territory stroke. The location of ischemic lesions were the posterior territory ( $n = 17$ ), right MCA( $n = 16$ ), left MCA ( $n = 14$ ), left ACA ( $n = 3$ ), right ACA( $n = 2$ ), watershed ACA-ACM ( $n = 3$ ) and lacunar ( $n = 2$ ). A specific etiology was identified in 7 patients: cardiac apical thrombi ( $n = 2$ , one with Takotsubo cardiomyopathy), stroke related to a previous neoplasm ( $n = 5$ ) and AF detected after long-term monitoring ( $n = 2$ ). 5 patients died during follow-up (17.86%).

**Conclusions:** Multiterritorial ischemic stroke poses a diagnostic challenge. A thorough research procedure must be performed in order to rule out such important etiologies as neoplasm or occult cardioembolic source and, consequently, apply the ideal treatment for these patients

**Trial registration number:** N/A

### AS15-072

#### LONG-TERM ECG MONITORING WITH TEXTILE DEVICE AFTER EMBOLIC STROKE OF UNDETERMINATED SOURCE (ESUS)

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**Background and Aims:** Embolic stroke of undetermined source (ESUS) represents 20–30% of all ischemic strokes. Current guidelines recommend cardiac monitoring for at least 24 hours for diagnostic

workup; however, the type of monitoring have not yet been established. Its diagnosis is fundamental for secondary prevention.

**Methods:** We conducted a prospective analysis of patients monitored with Holter ECG by smart textile (Nubbo®) for 3 weeks placed 30 days after admission for ESUS in our Comprehensive Stroke Center. Clinical characteristics, follow-up and echocardiographic findings for detection of atrial fibrillation are analyzed.

**Results:** There were 41 patients, 17 (41.5%) women. The age was 68, 4 years  $\pm$  11.2 years. 14 patients (34.1%) experienced another ischemic cerebral event. The most frequent vascular risk factor was hypertension (65.9%), 17 (41.5%) were on antiplatelet therapy, 2 patients (4.95%) were anticoagulated (not AF). 11 patients (26.8%) had a normal previous 24 hour Holter ECG, 30 (73.2%) were monitored with an AF detection software in our stroke unit in the acute period. The median CHA2DS2-VASc score was 4 (2–8) and the median NIHSS at admission was 2 (range 0–25). 15 (36.6%) patients presented left atrial enlargement. Paroxysmal AF was detected in 7 cases (17.1%). No significant differences in clinical characteristics were found between the group in which atrial fibrillation was detected vs. the group in which was undetected. In patients in whom AF was detected, treatment with ACOD was initiated.

**Conclusions:** In this work, higher detection rates 17.1% of atrial fibrillation were found. None of the factors studied was independently associated with a higher probability of detection of AF.

**Trial registration number:** N/A

## AS15-023

### DETECTING ATRIAL FIBRILLATION IN PATIENTS WITH CRYPTOGENIC STROKE (DAFICS): THE SOONER THE BETTER

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**Background and Aims:** Atrial fibrillation (AF) accounts for a substantial proportion of cryptogenic stroke (CS). Guidelines recommend at least 24 hours of Holter monitoring, but there is not a defined strategy for searching AF.

**Methods:** We conducted a prospective study to determine the prevalence of AF in patients with a CS or transient ischemic attack (TIA) and a 3 weeks Holter monitoring. In Group A (early monitoring), the Holter was started within the first week after the event and in Group B (late monitoring) from day 8 until 6 months after the stroke. We recorded age, sex, cardiovascular (CV) risk factors (hypertension, diabetes, dyslipidemia, smoking), CHA<sub>2</sub>DS<sub>2</sub>-Vasc score, laterality and topography (deep or cortical) of the stroke, and presence of left atrial enlargement (LAE).

**Results:** We included 80 patients ( $69 \pm 12$  years, 58% male), without statistically significant differences between Group A (42 patients) and Group B (38 patients) according to age, sex, CV risk factors, CHA<sub>2</sub>DS<sub>2</sub>-Vasc score or LAE. Mean time from CS to Holter was  $3 \pm 4$  days in Group A and  $59 \pm 44$  days in Group B. AF was detected in 23% of patients in Group A, compared with only 6% in Group B ( $p < 0.05$ ). Patients with AF were older ( $77 \pm 9$  vs  $68 \pm 12$  years,  $< 0.05$ ) and with higher rate of LAE (46% vs 19%,  $p < 0.05$ ).

**Conclusions:** The sooner the search of occult AF after a CS or TIA (ideally within the first week), with a prolonged ECG monitoring, the higher detection of AF. These results can have important clinical implications.

**Trial registration number:** N/A

## AS15-074

### IDENTIFYING A SURROGATE MARKER FOR ATRIAL FIBRILLATION POST STROKE

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**Background and Aims:** Identifying surrogate markers for atrial fibrillation (AF) may allow physicians to target patients for prolonged electrographic (ECG) monitoring after a non-lacunar stroke (Cortical infarct  $> 15$  mm in diameter) with no AF detected on initial standard 12 lead ECG or short term ECG monitoring.

Our aim was to identify any ECG or imaging parameters that could be used as potential surrogate markers for AF or paroxysmal AF (PAF).

**Methods:** Retrospective review of cardiac investigations (24 hour tape and Echocardiogram) was undertaken over 12 months for patients admitted to the stroke unit. Inclusion criteria were radiologically confirmed non lacunar stroke with subsequent AF or PAF found on ECG monitoring. Patients with significant carotid artery and vertebral disease were excluded. We reviewed the ECG for the presence of Supraventricular tachycardia (SVT), premature normal and aberrant beats. Echocardiogram data were reviewed for atrial size (normal atrial size  $< 20$  cm<sup>2</sup>).

**Results:** 67 patients were included. 39 patients had echocardiogram data available. SVT was detected in 7% of cases, premature normal beats in 24% of cases and premature aberrant beats in 39% of cases. Dilated left atrial size was detected in 64% of cases. Dilated right atrial size was detected in 59% of cases.

**Conclusions:** Atrial size appears to be a relatively sensitive surrogate marker for the development of PAF or AF. This is an important finding to consider in patients with non-lacunar strokes in whom there is no large vessel atherosclerotic disease. This group of patients would warrant longer-term monitoring for AF or PAF if initial monitoring has been negative.

**Trial registration number:** N/A

## AS15-031

### PREVALENCE OF RIGHT TO LEFT SHUNT IN ESUS PATIENT AND VALIDATION ROPE SCORE IN SISIFO POPULATION

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**Background and Aims:** We aimed to evaluate the performance of Risk of Paradoxical Embolism (RoPE) score in SISIFO (Studio Italiano di prevenzione nello Stroke Ischemico di pervietà del Forame Ovale) population. Moreover we wanted to identify the features that identify patients in which right to left shunt is more likely to be linked to the stroke we observe.

**Methods:** Using the dataset of SISIFO study we have calculated in all subjects the RoPE score, but we had to use the OCSP classification instead of the item "cortical infarct on imaging" because we had not these data. We further evaluated the neuro-imaging of patients enrolled in Vibo Valentia and Città di Castello in order to calculate the real RoPE score and its performance. We did not consider the cryptogenic stroke

as described in TOAST classification, but we classified patients as ESUS vs non-ESUS.

**Results:** In all ESUS patients the modified RoPE score predicted right to left shunt with a fair accuracy (AUC = 0.75, 95% CI = 0.69-0.81). Moreover we found that the prevalence of right to left shunt was higher in ESUS patients with respect to other stroke categories in people aged 40-59 or younger. In older patients we didn't observe any significant increase.

**Conclusions:** These results confirm the utility of RoPE score in the clinical setting; furthermore, our modified score shows the same effectiveness of the original one. Its independence from neuroimaging facilitates the applicability in non-highly specialised setting, where MR may not be immediately available.

**Trial registration number:** N/A

## AS15-051

### AGE-RELATED BURDEN AND CHARACTERISTICS OF EMBOLIC STROKE OF UNDETERMINED SOURCE: ONE-YEAR ITALIAN EXPERIENCE

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**Background and Aims:** Embolic stroke of undetermined source (ESUS) is a well defined but relatively new clinical entity, and few data are available on age-related burden of ESUS in the real world practice. Therefore, the purpose of our study was to provide information about it.

**Methods:** We prospectively analyzed data of patients consecutively admitted to our Stroke Unit (SU) along one year (2017, November 1st – 2018, October 31st). The etiology of stroke was defined according to TOAST criteria. ESUS was considered as a subset of cryptogenic stroke, and defined according to the international recommendations.

**Results:** In the analyzed period, 306 patients (52.3% females), mean age  $\pm$  SD  $77.9 \pm 11.9$  years, were discharged from our SU with diagnosis of ischemic stroke. Age distribution was: 12.4% < 65 years, 20.3% 65–74 years, 67.3%  $\geq$  75 years. In-hospital mortality was 7.5%. Figure 1 and 2 show the etiology of ischemic strokes in the whole cohort and according to age, respectively. Overall, in 80 patients (26.1%) the etiology was undetermined; in 25 (8.1%) it remained undefined because of death or severe comorbidity, making further diagnostic work-up not worthy. Cryptogenic stroke occurred in 55 patients (18%), and ESUS criteria were satisfied in 39 (12.7%). According to age, cryptogenic stroke was diagnosed in 21.1% (21.1% ESUS) of patients < 65 years, 24.2% (19.4% ESUS) of patients 65–74 years, 15.5% of patients  $\geq$  75 years (9.2% ESUS). **Conclusions:** In the real world practice, prevalence of ESUS in patients suffering from acute ischemic stroke is not negligible, and seems to decrease according to age.

**Trial registration number:** N/A

## AS15-053

### TRAUMATIC CAROTID ARTERIAL DISSECTION – VERNEUIL'S CASE REPORT FROM 1872

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**Background and Aims:** Though aortic dissection was first described by Laennec in 1826, it is generally believed that dissection of the cervical arteries was unknown before World War II.

**Methods:** We explored 19<sup>th</sup> century medical textbooks and searched for references of published studies on arterial dissection ("aneurysma dissecans").

**Results:** Several publications about carotid artery dissections from the 19<sup>th</sup> century were identified. Most interesting is a case report by the famous French surgeon Aristide Verneuil (1823–1895) about a patient with a traumatic dissection of his left internal carotid artery causing fatal brain stroke (*Bulletin de l'Académie der Médecine; scéance du 16 janvier 1872*). The report includes a detailed clinical description and post-mortem pathology, revealing an intimal tear and distant occlusive thrombus. The notion of arterial dissection (aneurysm dissecans) is not used by Verneuil yet. However, Heinrich Quincke, professor for internal medicine in Bern, Switzerland, cited Verneuil's case as an example of aneurysma dissecans of the carotid artery in 1876.

**Conclusions:** Carotid artery dissections was described and recognized as such during the last decades of the 19<sup>th</sup> century. The role of trauma was discussed at several occasions.

**Trial registration number:** N/A

## AS15-005

### SYMMETRIC DIMETHYLARGININE AND CAROTID INTIMA-MEDIA-THICKNESS AS POTENTIAL MARKERS OF ATRIAL CARDIOPATHY AND ATRIAL FIBRILLATION IN PATIENTS WITH EMBOLIC STROKE OF UNDETERMINED SOURCE

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**Background and Aims:** A relevant part of embolic strokes of undetermined source (ESUS) is assumed to be cardiogenic. In accordance with the recent results of the multicenter trials RE-SPECT-ESUS and NAVIGATE-ESUS detection of atrial fibrillation (AF) is still crucial for secondary prevention. Endothelial pathology is closely intertwined with atrial cardiopathy. In this study, we therefore aimed to investigate if markers of endothelial dysfunction and subclinical atherosclerosis may serve to indicate atrial cardiopathy and AF in embolic stroke patients.

**Methods:** As part of a study evaluating novel atrial echocardiographical parameters in patients with acute ischemic stroke of known and unknown origin, L-arginine, Asymmetric (ADMA) and Symmetric Dimethylarginine (SDMA) levels have been measured at day 7 (n = 88) and at one year follow-up (n = 98). Standard stroke diagnostics were available for all patients, including Carotid Intima-Media-Thickness

(CIMT). Prolonged Holter-ECG scheduled for 72h was obtained in ESUS-patients.

**Results:** ESUS-patients showed significantly lower baseline values of SDMA ( $p = 0.004$ ) and higher baseline values of L-arginine ( $p = 0.031$ ), L-arginine:ADMA-ratio ( $p = 0.006$ ), L-arginine:SDMA-ratio ( $p = 0.002$ ) and ADMA:SDMA-ratio ( $p = 0.013$ ) than AF-patients. CIMT was significantly broadened in AF-patients compared with ESUS-patients ( $p < 0.001$ ), independently from CHA2DS2VASC in the regression analysis ( $p = 0.014$ ). SDMA-levels were highly stable over time ( $p < 0.001$ ,  $r = 0.788$ ) and were significantly correlated with left atrial volume-index within the whole collective ( $P = 0.003$ ,  $r = 0.322$ ) and within the ESUS-subgroup ( $p = 0.003$ ,  $r = 0.446$ ). These associations were independent from CHA2DS2VASC and renal function in multiple linear regression ( $p = 0.02$  and  $p = 0.005$ , respectively).

**Conclusions:** Our results highlight SDMA and CIMT as potential markers of atrial cardiopathy and AF in patients who suffered ESUS.

**Trial registration number:** N/A

## AS15-058

### EXTRACRANIAL CAROTID ARTERY ANEURYSM: A RARE CAUSE OF ISCHEMIC STROKE

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**Background and Aims:** Extracranial carotid artery aneurysm (ECAA) is a rare cause of ischemic stroke or transient ischemic attack. We report the case of a patient and discuss the presentation, underlying etiologies, diagnostic methods and treatment of these aneurysms.

**Methods:** A 77 year-old man was hospitalized because of sudden left hemiparesis and dysarthria. These symptoms appeared immediately after he rubbed a right anterior cervical mass he had since three months. Brain imaging revealed an ischemic stroke in the right middle cerebral artery territory and the MR angiography (figure 1) showed a large right internal carotid artery aneurysm (13x15x19mm) at its origin with intraluminal thrombus. A positron emission tomography scanner (figure 2) was performed but didn't show significant carotid or other location of hypermetabolism. Biological data (with serological and immunological tests) were normal. An anticoagulant therapy was started and surgical treatment with endarterectomy was performed 24 hours after the patient's admission. He totally recovered. Pathological study of the lesion identified fibromuscular dysplasia (figure 3).

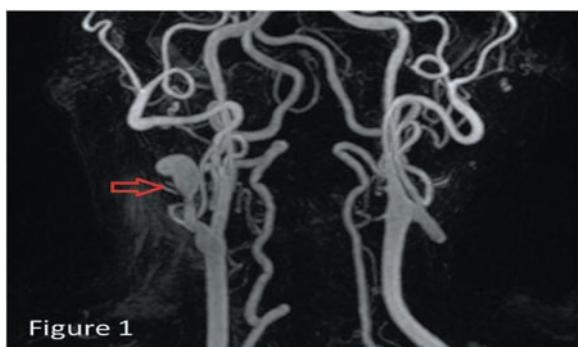


Figure 1

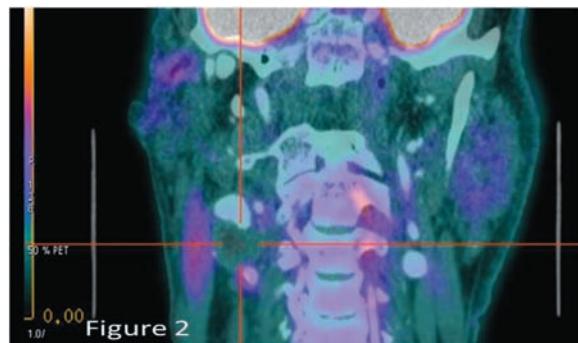


Figure 2

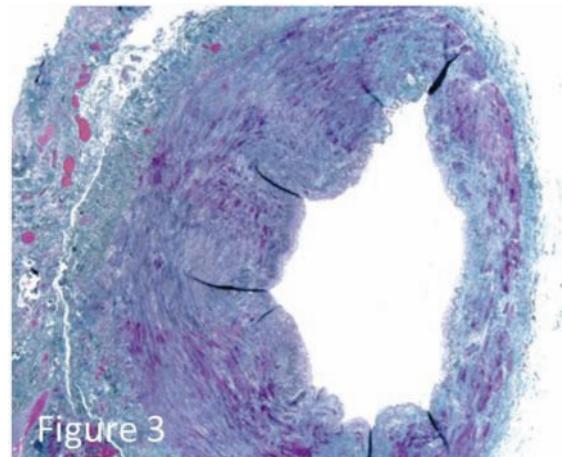


Figure 3

**Results:** ECAA could be symptomatic (ischemic stroke, transient ischemic attack, painless masses, dysphagia or rupture) or asymptomatic. Etiologies include atherosclerosis (the most common), fibromuscular dysplasia, infection, trauma or connective tissue diseases. Their treatment is usually open surgery or endovascular intervention.

**Conclusions:** This unusual cause of ischemic stroke need to be identified because of the particularities of the underlying etiologies and their specific treatment.

**Trial registration number:** N/A

## WITHDRAWN

analyzed using the TOAST and angiographic occlusion type (AOT) classification systems. We then developed a predictive scale with total 4 points for cardioembolism using the results from this study.

**Results:** There was no significant difference in the fraction of components in the thrombi within groups of TOAST and AOT system, while the platelet distribution patterns were different. The large artery atherosclerotic or truncal-type occlusion group had a mostly peripheral pattern, whereas the cardioembolic and undetermined or branching-site occlusion group had a mostly clustering pattern ( $p=0.02$  in TOAST classification;  $p=0.007$  in AOT classification). Patients with the scoring of 3 or 4 on our new scale had a sensitivity of 93.5%, a specificity of 100%, a positive predictive value of 100% and a negative predictive value of 83.3% for cardioembolic stroke.

**Conclusions:** The BOCS2 scale we've developed using a combination of the TOAST and AOT classification systems may be helpful as an adjunctive diagnostic tool for identifying cases caused by the cardiogenic embolism in undetermined stroke patients.

**Trial registration number:** N/A

## WITHDRAWN

### AS15-038

## FOLLOW UP IN EMBOLIC STROKE OF UNDETERMINED SOURCE (ESUS): CATCH-UP-ESUS REGISTRY STUDY PROTOCOL, INITIAL BASELINE DATA AND FIRST 3 MONTHS FOLLOW-UP

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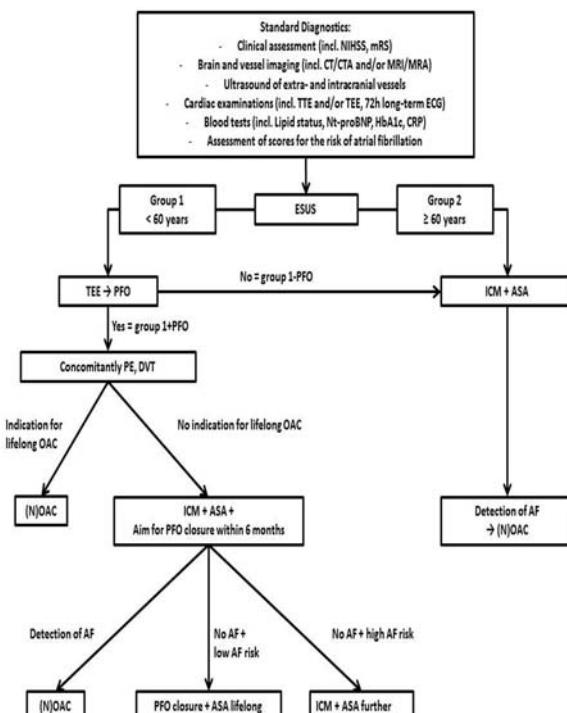
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**Background and Aims:** Until now there is no clear diagnostic and therapeutic pathway for patients with embolic stroke of undetermined source (ESUS). This prospective registry is intended to provide important data for an individualized approach to ESUS-patients based on a structured diagnostic and therapeutic algorithm.

**Methods:** The open-label, academic, prospective, single center, observational registry study started in 01/2018. All ESUS-patients ( $\geq 18$  years) treated in our hospital are included and are followed up for three years. Depending on age ( $< 60$  years or  $\geq 60$  years), patients are processed according to a standardized treatment algorithm designed interdisciplinarily by neurologists and cardiologists (see figure). Insertion of an implantable cardiac monitor (ICM) is sought in all patients. Patients  $< 60$  years without evidence of atrial fibrillation but with a concomitant relevant persistent foramen ovale (PFO) are planned for PFO closure within 6 months after stroke.



**Results:** Since the start of Catch-up-ESUS, 142 patients (mean age 67, 35% female) were included. 87% received ASA and 13% received oral anticoagulation for secondary stroke prevention. An ICM was implanted in 61%. A relevant PFO in the group <60 years was evident in 22 patients. To date, 94 patients have participated in the 3-month follow-up. 78 (83%) patients had a modified Rankin Scale of 0–2, and 2 (2%) patients died. Atrial fibrillation was detected in 10 patients (11%). In three patients, other causes of stroke were detected.

**Conclusions:** Catch-up-ESUS will provide urgently warranted data to individual diagnostic and therapeutic approaches in ESUS especially with respect to AF detection and PFO closure.

**Trial registration number:** N/A

## AS15-017

### CEREBRAL AMYLOIDANGIOPATHY AS A CAUSE FOR REVERSIBLE STROKE SYMPTOMS

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**Background and Aims:** Cerebral amyloidangiopathy (CAA) is characterized pathologically by deposition of β-amyloid in cerebral and leptomeningeal blood vessels, which leads to degeneration of blood vessel walls causing microaneurysms and occlusions. This causes lobar hemorrhages and infarction, respectively. In some cases β-amyloid depositions lead to inflammation causing cerebral amyloidangiopathy-related inflammation (CAA-RI). Patients present with (sub-) acute encephalopathy, headache, epileptic seizures and/or focal neurological deficits.

**Methods:** A 71-year-old man, known with hypertension and gout, presented to emergency department with confusion. At clinical assessment, confusion turned out to be aphasia together with homonymous hemianopia. CT-brain showed hypodensity parieto-occipital in the left hemisphere without cortical involvement suggesting edema. Additional MRI-brain showed large areas (bilateral occipital, temporal, parietal) with high signal intensity and swelling of white and gray matter with leptomeningeal enhancement. T2-weighted images and diffusion weighted images raised the suspicion of the presence of blood, there was no diffusion restriction. Gradient echo sequences confirmed the presence of superficial siderosis. This raised hypothesis of CAA-RI. Infectious causes were already excluded by cerebrospinal fluid and blood examination. Treatment with steroids started.

**Results:** After few days of steroid treatment patient developed psychosis and psychiatrist started antipsychotics, finally patient recovered. MRI brain improved substantially within few weeks: Patient was discharged for rehabilitation.

**Conclusions:** CAA-RI is a rare form of potentially reversible encephalopathy in subset of patients with CAA. Therefore early recognition is important.

**Trial registration number:** N/A

## AS15-063

### THE HUMAN CIRCULATING MICRORNA MIR-28-3P IS A POTENTIAL BIOMARKER FOR ISCHEMIC STROKE ETIOLOGY CLASSIFICATION

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**Background and Aims:** Cardioembolic and large-artery atherothrombosis (LAAT) ischemic stroke are two of the most frequent ischemic stroke etiologies. In some patients, it is not straightforward to find the stroke cause and it remains undetermined. In this context, biomarkers would be a useful diagnostic tool. MicroRNAs (miRNA) have demonstrated potential as biomarkers as they can be detected in blood, are stable, and change dynamically with pathologic processes. The aim of this study was to identify a distinctive miRNA expression profile between cardioembolic and LAAT stroke patients.

**Methods:** A non-targeted screening analysis was performed analyzing 179 miRNAs in plasma from 3 groups: cardioembolic patients (n=8), LAAT patients (n=8) and healthy controls (n=8) with Serum/Plasma Focus microRNA Panel (Exiqon). Afterwards, with the selected miRNAs in the screening phase, a validation analysis was performed with 20 patients in each group. The  $2^{-\Delta Ct}$  relative expression levels were calculated. MiR-29a-3p was used as endogenous control for normalization. Non-parametric Kruskall-Wallis test was used for statistical analysis.

**Results:** In the screening phase, 7 candidate miRNAs (miR-378a-3p, miR-421, miR-127-3p, miR-136-3p, miR-28-3p, miR-629-5p and miR-7-5p) with  $p < 0.1$  were identified discriminating between LAAT and cardioembolic stroke patients. In the validation analysis only miR-28-3p remained significantly downregulated in cardioembolic stroke patients compared to LAAT stroke patients ( $p = 0.011$ ) and to healthy controls ( $p = 0.028$ )

**Conclusions:** miR-28-3p was downregulated in plasma of cardioembolic stroke patients and could be a potential biomarker for ischemic stroke etiology classification.

**Trial registration number:** N/A

## AS15-075

### STROKE ETIOLOGY BASED ON EARLY ANALYSIS OF CLOT CYTOMETRY OBTAINED WITH FIRST PASS IN MECHANICAL THROMBECTOMY

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**Background and Aims:** To analyze clots with flow cytometry obtained in the treatment of hyperacute stroke as a diagnostic tool in stroke etiology

**Methods:** Consecutively intracranial clots were obtained with stent retriever devices in hyperacute stroke. Cell suspensions were labeled by direct immunofluorescence using monoclonal antibodies and acquired in flow cytometer. Leukocyte populations studied: granulocytes, monocytes, total lymphocytes (TL), TL (CD3 +), helper TL (CD3 +, CD4 +), suppressor-cytotoxic TL (CD3 +, CD8 +), TNK1 (CD3 +, CD56 / 16 +), NKL (CD3-, CD56 / 16 +) and B lymphocytes (CD19 +). Results were expressed as global and relative proportion within lymphocytes population PRTL(%).

All patients received complete diagnostic work up, atherosclerotic clots (severe symptomatic stenosis) versus cardiogenic clots (major structural heart disease and atrial fibrillation) were compared.

**Results:** 51 samples, atherosclerotic clots ( $n = 15$ ) were associated with higher CD4, CD3, CD 19, NK % PRTL ( $p < 0,05$ ) in comparison with cardioembolic clots (36). CD4 % PRTL 6,7 (3,1-9,6) vs 1,91 (0,5-5,1) and CD 19 % PRTL 1,9 (0,13 -3,5) vs 0,1 (0,0 – 0,5) remained significant in separate multivariate models. CD 4 PRTL% showed higher sensitivity but lower specificity (sensitivity 0,93, specificity 0,52) AUC 0,75 ( $p 0,005$ ) than CD 19 PRTL % 1,9 (sensitivity 0,53 specificity 0,94) AUC 0,74 ( $p 0,006$ ).

**Conclusions:** Clot analysis by flow cytometry in acute phase of stroke showed significant differences according to etiology

**Trial registration number:** N/A

## WITHDRAWN

thrombectomy, initial thin slice NECT reconstructions were registered with CT angiography images. Clots were segmented from the NECT scans and overlaid on a 3D visualization of the brain vessels. Using these post-processed images, clots were categorized based on their spatial configuration. These categories were subsequently correlated with the numbers of mechanical thrombectomy maneuvers used in each case.

**Results:** In 17 patients (16%) three or more recanalization maneuvers (median: 4) were needed for the final thrombectomy result. In all of these cases, clots were either found to be long with multiple branches (7 cases), or they were either segmented with short fragments or short and particularly small in diameter. In one of the 105 thrombectomy cases, no clot could be segmented. In this case, it took 4 stent retriever maneuvers in order to recanalize the mainstem of the middle cerebral artery with a remaining stenosis.

**Conclusions:** Proximal cerebral artery occlusions that require multiple thrombectomy maneuvers are either characterized by very long and complex configured clots with multiple branches, or they might be caused by very tiny and often segmented clots. While in the first category fragmentation during thrombectomy might cause multiple passes, tiny and segmented clots are typical for underlying intracranial arterial stenosis.

**Trial registration number:** N/A

## AS15-041

### IDENTIFYING STROKE IN THE DIZZY PATIENT: DEVELOPING AN EVIDENCE-BASED VERTIGO ASSESSMENT TOOL FOR USE IN THE EMERGENCY DEPARTMENT THROUGH LITERATURE REVIEW

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**Background and Aims:** Dizziness is a debilitating symptom reported by 5% of adults in any one year and accounts for 2.5% of visits to the ED in the US. The terms dizziness and vertigo are used interchangeably in modern literature and diagnostic research has focused on categorising symptom timing and trigger. 71% of ED vertigo patients have benign peripheral vestibular dysfunction however a small number (3 – 5%) have serious central pathology, mainly posterior stroke, mimicking peripheral aetiology. Acute onset persistent vertigo i.e. Acute Vestibular Syndrome (AVS) the percentage of posterior infarcts increases to ~25%. Despite the publication of single-site algorithmic assessments such as H.I.N. Ts and TiTrATE there remains considerable pitfalls in differentiating vertigo cause in the ED, mainly over-reliance on imaging. The authors propose that a clinical assessment tool, together with an education package, will embed the principles of Timing, Triggers and Targeted Examination in its context to AVS and enable the physician to appropriately triage, reason, screen and treat the other causes of vertigo presenting in the ED with structure and clarity.

**Methods:** Systematic literature review by keyword search across Pubmed and Cochrane Library online databases (2008–2018) with weighting towards recently published reviews.

**Results:** Identification of key clinical assessment and screening techniques amalgamated to produce a user-friendly Vertigo Assessment Tool (Lamb – VAT)

## AS15-024

### EFFICIENCY OF MECHANICAL THROMBECTOMY DEPENDS ON CLOT CONFIGURATION

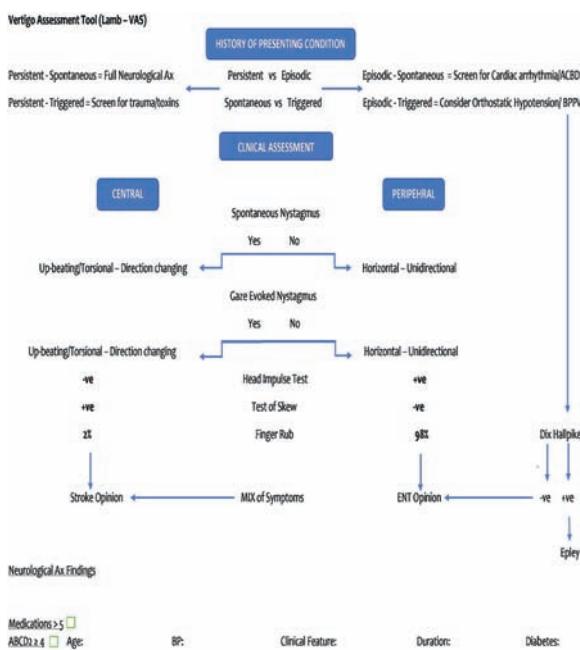
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**Background and Aims:** To investigate how the spatial configuration of clots affects the number of recanalization maneuvers.

**Methods:** In 105 patient suffering from acute ischemic stroke with proximal cerebral artery occlusion who underwent mechanical



**Conclusions:** The development of the Lamb-VAT is the first step in establishing a standardised tool to identify posterior stroke in the ED. Future research will focus on validating the tool and developing the educational package in a single-site trial.

**Trial registration number:** N/A

## AS15-008

### ASSOCIATION OF NEUTROPHIL COUNTS, NEUTROPHIL RATIO WITH THE OUTCOME OF MINOR STROKE AFTER INTRAVENOUS THROMBOLYSIS

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**Background and Aims:** Evidence about whether neutrophil counts, neutrophil ratio is related with the clinical outcome of minor stroke after thrombolysis is scarce. The purpose of this study is to explore the association of neutrophil counts, neutrophil ratio with the 3-month clinical outcome after minor ischemic stroke with intravenous thrombolysis.

**Methods:** A total of 163 patients with acute minor ischemic stroke (NIH Stroke Scale score  $\leq 5$ ) were included who received intravenous thrombolysis within window time between September 2013 and September 2017. Total neutrophils and leukocytes counts in whole blood samples at admission were measured. Neutrophil counts and neutrophil ratio were divided into tertiles, respectively. Clinical outcome was disability or death (defined as a modified Rankin Scale score  $\geq 2$ ) at 3 months. Multiple logistic regression analysis was used to estimate the association between neutrophil counts, neutrophil ratio and clinical outcome.

**Results:** During 3-month follow up, 36 patients (21.0%) had disability or death after stroke onset. Higher neutrophil counts was associated with increased risk of disability or death at 3 months (adjusted odds ratio [OR], 2.93; 95% CI 1.08-7.96; p for trend=0.03). Similarly, higher

neutrophil ratio was also associated with increased risk of disability or death at 3 months (adjusted OR 5.813; 95% CI 1.7-19.88; p for trend = 0.005).

**Conclusions:** Both higher neutrophil counts and neutrophil ratio on admission are associated with an increased risk of 3-month disability or death in minor ischemic stroke patients treated with intravenous thrombolysis.

**Trial registration number:** N/A

## AS15-006

### HIGH-SENSITIVITY TROPONIN INCREASES THE YIELD OF TRANSTORACIC ECHOCARDIOGRAPHY IN ACUTE ISCHEMIC STROKE

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**Background and Aims:** The estimated yield of echocardiography for acute ischemic stroke (AIS) is uncertain in not selected patients. We assessed whether high-sensitive troponin T (hs-cTnT) can improve the yield of transthoracic echocardiography (TTE) in patients with AIS.

**Methods:** We retrospectively studied consecutive patients with AIS admitted to our stroke center over a period of 22 months. We consider relevant findings on TTE: 1) cardioembolic source; 2) regional wall motion abnormalities in patients without a history of ischemic heart disease; 3) low ejection fraction ( $\leq 40\%$ ) in patients without a history of congestive heart failure; 4) unknown severe valvular heart disease, or 5) cardiac thrombus. As primary predictor, we studied high-sensitivity troponin at admission (cut off of 14 ng/L and 30 ng/L), adjusting for demographic and clinical characteristics.

**Results:** We included in the study 416 patients (age  $71.6 \pm 13.5$  years, 48.1% women): echocardiography was performed in 356 (85.6%) patients; 396 (95.2%) patients had troponin levels on admission. TTE provided relevant information in 26 patients (7.3%) and changed acute treatment decisions in about 60% of them. High-sensitivity troponin T (cut off 30 ng/L) was an independent predictor of the yield of echocardiography (adjusted odds ratio, 3.58; 95% CI, 1.31 – 9.74; P 0.0126).

**Conclusions:** Transthoracic echocardiography detected information that may potentially change the management in 7.3% of patients with AIS. High-sensitivity troponin increased the chance to detect relevant findings on TTE of about 3 times. Clinicians might use high-sensitivity troponin to select those patients in whom echocardiography is likely to provide relevant information to plan secondary preventive treatment.

**Trial registration number:** N/A

## AS15-034

### PREVALENCE AND PREDICTORS OF AORTIC ARCH ATHEROSCLEROSIS IN ACUTE ISCHEMIC STROKE PATIENTS IN BRAZIL

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**Background and Aims:** Large-vessel atherosclerosis is a major cause of acute ischemic stroke (AIS) worldwide and involves both intracranial and extracranial arteries, including the aortic arch. Aortic plaques  $> 4$  mm thickness and/or with mobile components are more likely to be

associated with thromboembolic events, but are often underdiagnosed, specially in Latin America. Computed Tomography Angiography (CTA) is a useful method with high sensitivity and specificity for the assessment of aortic arch atherosclerotic plaques after AIS. We aim to determine the frequency and predictors of aortic atherosclerotic disease in a Brazilian symptomatic population with AIS.

**Methods:** CTA exams from 100 adult acute stroke patients admitted between March-2014 and December-2016 at an academic tertiary stroke center in Brazil were reviewed by a blinded neuroradiologist for detection of aortic plaques >4mm thickness. Clinical information was obtained during the admission and in follow-up appointments, 3 to 6 months after stroke.

**Results:** The mean age was  $63.82 \pm 12.65$  years, 54% were male. Hypertension (70%), smoking (53%) and dyslipidemia (41%) were the most prevalent risk factors. Eighty four (84%) patients presented atherosclerotic plaques in at least one segment of the thoracic aorta and 18 (18%) patients had atherosclerotic plaques >4mm thickness. Age and smoking history were independently associated with aortic atherosclerotic plaques >4mm on CTA. Among those, 27.7% were diagnosed with large-vessel atherosclerosis stroke according to TOAST criteria.

**Conclusions:** Aortic atherosclerotic plaques are highly prevalent in AIS patients, and frequently underdiagnosed. Among modifiable stroke risk factors, age and smoking are the main predictors of aortic atherosclerotic plaques in acute stroke patients in Brazil.

**Trial registration number:** N/A

## AS15-001

### PREDICTORS OF SILENT ATRIAL FIBRILLATION IN EMBOLIC STROKE OF UNDETERMINED SOURCE

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**Background and Aims:** Atrial fibrillation (AF) may represent the underlying cause in a significant proportion of embolic stroke of undetermined source (ESUS) patients.

The present study was aimed to investigate detection rate and predictors of AF in a real-life population of consecutive ESUS patients.

**Methods:** We retrospectively enrolled all the consecutive patients referred to our Neurology Unit with a diagnosis of ESUS in which an implantable loop recorder (ILR) was positioned to look for occult AF from November 1st 2013 to September 31th 2017.

For each patient we recorded demographic features, vascular risk factors, baseline CHA2DS2-VASc score, neuroimaging data, holter ECG and echocardiography findings.

**Results:** In the study period we identified 133 patients with a diagnosis of ESUS referred to our Neurology Unit who underwent an ILR implantation to detect occult AF.

In the overall study population the AF detection rates at 3, 6, 9, 12 and 18 months were respectively 23.4%, 35.5%, 37.4%, 38.4% and 47.7%.

Expect for age, there was no significant difference in gender and vascular risk factors between AF and SR (sinus rhythm) patients; regarding stroke features only the percentage of patients with vertebrobasilar stroke was significantly different between in AF and SR patients.

Moreover the presence of left atrial enlargement in echocardiographic studies and the evidence of supraventricular tachyarrhythmia runs on 24h-Holter ECG were significantly more prevalent in AF Group versus SR Group

**Conclusions:** In our study about 50% of ESUS patients conceal an occult atrial fibrillation: holter ECG and echocardiographic findings can help to predict AF occurrence in this populations.

**Trial registration number:** N/A

## AS15-066

### BIOMARKERS AS ANALYTIC TOOL TO DIFFERENTIATE SUBGROUPS AMONG ESUS PATIENTS

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**Background and Aims:** Although atrial fibrillation (AF) comes to mind as the origin of ESUS (Embolic Stroke of Undetermined Source) subjects, recent clinical trials with direct oral anticoagulation raise suspicions on the heterogeneity of ESUS.

The clinical, radiological and prognostic characteristics of ESUS subjects with high aetiological suspicion of AF are established.

**Methods:** 176 ischemic stroke patients were studied. 78 of them, had a newly diagnosed with AF (nAF) and 98 subjects were met ESUS criteria. Biomarkers (BK) as NSE, IL-6, NT-proBNP, hs-troponin and hs-CRP were assessed.

Clinical, radiological characteristics and prognosis, using the modified Rankin scale (mRS) at 7 and 90 days, were compared in ESUS patients according to BK.

**Results:** The nAF subjects had greater levels of IL-6, NT-proBNP, hs-CRP and hs-troponin than ESUS subjects ( $p<0.001$ ). NT-proBNP demonstrated better discrimination for AF (AUC 0.73; CI 95% (0.66-0.81)  $p<0.001$ ). A cut-off point of 215pg/ml with negative predictive value of 88.6% was established. Up to 60% of ESUS subjects had levels of NT-proBNP  $\geq 215$  pg/ml. These were older (76.3 vs. 64.8 years;  $p<0.001$ ). The CHA2D2-VASC score was higher in ESUS subjects with NT-proBNP  $\geq 215$  pg/ml (5 vs. 4;  $p<0.001$ ). Greater stroke severity, measured by NIHSS (7 vs. 4;  $p=0.037$ ), and a worse 7-day prognosis were presented in ESUS subjects with NT-proBNP  $\geq 215$  pg/ml (2.5 vs. 1;  $p=0.024$ ). The scattered one territory pattern was greater in subjects with NT-proBNP  $\geq 215$  pg/ml (46.9% vs. 25%;  $p=0.028$ ).

	ESUS	NT- proBNP<215	NT- proBNP $\geq 215$	p-value
Total: n (%)	98 (55.7)	39 (39.8)	59 (60.2)	
Age, mean (SD) years old	71.6 (11.8)	64.6 (11.6)	76.3 (9.5)	<0.001
<b>Basal and clinical characteristics</b>				
women	40 (40.8)	10 (25.6)	30 (50.8)	0.029
Alcoholism	4 (4.1)	4 (10.3)	0 (0)	0.012
Smoking habits	20 (20.4)	10.8 (25.6)	10 (16.9)	0.273
Hypertension	68 (70.1)	24 (61.5)	44 (74.6)	0.324
Diabetes mellitus	21 (21.4)	8 (20.5)	13 (22.0)	0.948
Hyperlipidemia	48 (49.0)	18 (46.2)	30 (50.8)	0.996
Previous stroke	12 (12.2)	3 (7.7)	9 (15.3)	0.247
IHD	6 (6.2)	1 (2.6)	5 (8.5)	0.645
CHA2DS2-VASC	5.0 (4.0-6.0)	4.0 (3.0-5.0)	5.0 (4.0-6.0)	<0.001
<b>Severe stroke</b>				
mRS basal	0.0 (0.0-0.0)	0.0 (0.0-0.0)	0.0 (0.0-1.0)	0.500
NIHSS at admission	5.0 (3.0-9.5)	4.0 (2.0-7.5)	7.0 (3.0-10.0)	0.037
<b>Oxfordshire classification</b>				
TACI	17 (17.9)	4 (10.3)	13 (22.0)	0.428
PACI	46 (48.5)	20 (51.3)	26 (44.1)	
POCI	14 (14.7)	7 (17.9)	7 (11.9)	
LACI	18 (18.9)	8 (20.5)	10 (16.9)	
<b>Left atrial size</b>	41.0 (36.0-46.0)	40.0 (35.0- 43.0)	43 (38.0-47.0)	0.020
<b>Prognosis</b>				
mRS 7d	2.0 (1.0-3.0)	1.0 (0.0-2.0)	2.5 (1.0-4.0)	0.024
mRS 90d	1.0 (0.0-3.0)	1.0 (0.0-2.0)	2.0 (0.0-3.0)	0.080
<b>Radiological characteristics</b>				
DWI volume, Median (IQR)mL	2.9 (0.7-12.1)	3.4 (0.7-10.0)	2.5 (0.5-15.1)	0.961
<b>DWI patterns</b>				
Scattered one territory	31 (38.3)	8 (25.0)	23 (46.9)	0.028
Multiple territory	12 (14.8)	2 (6.3)	8 (16.3)	
Cortical	26 (32.1)	16 (50.0)	10 (20.4)	
Subcortical	12 (14.8)	5 (15.6)	7 (14.3)	

**Conclusions:** ESUS subjects with NT-proBNP $\geq$ 215pg/ml present similar characteristics to cardioembolic stroke patients. These subjects would benefit from further study to detect AF.

**Trial registration number:** N/A

## AS15-067

### CHARACTERISTICS AND BIOMARKERS IN THE CHALLENGE FOR THE DIAGNOSIS OF A NEW ATRIAL FIBRILLATION AMONG ESUS PATIENTS

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**Background and Aims:** The introduction of ESUS (Embolic Stroke Undetermined Source) concept attempts to better describe subjects with high suspicious of atrial fibrillation (AF). The relationship between atrial biomarkers (BK) and AF in these subjects has been established but not the cut-off point. Recent results of pharmacological trials could suggest a diversity of aetiology in ESUS.

Clinical, radiological and prognostic characteristic in ESUS and AF subjects are described. The best BK to detect AF in ESUS with cut-off point is assessed.

**Methods:** 488 ischaemic strokes were studied. Atheromatous (n=86) and small vessels strokes (n=80) according to TOAST classification and cardioembolic not-AF stroke (n=26) were excluded. Clinical, radiological characteristic of 296 subjects were compared: chronic AF (cAF; n=120), newly diagnosis AF (nAF; n=78) and ESUS (n=98). Prognosis was measured by modified Rankin Scale (mRS) at 90 days. NSE, IL-6, hs-CRP, hs-troponin and NT-proBNP were determined.

**Results:** ESUS subjects were younger (71.8 vs. 78.0 y 81.1y.o) and lower stroke severity, measured by NIHSS (5 vs. 7 y 9) than nAF and cAF ( $p < 0.001$ ). Scattered one territory pattern was predominated in nAF and cAF (54.2%, 58.6% vs. 38.2% p=0.0012). Worse 90-day prognosis was observed in cAF (3 vs. 1  $p < 0.001$ ).

NT-proBNP presented better discrimination for nAF in ESUS (0.73 CI 95% (0.66-0.81)  $p < 0.001$ ). Cut-off point  $\geq$ 215pg/ml obtained a negative predictive value of 88.6%, increasing risk to present AF up to 6 times (OR 6.33 CI 95% (2.16-18.53)  $p < 0.001$ ).

	AUC	CI 95%	p-value
NSE	0.58	0.49-0.67	0.080
IL6	0.65	0.56-0.73	<0.001
NT-proBNP	0.73	0.66-0.81	<0.001
hs-CRP	0.65	0.57-0.73	<0.001
Hs-troponin	0.61	0.52-0.69	0.019

NT-proBNP cut-off	New diagnosis AF	ESUS
<215 pg/mL	5 (6.4%)	39 (39.8%)
$\geq$ 215 pg/mL	73 (93.6%)	59 (60.2%)

Variable	Model 1		Model 2		Model 3		Model 4	
	OR (CI 95%)	p- valor	OR (CI 95%)	p- valor	OR (CI 95%)	p- valor	OR (CI 95%)	p- valor
Age	1.06 (1.03- 1.10)	<0.001	1.04 (1.00- 1.08)	0.077	1.03 (0.99- 1.07)	0.115	0.99 (0.95- 1.04)	0.993
DWI volumen	-	-	1.00 (0.99- 1.01)	0.607	-	-	1.00 (0.98- 1.01)	0.995
Scattered 1 territory pattern	-	-	2.03 (0.93- 4.43)	0.077	-	-	1.53 (0.64- 3.68)	0.338
ProBNP $\geq$ 215 pg/ml	-	-	-	-	6.33 (2.16- 18.53)	0.001	29.93 (3.53- 254.42)	0.002

**Conclusions:** The application of NT-proBNP with a cut-off of  $\geq$ 215pg/ml in ESUS subjects could determine hidden AF as the main aetiology.

**Trial registration number:** N/A

## AS15-076

### IMPLANTABLE LOOP RECORDERS FOR THE DETECTION OF ATRIAL FIBRILLATION IN PATIENTS WITH CRYPTOGENIC STROKE. EXPERIENCE IN A REFERENCE HOSPITAL

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**Background and Aims:** The search of an occult atrial fibrillation (AF) in patients who have suffered a Cryptogenic Stroke (CS), which has a high risk of recurrence, is of paramount importance as it will influence therapeutic decisions. Implantable loop recorders (ILR) have the highest detection rates but there is no consensus regarding which patients may be selected for long monitoring.

**Methods:** Retrospective observational study of patients who were implanted a ILR after a CS in a tertiary hospital between 2016–2018. We analysed clinical-demographic characteristics, AF detection rate and timing of the detection from the stroke.

**Results:** 30 patients with CS and ILR, median age 72 years (RIQ 16), 63.3% were men, 60% have high blood pressure, and 23.35% diabetes. 30% of them had left atrial enlargement in echocardiography. ILR were implanted a median of 124 days (RIQ 278) after the stroke, in the 3 first months in 40% of them. Atrial fibrillation was detected in 11 patients (36.7%), 36.4% in the first 6 months after the stroke, 45.5% in the first 3 months after the implant. In the univariate analysis we found female sex, advanced age, hypertension, and left atrial enlargement significantly related to detection of AF. We found no influence of the time from the stroke to the implant on the AF detection.

**Conclusions:** The occult AF detection rates in our sample were slightly higher than those described in the literature (Crystal-AF), being influenced by standard risk factors. There are controversies regarding the duration and method of monitoring, and the profile of the eligible patient.

**Trial registration number:** N/A

**AS15-012****USEFULNESS OF THE ACTEL SCORE TO PREDICT ATRIAL FIBRILLATION IN PATIENTS WITH CRYPTOGENIC STROKE: BEYOND THE MRWALLETS**

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**Background and Aims:** To establish the probability of undetected atrial fibrillation (AF) in patients with ischemic stroke, we previously compared patients with first diagnosed AF with patients with large or small artery disease, and obtained the 8-item MrWALLETS scoring system. In the present study we utilized cryptogenic strokes as control group, as in cryptogenic strokes the origin from a large or small artery has already been excluded.

**Methods:** We retrospectively assessed 186 ischemic stroke patients (mean age  $72.5 \pm 12.6$  years), 63 with first diagnosed AF and 123 with cryptogenic stroke, who had undergone 2 brain CT scans, echocardiography, carotid/vertebral ultrasound, continuous ECG monitoring and anamnestic/laboratory search for cardiovascular risk factors.

**Results:** In logistic regression, 5 variables were independently associated with AF, forming the "ACTEL" score: Age  $\geq 75$  years (OR 2.42, 95%CI 1.18-4.96,  $P = 0.02$ ; +1 point); hyperCholesterolemia (OR 0.38, 95%CI 0.18-0.78,  $P = 0.009$ ; -1 point); Tricuspid regurgitation  $\geq$  mild-to-moderate (OR 4.99, 95%CI 1.63-15.27,  $P = 0.005$ ; +1 point); left ventricular End-diastolic volume  $< 65$  ml (OR 7.43, 95%CI 2.44-22.6,  $P = 0.0004$ ; +1 point); Left atrium  $\geq 4$  cm (OR 4.57, 95%CI 1.97-10.62,  $P = 0.0004$ ; +1 point). The algebraic sum of these points may range from -1 to +4. The area under the ROC curve was 0.80 (95%CI 0.73-0.87). With a cut-off of  $\geq 2$  for AF identification, positive predictive value was 80.8%, specificity 92.7% and sensitivity 55.9%. In this context, the MrWALLETS score performed worse.

**Conclusions:** The ACTEL score, a simplified version of the MrWALLETS score, allows the identification of patients with first diagnosed AF, in the context of cryptogenic strokes, with high positive predictive value.

Trial registration number: N/A

**AS15-080****CAROTID DOMINANT IMMUNE MEDIATED ANGIOPATHY (CIMA):A GROUP OF REVERSIBLE VASCULITIS AFFECTING INTRACRANIAL VESSELS- A CASE SERIES**

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**Background and Aims:** Idiopathic carotid occlusion is a common problem in stroke etiology. Cryptogenic stroke occurs in nearly 25% cases. We describe 3 patients with history of idiopathic carotid occlusion and found to have isolated angiopathy of carotid to which the authors suggest a term of Carotid dominant Immune Mediated Angiopathy (CIMA).

**Methods:** Patients admitted under stroke unit presented with narrowed large intracranial arteries without stenosis of the extra cranial arteries, but with angiographic changes of vasculitis, CSF immune response and elevated titers of non-specific CNS auto antibodies were identified and documented and immune therapy was provided.

**Results:** Case1: A 53 year old male with infarcts in the splenium, posterior body of corpus callosum and left paramedian frontal lobe and cerebral digital subtraction angiogram (DSA) revealed stenosis of the terminal carotid extending to ACA.

Case2: A 58 year old male with history of stroke 3 months, had a recurrent event of right hemiparesis one month later and his DSA showed multiple areas of segmental narrowing and beading including his superficial temporal artery.

Case 3: A 28 year old lady with bilateral cerebellar and right sided PCA infarcts and multiple vessel narrowing.

All the 3 patients were worked up for vasculitis, cardiac and immunology which were normal. Indirect immuno-fluorescence with the serum of patients showed binding of antibodies to luminal carotids and mid cerebellar arteries of cow's circle of Willis.

All patients responded well to immunotherapy.

**Conclusions:** Patients with idiopathic carotid occlusion without systematic features of vasculitis are termed as carotid immune mediated angiopathy.

Trial registration number: N/A

**AS15-025****THROMBUS HISTOLOGY, DOES IT REALLY DEPEND JUST ON STROKE ETIOLOGY?**

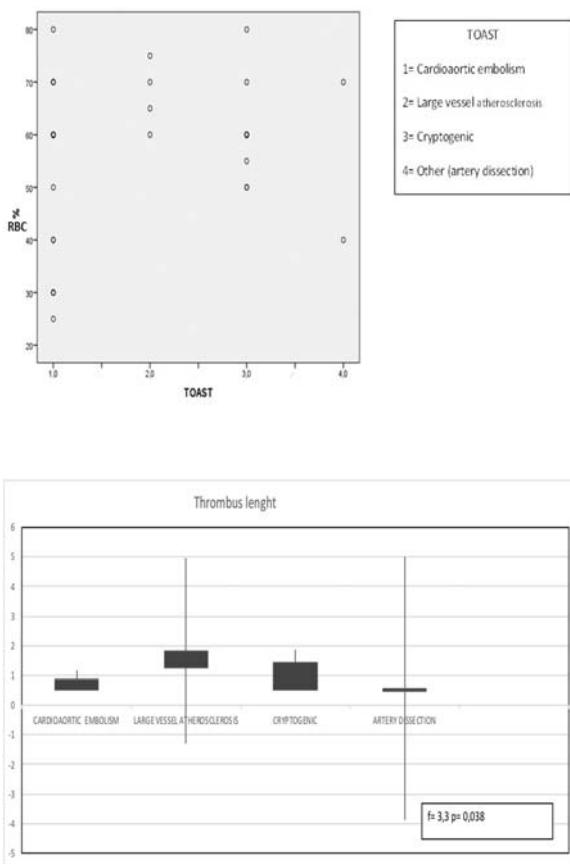
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**Background and Aims:** Analysis of thrombi responsible for large vessel occlusion (LVO) in acute ischemic stroke (AIS) may be a potential diagnostic tool for AIS ethiopathogenic classification, particularly in cryptogenic events. Nonetheless the available results are controversial. Aim of our study was to evaluate a possible correlation between AIS etiology and thrombus composition.

**Methods:** We analysed prospectively thrombi retrieved from LVO in AIS within twenty-four hours since the last time patients were seen healthy. Retrieved thrombi were stored in formaldehyde. Physical characteristics and histological composition, in terms of red blood cells (RBC), and fibrin and platelets (FP) percentage were determined. Thrombi composition was correlated with baseline radiological and interventional data and TOAST subtypes.

**Results:** We included 34 patients among 41 recruited. Twenty-five thrombi with prevalent RBC and nine with prevalent FP composition were collected. All the thrombi from patients with atherothrombotic stroke presented FB percentage over 70%. Nonetheless, no significant correlation between thrombi histology and AIS etiology was found. While we found a significant correlation between thrombus length (TL) and AIS subtypes, with a mean TL of 0.87mm in cardioembolic events, 1.83mm in atherothrombotic events, 0.55mm in artery dissections and 1.42mm in cryptogenic strokes ( $f = 3,30$ ,  $p = 0.38$ ).



**Conclusions:** Our results confirm no correlation between thrombus composition and stroke subtypes, suggesting that thrombus composition may also be related to mechanisms occurring in intracerebral arteries. Finally, we suppose that in cardioembolic and dissective strokes, smaller thrombi would detach from more stable thrombi lying in cardiac cavities and from arterial false lumen.

**Trial registration number:** N/A

#### AS15-048

#### NON-SUSTAINED ATRIAL TACHYCARDIA IN 24-HOUR HOLTER: A POTENTIAL CARDIAC SOURCE OF EMBOLISM IN ACUTE ISCHEMIC STROKE

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**Background and Aims:** Non-sustained atrial tachycardia (NSAT) is frequently observed in ischemic stroke patients and was reported to correlate with atrial fibrillation (AF). However, the contribution of NSAT to the cardioembolic stroke remains elusive. We investigated the prevalence of NSAT in ischemic stroke and the radiologic pattern of cerebral infarction in patients with NSAT.

**Methods:** We retrospectively reviewed acute ischemic stroke patient who performed 24-hour Holter monitoring, and selected patients with NSAT. Patients with atrial fibrillation were excluded. We classified them

by the trials of Org 10172 in Acute Stroke Treatment (TOAST) classification and analyzed the differences between stroke subtypes.

**Results:** Among 1756 patients, 876 patients had 24-hour Holter monitoring. NSAT was detected in 303 cases. 88 patients were classified as large artery atherosclerosis (LAA), 43 cardioembolism, 74 small vessel occlusion (SVO), 85 undetermined etiology (74, negative (UN); 18, two or more causes; 2, incomplete evaluation), 3 other etiology. Isolated arterial occlusion was found in 26% of patients classified as LAA and 42% of patient with UN had multiple embolic pattern infarctions. UN group had more total supraventricular beats of runs ( $49.3 \pm 242.5$  vs  $15.4 \pm 19.2$ ,  $p = 0.047$ ) and larger left atrial (LA) volume index ( $31.3 \pm 10.3$  vs  $27.2 \pm 8.1$ ,  $p = 0.067$ ) compared with SVO group.

**Conclusions:** Isolated arterial occlusive lesion and multiple territorial infarctions which suggest cardioembolic mechanism are frequently found in stroke patients with NSAT. Also LA size and number of supraventricular beats of runs is associated with embolic pattern of cerebral infarction. NSAT may be a potential cardiac source of embolism in patients without definite stroke mechanism.

**Trial registration number:** N/A

#### AS15-027

#### ANTITHROMBIN III DEFICIENCY AS A LIKELY ETIOLOGY OF CEREBRAL VENOUS THROMBOSIS IN A 48-YEAR-OLD MALE: A CASE REPORT

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**Background and Aims:** Cerebral venous thrombosis (CVT) is a rare cause of stroke. Diagnosis relies on high index of suspicion. Risk factors may either be acquired or hereditary. Among hereditary causes are thrombophilias and most common among them are Factor V Leiden mutation and prothrombin gene G20210A mutation, others include anti-thrombin III, Protein C and Protein S deficiencies. We report a case of a 48-year-old male presenting with a four-week history of progressive generalized headache and first onset seizure.

**Methods:** The patient had a personal history of mesenteric vein thrombosis and deep venous thrombosis in the lower extremities and a family history of portal vein thrombosis and sinus venous thrombosis.

**Results:** Contrast venography showed thrombosis in the left transverse sinus. Workup for an inherited thrombophilia was done. The patient and his one sibling had a 50% reduction in the plasma AT III activity level, highly suggesting a congenital AT III deficiency.

**Conclusions:** Antithrombin III deficiency is a rare autosomal dominant thrombophilia that leads to increased risk for recurrent venous thromboembolism. We emphasize the value of considering hereditary thrombophilia as an etiology of CVT for the anticoagulant prescription and genetic counselling of the patient and his relatives.

**Trial registration number:** N/A

#### AS15-037

#### DIAGNOSTIC ASSESSMENT OF DEEP LEARNING ALGORITHMS FOR CLASSIFICATION ISCHEMIC STROKE SUBTYPES

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**Background and Aims:** Using multi-center image-based stroke database that contains deep learning-friendly information, we developed the deep

learning-based software that automatically classifies stroke subtypes after reading diffusion-weighted magnetic resonance images. We then performed a clinical trial to assess the efficacy of the deep learning algorithm.

**Methods:** From 2,489 patients, we developed the automatic stroke classification system. Stroke subtype was designated by stroke neurologist as a ground truth. We used semi-3D convolutional neural network and soft vector machine using acute diffusion-weighted image and the presence of atrial fibrillation. Then, the automatic classification system was applied to 1,089 patients and compared with the classification by stroke neurologists.

**Results:** Mean age of trial data was 69 and 60% were men. Inter-rater agreements for stroke classification were 0.61 (by Cohen's Kappa, 95% confidence interval 0.57–0.65) between two stroke neurologists and 0.58 (0.54–0.63) between vascular neurologists' consensus and machine learning algorithm. Analysis of secondary outcomes showed that the sensitivity measuring the proportion of large artery atherosclerosis strokes (LAA) (based on the stroke neurologists' consensus) that were identified as having the stroke subtype by the automatic system was high: 0.762 (0.728–0.796). The specificity measuring the proportion of non-LAA strokes that were identified as such was higher: 0.856 (0.822–0.891). The sensitivity for small vessel occlusion strokes was relatively low 0.638(0.563–0.712), however the specificity was high: 0.831 (0.806–0.856). The sensitivity and specificity for cardioembolic strokes were both very high: 0.940 (0.905–0.974) and 0.945 (0.933–0.963).

**Conclusions:** We found that deep learning-bases automatic classification system had a high sensitivity and specificity for correctly classifying every stroke subtype.

**Trial registration number:** N/A

## WITHDRAWN

## AS15-052

### EARLY MIDREGIONAL PRO-ATRIAL NATRIURETIC PEPTIDE PREDICTS THE OCCURRENCE OF ATRIAL FIBRILLATION IN STROKE PATIENTS: DATA FROM THE BIOSIGNAL STUDY

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**Background and Aims:** We evaluated and validated the incremental predictive value of Midregional pro-Atrial Natriuretic Peptide (MR-proANP) in identifying underlying atrial fibrillation (AF) and recurrent vascular events after ischemic stroke.

**Methods:** In this interim analysis of the first 980 stroke patients within the prospective, multicenter BIOSIGNAL study (NCT02274727), we measured MR-proANP levels within 24h of stroke onset. Primary outcomes were known and newly detected AF (assessed by at least 7 days of ECG-monitoring) and a composite of cardiovascular death, stroke, or myocardial infarction within 365 days after stroke.

**Results:** After adjustment, higher logMR-proANP levels were associated with known AF (adjusted Odds ratio (aOR) 5.2 [95% CI: 3.04 – 8.86], p < 0.001) and newly detected AF (aOR 7.75 [95% CI: 4.87 – 12.33], p < 0.0001), as well as with the composite outcome (adjusted hazard ratio (aHR) 1.70 [95% CI: 1.06 – 2.47], p = 0.025). MR-proANP improved the discriminatory accuracy for the prediction of AF and the composite outcome when being added to the best multivariate models (including demographic and vascular risk factors, (table I)). Moreover logMR-proANP improved the validated ASSE score for the prediction of AF after stroke (table I). MR-proANP levels ≥255 pmol/L had a specificity of 89% and sensitivity of 40% for the diagnosis of newly detected AF.

Table I Discriminatory accuracy of MR-proANP regarding the prediction of known atrial fibrillation, newly detected atrial fibrillation and the composite of stroke, cardiovascular death, or myocardial infarction within 365 days after stroke

Predictors	AUC	95% CI	Likelihood ratio test <sup>a</sup>
<b>Known history of atrial fibrillation</b>			
Model 1 <sup>b</sup>	0.67	0.61 – 0.72	
Model 1 <sup>b</sup> and MR-proANP	0.85	0.81 – 0.88	<0.001
<b>Newly detected atrial fibrillation up to one year after stroke</b>			
Model 2 <sup>c</sup>	0.73	0.69 – 0.77	
Model 2 <sup>c</sup> and MR-proANP	0.83	0.79 – 0.87	<0.001
<b>Composite of stroke, cardiovascular death, or myocardial infarction</b>			
Model 3 <sup>d</sup>	0.79	0.73 – 0.84	
Model 3 <sup>d</sup> and MR-proANP	0.80	0.74 – 0.85	0.025

Abbreviations: AUC = area under the ROC curve; CI = confidence interval; MR-proANP = midregional proatrial natriuretic peptide; NA = not applicable; NIHSS = NIH Stroke Scale; ROC = receiver operating characteristics.

<sup>a</sup> To compare the AUCs of nested vs whole models, the likelihood ratio test was used.

<sup>b</sup> Model 1 (coronary, heart failure, previous stroke)

<sup>c</sup> Model 2 (ASF score to detect paroxysmal atrial fibrillation after stroke including: age x 0.76 points/year, stroke Severity NIHSS≤5 = 9 points, NIHSS>5 = 21 points)

<sup>d</sup> Model 3 (age, Charleson index, NIHSS, weight, heart rate, previous stroke, secondary therapy with antilipids post stroke, glucose) in a subgroup of patients with either cryptogenic stroke or cardioembolic stroke

**Conclusions:** MR-proANP is an independent marker for newly detected atrial fibrillation and cardiovascular events after stroke. Therefore MR-proANP could be used to identify patients at a high risk for cardiac thromboembolism and even guide treatment decisions for secondary stroke prevention.

Trial registration number: NCT02274727

### AS15-073

#### LONG-TERM OUTCOME IN CEREBRAL ARTERIA ISCHEMIC STROKE (AIS) DUE TO VARICELLA ZOSTER VIRUS (VZV) IN CHILDREN

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**Background and Aims:** Limited data are available on long-term outcome of children with VZV-related AIS. We aimed to describe the clinical, laboratory and neuroradiologic features of children affected by AIS due to post-VZV referred to our Institute.

**Methods:** We selected 11 pediatric patients (9 males) with AIS and a virologically confirmed VZV infection or with a VZV history in the previous 18 months. Clinical, neuroimaging and laboratory data were reviewed, focusing on pediatric score outcome measure (PSOM).

**Results:** Average age of AIS onset, VZV primary infection and interval between infection and AIS were: 5 years (range: 3–9.9 years), 4.8 years (range 2.3–9.4 years), and 4 months (range 10days–8months), respectively. The AIS involved the nucleo-capsular region in 9 cases, the cerebral cortex in 6 cases, the thalamus in 4 cases, and the pons in 1 subject. Nine out of 11 patients had an inflammatory focal cerebral arteriopathy (iFCA). Virological confirmation (VZV-DNA or anti-VZV IgG in the cerebrospinal fluid) was obtained in 4 patients. Three patients were treated with rTPA/trombectomy, 6 with antiviral agents associated with steroids in 5 cases. Prophylactic antiaggregants were administered to all patients. Mean age at last follow-up was 9 years (range 3.9–18years) with a mean follow-up of 4 years. iFCA were persistent in 6 cases and transient in 3 subjects. Another patient had a late asymptomatic iFCA. Median PSOM score was 1 (IQR 1–1.75).

**Conclusions:** Albeit a favorable evolution was initially described, our experience suggests that VZV-related AIS may result in persistent FCA and significant neurological impairment in the majority of cases.

Trial registration number: NA

### AS15-044

#### EMBOLIC STROKE OF UNDETERMINED SOURCE: A SINGLE-CENTER COHORT STUDY

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**Background and Aims:** The term Embolic Stroke of Undetermined Source (ESUS) refers to a non-lacunar infarct occurring in the absence of extra/intracranial atherosclerosis causing ≥50% luminal stenosis, major-risk cardiomebolic sources, and any other specific cause of stroke

**Methods:** Our aim was to provide a descriptive analysis of an ESUS population. We retrospectively analyzed data on consecutive patients admitted for ischemic stroke in our center in one year.

**Results:** Out of 342 patients, 246 received the complete diagnostic assessment proposed by CS/ESUS international working group. Stroke subtypes were: 20% ESUS, 39% cardioembolic, 17% atherothrombotic 5% lacunar, and 16% other causes. Mean age was lower in ESUS than cardioembolic and atherosclerotic stroke groups ( $66.4 \pm 13.7$  vs  $79.8 \pm 8.9$  years,  $p < 0.001$  and  $74.3 \pm 10.4$ ,  $p = 0.012$ , respectively). In comparison with cardioembolic stroke, ESUS presented lower mean NIHSS ( $5.2 \pm 5.2$  vs  $12.6 \pm 7.8$ ;  $p < 0.001$ ) and less frequent large-vessel occlusion at admission (65% vs 33%;  $p = 0.001$ ), while frequency of cortical/cortical-subcortical lesions were similar (89% and 86%;  $p = 0.144$ ) and higher than atherosclerotic stroke (63.3%;  $p = 0.022$ ). NT-proBNP blood levels ( $349.7 \pm 487.7$ ) were above normal range in ESUS, but lower than in the other groups. Left atrial size was increased in 55% of ESUS and 62% of cardioembolic strokes in comparison with 24% of atherosclerotic group ( $p = 0.013$ ).

**Conclusions:** In line with data from literature, ESUS patients were younger and suffered from less severe strokes when compared to cardioembolic stroke patients. However, they presented cortical lesions in the majority of cases, altered NT-proBNP and left atrial enlargement. These data might support a cardiogenic origin of emboli in this group.

Trial registration number: N/A

### AS15-007

#### ESUS AND PFO : VALIDATION OF THE ROPE SCORE, AND ITS UTILITY FOR AF PREDICTION

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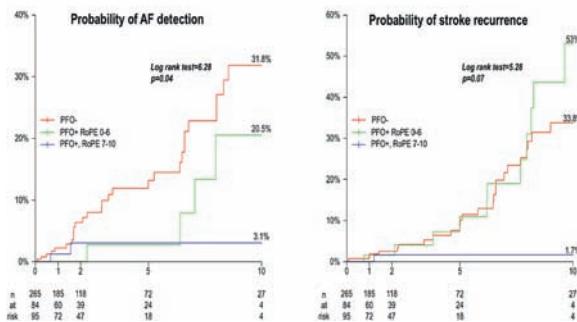
**Background and Aims:** PFO in ESUS patients may be incidental or pathogenic. Alternative mechanisms, such as covert atrial fibrillation, may be the actual stroke mechanism. The Risk of Paradoxical Embolism (RoPE) score was developed to estimate the probability that a PFO is pathogenic. We aimed at validating the RoPE score in a large ESUS population, and investigate the rate of AF detection during follow-up according to PFO status and RoPE score.

**Methods:** The study was conducted retrospectively on three stroke registries with prespecified data collection: the Acute STroke Registry and Analysis of Lausanne (ASTRAL), the Athens Stroke Registry (ASR) and the Larissa Stroke Outcome Registry (LASTRO).

**Results:** Among 455 ESUS patients (median age 59 years, 41% females, median follow-up 1.7 years) where PFO was searched, it was discovered in 40% (n=184). The prevalence of PFO increased with higher RoPE score values (Table). The performance of the RoPE score (AUC-ROC) was 0.75. The overall Kaplan-Meier estimate of 10-years AF detection and stroke recurrence were 26% (16.9-35%) and 34.4% (24-44.7%) respectively. The 10-year probability of AF detection was lowest in patients with PFO likely pathogenic (RoPE=7-10), intermediate in those with PFO likely incidental (RoPE=0-6) and highest in those without PFO (Figure). Stroke recurrence rate was non-significantly lower in PFO likely pathogenetic patient than in others.

RoPE score	N. of patients	PFO prevalence, %	PFO-attributable fraction, %
0-2	32	6 (0-15)	0 (0-0)
3	76	20 (11-29)	0 (0-18)
4	90	24 (16-33)	0 (0-32)
5	56	39 (26-52)	48 (5-69)
6	56	45 (32-58)	59 (29-76)
7	56	66 (54-78)	83 (72-91)
8	51	65 (52-78)	82 (69-91)
9-10	38	74 (60-88)	88 (78-95)

Table. PFO prevalence and PFO-attributable fraction (probability that a PFO is pathogenic) according to RoPE score value.



**Conclusions:** In this multicentre study of ESUS patient, the RoPE score was validated for discrimination of incidental and pathogenic PFO. Low RoPE scores also predict incidental AF during 10 year follow-up.

**Trial registration number:** N/A

## AS15-022

### VI STENOSIS OF VERTEBRAL ARTERY IN THE POSTERIOR CIRCULATION ISCHEMIC STROKE DUE TO LARGE ARTERY ATHEROSCLEROSIS

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**Background and Aims:** The VI segment stenosis of vertebral artery is a common site for large artery atherosclerosis. It causes approximately

20% of posterior circulation ischemic stroke. The aim of this study was to determine the risk factors, prevalence and prognosis of VI stenosis at acute ischemic stroke in the posterior circulation due to large artery atherosclerosis.

**Methods:** We reviewed the charts of 957 patients who were admitted with acute ischemic stroke between the dates January 2011 and May 2017. The demographic data, NIHSS scores at admission, acute ischemic stroke in the posterior circulation due to large artery atherosclerosis and mRS in follow-up period were recorded. We determined etiologic stroke subtypes using the automated Causative Classification System (CCS).

**Results:** A total of 80 (8.36%) patients with acute ischemic stroke in the posterior circulation due to large artery atherosclerosis. Thirty (37.5%) patients (27 females [90%], mean age  $67.4 \pm 14.3$  years) had symptomatic VI stenosis and 15 (18.75%) patients (13 females [86.7%], mean age  $68.2 \pm 18.05$  years) of them had isolated VI stenosis. No between group differences in history of vascular risk factors and mRS in follow-up period were observed ( $P > 0.05$ ). Admission NIHSS was higher in patients with VI stenosis than others ( $p = 0.049$ ).

**Conclusions:** The VI stenosis of acute ischemic stroke in the posterior circulation due to large artery atherosclerosis was 37.5 % in our registry. VI stenosis could be related to severe stroke.

**Trial registration number:** N/A

## AS15-064

### SHABU ABUSE AND ISCHEMIC STROKE IN AN ASIAN ADULT

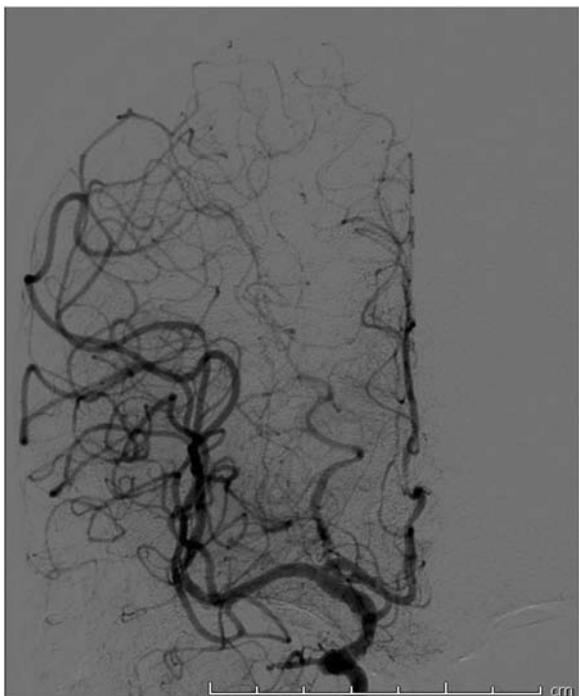
D. Villa<sup>1</sup>, S. Lanfranconi<sup>1</sup>, I. Ghione<sup>1</sup>, G. Valcamonica<sup>1</sup>, D. Gagliardi<sup>1</sup>, N. Bresolin<sup>1</sup> and S. Bonato<sup>1</sup>

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**Background and Aims:** Methamphetamine abuse is an increasingly recognized risk factor for stroke, causing up to 6% of ischemic strokes in young people. "Shabu", the purest form, is widespread in Southeast Asian communities. Shabu is frequently assumed by inhalation and it is typically associated with ischemic stroke. We are reporting a case of ischemic stroke in a Shabu abuser.

**Methods:** A 55-year-old Asian active Shabu abuser male presented with a 24-hours history of headache and left limbs weakness. The patient suffered from hypertension, diabetes and dyslipidemia. Neurologic evaluation revealed left facial palsy, left hemiparesis with sensory loss.

**Results:** Brain Magnetic Resonance Imaging (MRI) showed recent ischemic lesions located in frontal right deep white matter and corpus callosum. Multiple focal vessel wall thickening and narrowings affecting cervical and intracranial vessels and subocclusive stenosis of the right anterior cerebral artery were disclosed by MR Angiography and confirmed by cerebral angiography. To rule out central nervous system (CNS) or systemic vasculitis, autoimmune screening, lumbar puncture and total body positron emission tomography (PET) were performed with negative results. Intravenous metilprednisolone was administered without clinical and radiological improvements.



**Conclusions:** Amphetamine-related cerebral vasculopathy (ARCV) is associated to higher risk of strokes. Ischemic strokes may result from accelerated atherosclerosis, often associated with cardiovascular risk factors, rather than necrotizing arteritis. Even if radiological findings are

suggestive for CNS vasculitis, there is no evidence of inflammation or necrosis in histological samples. In support of this hypothesis, our patient did not recover after steroids treatment. Accelerated atherosclerosis represents the most likely pathogenic mechanism underlying ARCV.

**Trial registration number:** N/A

## AS15-047

### ARTERY OF PERCHERON INFARCTION: CLINICAL SPECTRUM AND ETIOLOGY

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**Background and Aims:** The artery of Percheron (AOP) is a variant of the paramedian arteries with a single trunk stemming off from one posterior cerebral artery to supply both paramedian thalamus and the rostral midbrain. Thus, occlusion of this artery results in bilateral thalamic and midbrain infarctions. The symptoms are often characterized by altered mental status, consciousness, and memory impairment, and oculomotor nerve deficit. Usually the etiology is cardioembolic or small vessel disease combined with individual anatomical predisposition.

**Methods:** We report 15 cases of stroke from Percheron artery occlusion, verified at our stroke unit between the years 2007–2018.

**Results:** Patients had varying degrees of altered state of consciousness, cognitive impairment, hemiparesis, dysarthria and oculomotor disturbance. All of these patients have a bilateral thalamic infarction and a midbrain involvement at CT scan or cerebral MRI. The diagnostic assessment revealed: atrial fibrillation in 3 patients, patent foramen ovale with moderate-severe right to left shunt in 2 patients, endovascular thrombotic apposition in diffuse parietal hypokinesia in 1 patient, severe carotid atheromasy in left ICA (70%) in 1 patient with fetal origin of left PCA, thrombosis of the apex of the basilar in 1 patient. Of all these patients, only two received thrombolytic therapy.

**Conclusions:** Our data are in line with the data in the literature and therefore confirm:

- the great clinical variability of AOP infarction
- the importance of neuroimaging, in particular MRI for acute differential diagnosis and therefore acute thrombolytic therapy
- the high risk of cardioembolic etiology and therefore the research of cardioembolic sources.

**Trial registration number:** N/A

## AS15-079

### JAK2 MUTATION IN EMBOLIC STROKE OF UNKNOWN SOURCE

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**Background and Aims:** The JAK2 V617F mutation is an acquired, somatic mutation present in the majority of patients with myeloproliferative neoplasm (essential thrombocythemia and polycythemia vera). Those disorders have been associated with arterial and/or venous thrombosis. The role of JAK2 mutations in cerebral ischemia of unknown origin has not been well described.

**Methods:** We report 6 cases of patients hospitalized for ischemic stroke with newly diagnosed chronic myeloproliferative disease from JAK2-V617F mutation.

**Results:** Patients had a variable age between 38–78 years, ischemic stroke in the territory of MCA, PCA BA, or VA. The findings excluded other frequent causes of ischemic stroke. Of these patients 4 had a

normal blood count, only 2 had thrombocytosis or polycythemia. All patients were treated with oncocarbide. Among these 4 started antiplatelet therapy and 2 anticoagulant therapy.

**Conclusions:** We confirm some data reported in the literature, that JAK2 mutation increases the risk of cerebrovascular thrombosis. Finally, we recommend the detection of JAK 2 mutation in patients with an embolic stroke of an indeterminate source, not only in patients with thrombocytosis or polycythemia, but also in patients with a normal cell blood count.

**Trial registration number:** N/A

## AS15-030

### CARDIAC INVESTIGATIONS IN PATIENTS WITH ACUTE ISCHEMIA

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**Background and Aims:** Cardioembolic stroke accounts for up to 30% of ischemic stroke. Cardiac investigations, echocardiogram (Echo) and ambulatory ECG (aECG), are routinely conducted in patients with acute ischemic stroke (AIS) without another known definitive cause. The aims of this audit were to assess the completion of cardiac investigation and the impact of the result on patients' management.

**Methods:** Using Sentinel Stroke National Audit Programme (SSNAP) data and the Transient Ischaemic Attack (TIA) registry, we identified all patients diagnosed with AIS or TIA in March 2018. For all suitable patients, cardiac investigations completion dates, results and further management plan were reviewed.

**Results:** During the study period, 103 patients were diagnosed with AIS (92) or TIA (13). 56 and 74 patients were identified as suitable for further aECG and Echo respectively. 2 patients did not have aECG, while 3 patients did not have Echo. The median completion times were 4 days (1 day to 9 months) for aECG, and 2 days (1 day to 5 months) for Echo. All test results were acknowledged at follow up. Management plan was changed by aECG in 7.4% (4/54) and Echo in 15.5% (11/71) patients.

**Conclusions:** Stroke patients had high cardiac investigation completion rate (97%). However under current practice, the positive finding rate in aECG was low compared with literature reported. Further change in aECG modality based medical evidence and advance in technology is required.

**Trial registration number:** N/A

### Epidemiology of Stroke

#### WITHDRAWN

**F. Al-Senani<sup>1</sup>, M. Salawati<sup>1</sup>, M. Aljohani<sup>1</sup>, M. Cuche<sup>2</sup>, V. Seguel Ravest<sup>3</sup> and S. Eggington<sup>4</sup>**

<sup>1</sup>National Neurosciences Institute- King Fahad Medical City, Department of Neurology, Riyadh, Saudi Arabia; <sup>2</sup>Medtronic International Trading Sarl, Neurovascular Health Economics and Reimbursement, Tolochenaz, Switzerland; <sup>3</sup>Medtronic Ltd, Neurovascular Health Economics and

## AS16-061

### COMPLETENESS OF CASE ASCERTAINMENT AND SELECTION BIASES IN TWO SWEDISH HOSPITAL-BASED STROKE REGISTERS

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**Background and Aims:** Data from hospital-based stroke registers are increasingly used to estimate epidemiological trends. We examined case ascertainment completeness and selection biases in two hospital-based stroke registers compared to a population-based register.

**Methods:** First-ever stroke cases (ischemic stroke or intracerebral hemorrhage) between March, 2015 and February, 2016 in the catchment area of Skåne University Hospital, Lund, Sweden were included from overlapping sources including two hospital-based stroke registers (Riksstroke and Lund Stroke Register (LSR), retrospective searches of outpatient clinics, primary care registers, and autopsy registers. The resulting population-based cohort was used as reference standard to assess completeness of case ascertainment and patient characteristics in Riksstroke and LSR.

**Results:** In total, 399 stroke patients were identified. Riksstroke detected 328 (82%) patients, whereas LSR detected 363 (91%). Patients undetected by the hospital-based registers had higher 28-day case-fatality than those detected (44% vs 9%;  $p = 0.001$ ). Patients only detected in primary care ( $n = 11$ ) more often lived in health care facilities compared to those detected by the registers (57% vs. 7%;  $p = 0.001$ ). Patients not detected by Riksstroke had less severe strokes compared to patients detected by Riksstroke (median NIHSS score 3 vs 5;  $p = 0.024$ ).

**Conclusions:** Some first-ever stroke patients are not captured by hospital-based screening methods commonly used in clinical stroke registers, resulting in selection biases in stroke mortality and stroke severity data in hospital-based stroke registers.

**Trial registration number:** N/A

## AS16-070

### FIRST STROKE INCIDENCE IN SAUDI ARABIA OVER THE NEXT DECADE: RESULTS FOR THE RIYADH REGION

**F. Al-Senani<sup>1</sup>, M. Salawati<sup>1</sup>, M. Aljohani<sup>1</sup>, M. Cuche<sup>2</sup>, V. Seguel Ravest<sup>3</sup> and S. Eggington<sup>4</sup>**

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Reimbursement, Watford, United Kingdom; <sup>4</sup>Medtronic International Trading Sarl, Corporate Health Economics & Reimbursement, Tolenenaz, Switzerland

**Background and Aims:** Saudi Arabia has a young but ageing and growing population, with 60% aged 30 years and below, leading to concerns about the increasing burden of stroke in the coming years. We built an epidemiological model to predict the number of first strokes (ischaemic strokes and intra-cerebral haemorrhages) over a ten-year period, using local population, mortality and stroke incidence data. Our analysis focused on the Kingdom's most densely populated region, Riyadh.

**Methods:** We used population data from the Saudi Statistics Authority as the basis for the model and applied published mortality rates and immigration/emigration data to predict the population of the Riyadh region over a ten-year period. We then used published age- and gender-specific stroke incidence rates from a Saudi study to predict the number of first strokes in each year.

**Results:** The population of the Riyadh region was expected to increase by 13.3% over ten years to 9,310,951. This was predicted to lead to a 77% increase in the number of first strokes over this period (from 3,520 in year one to 6,215 in year ten), due to a combination of an increasing and ageing population. In year ten, this is equivalent to 66.7 first strokes per 100,000 person-years.

**Conclusions:** Our analysis suggests a significant growth in demand for stroke services over the next decade, highlighting the need for expanded stroke care services and stroke prevention programmes. This modelling approach can be extended to other regions to assist with such planning exercises.

**Trial registration number:** N/A

## WITHDRAWN

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with environmental and socioeconomic risk factors. This type of studies could support the decision-making in the planning of resources for stroke care.

**Trial registration number:** N/A

## AS16-008

### THE IMPACT OF ATRIAL FIBRILLATION ON LONG-TERM SURVIVAL OF ISCHEMIC STROKE IN A BRAZILIAN STROKE COHORT (EMMA STUDY)

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I.M. Benseñor; <sup>1</sup>Universidade de São Paulo USP, Center for Clinical and Epidemiological Research- Hospital Universitário, sao paulo, Brazil

**Background and Aims:** Atrial fibrillation (AF) is considered an important risk factor for ischemic stroke corroborating to increase the risk of death. Thus, we evaluated the prognostic value of AF in the EMMA Study (Study of Stroke Mortality and Morbidity).

**Methods:** 1,120 ischemic stroke (IS) individuals (median age 70y-old) with information about AF (before event index) confirmed by electrocardiogram had long-term mortality risk evaluated according to AF presence (reference group: without AF). We performed Kaplan-Meier curves and Cox logistic regression models [cumulative hazard ratio (HR) with 95% confidence intervals (95% CI)] for all-cause, stroke (ischemic and hemorrhagic) and cardiovascular (coronary heart disease (CHD) including myocardial infarction, myocardial revascularization and heart failure due to CHD or other causes) mortality up to 12-year follow-up. It was calculated multivariate HR adjusted by age, sex and potential confounders such as hypertension, heart failure, CHD and medication use.

**Results:** Overall survival rate was 41.6% (654 deaths/ 1,120) and the poorest survival rate was observed among those who had AF compared to those without AF (median survival days: 515 (95%CI: 329 to 701) vs. 1,808 (95%CI: 1,578 to 2,013), respectively, p-log rank < 0.0001). Along 12-years of follow-up, prior AF was associated to increased mortality risks: all-cause (multivariate HR, 1.53; 95% CI, 1.26-1.87), stroke (multivariate HR, 1.40; 95% CI, 1.01-1.95) and CVD (multivariate HR, 2.25 ;95% CI, 1.59-3.18).

**Conclusions:** In the EMMA study, AF represented an independent predictor of poor long-term survival increasing all-cause and specific mortality risks, particularly CVD mortality about twice, among individuals who developed ischemic stroke.

**Trial registration number:** N/A

## AS16-052

### PATENT FORAMEN OVAL CLOSURE. A LONG-TERM PREVENTION

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**Background and Aims:** The patent foramen oval (PFO) is present approximately 50% of cryptogenic strokes. Recent clinical trials supported the endovascular closure of the patent foramen oval as a secondary prevention treatment in groups of patients and demonstrated less stroke recurrence than medical treatment.

**Methods:** We performed a retrospective analysis of patients with cryptogenic stroke and findings of PFO in the echocardiographic tests followed in our neurologic department from 2012 to 2017. We recorded epidemiological data, diagnostic findings, treatments, follow-up and

recurrence, in both groups of pharmacological treatment and non-invasive closure.

**Results:** A total of 259 patients with cryptogenic stroke were evaluated, 49 patients presented a diagnosis of paradoxical stroke caused by PFO after causal evaluation by TOAST and ASCOD scales. Average age was 49+- 8 years. Median value of ROPE score was 7. In 73% cases had an associated septum aneurysm (ASA) or massive right-left shunt, only 11% were moderate-mild and isolated. The recurrence rate of stroke due to large vessel occlusion in patients with PFO was less 2%. About 91% presented a good functional recovery in the third month (Rankin 0-2) The closure of the PFO was performed in 34% without complications, no variable showed significant differences. In this interventional group there was no recurrence in the mean follow-up of 3 years

**Conclusions:** Strokes caused by PFO present a very good prognosis with a very low recurrence in the medium/long-term in small series such as ours. About 70% of these patients with patent ovale foramen+ASA or massive shunt could be candidates to PFO closure.

**Trial registration number:** N/A

## AS16-024

### YOUNG ADULT STROKE IN TAIWAN: ETIOLOGIES AND OUTCOMES

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**Background and Aims:** Early-onset adult stroke has not been fully characterized in Asians. We investigated the etiologic subtypes, risk factors and 1-year outcomes of early-onset stroke (16 – 55 years old) in a Taiwanese cohort.

**Methods:** We retrospectively reviewed consecutive patients with acute stroke admitted to the Taipei Veterans General Hospital in Taiwan between 2009 and 2017. Patients were classified by age of onset ( $\leq$  or  $>$  55) and etiologic subtypes and regularly followed for 1 year.

**Results:** Among all stroke patients (n=8155), 17.6% (n=1310) were early-onset, who had slightly more spontaneous hemorrhagic stroke (50.8%) than ischemic stroke (49.2%). The most common etiologic subtypes of hemorrhagic stroke were hypertensive intracerebral hemorrhage (ICH), subarachnoid hemorrhage and undetermined ICH. The most common subtypes of infarction were large artery atherosclerosis, other determined diseases (52.5% arterial dissection) and embolic stroke of undetermined source. Smoking, alcohol overdrink, obesity, ischemic heart disease and family history of stroke were more in the early-onset than the elderly patients. The early-onset patients with familial stroke (n=87, 6.6%) were more males and more commonly had infarction than those without familial stroke. Monogenic diseases accounted for 5.7% of young familial stroke. At 1-year follow-up, the early-onset patients with infarction displayed greater functional improvements but more stroke recurrence than those with ICH.

**Conclusions:** Hypertensive hemorrhagic stroke and large artery atherosclerosis or dissection occlusion are characteristically common etiologies of young stroke in Taiwan. Early-onset infarction had higher recurrence yet better 1-year outcomes than early-onset ICH. Patients with familial versus non-familial aggregation had more ischemic infarction and monogenic diseases.

**Trial registration number:** N/A

**AS16-007**

**DIFFERENT STROKES FOR DIFFERENT FOLKS:  
A RETROSPECTIVE STUDY OF THE  
EPIDEMIOLOGY OF CEREBROVASCULAR  
DISEASES AMONGST CHINESE CANADIANS  
RESIDING IN TORONTO, CANADA**

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**Background and Aims:** It has been recognized in the past few decades that different ethnic groups living in Canada may have different stroke epidemiology. This presentation is focused on the stroke patterns of Chinese-Canadians living in the Toronto area of Canada.

**Methods:** Two retrospective case-controlled studies were carried out between 1990- 2000 to study the stroke characteristics of Chinese-Canadians living in Toronto. Statistical analysis was carried out by the Institute of Clinical Evaluative Sciences. A further retrospective study was also carried out in 2011 to look at the relationship between stroke and Type 2 diabetes mellitus amongst this population.

**Results:** Chinese-Canadians were found to have 1/6 the prevalence of extracranial vascular stenosis. They have a higher frequency of intracranial vascular disease which may be due to the higher frequency of hypertension and diabetes mellitus. Higher incidence of intracranial hemorrhage was found compared to Caucasian controls which may be due to the lack of awareness and optimal treatment of their hypertension. Details of the results of these three studies will be presented.

**Conclusions:** This is the first long term retrospective study of the stroke patterns and epidemiology for Chinese-Canadians residing in Toronto. Further prospective population-based study will be vital to study the important interaction between genetics and environment in the pathogenesis of different strokes for different folks.

**Trial registration number:** N/A

**AS16-068**

**EVALUATION OF CHANGE IN STROKE CARE  
IN THE PHILIPPINES USING RES-Q DATA**

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**Background and Aims:** There are 48 Acute Stroke Units in the Philippines. Of these, only 4 hospitals are utilizing the RES-Q data bank. The database will help assess the change in stroke care, treatment and outcome. The objective of this study is to assess the improvement in stroke care using RES-Q data in 4 tertiary hospitals in the Philippines.

**Methods:** This is a descriptive study using RES-Q data from the four participating hospitals in the Philippines namely: Jose Reyes Medical Center, Philippine General Hospital, Perpetual Succor Hospital and San Pablo Community Hospital. The data from the first 6 months, January-June 2018 was compared with the data taken from July- December 2018.

**Results:** Data shows an 1) increase in admission to acute stroke units; 2) 95% of acute stroke patients underwent rapid CT scan imaging within one hour of admission; 3) Improvement in the number of dysphagia screening and rehabilitation assessment 4) increase in thrombolysis rate from 8% to 20%; 5) improvement of door to needle time from 47 mins to 40 minutes and 6) increase utilization of anti-thrombotics, statins, antihypertensive medications and improvement in smoking cessation. The Mean MRS score on discharge was similar in both groups.

**Table 1 Demographic Data**

	January-June 2018	July 2018-Dec 2018
N	225	145
Mean Age	57	59
≤45	43 (19%)	21 (14%)
>45	182(80%)	124 (86%)
Male	151 (67%)	81 (56%)
Stroke subtypes		
Ischemic Stroke	153 (68%)	107 (73%)
ICH	63 (28%)	32 (22%)
TIA	8	3
SAH	1	2
Mean NIHSS on admission	8.5	7.9

**Table 2 Comparison of Stroke Care**

	January-June 2018	July-Dec 2018
Hosp Admission Stroke Unit	182 (80%)	144(99%)
CT Time		
≤ 1 hr of admission	159 (71%)	138 (95%)
> 1 hr of admission	52 (23%)	5 (3%)
Dysphagia screening Rehab assessment	188 (83%) 201 (89%)	128 (88%) 135 (93%)
IVT only	18(8%)	29(20%)
Mean MRS on discharge	2.11	2.17
Mean Door to needle time	47mins	40 mins
Antithrombotics	78%	96%
Statins	59%	70%
Antihypertensive	71%	74%
Smoking cessation	31%	40%
MRS on discharge		
MRS ≥ 3	31%	29%
MRS < 2	69%	70%

**Conclusions:** Based on the RES-Q data, there is improvement in stroke care in the four Philippine hospitals with the adaptation of the standardized stroke protocols, improvement in timelines and better MRS scores on discharge.

**Trial registration number:** N/A

**AS16-020**

**INFODEMIOLOGY OF STROKE: PUBLIC  
INTEREST ON STROKE USING GOOGLE  
TRENDS 2004–2018**

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**Background and Aims:** The concept of Infodemiology was introduced as an attempt to assess the pattern of informations on public health via the web. It represents a basic technique for health research applications through the Web. Google Trends provides publicly accessible information regarding search behaviors in a population, which may be studied for health campaign evaluation and disease monitoring.

**Methods:** we extracted the relative monthly frequency of the search terms: stroke, ictus, schlaganfall and avc from January 2004 to present using google trends. The extraction was done using the health subgroup area in the all world. The search term diabetes was adopted as reference together with other popular search terms.

**Results:** the most frequent search term adopted for the syndrome was the English term stroke with a relative frequency of searches ranging between 54–100/month. The second most frequent term used was the French AVC with a relative frequency range 3–16/month. The higher interest on stroke was on July 2018. We observed an annual trend in poor interest in winter. The interest on stroke was 25% compared to diabetes, 10% compared to celebrities.

**Conclusions:** the global trend of information demand upon stroke is slowly increasing in the last years, but still too far from other relevant medical conditions (diabetes). Despite stroke heavy social impact the interest is far from being comparable to that of other futile popular topics. Specific social media campaigns need to be developed to focus the interest of larger public on stroke. The use of social media influencers is probably the key point.

**Trial registration number:** N/A

### AS16-003

#### DOES SUPPLEMENTAL HEALTH INSURANCE AFFECT THROMBOLYSIS RATE IN ACUTE STROKE?

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**Background and Aims:** Thrombolysis for acute ischaemic stroke has been widely available in Ireland since 2007. Although all patients are eligible for free emergency hospital treatment, 25–40% of the Irish population carry supplemental health insurance. All stroke patients presenting to emergency departments are managed by the same thrombolysis pathway, regardless of insurance status. We examined if patients with supplemental insurance present more frequently within window for thrombolysis, potentially indicative of increased health concern or education in this population.

**Methods:** A retrospective analysis was carried out on admissions to a tertiary University Hospital, between 01/01/2013 and 30/06/2017, of patients coded as 'stroke' on the hospital electronic stroke register. The health insurance status of all thrombolysed strokes were compared to age and sex-matched controls at a ratio of 1:2, and to the entire register population, to analyse demographic factors.

**Results:** 189 patients were thrombolysed between 1/1/2013 and 30/6/2017, of a total 1,333 strokes (14.2%). The average age of the thrombolysis group was 73, while the average age of the entire stroke population was 70.1 ( $p = 0.008$ , t test). Insured patients were thrombolysed more frequently (28% v 24%) but this was not statistically significant ( $\chi^2 = 0.91$ ,  $p = 0.34$ ). There was no significant difference in the male: female ratio between thrombolysed and non thrombolysed groups (52.4 % vs. 55.4% males), ( $\chi^2 = 0.6$ ,  $p = 0.44$ ).

**Conclusions:** Patients presenting to St James' Hospital, with supplemental health insurance, are not more likely to get thrombolysis compared to patients without. Overall, the thrombolysis group were significantly older, but there was no difference between the sexes.

**Trial registration number:** N/A

### AS16-046

#### ACUTE ISCHEMIC STROKE DUE TO LARGE VESSEL OCCLUSION- PREVALENCE AND ELIGIBILITY FOR THROMBECTOMY AT A TERTIARY REFERRAL CENTER

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**Background and Aims:** Endovascular thrombectomy (ET) for acute ischemic stroke (AIS) caused by large vessel occlusion (LVO) can prevent severe disability and mortality. There is currently limited data on the epidemiology of LVO strokes and endovascular thrombectomy eligibility (ET). We aim to determine the incidence of intracranial vessel occlusion (IVO) strokes eligible for ET per 2018 American Heart Association (AHA) guidelines and characteristics of AHA ineligible population.

**Methods:** Retrospective chart review of all acute ischemic strokes at a comprehensive stroke center (CSC) between November 2014 and February 2017. Demographic, clinical and radiographic data were analyzed by a vascular neurologist to determine ET eligibility per AHA guidelines and characteristics of ineligible patients were investigated.

**Results:** Twenty-four percent of AIS harbor an intracranial vessel occlusion. 30% of IVO strokes and 47% of anterior circulation LVO strokes are thrombectomy eligible per AHA guidelines. Most common reasons for thrombectomy ineligibility among IVO strokes are presence of IVO other than ACLVO (35%,  $n = 224$ ), presence of large stroke burden (15%,  $n = 93$ ), baseline mRS  $\geq 2$  (14%,  $n = 89$ ) and NIHSS score  $< 6$  (11%,  $n = 73$ ).

**Conclusions:** At a comprehensive stroke center, 1 in 4 acute ischemic strokes harbor an intracranial vessel occlusion. 7 in 100 acute ischemic strokes, 3 in 10 strokes with vessel occlusion and 1 in 2 strokes with internal carotid or middle cerebral artery M1 occlusion are thrombectomy eligible per AHA 2018 guidelines. These data highlight that current guidelines render a majority of strokes thrombectomy ineligible and a large window of opportunity exists for indication expansion.

**Trial registration number:** N/A

### AS16-075

#### STROKE REGISTER AND PRIMARY CARE DATA INTEGRATION: COMPARABILITY AND DIAGNOSTIC VALIDITY

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**Background and Aims:** We aim to determine the comparability and diagnostic validity of stroke recording in primary care electronic health record and a stroke register and describe the pre and post-stroke vascular morbidities in the integrated dataset.

**Methods:** Descriptive analysis of population-based electronic health record database linkage between primary care (Lambeth DataNet LDN) and the South London Stroke Register (SLSR), covering a multi ethnic, socioeconomically diverse inner-city population of over 357,308. Data used for this study were an extract from registered stroke patients that were alive at 1<sup>st</sup> October 2013. It contains information on the diagnosis made in primary care, along with information on risk factors, treatments, other pre-stroke morbidities and post-stroke follow-up.

**Results:** The point prevalence of strokes was 6.64 per 1000 in SLSR and 6.98 in LDN. Using SLSR, there were 1,027 incident strokes and we managed to link 821 (80% overlap) patients with LDN data. The observed point prevalence of morbidities was similar in the two data sources. In the integrated data (SLSR/LDN) the pre-stroke prevalence was: Hypertension 69%; diabetes mellitus 32%; coronary heart disease 20%.

After stroke, the most common morbidities are cognitive impairment, depression and chronic kidney disease.

**Conclusions:** The integrated data across primary and secondary health-care services can provide novel insights on the pathway of pre and post-stroke vascular morbidities and groups at risk. The information could be used to inform better care co-ordination and inform the design of more efficient and effective pathways of care.

**Trial registration number:** N/A

## AS16-002

### NEW INSIGHTS INTO WEATHER AND STROKE: INFLUENCES OF AIR MASSES ON STROKE INCIDENCE IN A DEFINED EUROPEAN REGION

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**Background and Aims:** Meteorological factors seem to influence stroke incidence, but the complex association of weather and stroke remains unclear, results of various studies reveal contradictory results. Possible explanations are a lacking subdivision of ischemic strokes, small patient numbers, selection of only singular weather elements without investigation of weather changes and many more.

**Methods:** Almost 18.000 stroke cases from a stand-alone stroke center in Southern Germany were analyzed from 2006 – 2015 regarding main subgroups of strokes and subdivision of ischemic stroke etiologies applying the TOAST classification. An air mass classification has been determined and relative excess morbidities have been derived for the 7 resulting air mass categories taking into account the day of the event and as well the preceding 2 and 5 days respectively.

**Results:** Statistically significant findings ( $\alpha \leq 0.1$ ) reveal that dry tropical air masses were associated with a lower/higher risk for hemorrhagic/macroangiopathic strokes (MAS). Dry polar air masses were associated with a higher/lower risk for intracerebral bleedings/ischemic stroke subtypes. Moist air masses were associated with a reduced incidence of MAS. A strong temperature increase 5-days prior to the event was associated with a lower risk of hemorrhagic strokes. Temperature increases were associated with lower risks for MAS and cardio-embolic strokes. Strong temperature decreases were associated with a higher risk of MAS.

**Conclusions:** Temperature differences in dry air masses and temperature changes within 5 days prior to the event were associated with relevant changes in stroke incidence. Stroke etiology, age, gender and risk factors were decisive factors.

**Trial registration number:** N/A

## AS16-026

### MANAGEMENT AND OUTCOME OF IN-HOSPITAL ISCHEMIC STROKES ELIGIBLE TO THROMBOLYSIS: FINDINGS FROM THE RESUVAL REGISTRY

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**Background and Aims:** Literature has shown that in-hospital strokes (IHS) were associated to longer management delays, tended to be more severe than out-of-hospital strokes (OHS) and associated to worst prognosis. This study aimed to investigate management and outcome of IHS from the French RESUVal registry.

**Methods:** Data were retrospectively analyzed from an observational prospective multicentric registry of acute ischemic strokes. All eligible patients to tissue plasminogen activator (tPA) from 5 primary and 1 comprehensive stroke centers were reported, without age or delay limitations.

**Results:** From 2010 to 2016, we enrolled 137 IHS. They were more associated with risk factors than OHS with more cardiovascular history (42.34% vs 20.82%,  $p < 0.0001$ ), hypertension (69.34% vs 54.56%,  $p = 0.0015$ ) and more active smokers (29.20% vs 21.23%,  $p = 0.0465$ ). The delay symptom-thrombolysis was 35 minutes shorter (120 [90;150] vs 155 [125;195],  $p < 0.0001$ ) as well as the delay symptom-imaging (MRI/CT-Scan) (67 [36;105] vs 116 [89;153],  $p < 0.0001$ ). After risk adjustment, IHS and OHS presented good functional outcomes before stroke (mRS = 0) (67.74% vs 70.63%,  $p = 0.7201$ ). At 3 months, differences increased with more IHS with degraded mRS (mRS = 3/4/5) (26.61% vs 18.25%,  $p = 0.0004$ ). The occurrence of stroke when the patient is hospitalized was not a determinant for worst prognosis at 3 months (death or modified Rankin Score  $\geq 3$ ) (RR 1.17, IC 95% [0.87;1.59],  $p = 0.3019$ ).

**Conclusions:** Federation of emergency physicians and neurologists with common guidelines have led to a high-quality of care in the acute ischemic stroke management.

**Trial registration number:** N/A

## AS16-086

### SHORT AND LONG-TERM PROGNOSIS AFTER PRIMARY INTRA-CEREBRAL HAEMORRHAGE FROM 1998 TO 2011 IN NORTHERN PORTUGAL

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**Background and Aims:** Incidence of primary intracerebral hemorrhage (PICH) in northern Portugal halved in the last decade. We intended to investigate if there were changes in the short and long-term prognosis after these events.

**Methods:** All suspect first-ever-in-a-lifetime stroke were introduced into two community-based registries (ACINI 1998–2000 and ACIN2 2009–2011). Patients were followed-up for surviving status, vascular event recurrence and cause of death. Kaplan-Meier method was used to estimate survival rates and Cox regression was used to adjust survival for age.

**Results:** A total of 222 patients with PICH (111 in ACINI and 111 in ACIN2) were followed-up for 7 years. Median age of PICH patients was higher in the second study (73 vs. 68 years old,  $p = 0.02$ ) with no differences in sex. Survival at 30 days (ACINI 0.68, 95% CI 0.69-0.76 vs. ACIN2 0.73, 95% CI 0.64-0.80), 1 year (ACINI 0.56, 95% CI 0.46-0.64 vs. ACIN2 0.55, 95% CI 0.45-0.64) and 5 years (ACINI 0.39, 95% CI 0.31-0.49 vs. ACIN2 0.25, 95% CI 0.16-0.34) were not significantly different. Overall 7-year-survival was not different after adjusting for age. In 1-year-

survivors, vascular events (43% vs 27%) followed by non-vascular events (22% vs 23%) and infections (13 vs 23%) were the main causes of death. Stroke recurrence rate was not different (3.9% vs 5%).

**Conclusions:** Although PICH incidence decreased, short and long-term prognosis as well as stroke recurrence after PICH remained stable in the last decade.

**Trial registration number:** N/A

## AS16-056

### QUALITY OF LIFE OF STROKE SURVIVORS: EXPERIENCE OF A COHORT IN COLOMBIA

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**Background and Aims:** In clinical practice and research the post-stroke outcomes have been measured based on the degree of disability or dependence (The modified Rankin Scale, mRS). The scale ranges from 0 (no symptoms) to 6 (dead). However, it does not represent the reality about stroke impact on quality of life of stroke survivors.

Measure the quality of life in post-stroke patients using a multidimensional instrument.

**Methods:** We used a semi-structured questionnaire in 91 patients of a stroke cohort from 4 medical centers in Bucaramanga, Colombia. We interviewed them for rehospitalization and actual medical condition. In addition, we evaluated quality of life by The EuroQol EQ-5D-5L.

**Results:** Median age was 69.12 SD +/- 13.68 years. 40,4% (36) females and 59,6% (53) males. There was similar distribution between mRS ( $p=0.634$ ). 47.2 % patients were mRS  $\leq 2$  and 52.8 % mRS  $> 3$ . EQ-5D 5L results showed 73% of the patients reported 1/5-dimension problem and most of the patients reported problems in all dimensions (46.15%).

**Conclusions:** Patients who need some kind of help in daily life routines perceive worst their quality of life. Post-stroke treatment should include pain and depression management. Both of them are treatable problems by a physician. Additionally, healthcare professionals should increase strategies to improve the performance of daily activities by patients.

**Trial registration number:** N/A

## AS16-005

### TIME TO SEEK MEDICAL HELP DELAYS ONSET-TO-DOOR TIME IN PATIENTS WITH ISCHEMIC STROKE

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**Background and Aims:** Prehospital delay remains the main reason for excluding stroke patients for thrombolysis. The main reason for a late arrival to the hospital is a considerable delay in making the decision to seek for medical assistance (onset-to-alarm time, OAT). The main objective of our study was to describe the factors associated with a short (<30min) and long (>30min) OAT.

**Methods:** We developed an observational study from a consecutive cohort of stroke patients admitted to the Department of Neurology, University Hospital UANL between January 1<sup>st</sup> to December 1<sup>st</sup>, 2018. Clinical and demographical data were obtained using a standardized data capture from a Stroke Registry (i-ReNe).

**Results:** 163 patients were included. Mean age 60.47(SD 13.25), 62% were men. Median OAT was 60min (IQR:10–380min) and OTD was 649min (IQR:215–2,315min). 80(49.07%) had a short OAT. OAT consumed 1.7% (IQR:0–8.35%) of the OTD in the short OAT group and 33.3%(11.1–70.9%) in the long OAT group. Severity and manifestations of stroke did not differ between groups ( $p=NS$ ). Patients with a short OAT were more likely to be admitted directly to our stroke center (41.7% vs 26.5%,  $p=0.04$ ) and to receive thrombolysis (12.9% vs 4.9%,  $p=0.07$ ). Attributing symptoms to stroke ( $p=0.026$ ;OR 2.77, CI95%1.1–6.8) and perceiving symptoms as severe ( $p=0.018$ ;OR 2.49, CI95%1.1–5.3) were associated with a short OAT.

**Conclusions:** OAT is determinant for the hospital arrival, as it consumes a considerable amount of the prehospital time. Fostering stroke awareness and interpretation of symptoms are needed to increase the number of patients receiving intravenous thrombolysis, especially in countries with limited access to treatments with an extended time frame.

**Trial registration number:** N/A

## AS16-064

### CERVICAL ARTERIAL DISSECTION BEYOND THE NEUROLOGICAL PERSPECTIVE

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**Background and Aims:** Large hospital-based cohorts are an important source of information about cervical artery dissection (CeAD). We hypothesize that the neurological perspective on dissection may be colored by patient recruitment in stroke centers and search to explore alternative views on this disease.

**Methods:** Publications from stakeholders not trained as neurologists (pathologists, vascular surgeons, manual therapists or reports from patients – <http://www.vertebralarterydissection.com/cases/cases.htm>) were compared with publications from neurologists. We focused on diagnosis, etiology and stroke risk of CeAD.

**Results:** We observed significant divergences with regards to dissection, dependent on the stakeholders' perspectives. The merged concept of "cervical artery" is popular among neurologists, while others tend to treat the carotid and vertebral arteries separately. Neurologists consider the stroke risk due to acute CeAD as very high (60–80%), whereas others assume a risk < 10%. The diagnostic differentiation between purely intramural hematoma (IMH) and true dissection (with intimal tear) is of clinical importance, but rarely made in CeAD. Patients often report on diagnostic delay due to confusion of CeAD symptoms with migraine, but medical literature on this point is rare. Patient often report on dissection in direct context of chiropractic treatment.

**Conclusions:** The neurological perspective on cervical artery dissection is stand-alone in several important aspects. Most salient are the neurologists' extreme views about the stroke risk due to CeAD (60–80%) and the lacking differentiation between true dissections and IMH.

**Trial registration number:** N/A

## AS16-062

### INCIDENCE AND MORTALITY OF CEREBRAL VENOUS THROMBOSIS IN A NORWEGIAN POPULATION

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**Background and Aims:** Cerebral venous thrombosis (CVT) is an uncommon form of stroke, which often affects women, younger adults and children compared to ischemic and haemorrhagic stroke. The diagnosis of CVT is challenging because of a highly variable clinical presentation. The annual incidence has previously been estimated around 3–5 per million, but recent studies have suggested higher figures. The catchment area of our department covers approximately 530,000 inhabitants, roughly 10% of the total population of Norway. All new cases of CVT can be found in this complete and well-recorded patient population. This will provide more reliable estimates of the population-based incidence of CVT.

**Methods:** Retrospective chart reviews based on ICD-10 codes of all new cases of CVT at Akershus University Hospital in a 7-year period between 01.01.2011 and 31.12.2017.

**Results:** Sixty-two patients were identified and included. 53% were female and the mean age was 43.2 (range 0–80) years. The incidence of CVT was 1.75/100 000/year with no significant sex difference. The incidence for children and adolescents (n=9) was lower than for adults (n=53); 1.08 vs. 1.96 /100 000/years with the highest incidence for those > 50 years with 2.10/100 000/year. 10% of the adults had a known coagulopathy or thrombophilia as a risk factor. The 30-days and 1-year mortality rates were 3% and 6%, respectively. Clinical presentations, identified risk factors and radiological findings will also be presented.

**Conclusions:** The incidence of CVT in our population is higher than previously reported. The mortality rate was similar to previous studies.

**Trial registration number:** N/A

## AS16-009

### CLINICAL AND LABORATORY PROFILE OF VASCULAR INTRACRANIAL EVENTS AMONG LEUKEMIA PATIENTS : DESCRIPTIVE STUDY

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**Background and Aims:** Vascular intracranial events is not commonly founded in leukemia patient. Sign and symptom of the event is similar to acute stroke. The neurological deficit could appear, but it is commonly neglected, in addition the patient got hospitalized not in neurology ward. This study focused on clinical sign and laboratory parameter attritube to vascular intracranial event in leukemia.

**Methods:** A retrospective study, from January to December 2016, using ICD-10 code involving patients age more than 18 years old with leukemia complicated by intracranial hemorrhage, subdural hemorrhage, subarachnoid hemorrhage, intraventricular hemorrhage and brain infarction or ischemia. Vascular intracranial events was diagnosed with brain computerized tomography. We exclude trauma cases in this study.

**Results:** Of 1025 leukemia patients, 27 had vascular intracranial event (2.6%), including 20 intracranial bleeding and 7 brain infarction. Vascular intracranial event occurred at median of 10 months after diagnosis, with average 39 years old. AML is the most common leukemia type in intracranial bleeding (50%) and brain infarction (43%). Presenting sign and symptom which prompted brain imaging included headache (78%), nausea and vomit (37%), cranial nerve involvement (37%), vertigo (29.6%), hemiparesis (26%), seizure (14.9%), aphasia (7.4%), and syncope (3.7%). Brain infarction and intracranial bleeding contributed death in 57.1% and 70% patients respectively. 96% patient diagnosed with vascular intracranial event among leukemia had thrombocytopenia, 55% had hyperleucocytosis, and 44% had both thrombocytopenia and hyperleucocytosis.

**Conclusions:** Leukemia patients who complained of headache, nausea and vomit, wih thrombocytopenia or hyperleucocytosis or both should undergo imaging to detect vascular intracranial event.

**Trial registration number:** N/A

## AS16-090

### POST STROKE PATIENT COMPLICATIONS – RETROSPECTIVE ANALYSIS OF A STROKE UNIT

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**Background and Aims:** Stroke is a leading cause of morbidity and mortality in Portugal. Functional status after stroke represents a potential risk for complications and admission to emergency department (ED). The aim of this study was to analyze the population of stroke-surviving patients that went to ED in the first year after discharge from a Stroke Unit.

**Methods:** Observational study of stroke-surviving patients admitted in Stroke Unit during 2017 who returned to the ED within the first year after discharge. It was collected epidemiological information, clinical stroke features and reasons for ED observation.

**Results:** 288 patients were included, 52,8% (n = 152) were women, mean age 74 years. 86,5% (n = 249) of the patients suffered ischemic stroke. The cumulative incidence of ED admission was 5,9% (n = 17) at 7 days, 31,3% (n = 90) at 3 months and 63,5% (n = 183) at 1 year after discharge. There were 472 ED admission episodes mainly due to infectious disease (41,3%, n = 195) and trauma (11,9%, n = 56). From these, 19,9% (n = 94) caused hospitalization. Patients admitted to ED had lower median of Barthel index score at discharge ( $p < 0,037$ ); we did not find statistical significant relation between ED admission and clinical stroke features, other disability scores or destination at time of hospital discharge. Overall mortality during this period of time was 10,1% (n = 29).

**Conclusions:** There is a significant incidence of ED admission in stroke surviving patients, what is affected by physical functioning at discharge, a potentially modifiable variable.

**Trial registration number:** N/A

## AS16-094

### TRENDS IN STROKE INCIDENCE AND CASE FATALITY IN ARCADIA, GREECE BETWEEN 1993 AND 2016: A PROSPECTIVE POPULATION-BASED STUDY

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**Background and Aims:** We aimed to determine the temporal trends of stroke incidence and mortality in Greece during the recent decades.

**Methods:** We used data from three population-based studies that we performed in adults patients during 1993–1995, 2004 and 2015–2016 in Arcadia, Greece. Records were collected prospectively from the General Hospital of Tripoli (the only hospital in the province), Health Centers, General Practitioners, Private Physicians and registry offices. The annual

incidence and case fatality (crude and standardized to the European Population) were determined per 100,000 people.

16 in Greece.

**Results:** 1,315 patients (mean age:  $76.9 \pm 11.8$ , 54.2% men) with a first-ever stroke were recorded in the overall period. The annual incidence (age- and sex-standardized to the European population) was 251.6/100,000 (95%CI:230.8–274.2) during 1993–1995, 252.4/100,000 (95% CI:222.6–286.1) in 2004 and 211.3/100,000 (95%CI:192.4–232.2) during 2015–2016. Overall, the age- and sex-adjusted mortality was 27.5% (95% CI:23.3%–32.4%) during 1993–1995, to 25.8% (95%CI:20.1%–32.7%) in 2004 and 22.1% (95%CI:16.5%–25.5%) during 2015–2016. Between 1993 and 2016, stroke incidence and case fatality rate decreased by 16% and 34% respectively, with the steeper fall occurring during the last 10 years of the study period.

**Conclusions:** This prospective population-based study shows that stroke incidence and case fatality rates declined between 1993 and 2016 in Greece.

**Trial registration number:** N/A

## AS16-040

### DEVELOPMENT AND VALIDATION OF A STROKE IDENTIFICATION ALGORITHM USING THE NATIONAL HEALTH INSURANCE CLAIM DATABASE

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**Background and Aims:** Identifying acute ischemic stroke (AIS) among potential stroke cases is crucial for stroke researches based on a claim database. However, the accuracy of the conventional method based on the diagnostic codes of International Classification of Diseases was less than expected.

**Methods:** Stroke cases with principal or additional diagnosis codes of I60 (subarachnoid hemorrhage), I61 (intracerebral hemorrhage), I62 (other nontraumatic intracranial hemorrhage), I63 (cerebral infarction) and I64 (stroke, not specified) were recruited using the claim data from the participating hospitals. The datasets were randomly divided into the development and validation sets with a ratio of 7:3. Algorithm was developed and validated by matching cases identified by the algorithm to the registry database.

**Results:** A total of 40,443 cases (male, 54.2%; age,  $65.7 \pm 15.5$ ) were analyzed, of which 31.7% were matched to the registry database as AIS. We selected 16 key identifiers from the claim data and developed 37 conditions through combinations of those key identifiers. The key identifiers comprised brain CT, MRI, rt-PA, endovascular treatment, carotid

endarterectomy or stenting, antithrombotics, anticoagulants, etc. The sensitivity, specificity and diagnostic accuracy of the algorithm was 81.2%, 82.9% and 82.4% in the development set; 80.2%, 82.0% and 81.4% in the validation set, respectively.

**Conclusions:** Our stroke identification algorithm may be useful to study stroke epidemiology at a national level in Korea, in which all the residents are covered by the one insurance system and all the claim data were centered in one agency. However, further efforts to refine the algorithm are mandatory.

**Trial registration number:** N/A

## WITHDRAWN

## AS16-077

### HIGH INCIDENCE OF STROKE IN YOUNG ADULTS IN TARTU, ESTONIA, 2013–2017: A PROSPECTIVE POPULATION-BASED STUDY

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**Background and Aims:** Previous studies have found that stroke incidence in young adults is rising. The primary goal of this study was to find out the incidence of stroke in 18–54-year-old residents of Tartu, Estonia in 2013–2017.

**Methods:** A population-based prospective study was conducted in Tartu 2013–2017. We included all 18–54-year-old residents of Tartu with first

ever stroke (ischaemic stroke (IS), spontaneous intracerebral haemorrhage, subarachnoid haemorrhage) using overlapping data sources for case ascertainment. 86% of patients were hospitalised in the Department of Neurology, Tartu University Hospital. Additional sources: other departments of Tartu University Hospital, outpatient clinic, death certificates, Estonian Electronic Health Registry. All cases were reviewed by the study group. The diagnosis of stroke was based on the WHO criteria.

**Results:** We identified 110 cases (IS 72.7%). The mean age for females was 42.6 (+/- 8.9), for males 45.6 (+/- 8.0). The crude incidence was 39.8/100000 (95% CI 32.7-48.0), the age adjusted rate to the European standard population was 49.8/100000 (95% CI 40.4-59.1), IS 35.9/100000 (95% CI 28.0-43.9). In the 18-44 age group the crude incidence of stroke was 17.7/100000 (95% CI 10.6-27.6) for males and 21.9/100000 (95% CI 14.2-32.4) for females. In the 45-54 age group crude stroke incidence was 172.9/100000 (95% CI 125.1-232.9) for males and 77.3/100000 (95% CI 49.0-116.0) for females.

**Conclusions:** Our study shows higher incidence of stroke in this socio-economically important patient group compared to studies from other high-income countries. We hope to find contributing factors and outcome measures from the ongoing Tartu Young Stroke Registry to explain these results.

**Trial registration number:** N/A

## AS16-012

### EPIDEMIOLOGICAL ANALYSIS OF HOSPITALIZATIONS DUE TO RECURRENT STROKE IN THE SILESIAN PROVINCE, POLAND, FOR THE YEARS 2009–2015

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**Background and Aims:** There is a lack of recent epidemiological studies on recurrent stroke (RS) in Poland. The aim of the study was to analyze all hospitalizations related to RS in Silesia – industrial region covering 12% of Polish population (4.6 mln).

**Methods:** There was done statistical analysis of data contained in stroke questionnaires transferred to the Polish National Health Fund by hospitals in Silesia, Poland, between 2009 and 2015.

**Results:** In the analyzed period the number of RS hospitalizations in the Silesia was 18,063 (22.2% of all acute strokes). The percentage of RS has significantly decreased during the period considered ( $p < 0.001$ ). The same observation concerned recurrent ischaemic stroke (RIS), but not recurrent haemorrhagic stroke (RHS). The median hospitalization time was 14 days for RHS, and 11 days for RIS. Large-artery atherosclerosis and cardioembolism were significantly more often recognized in RIS than in first-ever ischaemic stroke (FIS) (consecutively, 38.2% vs 36.0%, and 21% vs 18.1%;  $p < 0.001$ ). The in-hospital mortality rate was significantly higher for RS than for first-ever stroke (18.4% vs 17.2%;  $p < 0.001$ ). The same observation was done for RIS vs FIS (16.2% vs 13.9%;  $p < 0.001$ ), and for RHS vs FHS (39.8% vs 36%;  $p = 0.004$ ). The rtPA therapy was applied to 5.3% of FIS and 3.2% of RIS patients ( $p < 0.001$ ).

**Conclusions:** This is the first so comprehensive and long-term analysis of RS in Silesia, Poland. It can help in the implementation of appropriate educational programs, and thus help to improve the health status of the society.

**Trial registration number:** N/A

## AS16-036

### SENSITIVITY OF ADMINISTRATIVE HOSPITAL DIAGNOSTIC CODING IN IDENTIFYING IN-HOSPITAL ACUTE STROKES COMPLICATING PROCEDURES OR OTHER DISEASES

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**Background and Aims:** Administrative hospital diagnostic coding data are increasingly used in “big data” research and to assess complication rates after surgery or acute medical conditions. Acute stroke is a common complication of several procedures/conditions, such as carotid interventions, but data are lacking on the sensitivity of administrative coding in identifying acute stroke during inpatient stay.

**Methods:** Using all acute strokes ascertained in a population-based cohort (2002–2017) as the reference, we determined the sensitivity of hospital administrative diagnostic codes (ICD-10) for identifying acute strokes that occurred during hospital admission for other reasons, stratified by coding strategies, study periods, and stroke severity (NIHSS  $</\geq 5$ ).

**Results:** Of 3011 acute strokes, 198 (6.6%) occurred during hospital admissions for procedures/other diseases, including 122 (61.6%) major strokes. Using stroke-specific codes (ICD-10 = I60-I61&I63-I64) in the primary diagnostic position, 66 of the 198 cases were correctly identified (sensitivity for any stroke 33.3%, 95%CI 27.1-40.2; minor stroke 30.3%, 21.0-41.5; major stroke 35.2%, 27.2-44.2), with no improvement of sensitivity over time ( $p$ -trend = 0.54). Sensitivity was lower during admissions for surgery/procedures than for other acute medical admissions (n% 17/23.3% vs. 49/39.2%,  $p = 0.02$ ). Sensitivity improved to 60.6% (53.6-67.2) for all and 61.6% (50.0-72.1) for surgery/procedures if other diagnostic positions were used, and to 65.2% (58.2-71.5) and 68.5% (56.9-78.1) respectively if combined with use of all possible non-specific stroke-related codes (i.e. adding ICD-10 = I62&I65-I68).

**Conclusions:** Low sensitivity of administrative coding in identifying acute strokes that occurred during admission does not support its use alone for audit of complication rates of procedures or hospitalisation for other reasons.

**Trial registration number:** N/A

## AS16-041

### IMPACT OF COMORBIDITIES ON LONG-TERM SURVIVAL AFTER ISCHEMIC STROKE BY AEIOLOGICAL SUBTYPE: THE SOUTH LONDON STROKE REGISTER

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**Background and Aims:** To identify the prevalence of comorbidities at the time of stroke and up to 10 years after first ever ischemic stroke (IS) and examine their impact on long-term survival by aetiological subtype.

**Methods:** Data were collected within the South London Stroke Register (SLSR) between 2000 and 2015. Baseline data included sociodemographic factors, ischemic stroke subtype (modified TOAST), case mix, effective intervention. Comorbidities data included hypertension, atrial fibrillation (AF), peripheral vascular disease (PVD), diabetes, hypercholesterolaemia, mental health conditions and cancer. Survival curves were performed

with Kaplan-Meier methods and Cox Proportional-hazards models were used for survival analyses.

**Results:** Hypertension (65.23%-32.08%), hypercholesterolaemia (27.34%- 35.63%), AF (17.78%-14.19%) and mental health conditions (anxiety, depression and cognitive impairment) were prevalent up to 10 years after IS. Baseline comorbidities such as AF (Hazard ratio (HR):1.28 [95% CI:1.10,1.49]), PVD (HR:1.30 [1.05,1.60]), diabetes (HR:1.20 [1.05,1.38]), cognitive impairment (HR:1.21 [1.03,1.41]) and cancer (HR:1.39 [1.09,1.77]) increased the risk of death after IS. Large artery atherosclerosis (LAA) patients with diabetes (HR:2.21 [1.37,3.58]) had an even higher risk of death whereas hypercholesterolaemia (HR:0.52 [0.31,0.88]) reduced their death risk. AF (HR:2.28 [1.38,3.74]) and cognitive impairment (HR:1.93 [1.37,2.72]) were associated with even worse survival for small vessel occlusion (SVO) patients.

**Conclusions:** Cardiovascular related diseases and mental health conditions were prevalent after IS. Ischemic stroke patients with comorbidities, such as PVD, diabetes, cognitive impairment and cancer had a higher death risk. For stroke subtypes, LAA patients with diabetes and SVO patients with cognitive impairment had even worse survival.

**Trial registration number:** N/A

## AS16-080

### EPIDEMIOLOGICAL ANALYSES TO INFORM STROKE CLINICAL PRACTICE GUIDELINE DEVELOPMENT

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**Background and Aims:** Aim is to analyse epidemiology of prevalence and incidence of ischaemic stroke, its main causes, brain imaging using MRI, recanalization therapies, secondary prevention with antiplatelet and anticoagulants, mortality data and to inform development of clinical practice guideline on stroke in the Czech Republic.

**Methods:** We have used Institute of Health Information and Statistics of the Czech Republic (IHIS CR) data collected through National Health Information System and National Health Registers of the Czech Republic from 2015 to 2017 for analysis. Main diagnosis analysed was I63 (cerebral infarction) and of the following secondary diagnosis: I48 (atrial fibrillation and flutter), I35.9 (non-specified aortic valve disease), Q21.1 (atrial septal defect), or I33.0 (acute and subacute endocarditis). We have also analysed use of brain imaging with MRI, recanalization treatment using intravenous thrombolysis and mechanical thrombectomy, stroke secondary prevention with antiplatelet drugs and anticoagulation as well as hospital admissions and mortality.

**Results:** In total 159.344 patients were diagnosed with an ischaemic stroke from 2015 to 2017. Average prevalence of ischaemic stroke in the Czech Republic is 54.9 patients per 100 000. 98 % of patients with ischaemic stroke had atrial fibrillation or flutter as a secondary diagnosis. 57.2 % of patients with a diagnosis of ischaemic stroke were female and 42.8 % male. 22.2 % of patients with stroke received intravenous thrombolysis or mechanical thrombectomy in the Czech Republic in 2017. 82.8 % of patients with ischaemic stroke had prescribed either antiplatelets or anticoagulants in 2017.

**Conclusions:** The epidemiological analysis informed national stroke guideline development programme.

**Trial registration number:** N/A

## AS16-071

### ASSOCIATION OF A WEIGHTED GENETIC RISK SCORE FROM MMP7, MMP8, MMP26 WITH RISK OF ISCHEMIC STROKE

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**Background and Aims:** Previous studies reported that matrix metalloproteinase-7 (MMP-7) MMP-8 and MMP-26 were involved in the progress of atherosclerosis. Therefore, we aimed to evaluate the association of a weighted genetic risk score from the single nucleotide polymorphisms (SNPs) of MMP7, 8, 26 with risk of ischemic stroke.

**Methods:** In this study, there were 500 ischemic stroke patients and 500 age-, sex- matched healthy controls. A structured questionnaire including demographic data, lifestyle, and disease history were collected from the study subjects. The genetic risk score was a weighted average of the number of risk genotype across the selected SNPs from MMP7, MMP 8, MMP 26, with the weights being the log of the OR reported for each SNP. The genotypes of selected SNPs were determined by polymerase chain reaction-restriction fragment length polymorphism (PCR-RFLP). Multivariate logistic regression models were used to analyze the relationship between the genetic risk score and risk of ischemic stroke.

**Results:** After adjusting for age, gender, smoking, alcohol drinking, hypertension, diabetes and obesity, a significant positive association was found between study subjects with high genetic risk score and risk of ischemic stroke. After further analysis in the subgroups of large-artery atherosclerosis, small-vessel occlusion and cardioembolism, the significant positive association was observed in small-vessel occlusion (OR = 2.20, 95% CI = 1.21-4.03) and cardioembolism (OR = 2.53, 95%CI = 1.00-6.38).

**Conclusions:** The genetic score from MMP7, MMP8, MMP26 may be used to identify those individuals at greater risk for ischemic stroke.

**Trial registration number:** N/A

## AS16-044

### RES-Q IS THE FIRST EFFECTIVE STROKE REGISTRY TO DISPLAY THE CLINICAL DIFFERENCE IN STROKE EPIDEMIOLOGY IN NORTH AND SOUTH IN A MOUNTAINOUS COUNTRY

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**Background and Aims:** Data on stroke types distribution, in-hospital mortality and logistics are lacking in Kyrgyzstan, where 40% of geographic areas are covered by mountains. North and South are divided by highland mountainous range, making lifestyle of South and North and stroke treatment approach different. ESO-EAST in Kyrgyzstan aimed to implement the population-based stroke care quality register in 2016 to reflect epidemiology of stroke.

**Methods:** RES-Q register based on 24 variables reflects the stroke demographics, severity (NIHSS and mRS), time from the onset to admission, stroke type and discharge information. A paper-based form was developed by Kyrgyz scientists and filled out by doctors at south area and later the data were transferred into electronic-based RES-Q registry.

**Results:** A total of 647 strokes were registered in RES-Q, Kyrgyzstan in a period 2016–2018 years. There were 50.9 % males in all sample, but in the south capital – just 38.8% of males, leaving a stroke dominance in

females. Patients from south region were significantly younger ( $p = 0.003$ ) with the median age of 59 (19;92) with a median NIHSS 10, and more hemorrhagic transformation in ischemic strokes (IS). A TOAST subtype diagnosis was reached in 76% of patients in north and just 38% in south. Antiplatelets, anticoagulants and statins are much less prescribed in IS in discharge in south region.

**Conclusions:** First country registry RES-Q made possible to compare stroke subtypes and severity across the altitudes, revealing that patients from south of Kyrgyzstan are younger, have more severe strokes despite of the quicker time of admission to clinic.

**Trial registration number:** N/A

## AS16-034

### COMPARATIVE RATES OF MORBIDITY AND MORTALITY FROM STROKE IN KAZAKHSTAN BETWEEN 2015–2017 YEARS

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**Background and Aims:** With the rapid spread of new interventions in stroke care and at a point when the Kazakhstan undergoing never ceasing reforms of the healthcare system it is timely to examine the epidemiology of stroke within the country to set specific priorities for stroke service.

**Methods:** Between 2015 and 2017, 120,078 patients were hospitalized with stroke diagnosis in Kazakhstan. According to the last 3-year data, the amount of patients with stroke is growing as well as stroke-hospitalized morbidity (Table I).

Table I. Kazakhstan stroke epidemiology: N absolute numbers; HM hospitalized morbidity; IS Ischaemic stroke; HS Haemorrhagic stroke.

Year	Stroke patients (N)	HM per 100000 population	IS	HS	Not specified %	Thrombolysis %	Neurosurgical procedures %
2015	38,518	219.7	28,717	9,102	699	0.9	2.4
2016	40,266	226.5	29,851	9,537	878	1.3	2.9
2017	41,292	229.2	30,234	9,876	1,182	2.2	5.1

Sex and age structure analysis of the stroke patients in 2017 showed that men are more prone to stroke and the incidence rate higher in 46–55 and 56–65 age groups (23%).

Hospital mortality rate was around 13.3% within all admitted patients with stroke. 1<sup>st</sup> day mortality rate – 3.3%. 30-day after discharge mortality rate is 7.0%. Both indicators are national quality indicators which allows to assess both hospital and local GP clinic services.

In Kazakhstan, thrombolysis by alteplase is reimbursed by government and is available in SCs.

**Results:** Stroke remains a devastating disease worldwide and without up-to-date picture of stroke system and subsequent interventions, it might worsen.

**Conclusions:** -

**Trial registration number:** -

## WITHDRAWN

**AS16-055****CLINICAL CHARACTERISTICS OF PATIENTS PRESENTING WITH MINOR STROKE: A SINGLE CENTER, ONE-YEAR RETROSPECTIVE OBSERVATIONAL STUDY**

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**Background and Aims:** Contemplating the use of N-acetylcysteine as a neuroprotectant, with dextran as an antithrombotic for patients with NIHSS less than or equal to 5, we quantified treatment-relevant clinical characteristics of a sample of this patient population at a single stroke center over one year.

**Methods:** Patients with NIHSS < or = 5 in 2017 were identified retrospectively through "Get with the Guidelines." Clinical characteristics gathered were patient-specific NIHSS scores, treatment status and presence of intracranial hemorrhage (ICH) on admission. ICH was defined as any hemorrhage noted on admission CT or MRI.

**Results:** One-hundred twenty-eight of 310 (41%) patients with ischemic stroke had NIHSS < or = 5. The mean age was  $66 \pm 18.8$  and 47% ( $n = 60$ ) were male. Median NIHSS was 1 (IQR 0–3). Thirty-seven (29%) had NIHSS of 0: 26 improved prior to evaluation, 10 had symptoms not coded by NIHSS, and 1 both improved and had symptoms not coded by NIHSS. One-hundred twenty-six patients (98%) did not receive acute treatment. Two received IVtPA. None were treated endovascularly. Seven had ICH on admission. Six had renal failure. None had hepatic failure. Of presenting stroke symptoms, most common was facial palsy ( $N = 44$ ), followed by dysarthria ( $N = 26$ ), sensory loss ( $N = 23$ ), visual defects ( $N = 13$ ), best language ( $N = 13$ ). The remainder symptoms were represented less than 10% of the time.

**Conclusions:** Minor stroke symptoms may not be captured by the current NIHSS. This population rarely had renal or hepatic failure, making them good candidates for combination N-acetylcysteine and dextran.

**Trial registration number:** N/A

**AS16-092****EPIDEMIOLOGICAL PROFILE OF PEDIATRIC STROKE POPULATION AT A TERTIARY OUTPATIENT NEUROVASCULAR CENTER IN BRAZIL**

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**Background and Aims:** stroke importance is on the rise. Reperfusion therapies are improving outcomes and survival. However, some populations, such as pediatrics, don't yet seem to benefit. Scientific evidence regarding stroke care and management in children is scarce, although it is among top 10 childhood mortality. We aim to address pediatric stroke profile at a tertiary neurovascular center in Brazil.

**Methods:** retrospective chart review of individuals with stroke onset from zero to less than 18-years-old, evaluated from may/1998-april/2018. Demographic, neurological phenotype, time intervals and therapeutic strategies were evaluated.

**Results:** from 6192 patients and 34.144 appointments, 92 subjects and 650 related appointments were identified, with 4.6 children/year. Median age 7.5[2.25-13], and 47(51.1%) males. Stroke types: 63(68.5%) ischemic, 5(5.4%) hemorrhagic, 8(8.7%) cerebral venous thrombosis, 7(7.6%) other,

6(6.5%) non-stroke, 3(3.3%) undefined. Defined etiologies: sickle-cell anemia, embolic source (PFO/structural cardiopathy), arterial dissections, transinfectious onset, Moya-Moya syndrome (non-sickle-cell-related), perinatal stroke. NIHSS was available for only 12 children – median value of 2 [0-3]. Secondary prophylaxis: ASA 31(50.8%), warfarin 13 (21.3%), no treatment 9 (14.8%), ASA + warfarin 4(6.6%), clopidogrel 2(3.3%), other 2 (3.2%). Only 48(52.1%) had some available information, and only 32(34.7%) were acutely in-hospital admission. Only 1 (1.9%) was submitted to reperfusion therapy. Any procedure: 9(16.9%) from 53 were submitted to some sort of procedure: 4(7.5%) neurosurgery and 5(9.4%) endovascular.

**Conclusions:** pediatric stroke is a complex and diverse entity among Brazilian population, yet too little we know about it. Low recognition, low acute admission rates and low exposure to reperfusion therapies are important issues to address, among others.

**Trial registration number:** N/A

**AS16-057****THE NORWEGIAN STROKE IN THE YOUNG STUDY – NORSYS INCIDENCE AND PARTICIPATION IN A THREE-GENERATION FAMILY RESEARCH PROGRAM**

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**Background and Aims:** NOR-SYS is a three-generation study of young ischemic stroke. We studied incidence, pre-stroke education and employment among young stroke patients, and evaluated the participation of partners, adult offspring and parents.

**Methods:** Patients aged 15–60 years with radiologically verified acute ischemic stroke, who were admitted to Haukeland University Hospital from September 2010 to August 2015 were included. Patients' partners, common adult offspring  $\geq 18$  years and biological parents of patients and partners were invited to participate.

**Results:** 385 patients, 260 partners (80.0%) and 414 adult offspring (74.6%) were included. The mean annual incidence rate was 45 per 100 000. Ischemic young stroke was more prevalent among men with a ratio of 2.2:1 ( $p < 0.05$ ). There was no sex difference in educational status ( $p = 0.104$ ). Pre-stroke employment differed depending on sex ( $p < 0.001$ ). Male patients were predominantly fulltime employed (78.4% vs. women 47.1%), whereas more women were employed part-time (21.5% vs. men 3.8%). Among living patients' parents, 93 fathers (57.4%) and 136 mothers (54.6%) participated. Among living partners' parents, 48 fathers (21.3%) and 66 mothers (38.8%) participated.

**Conclusions:** The mean incidence of ischemic stroke at age 15 to 60 years was 45 per 100 000 population/ year, and more males were affected. Pre-stroke employment differed according to sex. Participation rates for partners and adult offspring were high. Participation for patients' parents was medium, and participation for partners' parents was low.

**Trial registration number:** N/A

**AS16-060**

**OLDER AGE IS ASSOCIATED WITH A HIGHER INCIDENCE AND LOWER SURVIVAL IN A RETROSPECTIVE POPULATION-BASED COHORT OF ANEURYSMAL SUBARACHNOID HAEMORRHAGE**

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**Background and Aims:** The association between age and the incidence and outcome of ischaemic stroke is well established. Its role in aSAH, which has a younger age at onset, is uncertain. Using a population-based statewide study, we examined the incidence and outcome of aSAH with a focus on age as a predictor of outcome.

**Methods:** In a statewide (n~500,000) population-based retrospective cohort study of aneurysmal subarachnoid haemorrhage from 2010–2014 we collected data from multiple overlapping sources (administrative databases, digital medical records and death registers). We examined the incidence rate (95% CI) and relative risk of death by 30-days and 1-year using log binomial regression with adjustment for sex and Glasgow Coma Scale.

**Results:** Among 237 aSAH (70.0% women) the mean (SD) age was 61.0 (16.6) with 8.9% aged < 40 years, 52.3% aged 40–65 years and 38.8% aged >65 years. The incidence rate per 100,000 people per year increased with age: < 40 years, 3.48 (95% CI 2.17, 4.79); 40–65 years 16.59 (95% CI 14.09, 19.10); >65 years, 25.66 (95% CI 19.82, 31.52). Those aged >65 years (compared to those aged < 40 years) had a higher risk of death at 30 days (RR 1.44, 95% CI 1.15-1.80) and 1 year (RR 1.66 95% CI 1.34, 2.06).

**Conclusions:** Although mean age of onset is lesser than for ischaemic stroke, the incidence and outcomes of aSAH are worse in older people. Further investigation of the factors contributing to aneurysm rupture and appropriate management in older people is needed.

**Trial registration number:** N/A

**AS16-059**

**PREVALENCE OF DIABETES IN VASCULAR DISEASE**

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**Background and Aims:** Diabetes mellitus (DM) is a major risk factor for atherosclerosis-related vascular diseases. This study aimed to compare the prevalence of DM in cerebrovascular and cardiovascular disease in a regional Australian hospital.

**Methods:** We conducted a retrospective study (January 2015 to June 2017) to determine the prevalence of DM among ischaemic stroke (IS) and acute coronary syndrome (ACS) admissions to Ballarat Health Services. Diabetic control was based on HbA1c (%), measured within three months of index presentation. Logistic regression analysis was used to determine whether statistical significance was observed.

**Results:** We identified 470 IS and 406 ACS events. Rates of DM in both populations were similar [119 (25.3%) in IS; 122 (30.1%) in ACS; p=0.118] with type 2 DM being significantly more frequent [116 (24.7%) in IS; 115 (28.3%) in ACS; p=0.222]. Average HbA1c scores

were substantially higher in IS (8.09%) than ACS (7.36%); p = 0.009. There were significantly more IS patients (61.6%) with an HbA1c >7% compared with ACS (45.8%); p = 0.05.

**Conclusions:** We found no difference in the prevalence of DM in IS and ACS. This reflects the increased risk of atherosclerosis, responsible for both disease processes, in patients with DM. However, in our population, those with poorer diabetic control were more likely to develop stroke than an ischaemic cardiac event. We suggest that this might be because IS is caused by macro and microvascular disease, as opposed to ACS, which is almost exclusively a macrovascular complication of DM. Our results require validation in a larger and varied population.

**Trial registration number:** n/a

**AS16-018**

**ATRIAL FIBRILLATION'S VERY HIGH PREVALENCE IN THE POPULATION MIGHT EXPLAIN HIGHER STROKE INCIDENCE RATES IN HUNGARY. A POPULATION-BASED STUDY IN NORTHERN HUNGARY**

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**Background and Aims:** The incidence of ischemic stroke and stroke mortality is especially high in Hungary compared to the EU, therefore population-based studies on vascular risk factors have utmost importance. The aim of our study was to calculate the prevalence of known vascular risk factors in our population, and analyze their consequences.

**Methods:** Our population-based study involved 3 regions in Nograd county, Northern Hungary. Eighteen randomly assigned general practitioners (responsible for a total population of 88 222) had to choose randomly 50 persons from their praxis. We used multivariate logistic regression model to assess possible correlations between risk factors.

**Results:** Our study involved 886 persons with average age of 52.4 for women, 52.8 for men. Hypertension, diabetes, atrial fibrillation (AF), regular alcohol consumption, depression (measured by Beck-scale), lack of physical exercise all had higher prevalence as compared to published data on Western European population. The prevalence of AF was extremely high, 5.6%. Age (p<0.001), uncontrolled hypertension (p<0.001), obesity (p=0.01), and severe depression (p<0.001) measured on Beck-scale predicted higher risk of AF when we analyzed the possible correlations between risk factors.

**Conclusions:** Our population-based study in rural Northern Hungary identified very high prevalence of vascular risk factors. In particular, the prevalence of AF was almost 3 folds higher than in Germany. Moreover, age, uncontrolled hypertension, obesity and severe depression all predicted higher risk of AF. All these data suggest, that detecting AF in the population and risk factor management in general have great importance in our country, and specialized health-care programs should focus on this target.

**Trial registration number:** N/A

**AS16-023**

**DEPRESSION AND RISK OF STROKE: GENDER DISPARITIES. WHO PROGRAM MONICA- PSYCHOSOCIAL STUDY**

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**Background and Aims:** To determine gender differences in the prevalence of depression in general population aged 25–64 years and to estimate its impact on the risk of stroke in the population of Russia/Siberia. **Methods:** Under the third screening of the WHO program MONICA-psychosocial random representative sample of including both genders aged 25–64 years was surveyed in Novosibirsk in 1994 (n=1346, males 48.8%, mean age 44.9±0.4 years, response — 77.3%). Registration of socio-demographic data and assessment of depression (D) was made at the baseline. 35 cases of new-onset stroke in women and 22 in men were identified over 16-year of follow-up.

**Results:** In a general population of 25–64 years 54.5% of women and 29% of men had a D. 11.8% of women and 3.1% of men had a major D. The risk of stroke in people with depression over 16-year period was higher in men (HR = 5.8) compared to women (HR = 4.6). After adjustment for age, marital status, education, occupation there was an increasing of stroke risk in women up to 8.5 (p < 0.05) but in men it was slightly attenuated (4.2-fold higher). The risk of stroke was higher in men with an initial level of education, in widowed men and divorced men (p for all < 0.05). Depending on age group risk of stroke was higher in older ones both in men and women with D (HR = 3.1 and HR = 6.9, respectively; p for all < 0.05).

**Conclusions:** Women stronger than men experienced depression but depression increases the risk of stroke in both men and women.

**Trial registration number:** N/A

suggest that France have succeeded in reducing social inequities regarding stroke management.

**Trial registration number:** Clinical Trial Registration: NCT02596607

## AS16-019

### THE CLEVELAND CLINIC ABU DHABI STROKE REGISTRY (CCADSR): SIGNIFICANT DIFFERENCE IN THE AGE OF ONSET BETWEEN UNITED ARAB EMIRATES NATIONALS (UAEN) AND EXPATS

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**Background and Aims:** Data on stroke epidemiology in United Aram Emirates (UAE) is limited.

**Methods:** Cleveland Clinic Abu Dhabi is a regional stroke center. CCADSR covers all stroke admissions: ischemic stroke (IS), intracerebral hemorrhage (ICH) and subarachnoid hemorrhage (SAH) from May 2015 till May 2018. We compared the age of onset of strokes between Expats and UAE Nationals (UAEN).

**Results:** All strokes 1013: (mean age 55.9 y; min 17, max 98y; 68.4% men; 36.7% UAEN). Expats were significantly younger than UAEN (52.83y vs. 61.04y; p < 0.001) both in men (51.92 vs. 60.55; p < 0.001) and women (55.33y vs. 61.75; p < 0.006). There were 590 IS (58.73y; 17–98y; 68.5% men; 40% UAEN) Expats were significantly younger than UAEN (54.97y vs. 62.76y; p < 0.001) in men (54.97y vs. 62.76y; p < 0.001) but not in women (61.09y vs. 61.41y; p = ns). There were 176 ICH (52.8y; 20–97y; 71.6% men; 46.8% UAEN); Expats were significantly younger than UAEN (47.6y vs. 62.3y; p < 0.001) both in men (47.91y vs. 59.34y; p < 0.001) and women (46.59y vs. 67.67y; p < 0.001). There were 117 SAH (46.74y; 18–77y; 61.53% men; 21.36% UAEN). There was no age difference between Expats and UAEN (45.7y vs. 50.6y; p = ns) neither in men (43.77 vs. 49.5y; p = ns) nor in women (48.97 vs. 52y; p = ns).

**Conclusions:** Expats were significantly younger at the onset of stroke than UAEN for all strokes, IS and ICH. There was no difference in age in women with IS though. All types of stroke were more frequent in men which is likely related to influx of mainly male Expats to UAE.

**Trial registration number:** N/A

## AS16-069

### IS THERE AN ASSOCIATION BETWEEN ACCESS TO A STROKE REPERFUSION STRATEGY AND SOCIAL DEPRIVATION? FRENCH POPULATION-BASED COHORT STUDY

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**Background and Aims:** A number of studies found an association between socio-economic level and quality of stroke care but few focused on acute ischemic stroke (IS) treatment. The aim of the present study was to determine whether social deprivation was associated with access to reperfusion therapy in a population-based cohort.

**Methods:** Access to thrombolysis and/or thrombectomy was collected for all patients managed for confirmed IS from November 2015 to December 2016, in the Rhône French County (STROKE69 cohort). The socioeconomic status was measured for each patient using the European Deprivation Index (EDI) calculated thanks to socioeconomic variables. We conducted multivariate logistic regression analysis adjusted for potential confounders (sex, age, stroke severity, medical history and place of first admission) to assess the association between EDI and reperfusion strategies.

**Results:** Of 1231 consecutive patients, 241 (19.6%) were treated with reperfusion strategy. Among those, 27.0% deprived (level 5 of EDI) and 73.0% non-deprived patients were treated. Elderly patients, over 80 years, (adjOR, 0.44, 95% CI 0.14-1.39) and those with stroke history (adjOR, 0.34; 95% CI 0.18-0.61) had lower chance of accessing reperfusion therapy. On the opposite, first admission in a comprehensive stroke center (aOR, 2.85, 95% CI 1.51-5.39) and high severity (NIHSS > 20) levels were associated with higher access to reperfusion strategy.

**Conclusions:** Although social deprivation has been associated with less good quality of care and outcomes in acute IS patients, access to reperfusion strategies was not associated to social deprivation level. This

## AS16-043

### INCIDENCE OF STROKE IN ARGENTINA: INITIAL DATA FROM A POPULATION BASED EPIDEMIOLOGICAL STUDY (ESTEPA)

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**Background and Aims:** Stroke is one of the leading causes of mortality and disability worldwide. Regional data is essential to assess the local impact of the disease and to plan rational adjudication of public health resources. Stroke incidence data in Latin America are scant. We determined one-year incidence of stroke in a sample representative of the Argentinean population.

**Methods:** EstEPA is a population-based study to assess prevalence, incidence, mortality and burden of disease for stroke in General Villegas, Buenos Aires, Argentina. The incidence study is being performed according to the methodology of WHO STEPS stroke surveillance manual and will detect all first-ever strokes during a 5-year period (2017–2022).

**Results:** During the first year of the study we identified 38 first-ever strokes. The average incidence rate (cases per 100,000 population per year) was 123.1. Age-standardized incidence rate adjusted for WHO's World population was 86.9/100,000 (95% CI, 50–117). Stroke incidence rates age/sex standardized to the Argentinean population was 109/100,000 (95% CI, 75–145), slightly higher for men (122; 95% CI, 61–183) than for women (96; 95% CI, 54–137), and increased with age for both sexes.

**Conclusions:** First-ever stroke incidence was lower than previously reported in other Latin-American countries, and similar to recent reports in Argentina. These numbers are consistent with substantial regional differences and/or a progressive decline in the incidence of strokes over time. A longer recruitment period will help to better define this important aspect of stroke epidemiology in our country.

**Trial registration number:** N/A

## AS16-016

### IMPACT OF VASCULAR RISK FACTORS IN THE EXTREMADURA POPULATION: HERMEX COHORT CONTRIBUTIONS FOR A PREVENTIVE STRATEGY FOR STROKE

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<sup>6</sup>FUNDESLAUD, Unidad de Investigación Área de Salud Don Benito-Villanueva de la Serena, Villanueva de la Serena- Badajoz, Spain

**Background and Aims:** To determine the population attributable fraction (PAF) of the major risk factors (RF) for the occurrence of Stroke in an Extremadura population cohort and therefore recommend priority preventive measures in health.

**Methods:** Design, Cohort study. Location: Representative population sample of a health area of Extremadura (Spain) Participants: 2833 individuals, from 25 to 79 years old, randomly selected and recruited between 2007 and 2009. Antecedents and clinical parameters were recorded, a follow up until December 31, 2015 were done. Measurements: Explanatory variables: Age, sex, physical exercise, obesity, current smoking, arterial hypertension, diabetes mellitus (DM), atrial fibrillation (AF) and hypercholesterolemia. Outcome variable: First event of the stroke. Fully adjusted hazard ratios (HR) were calculated by Cox regression. The PAFs were calculated using Levin's formula.

**Results:** 2669 subjects were included, 103 had previous history of cardiovascular disease and 61 were lost. The follow-up was 6.9 years (IR 6.5-7.5). 53 events were recorded (45 ischemic, 8 hemorrhagic). Incidence rate of stroke 2.96/1000 people-year. Adjusted HR (95% CI) were: age 1.1 (1.06-1.14), sex 0.9 (0.5-1.6), hypertension 2.6 (1.1-6.2), current smoking 2.8 (1.3-5.9), AF 2.5 (1.3-5.1), hypercholesterolemia 1.6 (0.9-2.9), DM 1.6 (0.9-2.8), obesity 1.3 (0.8-2.3) and physical exercise 0.4 (0.1-0.9). The main PAF (95% CI) were: hypertension: 36.4% (2.9-65.1), current smoking 49.1% (15.3-72.3), and AF 2.1 (0.4-5.3).

**Conclusions:** Hypertension and current smoking confers the greatest burden of stroke in the population of Extremadura, followed by and atrial

fibrillation. And physical activity is protective against stroke. These factors are priority objectives for a population-based preventive strategy.

**Trial registration number:** N/A

## WITHDRAWN

## AS16-079

### ISCHEMIC STROKE : EVOLUTION OF SECONDARY PREVENTION TREATMENTS DURING THE FIRST YEAR

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**Background and Aims:** One of the main challenges after ischemic stroke (IS) is to prevent recurrence by controlling risk factors such as hypertension, diabetes, dyslipidemia and atrial fibrillation. In this way, secondary prevention treatments are effective but adherence of patients constitutes a key issue. This study describes the persistence of different secondary prevention treatments during the first year post-stroke.

**Methods:** All IS patients admitted in any emergency department or Stroke Unit (SU) of the Rhône are (France) were included in the STROKE69 cohort (November 2015 – December 2016). Data on treatment prescription at hospital admission and upon hospital discharge were collected from medical files. Data on treatment prescriptions at 3 and 12 months were collected by a mailed self-questionnaire and telephone interview with the patient and/or his/her caregiver.

**Results:** The analysis was conducted within the 374 IS patients who were managed in a SU. Men represented 62% (n=231) and mean age was  $68.2 \pm 14.7$  years. At 12 months, the number of patients under treatment decreased respectively from 64 to 48% (-16%) for antihypertensive treatment, from 77 to 49% (-28%) for lipid lowering drugs, from 93 to 64% (-29%) for antiplatelets or anticoagulants and from 13 to 8% (-5%) for antidiabetics. Antiarrhythmics increased from 2 to 3% (+1%). Most treatment stops occurred in the first three months.

**Conclusions:** These results suggest that preventive treatments after an IS are not appropriately maintained over time. We have to further investigate the reasons for these stops: control of risk factors, non-persistence due to patient or to physician (non-adherence to guidelines).

**Trial registration number:** NCT02596607

## AS16-045

### EFFECTS OF TEMPERATURE EXTREMES ON STROKE RATES IN QATAR: A FOUR-YEAR COMPREHENSIVE STUDY

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**Background and Aims:** There is a growing body of evidence suggesting that acute cardiovascular events including stroke are not distributed randomly over time, but instead depend on months/season of the year. We report the impact of meteorological variables in extremely hot arid climate on stroke.

2.6.0

**Methods:** Acute stroke patients admitted from January 2014 to December 2017 were included. The data included demographics, clinical risk factors, temperature, solar radiation, relative humidity, dew point, wind speed and atmospheric pressure. We calculated stroke rates/100,000/ month.

2.6.0

**Results:** There were 3654 cases of stroke [ischemic stroke [IS]: 2956 (80.9%); and intracerebral hemorrhage [ICH]: 698 (19.1%)] with no difference in hematocrit, creatinine and blood urea between hotter and cooler seasons [ $p>0.05$ ]. We observed a positive significant correlation of IS with

mean temperature (AOR: 1.023; 95% CI: 1.009 – 1.036;  $P = 0.001$ ) and solar radiation (AOR: 1.268; 95% CI: 1.021 – 1.575;  $P = 0.032$ ) showing a 2.3% and 26.8% higher risk relative to ICH respectively, a negative correlation between IS with relative humidity (AOR: 0.99; 95% CI: 0.984 – 0.997;  $P = 0.002$ ) and atmospheric pressure (AOR: 0.977; 95% CI: 0.966 – 0.989;  $P < 0.001$ ) was observed, 1% increase in the relative humidity correlate with 2.4% and 1% lower risk of IS incidence relative to ICH respectively.

2.6.0

**Conclusions:** We demonstrated a distinct seasonal pattern in the incidence of stroke with an increase in IS rates relative to ICH during the summer months with higher solar radiations that cannot be explained by physiological measures suggestive of dehydration or hem-concentration.

2.6.0

**Trial registration number:** N/A

2.6.0

## AS16-025

### IMPACT OF NIHSS IN ISCHEMIC STROKE TO ACCESS TO THROMBOLYSIS: FINDINGS FROM THE RESUVAL REGISTRY

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**Background and Aims:** Literature highlighted increased prehospital and reperfusion delays for strokes associated to low neurological deficit. Our study aimed to compare management delays depending on the NIHSS (National Institute of Health Stroke Score) in the RESUVal registry.

**Methods:** We retrospectively analysed data from an observational prospective multicentric registry of acute ischemic strokes. All eligible patients to thrombolysis from 5 primary (PSC) and 1 comprehensive stroke centers (CSC) were reported with no age or delay limitations.

**Results:** From 2010 to 2017, we enrolled 2307 out-of-hospital strokes; 21% of minor strokes (NIHSS 0–4), 35% of moderate (5–10), 18% of moderate to severe (11–15), 19% of severe (NIHSS 16–20) and 7% of serious strokes (NIHSS>20). Except younger age among minor strokes (70 y [58;81]), cardiovascular risk factors were similar between groups. Minor strokes were associated with longer delay symptom – first medical contact (45 min [20;94] vs 41[15;80] vs 32[15;65] vs 30[15;60] vs 30 [18.5;65]) and symptom – first admission (95 [65;123] vs 90[69;120] vs 81 [60;110] vs 82 [60;109] vs 80 [65;110]). The delay admission PSC/CSC – thrombolysis was extended in minor strokes (59 [47;78] vs 55 [44;72] vs 53[41;65] vs 50 [41;65] vs 53 [43;67]), minor strokes were associated with better functional outcome at 3 months (mRS  $\leq 2$ : 86.48% vs 74.49% vs 50.49% vs 28.57% vs 38.19%) and lower mortality (2.64% vs 5.06% vs 12.24% vs 20.84% vs 32.56%).

**Conclusions:** Despite a better prognosis, we can still improve delays in minor stroke management through our area. It could go through a public information program.

**Trial registration number:** N/A

## AS16-015

### 'PREHOSPITAL' DELAY IN ACUTE STROKE REPERFUSION THERAPY IN NATIONAL CAPITAL OF INDIA (DELHI)

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**Background and Aims:** The reasons for prehospital delay in acute stroke reperfusion care are many including delay in seeking medical care or delay after the Initial Medical Contact (IMC). We tried to find out the timing of IMC of patients coming to AIIMS Delhi Emergency Stroke Services.

**Methods:** The data was collected prospectively (July 10, 2018-Jan 10, 2019) from the feasibility screening log of an on-going RCT (PROLEVIS). All Stroke patients admitted in Unit 2 were included. Time of onset of stroke, neuroimaging, arrival time at IMC/AIIMS were collected prospectively.

**Results:** We screened 107 patients and 2 were excluded for insufficient data. Forty patients arrived AIIMS directly and 65 patients had IMC elsewhere. Of these 65 patients (Ischemic stroke-36, ICH-23, CVT-6), 53 (IS-27) reached within 4.5 hrs, 59 (IS-32) within 6 hrs, 62 (IS-34) within 24 hrs. Of the 32 ischemic stroke patients (IMC < 6 hrs), 14 (44 %) had neuroimaging before referral, but only 1 patient was thrombolysed (AIIMS). Among the IS with IMC outside AIIMS, 15 patients were wake up stroke. Out of 40 patients (IS-32, ICH-8) who directly reached AIIMS,

21 were within 4.5 hrs (IS-15), within 6 hrs-25 (IS-18), within 24 hrs -37 (IS-29). Three patients within 4.5 hrs were wake up stroke. 31% (10/32, IVT-7, MT-3) of Ischemic stroke patients reaching AIIMS directly underwent acute stroke reperfusion therapy.

**Conclusions:** Half of (53 %) Ischemic stroke patients reaching AIIMS have IMC outside and 75 % of these reach IMC within 4.5 hrs.

**Trial registration number:** N/A

## AS16-067

### CASES PRESENTED WITH DIAGNOSIS OF STROKE IN PERIOD 2016–2017 THE EMERGENCY OF REGIONAL HOSPITAL DURRES, ALBANIA

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**Background and Aims:** In Albania, a complete epidemiological study has not yet been conducted across the country, but the number of stroke patients is considered relatively high, comparable to the countries of eastern Europe due to the high risk factors such as hypertension, hyperlipidemia diabetes mellitus, fibrillation.

**Methods:** In 2016–2017, in Emergency of Durres Hospital, 870 cases were diagnosed with Stroke. Of all cases, 802 were diagnosed by emergency physicians and 69 by family physicians. In the total number with Stroke 228 patients (26%) were recurrent and 642 (74%) were new cases. Are classified as Ischemic Stroke 574 cases (66%) and 296 cases (34%) classified as haemorrhagic Stroke.

**Results:** In hemorrhagic cases 29 patients (9.8%) were diagnosed with HSA, out of which 18 cases were subjected to neurosurgical intervention. Were presented within the first 3 hours of starting ischemic Stroke only 34% (196), of these 115 patients (59%) are sent for thrombolysis and 12 cases (6.1%) for thrombectomy in University Hospital of Tirana. By gender 53% of cases (457) were female and 47% of cases (413) were males. The average age of patients was 64.7 years for ischemic Stroke and 56.4 years for haemorrhagic Stroke. The main risk factor in all cases was HTA 61% (530), the second most frequent factor being smoking (55%) (482), with hyperlipidemia 54% (477), 17% (173) atrial fibrillation, 18% (187) diabetes mellitus,(92) 10.5% alcohol consuming, post myocardial infarction 9% (89).

**Conclusions:** First risk factor in our study was Hypertension and by gender females had higher prevalence in front of males.

**Trial registration number:** 802

## AS16-001

### SINGLE-NUCLEOTIDE POLYMORPHISMS OF TIGHT JUNCTION COMPONENT CLAUDIN-5 AND LEUKOARAIOSIS

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**Background and Aims:** The blood-brain barrier disruption plays a major role in the development of leukoaraiosis (LA). Claudins are the integral component of tight junction (TJ). Previous study showed that claudin-3 and claudin-5 play a significant role in TJ formation and integrity of the BBB. The aim of this study was to evaluate whether genetic variations in claudin-5 gene are associated with the development of LA.

**Methods:** LA has to be diagnosed based on FazekasScale and grouped into two classes: periventricular white matter (PVWM) and deep white

matter (DWM). A total of 183 LA-PVWM and 156 LA-DWM cases were enrolled from the individuals who underwent brain magnetic resonance imaging with obtainable vascular risk factors. Genotyping of claudin-5 single nucleotide polymorphisms (rs1548359, rs10314 and rs739371) was performed by real-time polymerase chain reaction with LightCycler 2.0.

**Results:** The genotypic frequency of claudin-5 and combination effects of 3 SNPs showed no significant difference between controls and both type of LA. However, to simplify synergistic allele combinations, the individuals carrying haplotypes C-G-C (rs1548359/rs10314/rs739371) increased development of LA-DWM by 1.44 times of control.

**Conclusions:** This study provides weak evidence of genetic polymorphisms of claudin-5 associated with susceptibility of LA.

**Trial registration number:** N/A

## AS16-010

### PROSPECTIVE STUDY EVALUATING CLOPIDOGREL RESISTANCE IN ISCHEMIC STROKE PATIENTS FROM DIFFERENT ETHNIC GROUPS IN NORTHERN ISRAEL

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**Background and Aims:** Clopidogrel is a thienopyridine anti-platelet agent widely used to reduce the risks of coronary artery diseases and cerebrovascular diseases. Despite its relatively potent antiplatelet effect, numerous factors may cause inadequate response to clopidogrel including variable generation of the active metabolite due to genetic polymorphism commonly CYP2C19 enzyme. Different alleles of CYP2C19 have been identified and vary by ethnicity; loss-of-function genetic variants such as CYP2C19\*2 or CYP2C19\*3 are more prone to have high residual platelet reactivity (HRPR) under clopidogrel therapy, while variant CYP2C19\*17 is associated with increased drug activation.

**objective:** To evaluate the prevalence of clopidogrel resistance in patients with ischemic stroke from various ethnic groups in the north of Israel.

**Methods:** This prospective study will be conducted in Ziv Medical Center in Israel on 300 patients from different ethnicities admitted to neurology department. The groups will consist of Jewish communities (Ashkenazi, Sephardi) and Arab populations (Muslim, Christian, Druze). Clinical and demographical data will include: age, gender, ethnicity (defined by the grandparents' birthplace), stroke severity, medical treatment history and pre-existing health conditions.

Platelet aggregation will be determined by vasodilator-stimulated phosphoprotein assay (PLT VASP/P2Y12, BioCytex, France). Low levels of VASP-phosphorylation reflects receptor activation, while high levels reflects P2Y12 inhibition. This assay will be performed blinded on citrated whole-blood samples collected at least 7 days after clopidogrel administration (75mg), then analyzed within 48 hours after collection. The results will be reported as a percent value of platelet reactivity index (PRI) with a cutoff value of 50% (clopidogrel resistance with PRI $\geq$ 50%).

**Results:** ongoing

**Conclusions:** ongoing

**Trial registration number:** Trial Protocol Number 0112-17-ZIV

**AS16-049****ESTIMATION OF THE FREQUENCY OF  
ELIGIBLE PATIENTS FOR THROMBECTOMY  
USING THE NIHSS SCORE IN THE  
POPULATION-BASED BREST  
STROKE REGISTRY****L. Simoni<sup>1</sup>, M. Consigny<sup>2</sup>, A. Dion<sup>2</sup> and S. Timsit<sup>1</sup>**<sup>1</sup>CHU Cavale Blanche, Neurology, Brest, France; <sup>2</sup>CHU Cavale Blanche, Clinical Investigation Center – INSERM CIC 0502, Brest, France

**Background and Aims:** Thrombectomy improved the management of ischemic strokes with large vessel occlusion (LVO). However, the number of patients eligible to this treatment among all ischemic strokes is not known. The NIHSS is the best clinic score predicting a LVO. The aim of our population-based study was to estimate, using the NIHSS score, the expected number of patients eligible for thrombectomy among those with ischemic strokes.

**Methods:** We studied ischemic strokes that occurred in 2013 in the population-based registry of Brest. We estimated the number of patients eligible for thrombectomy using the positive and negative predictive values of the initial NIHSS from previous studies assessing its sensitivity and specificity to predict LVO.

**Results:** In 2013, 767 patients had an ischemic stroke. 102 patients were excluded due to missing data. 53,8% of the remaining arrived at hospital within the first 6 hours. According to the two articles that fulfill the selection criteria, between 23,83% and 45,4% of patients arrived within 6 hours would have a LVO. Considering only patients with a modified Rankin Scale  $\leq 2$  before stroke, 7,88 % to 15,01% of all ischemic strokes patients would be eligible to thrombectomy.

**Conclusions:** We estimated that between 5800 to 12500 patients in France each year would be eligible to thrombectomy. However, only 5591 thrombectomy were performed in France in 2017, representing 6,74 % of ischemic strokes. According to our results, a significant number of patients might be currently eligible to an endovascular treatment even though they do not have access to it.

**Trial registration number:** N/A

**WITHDRAWN****AS16-017****RISK FACTORS AND MECHANISMS OF  
ISCHAEMIC STROKE IN REGIONAL  
AUSTRALIA- AN AGE-BASED ANALYSIS****P. Siriratnam<sup>1</sup>, A. Godfrey<sup>1</sup>, E. O'Connor<sup>1</sup>, D. Pearce<sup>2,3</sup>,  
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**Background and Aims:** Stroke is the second leading cause of mortality globally. Commonly seen as a disease of the aging, ischaemic strokes are increasingly occurring at younger ages. Recent studies suggest that the profile of young stroke patients is similar to that of the older population, particularly in relation to risk factors. We aimed to determine the differences in risk factors and stroke type in our ischaemic stroke population based on age.

**Methods:** We conducted a retrospective analysis of all ischaemic stroke patients admitted to Ballarat Base Hospital from 2015–2017. Data were collected on demographics, risk factor profiles and mechanism of stroke recorded in the hospital stroke database. We dichotomised the population based on an age cut-off of 50 years, and compared the two groups using Pearson's chi square test or Fishers exact test.

**Results:** We identified 391 ischaemic stroke patients; 30 patients aged 18 to 50, and 361 patients  $>50$  years of age. At least one of the six risk factors assessed was present in 86.7% of the younger group, compared to 97.2% in the older group ( $P = 0.016$ ). Younger patients were significantly less likely to have modifiable risk factors such as hypertension and ischaemic heart disease compared to the older group, but more likely to have cryptogenic, cardioembolic or other/rare mechanisms of stroke.

**Conclusions:** Although older patients are more likely affected by traditional vascular risk factors, prevalence in those  $\leq 50$  reinforces the importance of primary prevention. The mechanisms of stroke in the  $\leq 50$  group suggests the need for detailed diagnostic work-up.

**Trial registration number:** N/A

**AS16-028****SIMILARITY AND DIFFERENCES IN  
ATHEROTHROMBOSIS, AORTOGENIC  
EMBOLISM, AND BRANCH  
ATHEROMATOUS DISEASE****S. Suzuki<sup>1</sup> and S. Fujimoto<sup>2</sup>**<sup>1</sup>Fukuoka Kieikai Hospital, Stroke, Fukuoka, Japan; <sup>2</sup>Jichi Medical University, Division of Neurology- Department of Medicine, Shimotsuke, Japan

**Background and Aims:** Branch atheromatous disease (BAD) and aortogenic embolism (Ao) are classified as “unclassified” in accordance to TOAST classification; however, their pathophysiology seems to be similar to those of atherothrombosis (AT). Here we compared these three category of ischemic cerebrovascular disease (iCVD).

**Methods:** A consecutive series of 1079 patients with acute iCVD were included. Of them, 180 (16.7%), 159 (14.7%), 251 (23.3%), and 489 (45.3%) were classified as AT, lacunar, cardiogenic embolism, and unclassified according to TOAST classification, respectively. In “unclassified”, 82 and 180 patients were thought to be BAD and Ao, respectively.

**Results:** Median age of BAD was 71.5. It was lower comparing to both AT (76.5) and Ao (76). Left sided stroke was more frequent in BAD (57.3%) and Ao (46.5%). On the other hand, laterality was not significant in AT. Area perfused by middle cerebral artery (MCA; 74.1%) was the most affected area following vertebra-basilar artery (VA-BA; 23.5%) in BAD. In AT, affected area was perfused by MCA (47.2%), internal carotid artery (ICA; 19.4%), and VA-BA (16.1%), respectively. In Ao, affected area was perfused by MCA (59.0%), and VA-BA (20.5%), respectively. Hypertension was noted in 73.2%, 80.6%, and 84.4% in patients with BAD, AT, and Ao, respectively. Diabetes mellitus was noted in 30.5%, 41.1%, and 32.8% in patients with BAD, AT, and Ao, respectively. Prior iCVD was most frequent in AT (23.9%), followed by Ao (17.2%) and BAD (12.2%).

**Conclusions:** Patients with BAD and Ao had many similarities comparing to patients with AT; however, some differences existed.

**Trial registration number:** N/A

**AS16-072****COMORBIDITIES PREVALENCE IN ELDERLY  
PATIENTS WITH CARDIOEMBOLIC  
TIA/STROKE**

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**Background and Aims:** Chronic diseases such as stroke often are accompanied by other comorbidities which can alter the prognosis and management of our patients. The objective of our study is to assess the prevalence of the principal comorbidities in elderly patients with cardioembolic TIA/stroke.

**Methods:** This is a retrospective observational all population-based study that worked with data from all patients older than 64 years, registered within the public health system of Aragon (2010–2015; 1.3 million) with the diagnosis of cardioembolic stroke (infarct or TIA). The prevalence of every comorbidity was described in global and by sex and age groups. We define multimorbidity as  $\geq 5$  diseases.

**Results:** Of 875 patients (mean age 82.7 years; 56.5% female), the mean number of comorbidities per patient was 8.1 (SD 3.4); hypertension was the more prevalent comorbidity, follow up by dislipemia in all age groups.

Diabetes, cardiovascular diseases and chronic heart failure were the third more frequent in each age-group respectively (65–74, 75–84,  $\geq 85$ ). Multimorbidity was present in 86.8% of our patients, being more frequent in women (436, 88.4%) and in those in the age-group of 75–84 years (335, 90.1%).

**Conclusions:** A cardioembolic stroke is not an isolated entity in elderly patients. In our approach to these patients, we should pay special attention to multimorbidity and cardiac diseases, which are frequent in these patients.

**Trial registration number:** N/A

**WITHDRAWN****AS16-091****SHORT- AND LONG-TERM PROGNOSIS OF  
FIRST-EVER ISCHEMIC STROKE IN PATIENTS  
WITH ATRIAL FIBRILLATION**

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**Background and Aims:** Atrial fibrillation (AF) is a major risk factor for stroke. We investigated the short- and long-term prognosis of patients with a first-ever ischemic stroke (FEIS) and AF.

**Methods:** Prospective population-based registry including all the residents with a FEIS in 2011–2013 and followed up to 2018.

**Results:** Out of 919 patients with FEIS, 294 (32.3%; 188 women) had documented AF (mean age  $82.1 \pm 8.1$  years). The 30-day, 1-year, and 5-year survival probability ( $P < 0.001$  for all time points) was lower in patients with AF than in those without the arrhythmia. At 30 days the most common causes of death in patients with and without AF were cerebral, cardiac, unknown, and from a new fatal stroke; from day 31 day onward and up to 5 years we observed in both groups a progressive reduction of cerebral deaths and an increase of cardiac deaths ( $P > 0.05$  for all distributions). The Cox analysis, including age, sex, and vascular risk factors showed that AF at 30 days (HR 1.45, 95%CI 1.04-2.01) and at 1 year (HR 1.35, 95%CI 1.04-1.74) and diabetes mellitus at 30 days (HR 1.72, 95%CI 1.23-2.39) and at 1 year (HR 1.60, 95%CI 1.25-2.13) were independent predictors of short-term mortality; diabetes mellitus was also a 5-year predictor of mortality (HR 1.37, 95%CI 1.10-1.72).

**Conclusions:** Patients with FEIS and AF had the worst short-term prognosis underlining the need for closer monitoring of heart disease in both patients with and without AF to improve the long-term prognosis of patients with FEIS.

**Trial registration number:** NA

### AS16-053

#### VALIDATION OF STROKE MIMIC PREDICTION SCALES IN THE EMERGENCY DEPARTMENT

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**Background and Aims:** Intravenous thrombolysis is the standard of care for acute ischemic stroke patients presenting within 4.5 hours of symptom onset. However, up to 30% of patients presenting with acute stroke symptoms are stroke mimics, posing a significant diagnostic challenge. Moreover, thrombolytic treatment in stroke mimics carries potential harm without benefit. Stroke mimic prediction scales may identify stroke mimics in the Emergency setting, therefore averting unnecessary thrombolysis. The aim of this study is to validate four existing stroke mimic prediction scales.

**Methods:** We retrospectively reviewed consecutive patients given intravenous thrombolysis at a primary stroke centre between January 2015 and October 2017. Clinical information at the Emergency Department up to the time of thrombolytic administration was reviewed. Final clinical diagnosis of stroke mimic was made by a neurologist. Four stroke mimic prediction scales were chosen (FABS, Simplified FABS, TeleStroke Mimic Score (TMS), Khan's Score). The 4 scales were simultaneously rated by an independent rater blinded to the final diagnosis. Analysis using area under receiver operating characteristics curve (AUROC) was performed.

**Results:** A total of 257 patients were given intravenous thrombolysis and 17 (6.6%) were stroke mimics. TMS had the highest discrimination for stroke mimic ( $AUROC = 0.78$ ; 95% CI 0.65-0.91), followed by Khan ( $AUROC = 0.68$ ; 95% CI 0.55-0.82), FABS ( $AUROC = 0.5$ , 95% CI 0.5-0.73) and Simplified FABS ( $AUROC = 0.5$ , 95% CI = 0.5 – 0.72). TMS discriminated better over FABS and Simplified FABS score ( $p < 0.001$ ).

**Conclusions:** TMS performed the best in discriminating stroke mimic among patients who presented with acute stroke symptoms.

**Trial registration number:** N/A

### AS16-066

#### ACUTE AND SUBACUTE SILENT CEREBRAL INFARCTION IN PATIENTS BEFORE ELECTIVE CORONARY INTERVENTION

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**Background and Aims:** Incidence and prevalence of silent cerebral infarction (SCI) is not clear. The aims of our study were to detect acute and subacute SCI using magnetic resonance (MRI) in patients before elective coronary intervention, measure the volume of SCI and investigate the risk factors associated with SCI.

**Methods:** Patients indicated for elective coronary angiography, angioplasty or stenting were enrolled in this study. Brain MRI was performed before cardiac intervention. The presence of acute and subacute SCI was evaluated, SCI volume was measured and risk factors associated with SCI were investigated. Cognitive functions were tested and correlated to SCI.

**Results:** Between November 2015 and July 2017, 144 patients were enrolled to study (103 men, 41 women). Acute/subacute SCI were detected in 9 out of 144 (6.3%) on MRI before cardiac intervention. History of stroke or TIA were associated with a higher risk of SCI ( $p = 0.05$ ). Ipsilateral internal carotid stenosis  $> 50\%$  was diagnosed in one patient. Patients with the history of stroke/TIA had a larger volume of SCI ( $p = 0.008$ ). We did not find statistically significant differences in cognitive function tests between patients with acute/subacute SCI and without SCI ( $p > 0.05$ ).

**Conclusions:** Acute/subacute SCI was detected in 6.3% of patients indicated to elective coronary intervention. History of stroke or TIA were predictors of the presence of SCI and also its volume. No correlation between SCI and cognitive dysfunction was found.

**Trial registration number:** Study was performed as a substudy of Sonoreduct trial, registered at [www.clinicaltrials.gov](http://www.clinicaltrials.gov) (NCT02351050).

### AS16-030

#### ANTIPHOSPHOLIPID ANTIBODIES PREDICT POST-STROKE DEPRESSION AFTER ACUTE ISCHEMIC STROKE

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**Background and Aims:** Antiphospholipid (aPLs) activity was reported to be increased in depressive patients, while the impact of antiphospholipid antibodies (aPLs) on post-stroke depression (PSD) is still unclear. Our study was conducted to investigate the association between anti-phosphatidylserine (aPS), anticardiolipin (aCL) antibodies and depression after acute ischemic stroke.

**Methods:** aPS and aCL were measured in 497 ischemic stroke patients recruited from 7 of 26 participating hospitals of China Antihypertensive Trial in Acute Ischemic Stroke (CATIS). 24-item Hamilton Depression Rating Scale was used to evaluate PSD status at 3 months after stroke.

**Results:** aPLs titers were higher among the depressive patients than those without depression symptoms [5.92 U/mL (3.45-9.95) vs 4.63 U/mL (2.73-8.02),  $P=0.002$  for aPS; 6.11 U/mL (4.71-8.30) vs 5.44 U/mL (4.07-7.63),  $P=0.0005$  for aCL]. Compared with aPS-negative or aCL-negative, the adjusted odds ratios (ORs) [95% confidence intervals (CIs)] associated with aPS-positive or aCL-positive were 1.77 (1.07-2.92) or 2.05 (1.11-3.78) for risk of PSD. On continuous analyses, per 1-SD increment of aPS and aCL were associated with 29% (OR 1.29, 95% CI 1.05-1.58) and 30% (OR 1.30, 95% CI 1.05-1.60) increased risks for PSD, respectively. Adding aPL quartiles to conventional risk factors models significantly improved risk reclassification for PSD (net reclassification improvement index = 21.9%,  $P=0.015$  for aPS; net reclassification improvement index = 32.54%,  $P=0.0003$  for aCL).

**Conclusions:** Higher aPS and aCL levels were associated with increased risk of PSD at 3 months after an acute ischemic stroke. Our findings provide evidence supporting that aPLs play an important role in post-stroke depression prediction.

**Trial registration number:** N/A

## AS16-031

### CO-EFFECT OF SERUM GALECTIN-3 AND HIGH DENSITY LIPOPROTEIN-CHOLESTEROL ON THE PROGNOSIS OF ACUTE ISCHEMIC STROKE

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**Background and Aims:** The association of combined galectin-3 and HDL-C with prognosis of acute ischemic stroke remains unknown. This study aimed to evaluate the co-effect of galectin-3 and HDL-C on death and vascular events within one year after ischemic stroke.

**Methods:** Based on China Antihypertensive Trial in Acute Ischemic Stroke (CATIS), a prospective study was conducted among 2819 patients with acute ischemic stroke. The study outcome was a combination of death and vascular events, within one year after ischemic stroke. The secondary outcome was separately those of recurrent stroke, vascular events and death.

**Results:** During the one-year follow-up period, a total of 238 patients experienced primary outcome. The multivariate adjusted hazard ratios (95% confidence intervals) of primary outcome, recurrent stroke and vascular events were 1.55(1.06-2.25), 1.82(1.10-3.02) and 1.87(1.21-2.90), respectively, in patients with both high galectin-3 and low HDL-C compared to those with both low galectin-3 and high HDL-C. The addition of galectin-3 and HDL-C to conventional factors significantly improved predictive value. Net reclassification index was 15.7% for primary outcome, 18.3% for recurrent stroke and 20.5% for vascular events.

**Conclusions:** Combination of high galectin-3 and low HDL-C was associated with primary outcome, recurrent stroke and vascular events within one year after ischemic stroke, suggesting that the combination of galectin-3 and HDL-C should be used to identify the individuals at risk of poor prognosis after ischemic stroke.

**Trial registration number:** N/A

## AS16-084

### MAPPING OF EXISTING GLOBAL DATA SOURCES IN ISCHEMIC STROKE AND LARGE HEMISPHERIC INFARCTION

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Medical Affairs, Cambridge, USA; <sup>4</sup>YOLARX Consultants, Inc, Montreal, Canada; <sup>5</sup>Université de Montréal, Faculty of Pharmacy, Montreal, Canada

**Background and Aims:** Large hemispheric infarction (LHI) is a severe form of ischemic stroke associated with significant morbidity and mortality. To date, comprehensive analysis of observational data sources in this area has not been performed; yet such data may help understand various aspects of the disease. This project aimed to identify and characterize existing registries and cohorts of patients with ischemic stroke or LHI in North America, Europe, and Asia-Pacific.

**Methods:** Existing global observational data sources were identified through a literature search using MEDLINE and Embase (01 Jan. 2013–11 Apr. 2018) and pragmatic searches of web sources. Relevance of data sources was assessed using pre-defined criteria. For each retained source, information on data availability, access policy, and linkage capacities was sought through an in-depth review of articles and contact with database custodians. Availability of Patient characteristics, safety data, and health care utilization information was recorded in a standardized data extraction form.

**Results:** Among the 1,050 abstracts included in the literature search output, 177 data sources were identified. Pragmatic searches uncovered 33 additional sources. Using the criteria of relevance, 58 data sources were retained. Most originate from Europe ( $n=30$ ) followed by North America ( $n=17$ ) and Asia-Pacific ( $n=10$ ). Disease registries were the most common type of data source ( $n=33$ ). A total of 39 sources could provide data for natural history studies and 15 for drug safety and effectiveness research.

**Conclusions:** Observational data sources on ischemic stroke or LHI are available globally across multiple regions and can inform disease understanding and context for therapeutic impact.

**Trial registration number:** N/A

## AS16-029

### ASSOCIATION OF EXTREMELY HIGH LEVELS OF HIGH-DENSITY LIPOPROTEIN CHOLESTEROL WITH THE POOR OUTCOMES AFTER ISCHEMIC STROKE

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**Background and Aims:** Some observational studies found extreme high levels of high-density lipoprotein cholesterol (HDL-C) were significantly associated with increased risk of all-cause mortality and atherosclerotic CVD mortality in general population. However, the effect of extremely high levels of HDL-C on prognosis of ischemic stroke is not well described. We investigated the association between high levels of HDL-C and risk of poor prognosis after ischemic stroke.

**Methods:** A total of 3649 acute ischemic stroke patients were included in this analysis. The primary outcome was a combination of death and major disability (modified Rankin Scale score  $\geq 3$ ) at 3 months after stroke. All participants were divided into 5 groups according to HDL-C quintiles: < 0.99 mmol/L(Q1), 0.99-1.15 mmol/L(Q2), 1.16-1.31 mmol/L(Q3), 1.32-1.54 mmol/L(Q4), and  $\geq 1.55$  mmol/L(Q5). The association of HDL-C with primary outcomes at 3-month after stroke was examined in multivariable logistic regression analyses.

**Results:** Compared with the third quintile of HDL-C (1.14-1.31 mmol/L), the odds ratios (95% confidence intervals) of primary outcomes associated with the highest quintiles of HDL-C ( $\geq 1.55$  mmol/L) was 1.40 (1.08-1.81) after adjustment for age, sex, time from onset to hospitalization, antihypertensive treatment, current smoking, alcohol consumption, body mass index, dyslipidemia, history of heart disease, blood glucose, history of hypertension, family history of stroke, systolic blood pressure at baseline and ischemic stroke subtypes. The odds ratios (95%

confidence intervals) of 1.36 (1.10-1.84) remained significant after further adjustment for NIHSS.

**Conclusions:** Extreme high HDL-C was significantly associated with increased risk of primary outcomes among ischemic stroke patients.

**Trial registration number:** N/A

## AS16-032

### DISCONTINUITY IN THROMBOLYSIS VOLUME DURING ICD 9 TO ICD 10 TRANSITION IN THE UNITED STATES NATIONAL INPATIENT SAMPLE

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**Background and Aims:** Transition from ICD version 9 to 10 was mandated for US hospitals on Oct 1, 2015. ICD codes for thrombolysis in ischemic stroke (IS) are often used for research and quality assurance.

**Methods:** The 2015–2016 period of the National Inpatient Sample, a weighted 20% sample of all inpatient US hospital discharges, was examined. During the ICD 9 period, discharges of interest were identified using codes for IS (Table 1) combined with the procedural code associated with thrombolysis (Table 2). Two strategies were used in the ICD 10 period (Table 2): 1) ICD 9 procedural code (99.10) was mapped to only the ICD 10 code for thrombolytic given into a peripheral vein and 2) to all related new ICD 10 codes including injection of thrombolytic agent into an artery, a central vein, or the heart. In both strategies, these codes were combined with ICD 10 codes for IS (Table 1).

Table 1: ICD code for Ischemic Stroke

Ischemic Stroke	<ul style="list-style-type: none"> <li>Identified using ICD 9 codes in the first 3 positions: I43 (Occlusion and stenosis of precerbral arteries) OR I44 (occlusion of cerebral arteries) OR I46 (acute, but ill-defined, cerebrovascular disease) OR I47.1 (Other generalized ischemic cerebrovascular disease)</li> <li>Identified using ICD 10 codes in the first 3 positions: I63 (cerebral infarction) OR I64 (stroke not specified as haemorrhage or infarction) OR I67.81 (Acute cerebrovascular insufficiency) OR I67.82 (Cerebral ischaemia) OR I67.89 (Other cerebrovascular disease)</li> </ul>
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Table 2: ICD codes for Thrombolysis

Exposure to IV tPA	<ul style="list-style-type: none"> <li>Using ICD-9-CM code in any position: 99.10 (Injection or infusion of thrombolytic agent)</li> <li>Strategy 1, using ICD-10-PCS code in any position: 3E03317 (Introduction of Other Thrombolytic into Peripheral Vein)</li> <li>Strategy 2, using ICD-10-PCS codes in any position: 3E03317 (Introduction of Other Thrombolytic into Peripheral Vein) OR 3E04317 (Introduction of Other Thrombolytic into Central Vein) OR 3E05317 (Introduction of Other Thrombolytic into Peripheral Artery) OR 3E06317 (Introduction of Other Thrombolytic into Central Artery) OR 3E08317 (Introduction of Other Thrombolytic into Heart)</li> </ul>
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**Results:** Within the 3rd quarter of 2015, there were 2,208 sampled discharges who received thrombolysis for IS representing a total of 11,040 patients. Within the last quarter of 2015 there were 1,862 sampled discharges representing 9,310 patients using strategy 1 and 2,128 sampled discharges representing 10,640 patients using strategy 2 (Table 3, Figure 1).

Table 3: Discharges identified using ICD codes

	Total Discharges	Thrombolytic Strategy 1	Thrombolytic Strategy 2	Ischemic Stroke (IS)	IS and Thrombolytic Strategy 1	IS and Thrombolytic Strategy 2
2015Q1	1797650 (8,988,249)	6353 (31765) 0.35%	6353 (31765) 0.35%	29569 (147845) 1.64%	2070 (10350) 0.12%	2070 (10350) 0.12%
	1785546 (8,927,729)	6356 (31780) 0.36%	6356 (31780) 0.36%	29827 (149135) 1.67%	2155 (10775) 0.12%	2155 (10775) 0.12%
2015Q3	1789213 (8,946,046)	6394 (31970) 0.36%	6394 (31970) 0.36%	29748 (148740) 1.66%	2208 (11040) 0.12%	2208 (11040) 0.12%
	1774617 (8,873,084)	3739 (18695) 0.21%	6000 (30000) 0.34%	29651 (148255) 1.67%	1862 (9310) 0.10%	2128 (10640) 0.12%
2016Q1	1797772 (8,988,852)	3906 (19530) 0.22%	6106 (30530) 0.34%	30388 (151940) 1.69%	2028 (10140) 0.11%	2277 (11385) 0.13%
	1771304 (8,856,513)	3981 (19905) 0.22%	6046 (30230) 0.34%	30279 (151395) 1.71%	2134 (10750) 0.12%	2360 (11800) 0.13%
2016Q3	1783052 (8,915,253)	4254 (21270) 0.24%	6336 (31680) 0.36%	30131 (150655) 1.69%	2152 (10760) 0.12%	2392 (11960) 0.13%
	1776301 (8,881,498)	4286 (21430) 0.24%	6353 (32675) 0.37%	30756 (155780) 1.73%	2245 (11225) 0.13%	2524 (12620) 0.14%
2016Q4	14275455 (7,137,243)	39269 0.28%	31023 0.22%	240349 (1201745) 1.68%	16854 (84270) 0.12%	18114 (90570) 0.13%
	Total (7,137,243)					

\* Cell format: sample size (representative population size) weighted % of all NIS discharges adjusted for sampling techniques

Figure 1-Hospital Discharges with Thrombolysis for Ischemic Stroke in the United States, Jan 2015- Dec 2016



**Conclusions:** Significant discontinuity was seen during the ICD 9 to ICD 10 transition period which necessitates the need for more rigorous validation of these codes prior to use for identify patients undergoing thrombolysis for IS in administrative data.

**Trial registration number:** N/A

## Experimental – Translational Medicine

### AS32-020

### COMBINED REHABILITATION PROMOTES THE RECOVERY OF FUNCTIONAL AND STRUCTURAL FEATURES OF HEALTHY NEURONAL NETWORKS: IN VIVO OPTICAL IMAGING IN A MOUSE MODEL OF STROKE

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**Background and Aims:** Rehabilitation is the most effective treatment for promoting the recovery of motor deficits after stroke. One of the most challenging experimental goals is to unambiguously link brain rewiring to motor recovery prompted by rehabilitative therapy.

**Methods:** Here, we investigate which facets of cortical remodeling are induced by rehabilitation by combining optical imaging and manipulation tools in a mouse model of focal stroke on the primary motor cortex. We took advantage of a rehabilitation paradigm that combines motor training and pharmacological inhibition of the contralesional primary motor cortex (M1) with Botulinum Neurotoxin E (BoNT/E), recently shown by Spalletti and colleagues (2017) to promote a generalized motor recovery.

**Results:** We demonstrate that combined rehabilitation promotes the progressive restoration of cortical motor maps and of cortical activity in parallel with the reinforcement of inter-hemispheric connectivity. Furthermore, we reveal that the increase in vascular density goes along with the stabilization of peri-infarct neural circuitry at synaptic level.

**Conclusions:** The present work provides the first evidences that rehabilitation is sufficient to promote the combined recovery of distinct structural and functional features distinctive of healthy neuronal networks.

**Trial registration number:** N/A

## AS32-029

### GP9IDS-TAT, A SELECTIVE NOX2 PEPTIDE INHIBITOR, PROTECTS IN VITRO BLOOD-BRAIN BARRIER FROM ISCHAEMIC INJURY

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**Background and Aims:** Oxidative stress, associated with excessive availability of reactive oxygen species (ROS), plays a major role in blood-brain barrier (BBB) damage during ischaemic stroke. Nox2 constitutes the main source of vascular oxidative stress. This study investigates whether selective inhibition of Nox2 by gp91ds-tat can prevent ischaemic injury-induced BBB damage.

**Methods:** An in vitro model of human BBB was established by co-culture of human brain microvascular endothelial cells (HBMEC), astrocytes and pericytes before their exposure to 4 h of oxygen-glucose deprivation (OGD), OGD followed by 20 h of reperfusion (OGD+R), or to OGD ± R with/out gp91ds-tat (50 µM). The integrity and function of the BBB were studied by measurements of transendothelial electrical resistance (TEER) and paracellular flux of low (sodium fluorescein; NaF, 376Da) and high (Evan's blue-labelled albumin; EBA, 67kDa) molecular weight permeability markers, respectively. NADPH oxidase activity and superoxide anion levels were assessed by (modified) lucigenin chemiluminescence assay. The cytoskeletal organisation of all three cell lines was examined by actin filament staining.

**Results:** OGD disrupted BBB integrity and function as evidenced by decreases in TEER and increases in flux of NaF and EBA which were significantly attenuated by reperfusion and completely normalised by inhibition of Nox2. Similarly, OGD-mediated increases in HBMEC NADPH oxidase activity and superoxide anion release were markedly attenuated by gp91ds-tat which also appeared to prevent OGD-evoked stress fibre formation in all three cell lines.

**Conclusions:** Selective inhibition of Nox2 appears to protect human BBB integrity and function during or after ischaemic injury by attenuating oxidative stress and maintaining cellular architecture.

**Trial registration number:** N/A

## AS32-016

### HEAD DOWN TILT 15° AS COLLATERAL THERAPEUTIC IN EXPERIMENTAL ISCHEMIC STROKE: EFFICACY, SAFETY AND HEMODYNAMICS

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**Background and Aims:** Cerebral collaterals are recruited after large vessel occlusion (LVO) and highly affect tissue outcome in acute ischemic stroke. We investigated head down tilt 15° (HDT15°) as a therapeutic strategy for acute modulation of collateral flow in rat model of LVO ischemic stroke.

**Methods:** Ischemic stroke was induced by transient middle cerebral artery (MCA) occlusion in Wistar rats ( $n=72$ ), randomly assigned to HDT15° or flat position for 1 hour, starting 30 minutes after occlusion. Primary outcomes were infarct volume and functional neuroscore, secondary outcomes were mortality, cerebral hemodynamics and cardiovascular parameters.

**Results:** Treatment with HDT15° was associated with lower infarct volumes (54.07 mm<sup>3</sup> absolute mean difference;  $p < 0.001$ ) and higher chance of good functional outcome (72.2% versus 31.0%, OR 5.77,  $p = 0.003$ ) compared to untreated animals. Both Laser Doppler monitoring and dynamic susceptibility contrast perfusion MRI showed that HDT15° acutely and selectively increased cerebral perfusion in the MCA territory by approximately 25%. HDT15° caused neither treatment-related death nor changes in cardiorespiratory parameters.

**Conclusions:** Our findings suggest that HDT15° acutely increases collateral flow in acute ischemic stroke due to LVO and provides a tissue-saving effect without major safety concerns. Further research is needed to develop HDT15° as a pre-hospital therapy for enhancing collateral flow in suspected ischemic stroke prior to recanalization therapy. Please indicate the Trial registration number: in the following box.

N/A

## WITHDRAWN

**WITHDRAWN**

**Background and Aims:** Stem cell technology and transplantation has helped scientists to study its potential role in neural repair and regeneration. The fate of stem cells is determined by its niche, consisting of cells and trophic growth factors. This study evaluates functional potential of bone marrow derived mononuclear stem cells (BM-MNC) in chronic ischemic stroke through fMRI & H-NMR spectroscopy.

**Methods:** Twenty ( $n = 20$ ) chronic stroke with 3 months to 1.5 years of index event were recruited with MRC of hand muscles at least 2; Brunnstrom stage: 2–5 with  $n = 20$  age matched healthy controls. These patients were randomized to group 1 receiving autologous BM-MNC (mean 60–70 million) and other receiving saline infusion/placebo in group 2. All patients were administered with neuromotor rehabilitation regime for 2months. Clinical assessment (FM, mBI, MRC, Ashworth) were done at baseline, 2 & 6months. Block design with alternate baseline and activation task with TR = 4520 ms, TE = 44 ms, was performed.

**Results:** No serious adverse events were observed. There was no statistical significant clinical improvement in FM (95% CI; 7.2 to 3.35,  $p = 0.85$ ) & mBI (95% CI; 11.3 to 5.5,  $p = 0.81$ ). Laterality index of BA 4 & 6 was statistically insignificant ( $p = 0.45$  and  $p = 0.06$  respectively). We observed elevated peaks of glutamate, glutamine (2.32ppm) and acetone (1.9ppm) in group 1 and glucose (4.0 ppm)/ lactate peaks were observed in the group 2 ( $p > 0.05$ ).

**Conclusions:** Intravenous infusion of bone marrow derived mononuclear stem cell is safe and tolerable in stroke. Stem cells and physiotherapy might aid in functional recovery as demonstrated by fMRI & serum spectroscopic analysis.

**Trial registration number:** (CTRI/2014/09/005028).

**AS32-030****EXPLORING CONTRAINDICATIONS FOR THROMBOLYSIS: RISK OF HAEMORRHAGIC TRANSFORMATION IN MICE WITH RECENT ISCHEMIC STROKE OR HYPERGLYCAEMIA**

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**Background and Aims:** Patients with acute ischemic stroke often do not receive thrombolysis with recombinant tissue plasminogen activator (rt-PA) because of various contraindications. In this translational study, we evaluated whether rt-PA treatment after a recently induced experimental ischemic stroke or in the presence of hyperglycaemia increases haemorrhagic transformation (HT) or worsens functional outcome.

**Methods:** In total, 60 male C57BL/6 N mice were used. Ischemic stroke was induced by transient middle cerebral artery occlusion (tMCAO). Mice designated to develop hyperglycaemia were pre-treated with streptozotocin four weeks before tMCAO. One or 14 days after tMCAO rt-PA or saline (control group) were administered, respectively. Functional outcome was assessed by a blinded rater. To evaluate HT characteristics, photometric hemoglobin assay and semiquantitative histopathological analysis were performed.

**Results:** Thrombolysis applied one day after tMCAO did not increase HT as compared to the control group ( $8.4 \pm 4.6 \mu\text{l}$  vs.  $9.0 \pm 4.1 \mu\text{l}$ ,  $n = 5$ ,  $p = 0.8506$ ). Regarding functional outcome, rt-PA treatment did not worsen the neurological deficit in comparison to the control cohort ( $n = 10$ ,  $p = 0.6445$ ). Histopathological analysis revealed no differences considering HT between rt-PA treated groups and control groups (24h after tMCAO,  $n = 5$ ,  $p > 0.99$ ; 14 days after tMCAO:  $n = 10$ ,  $p = 0.5822$ ). In contrast hyperglycaemia ( $n = 9$ ,  $409 \pm 92 \text{ mg/dl}$ ) increased HT after rt-PA in comparison to controls ( $n = 9$ ,  $p < 0.001$ ).

**Conclusions:** The results of our experimental study suggest that rt-PA treatment after a recent ischemic stroke does not increase HT volume or

**AS32-008****FUNCTIONAL POTENTIAL OF BONE MARROW DERIVED MONONUCLEAR STEM CELLS IN CHRONIC STROKE. AN FMRI SPECTROSCOPIC ANALYSIS**

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worsen functional outcome. However, severe hyperglycaemia seems to aggravate HT.

**Trial registration number:** N/A

## AS32-001

### CONTINUOUS STIMULATION OF THE LATERAL PONTINE TEGMENTUM IMPROVES SKILLED WALKING IN RATS AFTER PHOTOTHROMBOTIC STROKE

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**Background and Aims:** Gait impairment after stroke is usually considered as a loss of cerebral function but might also be the result from a dysfunctional descending input to the spinal motor centres. Disturbed network activity could be an option for neuromodulation of cerebral regions involved in locomotion. The lateral pontine tegmentum (LPT), which contributes to the initiation and control of gait, might be a promising target for invasive stimulation. This study investigates whether continuous stimulation of the LPT has an effect on impaired gait in rats after stroke.

**Methods:** Fourteen rats were trained to cross a horizontal ladder and a wooden beam for seven days. On day eight, a photothrombotic lesion of the right sensorimotor cortex was induced and a microelectrode was implanted into the LPT ipsilateral to the lesion. On day eleven, high-frequency stimulation ( $n=7$ ) and sham-stimulation ( $n=7$ ) was started and proceeded 24h a day for ten days. Both tests have been videographically recorded before/after operation as well as immediately/24h after stopping stimulation.

**Results:** Haemalaun/eosin staining revealed correct placement of electrodes within the LPT in all animals. In the Ladder-Rung-Walking-Test, a significant improvement of skilled walking was observed in stimulated animals compared to sham-stimulated rats 24h after finishing stimulation. In the Beam-Walking-Test however, no significant difference was seen between both groups regarding gait impairment.

**Conclusions:** LPT-stimulation seems to improve control of gait but not balance after stroke. Functionally, it might shield spinal locomotor centres from abnormal cortical inputs after stroke allowing an independent functioning of these circuits.

**Trial registration number:** N/A

## WITHDRAWN

**Methods:** Rats were subjected to an embolic or a transient middle cerebral artery occlusion (eMCAO and tMCAO) model. Rats received recombinant tissue plasminogen activator (tPA) or saline for one hour using a randomized treatment regime. Blood samples were collected at five time points and CPU and proCPU levels were determined. The tMCAO model was extended with two additional treatment groups, AZD9684 alone or with tPA.

**Results:** Activation of proCPU/CPU system was clearly demonstrated upon AIS induction both in tPA treated and in untreated rats with a peak of CPU after the end of the treatment and then a progressive return to baseline level 5 hours after AIS onset. Administration of AZD9684 in tMCAO model clearly suppressed the *in vivo* generation of CPU ( $p < 0.01$ ), reduced microvascular thrombosis, assessed by the quantification of fibrin (ogen) deposition, but did not significantly reduce the final infarct volume in comparison to untreated rats.

**Conclusions:** Our study demonstrates a pronounced activation of CPU during MCAO and suggests that CPU generation could reflect ongoing microvascular thrombosis. Selective inhibition of CPU reduced microvascular thrombosis without significant impact on final infarct volume.

**Trial registration number:** N/A

## WITHDRAWN

**WITHDRAWN****NICORANDIL EFFECTS ON THE ACUTE BRAIN ISCHEMIA IN MCAO-INDUCED STROKE RAT MODEL****A. Borhani-Haghghi<sup>1</sup>, A. Safari<sup>2</sup>, M.R. Namavar<sup>1</sup> and****M. Khastkhodaei<sup>3</sup>**

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**Background and Aims:** Stroke is the second leading cause of death worldwide, as well as being a significant social, psychological and economic burden. There is no effective and generally accepted treatment for the acute ischemic stroke except thrombolysis with recombinant tissue plasminogen activator that has many limitations. Nicorandil, a potassium ATP channel opener, inhibits intracellular caspase and prevents apoptosis in cells. The aim of this study was to evaluate nicorandil effects on the acute brain ischemia.

**Methods:** 28 male Sprague Dawley rats weighing 200–250 g were randomly divided into four groups: the sham group that tolerated anesthesia and surgery without middle cerebral artery occlusion (MCAO) and drug or vehicle. The control, nicorandil 1 and 3 mg/kg groups underwent MCAO and received nicorandil solvent, nicorandil 1 and 3 mg/kg intraperitoneally, respectively. The behavioral recovery of rats were evaluated using Garcia score test and ischemic size parameters by using stereological methods.

**Results:** Behavioral tests showed that nicorandil-treated animals had better performance in Garcia score test than control group ( $P < 0.05$ ). Histological and stereological evaluation did not show significant difference in the total volume of the brain between groups. However, the nicorandil significantly decreased infarction and ischemic size and infarction percentage in comparison to the control group and this decrease was more obvious in higher dose ( $P < 0.001$ ) than lower dose ( $P < 0.05$ ).

**Conclusions:** Nicorandil improved not only the sensory and motor behaviors, but also it reduced ischemic size and these improvements were dose dependent. Furthermore, the neurological improvements were correlated with histological findings.

**Trial registration number:** N/A

**WITHDRAWN****WITHDRAWN**

**AS32-048****INVESTIGATING THE INTERPLAY OF ISCHEMIA AND AMYLOID AT THE BLOOD-BRAIN BARRIER**

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**Background and Aims:** Cerebral amyloid angiopathy (CAA) is a common cause of small vessel disease which develops as a result from amyloid- $\beta$  (A $\beta$ ) deposits in the cerebrovasculature, leading to an increased risk of microbleeds, intracerebral haemorrhage and ischemic stroke. Since ABC-transporters like P-gp and Bcrp severely affect stroke recovery as well as play an important role in A $\beta$  clearance, the complex interplay of transporter, tight junction (TJ) and receptor regulation during CAA progression was determined.

**Methods:** qPCR analysis was performed on primary mouse brain endothelial cell cultures exposed to A $\beta$ 1-40 and oxygen-glucose deprivation (OGD). Ex vivo transport studies with intact brain microvessels from aged APP23 mice (CAA model) were used to analyse transporter activity.

**Results:** While a 24h exposure with 12nM A $\beta$ 1-40 prior to 24h of OGD had no significant effect, qPCR data show that the presence of A $\beta$  during OGD counteracts the down-regulation of TJs (Occludin, ZO-1, Claudin-5), P-gp, Bcrp and Mrp4.

The ex vivo transport studies demonstrate that specific P-gp and Bcrp activity is down-regulated in 14 months old APP23 mice when compared to aged-matched wild-type (WT) controls. A down-regulation of P-gp and Bcrp activity was also seen between 3 and 20 months old WT mice.

**Conclusions:** The qPCR results suggest a beneficial role of A $\beta$ 1-40 in ischemia during a stroke event, while the transport studies indicate that P-gp and Bcrp activity decline is a potential contributor to age-associated vascular dysfunction and CAA development, and that the course of P-gp regulation in APP23 mice could be translated into a clinical marker for CAA.

**Trial registration number:** N/A

**AS32-039****N-BUTYLPHthalide IMPROVES THE MITOCHONDRIAL AXONAL TRANSPORT AND ACETYLCHOLINE RELEASE OF NEURONS UNDER HYPOPERFUSION**

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**Background and Aims:** Mitochondrial dynamics, especially mitochondrial axonal transport, plays an important role in maintaining synaptic function of neurons. Our previous study showed that chronic hypoperfusion can increase axonal mitochondrial docking by molecular modulation of mitochondria docking protein SNPH. N-Butylphthalide, as a small molecule freely passing through the blood-brain barrier, could effectively influence the expression on mitochondrial docking protein SNPH. In this study, we aimed to discuss the effect of N-Butylphthalide on the axonal transport of mitochondria and the release of acetylcholine transmitter at axonal terminal of the cholinergic neurons of the forebrain after hypoglycemia/hypoxia stimulation.

**Methods:** The cholinergic neurons of the forebrain were cultured in vitro. Mitochondrial axonal transport was observed by the living cells workstation. Mitochondrial transport related regulatory proteins Milton and Miro expression were detected. The acetylcholine transmitter

released from neuronal axon terminals was determined by high performance liquid chromatography.

**Results:** N-Butylphthalide decreased mitochondrial docking under hypoperfusion condition. It increased axonal transport of mitochondria and the ratio of anterograde/retrograde motile mitochondria by up-regulated the expression of transporter related regulatory proteins Milton and Miro. The mitochondrial functions including membrane potential and ROS production were also reversed. More importantly it reversed the transmitter release of acetylcholine.

**Conclusions:** N-Butylphthalide can improve the axonal transport of mitochondria and the release of acetylcholinergic transmitters at axon terminals after hypoglycemia/hypoxia stimulation. This may provide a possible new strategy for the treatment of vascular dementia.

**Trial registration number:** N/A

**AS32-045****BASELINE MRI CHARACTERISTICS ARE ASSOCIATED WITH QUANTITATIVE ASSESSMENT OF THROMBUS HEMOGLOBIN CONCENTRATION**

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**Background and Aims:** A better thrombus characterization could be useful to predict acute ischemic stroke (AIS) etiology, tissue-type Plasminogen Activator (t-PA) induced-thrombolysis and endovascular therapy (EVT) response. Until now, only histological analyses of thrombi were performed with controversial results. Our aim was to study the association between the susceptibility vessel sign (SVS) on baseline MRI and the quantitative hemoglobin concentration (HbC) of thrombi from EVT-treated AIS patients.

**Methods:** SVS and two-layered SVS (TLSVS) on baseline MRI of 84 anterior AIS patients were reviewed blinded to clinical and biochemical data. Thrombi retrieved during EVT underwent biochemical analysis on their homogenate. HbC was measured with two different methods, an ELISA-based method and a hem quantitative method.

**Results:** SVS and TLSVS were respectively founded in 85.7% and 50.0% of cases. The median ELISA-based HbC was 253 µg/mg (IQR, 177 to 333) and the median hem concentration was 219 µg/mg (131 to 264). A perfect correlation between these 2 methods was found ( $r = 0.958$ , 95%CI, 0.936 to 0.973). Patients with TLSVS had a higher weight of retrieved thrombi (31.1 [16.5 to 68.3] in TLSVS(+) vs. 17.7 [11.7 to 33.3] in TLSVS (-);  $p = 0.005$ ) and a higher HbC (median, 278; IQR; 221 to 331) than patients without TLSVS (median, 196; IQR; 139 to 301;  $p = 0.010$ ). Biochemical characteristics of thrombi did not differ significantly according to SVS status.

**Conclusions:** Our study shows for the first time according to 2 biochemical quantitative assessments of HbC that TLSVS was significantly associated with a higher thrombus weight and hemoglobin concentration.

**Trial registration number:** N/A

**AS32-051**

**LITHIUM MODIFIES SECRETION PATTERNS OF EXTRACELLULAR VESICLES DERIVED FROM MESENCHYMAL STEM CELLS INDUCING MIRNA-1906-DEPENDENT NEUROPROTECTION AND NEUROREGENERATION AGAINST EXPERIMENTAL STROKE IN MICE**

**T. Döppner<sup>1</sup>**

Bozena Zechmeister Xuan Zheng Matteo Haupt Lisa Janssen Simone Lieschke Bert Bosche Fengyan Jin Vivek Venkataramani Mathias Bähr;  
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Göttingen, Germany

**Background and Aims:** Lithium modifies disease progression of bipolar disorders, but also mediates neuroprotection and neuroregeneration in pre-clinical stroke models. On the contrary, neuroregeneration is also stimulated upon transplantation of mesenchymal stem cells (MSCs), and in vitro co-priming of MSCs with lithium further enhances the neuroregenerative potential of grafted MSCs. The latter, however, mediate their effects by extracellular vesicles (EVs). We therefore hypothesized that in vitro pre-incubation of MSCs with lithium modifies EV secretion patterns, enhancing the therapeutic potential of EVs derived from lithium-treated MSCs ("Li-EVs").

**Methods:** Cultured neurons were exposed to oxygen-glucose-deprivation (OGD) and treated with Li-EVs, native EVs ("EVs"), or PBS ("control"). C57BL6 mice underwent middle cerebral artery occlusion and were treated on days 1, 3, and 5 post-stroke followed by an observation period of three months.

**Results:** Li-EVs significantly enhanced survival of cultured neurons against OGD in comparison to cells treated with EVs or PBS. Likewise, treatment with Li-EVs reduced brain injury, enhanced neurological recovery, and stimulated post-stroke neuroregeneration in stroke mice. The pre-incubation of MSCs with lithium changed the characteristics of these Li-EVs. EV enrichment using polyethylene glycol yielded a significantly increased number of EVs after lithium treatment. Lithium also altered the miRNA contents of EVs, among which miR-1906 was significantly increased. Li-EVs containing miR-1906, a novel toll-like-receptor-4 (TLR4) regulator, reduced post-stroke cerebral inflammation via down-regulation of TLR4. The latter was associated with reduced proteasomal activity in lesioned brain regions.

**Conclusions:** Li-EVs might be an innovative novel tool for adjuvant stroke treatment without the possible side effects known from MSC transplantation.

**Trial registration number:** N/A

**AS32-055**

**REMOTE ISCHAEMIC PER-CONDITIONING PROVIDES PROLONGED NEUROPROTECTION 4 DAYS AFTER A SINGLE DOSE: DATA FROM AN EX-VIVO IN-VITRO BLOOD BRAIN BARRIER MODEL**

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**Background and Aims:** Remote ischaemic per-conditioning (RIC) in pre-clinical ischaemic stroke is neuroprotective and is achieved by repeated transient occlusion of the blood supply to a limb. The mechanisms of action are not fully understood, though release of numerous neurohumeral chemical messengers have been implicated.

**Methods:** We aimed to establish if plasma acquired four days post RIC (or sham) from participants of the Remote ischaemic Conditioning After Stroke Trial (RECAST [England Stroke 2017]) demonstrates neuroprotective properties. An *in vitro* 4-hour oxygen glucose deprivation (OGD) blood-brain-barrier (BBB) model (comprising human astrocytes, pericytes, brain microvascular endothelial cells and neurons) was treated with 70µL of plasma prior to OGD. Transepithelial resistance (TEER, reflecting BBB permeability), apical and basal lactate dehydrogenase (LDH) and interleukin 6 (IL-6) (markers of cell damage) were measured at time-points pre-OGD (baseline), immediately post-OGD and 24 hours.

**Results:** Over 24 hours, there was a significant reduction in TEER (i.e. increased permeability) in the control/sham group ( $n=4$ ) compared to RIC ( $n=4$ ), (mean difference in change from baseline 14.75%,  $p < 0.001$ , repeated measures ANOVA). IL-6 production from apical and basal compartments was significantly lower at 24 hours in the RIC group (1061pg/mL versus 225pg/mL,  $p = 0.004$ ,  $n=4/\text{group}$ ) but was not significantly different pre-OGD or post-OGD. LDH did not differ between groups at any time point.

**Conclusions:** Plasma obtained 4 days after a single 'dose' of RIC following ischaemic stroke displays neuroprotective properties, potentially through anti-inflammatory mechanisms. This *ex-vivo* *in vitro* method could be used to explore further mechanisms of action and optimal RIC dosing parameters.

**Trial registration number:** N/A

**AS32-040**

**ENDOTHELIAL PROGENITOR CELL PROFILE OF MOYAMOYA ANGIOPATHY ITALIAN PATIENTS**

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**Background and Aims:** Moyamoya angiopathy (MA) is a rare and disabling cerebrovascular condition characterized by recurrent ischemic/hemorrhagic strokes. The disease pathophysiology is unknown limiting the development of effective treatments. Surgical revascularization is the only available treatment to reduce the follow-up stroke risk. Circulating endothelial progenitor cells (cEPCs) were hypothesized to be involved in vascular remodeling of MA. It remains unclear whether cEPCs might be considered as a prognostic MA marker. Our aim is to characterize the level and function of cEPCs in a cohort of adult Italian MA patients.

**Methods:** 18 healthy donors (HD), 10 unrelated controls (UNR) and a subgroup of 20 MA patients belonging to the wider MA patient-population of GEN-O-MA project, were included. For each patient clinical and neuroradiological data and a blood sample were collected. cEPCs were isolated from whole blood as CD45<sup>dim</sup> CD34<sup>+</sup>CD133<sup>+</sup>mononuclear cells. Gene-expression (GE), ELISA and functional assays were also performed to characterize cEPCs.

**Results:** MA patients were characterized by a significant decrease of cEPC level as compared to HD ( $p = 0.038$ ). Analysis of endothelial markers and growth factors of cEPCs at various stages, evidenced a

peculiar GE pattern in MA patients in comparison to HD. Although we observed an impaired functionality in cEPCs from selected MA patients as compared to HD, no significant difference was globally found in vasculogenic capacity.

**Conclusions:** These findings suggested that cEPC level could represent a potential pathogenetic marker of MA. A better characterization of phenotype and function of MA-cEPCs is expected through a careful stratification of MA patients based on their clinical/neuroradiological profile.

**Trial registration number:** N/A

## AS32-034

### INTRAARTERIAL ADMINISTRATION OF THERAPEUTIC ENDOTHELIAL PROGENITOR CELL SECRETOME IN BIOCOMPATIBLE MAGNETIZED NANOCAPSULES FOR SUSTAINED RELEASE IN A MOUSE MODEL OF TRANSIENT CEREBRAL ISCHEMIA

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**Background and Aims:** Advanced therapeutic products are promising for stroke neurorepair but challenging for brain delivery. Our aim is to administrate a new nanomedical carrier with endothelial progenitor cells (EPCs)-derived secretome and demonstrate a safe brain delivery in cerebral ischemia.

**Methods:** Secretome was encapsulated in poly (D-L-lactic-co-glycolic acid) (PLGA) nanocapsules (230nm) functionalized with superparamagnetic iron oxide nanoparticles (SPIONs) for delivery under a local magnetic field and fluorescent tags (Cy7.5).

To study biodistribution, mice were injected either intravenously or through the internal carotid artery (ICA) with 1–1.5mg of nanocapsules in saline and tracked by magnetic resonance imaging (MRI) and molecular fluorescent imaging (FMI, IVIS Spectrum), showing an advantage of intraarterial administration for brain delivering, confirmed by Prussian Blue-stain and ex-vivo FMI.

Intraarterial administration was protocolized in the intraluminal MCAO model by cannulating the external carotid artery 30 min after reperfusion with a 0.20mm micro-catheter directed to the ICA and connected to an infusion pump.

**Results:** Nanocapsules were visualized in agarose-phantoms by MRI and by FMI. *In vitro* we observed a 1-week sustained protein-release. Mice receiving intravenous nanocapsules did not show major adverse effects (no weight loss, no pancreatic/renal/liver toxicity) after 2 weeks.

Regarding safety, C57BL/6J ischemic mice treated with either vehicle or 0.85mg of nanocapsules in 150µl of saline (75µl/min), following the aforementioned protocol, did not show significant differences at 48 hours in infarct size nor hemorrhagic events.

**Conclusions:** We have proved the safety and feasibility of acute intraarterial nanocapsule administration after cerebral ischemia to further deliver therapeutic secretome, which could be considered in the context of endovascular interventions.

**Trial registration number:** N/A

## AS32-013

### ADMINISTRATION OF ADIPOSE TISSUE MESENCHYMAL STEM CELLS IMPROVES BRAIN REPAIR IN HYPERGLYCEMIC STROKE RATS

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#### Background and Aims:

**Introduction:** Over 50% of patients with an acute stroke have hyperglycemia, which is associated with a poorer outcome and prognosis.

**Aim:** To investigate the impact of hyperglycemia on behavioral recovery and brain repair of intravenously delivered human adipose tissue-derived mesenchymal stem cells (hAD-MSCs) in a rat model of permanent middle cerebral artery occlusion (pMCAO).

**Methods:** Material/Methods: Hyperglycemia was induced in male rats by administration of nicotinamide and streptozotocin. The rats were then subjected to stroke by a pMCAO model. At 48 hours after stroke, 1x10<sup>6</sup> hAD-MSCs or saline was intravenously administered. We evaluated: behavioral outcome, infarct size by MRI and brain plasticity markers by immunohistochemistry (glial fibrillary acidic protein [GFAP], Iba-1, synaptophysin, doublecortin, CD-31, collagen-IV, and α-smooth muscle actin [α-SMA]).

**Results:** The hyperglycemic group exhibited more severe neurological deficits; lesion size and diffusion coefficient were larger compared with the non-hyperglycemic animals ( $p < 0.05$ ). GFAP, Iba-1 and α-SMA were increased in the hyperglycemic group. The hyperglycemic treated group had significantly improved neurological impairment ( $p < 0.05$ ). Although T2-MRI did not show differences in lesion size between groups, the rADC values were significantly lower in the treated group ( $p < 0.05$ ). Levels of GFAP, Iba-1 and arterial wall thickness were lower in the hyperglycemic treated group than in the nontreated hyperglycemic group at 6 weeks after stroke.

**Conclusions:** The rats with hyperglycemic ischemic stroke exhibit increased lesion size and impaired brain repair processes, which lead to exacerbated behavioral recovery. Thus, hAD-MSC administration induced better anatomical tissue preservation, associated with a good behavioral outcome.

**Trial registration number:** N/A

## WITHDRAWN

COX-2, NOS-2 and NF-KB in the limbic areas as compared to the MCAO group.

**Conclusions:** The nano-thimoquimone at physiological concentration has shown a significant protection on the neurotoxicities-induced by cerebral stroke.

**Trial registration number:** N/A

#### AS32-046

### TIDEGLUSIB EXERTS NEUROPROTECTIVE EFFECT IN BRAIN ISCHEMIC REPERFUSION INJURY IN RATS

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**Background and Aims:** Ischemic stroke is the most common type of stroke. GSK 3 $\beta$  activation has been proposed as a contributing factor in the etiology of stroke by aggravating excitotoxicity, inflammation, apoptosis and oxidative stress. Tideglusib, a thiazolidinone derivative is a potent GSK 3 $\beta$  inhibitor. In this study, we hypothesized that tideglusib may show neuroprotective effect in stroke by modulating GSK 3 $\beta$ .

**Methods:** In male Wistar rats (250–280g) middle cerebral artery was occluded for 90 min using doccol suture. In post-treatment group, tideglusib (50 mg/kg) was administered 30 min after occlusion. In pre-treatment group, tideglusib was administered once daily for 2 days and 30 min before middle cerebral artery occlusion (MCAo) on 3<sup>rd</sup> day. The rats were examined for behavioral parameters like neurological deficit score, motor incoordination by rotarod. The effect on infarct damage was assessed using MRI, 24 hours after the last dose.

**Results:** Tideglusib pre-treatment significantly improved neurological deficit score ( $p < 0.01$ ) and time spent on rotarod ( $p < 0.01$ ) when compared with MCAo, while post treatment did not show significant improvement. Similarly, tideglusib treatment significantly ( $p < 0.05$ ) reduced infarct area ( $23.4 \pm 4.5\%$  of ipsilateral area) in pre-treatment group as compared to MCAo group ( $41 \pm 3.3\%$  of ipsilateral area), while post-treatment did not reduce infarct area significantly.

**Conclusions:** These results showed that tideglusib pretreatment reduced the damage caused during ischemic stroke. This study suggests the potential of tideglusib as a prophylactic agent in high risk ischemic stroke patients.

**Trial registration number:** N/A

#### AS32-028

### INHIBITION OF PROTEIN KINASE C-B PROTECTS IN VITRO BRAIN BARRIER FROM ISCHAEMIA-EVOKED DAMAGE

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**Background and Aims:** Ischaemic stroke impairs cerebral barrier and as a consequence trigger brain edema formation and hemorrhagic transformation. This study aims to examine whether the inhibition of protein kinase C- $\beta$  (PKC- $\beta$ ) preserves blood-brain barrier (BBB) against ischaemic injury-mediated damaged.

**Methods:** An in vitro model of human BBB comprising human brain microvascular endothelial cells (HBMECs), human astrocytes cells (HAs) and human pericytes cells (HPs) were subjected to 4 hours of oxygen-glucose deprivation (OGD) alone or followed by 20 hours of reperfusion (OGD  $\pm$  R) in the absence or presence of PKC- $\beta$  inhibitor

#### WITHDRAWN

(LY333531, 0.05 µM). The integrity and function of the BBB were evaluated by measurements of transendothelial electrical resistance (TEER) and flux of low (sodium fluorescein [NaF], Mw: 376 Da) and high (Evan's blue-labelled albumin [EBA], Mw: 67 kDa) molecular weight permeability markers, respectively. The cytoskeletal changes in each cell line were analysed through staining of actin filaments.

**Results:** OGD ± R perturbed BBB integrity and function, as confirmed by significant decreases in TEER and concomitant increases in paracellular flux of NaF and EBA. In concert with these changes, OGD ± R also evoked dramatic changes in cellular architecture, as evidenced by formation of actin stress fibres in all cell lines. Inhibition of PKC-β preserved BBB integrity and function to which prevention of ischaemia-mediated formation of stress fibres appeared contribute.

**Conclusions:** Inhibition of PKC-β in ischaemic settings may be of therapeutic value in the prevention and/or restoration of BBB integrity and function.

**Trial registration number:** N/A

## WITHDRAWN

**Background and Aims:** Epilepsy, a group of serious disorders of the central nervous system characterized by a predisposition to recurrent unprovoked seizures due to abnormal excessive synchronous neural activity. Animal models of pilocarpine-induced seizures have been employed to demonstrate that ongoing epileptic activity in the brain can affect both excitatory and inhibitory synapses and thus neuronal plasticity. Neurotransmitters play a vital role in the functioning of brain. Our study aimed to investigate the changes in brain neurotransmitters in Wistar rat models of pilocarpine-induced seizures.

**Methods:** Total 75 animals of pilocarpine-induced seizures models for epilepsy were studied. Behavioral, electroencephalographic and morphological changes induced by systemic administration of pilocarpine hydrochloride were studied in 3–90-day-old rats. Pilocarpine, 100, 200 and 380 mg/kg, presented a characteristic array of behavioral patterns in developing rats. Determination of brain norepinephrine, Gamma-aminobutyric acid (GABA), dopamine and serotonin was carried out using high performance liquid chromatography (HPLC) system, Agilent technologies 1100 series.

**Results:** The mean values of brain norepinephrine, dopamine and serotonin levels in pilocarpine-induced seizures rat brain were significantly increased compared to control group, which consequently, may reduce seizure susceptibility and epilepsy comorbidities. There was a significant decrease in Gamma-aminobutyric acid (GABA) values in treatment group compared to control.

**Conclusions:** Neurotransmitters play a vital role in brain functioning and also have important function in epilepsy status.

**Trial registration number:** n/a

## AS32-003

### PATHOLOGICAL DEFORMATIONS OF INTERNAL CAROTID ARTERY: PATHOMORPHOLOGICAL AND BIOMECHANICAL MODELS

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**Background and Aims:** Pathological deformations of internal carotid artery (PD ICA) are factors leading to acute brain blood circulation disorders such as transient ischemic attack, ischemic stroke. The aim is to assessment pathomorphological and biomechanical changes in deformed ICA.

**Methods:** There were 377 clinical cases of patients operated on carotid stenosis. Following methods have been used: histological investigation; immunohistochemical method with monoclonal antibodies (RAH C11-0.1, RAH C33, CIV 22, TIMP-1, MMP-9); biomechanical modeling (ANSYS, Workbench, SolidWorks 2008), statistic assessment of received data.

**Results:** PD were associated with atherosclerosis (AS) – 37.4 %; fibromuscular dysplasia (FMD) – 33.1 %; AS and FMD – 22.3 %. PD without another diseases were diagnosed in 7.2 %. Pathomorphological changes: connective-tissue deformation of the artery wall at the corner and proximal part of inflection; smooth muscles atrophy – distal part. Immunohistochemical analysis showed high expression of collagen I and III in the middle and external layers, collagen IV in the middle layer of the artery wall. Biomechanical models of PD ICA with different angles demonstrated blood circulating disorders depending on types of PD ICA, angle on inflection, concomitant diseases. As a result, the most dangerous deformations are angles 30° and 60°, because of them influence on gradient of pressure into the artery wall.

## AS32-053

### MODULATION AND ROLE OF BRAIN NEUROTRANSMITTERS IN PILOCARPINE-INDUCED SEIZURES IN THE RAT

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**Conclusions:** The phenomenon of evolution of PD ICA is revealed: the increase of the pressure gradient and the appearance of high tensile areas leads to the fact that the bending angle becomes sharper and the deformation is more pronounced.

**Trial registration number:** N/A

## AS32-054

### LYOPHILIZED CORD BLOOD IN NEURO-IMMUNE CHANGES CORRECTION IN EXPERIMENTAL ISCHEMIC STROKE

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**Background and Aims:** Human cord blood (HCB), multicomponent in cell composition and complex of biologically active compounds, can be used in ischemic stroke (IS) as cell therapy. We tested lyophilized leukoconcentrate of cord blood (ILKCB) for the treatment of IS.

Aim of this work is to evaluate the ability of ILKCB to act as a neuro-immune disorders corrector in rats with IS induction.

**Methods:** Experiments were carried out on male Wistar rats weighing 160–180 g, 6 months of age. IS was simulated by occlusion of the middle cerebral artery (MCAo). Lyophilization of LKCB was done (Goltsev A.N. et al. 2016). ILKCB were injected intraperitoneally (5\*10<sup>6</sup> cells) 6 hours after MCAo. Groups of animals: 1. intact (control); 2. IS; 3. IS + ILKCB. Immune status was assessed before and after treatment on the 3rd, 7th, 14th, 21st days. The content of CD3+, CD4+, CD8+, CD16+, CD25+ cells in the spleen was measured using cytofluorimetry. Also CIC, CRP and cytokines (IFN- $\gamma$ , IL10) were measured. Neurological status was assessed by "Open field" and "Cross maze" tests.

**Results:** Usage of ILKCB in IS treatment provided the normalization of immune status indicators, namely restoration of the deficit of CD3+ cells, correction of regulatory cells state indicators. Decrease of CIC, CRP and increase of blood lymphocytes was seen. Recovery of immune status correlated with indicators of morphological studies of the brain, lymphoid organs and the neurological status of animals.

**Conclusions:** Results of the experimental study show potential immunomodulatory and neuroprotective effects of ILKCB in the treatment of IS in acute phase.

**Trial registration number:** N/A

## AS32-021

### THE ANALYSIS OF INFLAMMATORY CYTOKINE/CHEMOKINE BIOMARKERS IN ACUTE STROKE PATIENTS

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**Background and Aims:** Ischemic stroke is known to reach 80% of all strokes and is the second most common cause of death worldwide. Stroke pathology in rodent models are not similar to human one and pathological events at acute stage of stroke are not known. Brain cells (neurons, astrocytes, oligodendrocytes, microglia, pericyte and

endothelial cells) are capable of producing inflammatory mediators, and are known to undergo many cytokine changes due to acute stroke.

**Methods:** We prospectively recruited 8 patients who underwent neuro-interventional recanalization treatment with acute cerebral infarction due to large artery occlusion. Samples (whole blood) were collected at control (normal patients), Pre-recanalization (Post-occlusion), Post-recanalization (Post-reperfusion), PR-1day, PR-7day, PR -1month (1day, 7day, 1month after post-recanalization). To analyze protein expression by time, cytokine/chemokine protein array were performed.

**Results:** Several proteins such as growth factor, interleukins and chemokine showed the significant changes at acute stage by time dependent manner. In the observed proteins IL4, CSF2, CXCL12, CCL5, IL1B and IL10 proteins changed after post-recanalization.

**Conclusions:** In conclusion, these results suggested that the alteration of these protein may indicate the pathological events at acute stage of ischemic stroke.

**Trial registration number:** N/A

## AS32-050

### INSIDE THE THROMBUS: FACTORXIII AS A CLOT STABILIZER IS ASSOCIATED WITH INCOMPLETE RECANALIZATION AFTER MECHANICAL THROMBECTOMY IN STROKE

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**Background and Aims:** The implementation of endovascular mechanical therapies enabled the histological analysis of thrombi retrieved from acute ischemic stroke (AIS) patients. Despite of the combination of mechanical and pharmacological therapies not all patients achieve successful revascularization. In this study we analysed the content of two factors that promote clot stabilization and impair fibrinolysis (thrombin activatable fibrinolysis (TAFI) and FXIII) and their relationship with complete revascularization (TICI 2b or 3) after mechanical thrombectomy.

**Methods:** Forty-three thrombi were retrieved from AIS patients by endovascular procedures and their content in TAFI and FXIII were characterized by immunohistochemical analysis. In addition, plasma samples from AIS patients were obtained.

**Results:** 16% (7/43) of AIS patients did not achieve complete revascularization after mechanical thrombectomy. TAFI was detected in almost all thrombi, but its content was not different between patients with or without complete recanalization. On the other hand, structural FXIII was increased in patients that failed to recanalise after MT [median, IQR; 4.3, (0.8-6.5) vs 0.1, (0.0-2.3), p = 0.03]. From receiver operating characteristic curves, we established a cut-off value for FXIII (2.77, sensitivity = 71% and specificity = 83%) and complete recanalization after mechanical thrombectomy. On binomial logistic regression analyses, this cut-off value was independently related with complete recanalization (OR = 9, IC 95% = 1.25-65.7, p = 0.03) after adjustment for potential confounders.

**Conclusions:** Complete recanalization after mechanical thrombectomy is associated with FXIII levels in occlusive thrombi retrieved from AIS patients. Therefore, FXIII could be a potential target for novel therapeutic strategies combined or not with mechanical thrombectomy in stroke.

Trial registration number: N/A

## AS32-024

### MODULATING THE COUNTER REGULATORY RENIN ANGIOTENSIN SYSTEM AXIS IN THE STROKE PRONE SPONTANEOUSLY HYPERTENSIVE RAT IN ISCHAEMIC STROKE

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**Background and Aims:** Our group have previously demonstrated that the counter regulatory renin angiotensin system (RAS) peptide, angiotensin-(1–9), acts via the angiotensin II type 2 receptor (AT<sub>2</sub>R) to oppose detrimental effects of perturbations in RAS in cardiovascular pathologies. We aimed to investigate if Ang-(1–9) has a beneficial effect on stroke outcome in the stroke prone spontaneously hypertensive rat (SHRSP), which possesses clinically relevant comorbidities.

**Methods:** Randomly allocated male SHRSP (17–23 week old, 270–310g) received a stereotactic injection of  $5 \times 10^{10}$  vg adeno-associated serotype 9 expressing Ang-(1–9) (AAV9-Ang-(1–9)) ( $n = 6$ ) or AAV9-eGFP (control virus, enhanced green fluorescent protein) ( $n = 5$ ), at striatal and cortical sites in each hemisphere, or cranial burrholes with durotomy for the non-viral control group ( $n = 5$ ). After 4 days, animals underwent transient middle cerebral artery occlusion (tMCAO) with recovery for 10 days. Functional outcome was measured using a 30-point neurological score, tapered beam and sticky label test. Infarct volume was measured using histology and systolic blood pressure by tail-cuff plethysmography. All measurements and analysis were performed blinded.

**Results:** In this pilot therapeutic study, AAV9-Ang-(1–9) delivery showed promising improved functional outcome compared to burrhole only and AAV-eGFP control groups (Table 1) although this failed to reach a statistically significant level due to small group size. AAV9-Ang-(1–9) delivery did not alter systolic blood pressure compared to burrhole only, and infarct analysis has shown no statistically significant differences between groups (Table 1).

**Table 1.** Functional outcome measures (neurological score, tapered beam and sticky label test), infarct volume and change in mean systolic blood pressure across treatment groups. Data presented as mean  $\pm$  SEM.

Treatment group	Mean value across baseline and days 3, 7 & 10 post tMCAO			Day 10 post tMCAO	%Change in systolic blood pressure after surgeries
	Neuroscore (/30)	%Footfalls on affected side (tapered beam)	Time to contact sticky label on affected side (s)	Infarct volume (mm <sup>3</sup> )	
Burrhole ( $n=5$ )	22.4 $\pm$ 1.7	20.3 $\pm$ 3.6	42.8 $\pm$ 4.6	201.5 $\pm$ 12.7	+4.9 $\pm$ 3.4
AAV9-eGFP ( $n=5$ )	23.0 $\pm$ 1.7	23.6 $\pm$ 11.1	36.0 $\pm$ 4.0	205.6 $\pm$ 21.9	+0.8 $\pm$ 2.0
AAV9-Ang-(1–9) ( $n=6$ )	24.5 $\pm$ 0.3	12.1 $\pm$ 2.0	31.0 $\pm$ 5.0	172.2 $\pm$ 30.1	+4.8 $\pm$ 6.4

**Conclusions:** Trends in functional outcome with delivery of AAV9-Ang-(1–9) prior to tMCAO, demonstrate promising potential for targeting the counter-regulatory RAS in ischaemic stroke.

Trial registration number: n/a

## AS32-057

### DISTRIBUTION AND MIGRATION OF MESENCHYMAL STEM CELL AND DIRECTLY REPROGRAMMED NEURAL PROGENITOR CELLS AFTER INTRA-ARTERIAL TRANSPLANTATION IN RATS WITH EXPERIMENTAL ISCHEMIC STROKE

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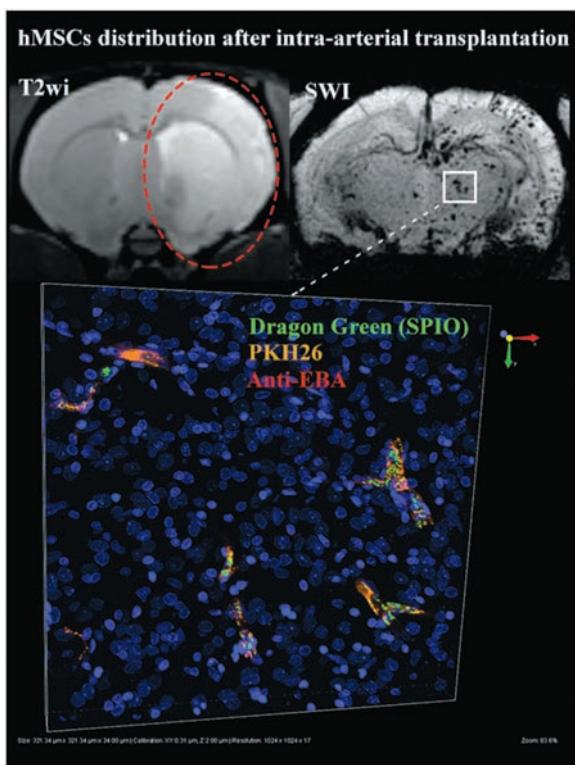
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**Background and Aims:** It has been shown that intra-arterial transplantation of mesenchymal stem cells can enhance stroke recovery in animal models and in humans according to the outcomes of first clinical trials. In vivo tracking of transplanted cells is essential for understanding the mechanisms of their beneficial effects. In these study we evaluated in vivo distribution and migration of human mesenchymal stem cells (hMSCs) and compared it with directly reprogrammed from human bone marrow MSCs neural progenitor cells (drNPCs) in ischemic stroke model in rat.

**Methods:** Male Wistar rats 24h after 90 minutes MCAO were transplanted intra-arterial into the right ICA with saline ( $n = 10$ ) and  $5 \times 10^5$  in 1 ml MSCs isolated from human placenta ( $n = 15$ ) or NPCs directly reprogrammed from human bone marrow MSCs ( $n = 15$ ) without genetic engineering techniques. For in vivo and ex vivo detection cells were double-labeled with the combination of SPIO and PKH26. 7T-MRI, behavioral test and postmortem immunohistochemistry were performed in dynamic.

**Results:** After intra-arterial injection all types of transplanted cells were distributed in the hemisphere of administration mainly periphery to the infarction zone and in brain stem. Cells were visualized inside the vessels in contact with the vascular wall (fig.1). hMSCs remained in brain for up to 3–4 days, while drNPCs not more than for 24 hours. Transplantation of both types of stem cells induced significantly faster stroke recovery already after 7d. However, administration only of drNPCs accelerated reduction of stroke volume.



**Conclusions:** Our results indicate different migration and mechanisms of therapeutic action of different stem cells types.

**Trial registration number:** N/A

## WITHDRAWN

plasma levels of A $\beta$ 40, A $\beta$ 42, and the ratio A $\beta$ 40/A $\beta$ 42 between focal ischemia groups and sham-operated group (all  $P > 0.05$ ).

**Conclusions:** No A $\beta$  plaques were found in thalamus and hippocampus up to 3 years after stroke in nonhuman primates. Other non-amyloid neurodegenerative mechanisms might be involved in post-stroke cognitive impairment and require further research.

**Trial registration number:** N/A

## AS32-056

### BRAIN SELECTIVE HYPOTHERMIA WITH INTRA-ARTERIAL COLD INFUSIONS PLUS EARLY NORMOBARIC HYPEROXYGENATION FOR NEUROPROTECTION IN EXPERIMENTAL ACUTE ISCHEMIC STROKE

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**Background and Aims:** Characterized by strong and brain-selective cooling performance paired with minor (systemic) adverse effects, intra-arterial cold infusions (IACI) into brain-supplying arteries have been reported as neuroprotective in experimental ischemic stroke. Combining normobaric hyperoxygenation (NBHO, i.e. 100% oxygen) with IACI might potentiate neuroprotection by increasing oxygen supply, and reducing metabolism during ischemia and mitigating oxidative stress during reperfusion.

**Methods:** NBHO+IACI vs NBHO vs IACI vs controls in a transient filament MCAO rat model. 100% oxygen was initiated 10min after MCAO, continuous IACI (0°C, 12mL) into the internal carotid artery were started 2min prior to reperfusion, both treatments were stopped (simultaneously) after 65min and 15min. Infarct and edema growth were estimated by MRI incl. perfusion, diffusion and T2 during ischemia, at 24h and 2weeks. Neurological tests were performed for functional outcome. NeuN, IB4 and GFAP staining was used to illustrate selective neuron loss (SNL), microglia activation and gliosis at 2weeks. Effect of arterial on penumbral oxygenation was evaluated with pre/post-treatment blood gas analyses and MBAI staining at 24h.

**Results:** In accordance with previous studies, NBHO reduced infarct growth by 50% vs. controls. Cerebral edema, penumbral oxygenation, functional outcome, SNL, microglia activation and gliosis were improved or reduced. In contrast, IACI were not beneficial and no synergistic neuroprotection was found for NBHO+IACI.

**Conclusions:** Our findings confirm strong NBHO-mediated neuroprotection in AIS, while IACI were not neuroprotective. Longer duration of brain-selective hypothermia might be the key, but IACI volume is the limiting factor. MRI, functional and histological results will be discussed in the context of current literature.

**Trial registration number:** N/A

## AS32-035

### IMPAIRED ASSOCIATIVE MEMORY, VISUAL DISCRIMINATION AND BEHAVIOURAL FLEXIBILITY AFTER EXPERIMENTAL STROKE

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**Background and Aims:** Numerous clinical studies have documented the high incidence of cognitive impairment after stroke. Pre-clinical

modelling of stroke offers an excellent approach to furthering our understanding of how stroke initiates cognitive impairment. One challenge that this approach has historically faced is that classical tasks rely on stressful conditions to stimulate performance, which can negatively impact on brain recovery. Assessment of cognition in pre-clinical models of stroke could be enhanced by using more sensitive and translationally relevant platforms. Here, we aimed to investigate post-stroke cognitive impairment in an experimental model of stroke by using a mouse touchscreen platform and understand the mechanisms behind these deficits.

**Methods:** C57BL/6 male mice were subjected to photothrombotic occlusion at the left motor and somatosensory cortex or sham surgery. Motor function was evaluated using the cylinder and grid walk task. Cognitive performances were assessed using the mouse touchscreen platform starting from 1 week to 1 month post-stroke. Brains were collected for further biochemical and cellular analyses.

**Results:** As expected, mice exhibited limb use deficits after stroke. Strikingly, stroke significantly impaired associative memory, visual discrimination and behavioural flexibility performances compared to sham. Further protein and histology analyses revealed a persistent loss of neurons, inflammation processes and accumulation of neurotoxic proteins at secondary neurodegeneration sites.

**Conclusions:** Our results demonstrate that the touchscreen platform represent a valid testing system for the assessment of different cognitive domains in pre-clinical models of stroke. Our results also suggest these cognitive deficits might be due to secondary neurodegeneration processes in areas remote from the primary infarct.

**Trial registration number:** N/A

## WITHDRAWN

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**Trial registration number:** N/A

## AS32-009

### RUNNING WHEEL TRAINING NORMALIZES STROKE-INDUCED HYPEREXCITABILITY OF PERIINFARCT NEURONS

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**Background and Aims:** Increased axonal sprouting was identified as a key structural correlate of exercise-enhanced stroke recovery. The effects of exercise on neuronal functionality and synaptic transmission of periinfarct neurons are still unclear, though.

**Methods:** Mice were subjected to photothrombotic stroke and either running wheel training or standard housing. Fourteen days after ischemia, acute brain slices were prepared and single cell excitability of cortical neurons from both, periinfarct area and contralateral hemisphere, was investigated in current clamp mode. To this end, a series of depolarizing currents of increasing intensity (from +20 to +160 pA) was applied, and the number of elicited action potentials (APs) was recorded.

**Results:** We found a significantly increased number of APs in periinfarct neurons in mice without exercise in comparison to mice that underwent running wheel training ( $p < 0.0001$ , 2way ANOVA). Comparing the number of APs between neurons from the ipsilateral and contralateral hemisphere of mice without exercise revealed that neurons from the periinfarct area generated a significantly higher number of APs ( $p < 0.01$ , 2way ANOVA). A similar analysis in trained mice, by contrast, showed almost no differences between the number of elicited APs in the ipsilateral and contralateral hemisphere.

**Conclusions:** Our findings demonstrate that cortical stroke leads to hyperexcitability of periinfarct neurons, which can be normalized by running wheel training. In our future experiments, we will perform detailed analyses of ion channel activity and neurotransmitter release to identify the mechanisms, by which exercise attenuates post-stroke hyperexcitability of cortical neurons.

**Trial registration number:** N/A

## AS32-031

### USING ANIMAL CLASSIFICATION OF FUNCTIONING FOR RATS WITH EXPERIMENTAL STROKE FOR COMPARISON WITH THE RESTRICTION OF FUNCTIONING ASSESSED USING THE ICF IN ACUTE STROKE PATIENTS

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**Background and Aims:** Using the principles of the ICF, we have developed an animal classification of functioning, adapted for Wistar rats. In the animal classification of functioning, coding is applied as in the ICF, which allows to compare violations and limitation in rats and humans. Aim: to compare the clinical manifestations in humans with acute stroke

in left middle cerebral artery (LMCA) with the manifestations of the focal cerebral ischemia in rats with occlusion LMCA.

**Methods:** The study enrolled patients ( $n=27$ ) with acute stroke in LMCA with mRS  $>3$  points. Patients were evaluated by a multidisciplinary team using the ICF. For stroke in rats, we used a Koizumi model of the 30-min filament occlusion of LMCA ( $n=12$ ) and Zhao model of LMCA ligation with 40-minute two common carotid arteries occlusion ( $n=12$ ). All animals were evaluated by scales and animal classification of functioning 48 hours later after surgery.

**Results:** The study enrolled patients ( $n=27$ ) with acute stroke in LMCA with mRS  $>3$  points. Patients were evaluated by a multidisciplinary team using the ICF. For stroke in rats, we used a Koizumi model of the 30-min filament occlusion of LMCA ( $n=12$ ) and Zhao model of LMCA ligation with 40-minute two common carotid arteries occlusion ( $n=12$ ). All animals were evaluated by scales and animal classification of functioning 48 hours later after surgery.

**Conclusions:** Animal classification of functioning allows comparing experimental models of stroke in rats and comparing limitation of functioning in humans and animals during cerebral ischemia.

**Trial registration number:** N/A

#### AS32-044

### TEMPORAL EXPRESSION PROFILE OF HEME OXYGENASE-I AFTER CEREBRAL ISCHEMIA REPERFUSION INJURY IN RATS

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**Background and Aims:** Heme oxygenase-I (HO-I) is a ubiquitous and redox-sensitive inducible stress protein that degrades deleterious heme to CO, free iron and biliverdin. Recently, HO-I activators have shown neuro-protective effect in various neurological conditions including stroke. The present study evaluates the expression pattern of HO-I at various time points after ischemia reperfusion in rats.

**Methods:** Male Wistar rats (260–290 g) were subjected to middle cerebral artery occlusion (MCAo) for 60 min using docal suture followed by reperfusion. In sham, all procedures were performed except insertion of suture. Rats were grouped based on time after reperfusion as sham, 2 h, 8 h, 24 h, 72 h and 7 days. After each specified time, MRI was done. Rats were then euthanized; HO-I expression was studied by western blot and immunofluorescence staining.

**Results:** MRI revealed ischemia reperfusion damage at all-time points. As revealed by western blot, HO-I expression in peri-infarct cortex was up-regulated significantly ( $p < 0.05$ ) at 2 hr when compared with sham, with gradual increase at 8 hr. HO-I expression was maximum at 24 hr ( $p < 0.01$ ) as compared with sham, with no significant change at 72 hr. At 7th day the expression of HO-I was significantly reduced when compared with 24 hr group. Immunofluorescence data was complimentary to western blot data. HO-I expression was significantly increased at all-time points compared to sham.

**Conclusions:** The results showed that HO-I expression was significantly increased as early as 2 hr after MCAo. Hence, targeting HO-I at very early stage after stroke may produce better benefits post stroke.

**Trial registration number:** NA

#### WITHDRAWN

#### AS32-023

### CYTOSPORONE-B-MEDIATED ACTIVATION OF THE NUCLEAR RECEPTOR NR4A1 RESULTS IN IMPROVED FUNCTIONAL OUTCOME AND REDUCED INFARCT VOLUME FOLLOWING CEREBRAL ISCHEMIA IN MICE

**J.K. Strecker<sup>1</sup>**

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**Background and Aims:** The inflammatory reaction following cerebral ischemia comes along with immigration and activation of immune cells which has substantial impact on the final brain damage. In our study, we show that the transcription factor NR4A1 has a crucial influence within strokes pathophysiology as mice devoid of NR4A1 show worsened functional outcome and increased infarct volumes when compared to wild-type mice. As our data suggest an anti-inflammatory role for NR4A1, we hypothesised that NR4A1-activation by its agonist Cytosporone-B limits ischemia-induced immune response and infarct expansion.

**Methods:** Wildtype ( $n=43$ ) and NR4A1-deficient ( $n=8$ ) mice were subjected to occlusion of the MCA (MCAO, 30 min). Animals were injected with Cytosporone-B (13 mg/kg, i.p.) 3h ( $n=21$ ) or 12h ( $n=14$ ) after reperfusion. Mice were tested for functional outcome and infarct volume, gene-expression and neutrophil immigration were analyzed via RT-PCR, histology and FACS.

**Results:** Mice devoid of NR4A1 showed worsened functional outcome ( $p < 0.001$ ) and increased infarct volume ( $p < 0.01$ ) when compared to wildtype mice. Treatment with Cytosporone-B resulted in improved functional outcome ( $p < 0.01$ ) and reduction of the infarct size ( $p < 0.01$ , 3h group;  $p < 0.001$ , 12h group) in wildtype mice when compared to placebo-treated group. Decreased ischemia induced deficits were accompanied by reduced influx of neutrophil granulocytes.

**Conclusions:** NR4A1-deficient mice develop enlarged infarcts and aggravated functional outcomes, whereas Cytosporone-B-activation of NR4A1 results in improved functional outcome and diminished brain damage concluding a prominent influence of NR4A1 in regulation of the immune response and development of brain injury. Therefore, Cytosporone-B-mediated activation of NR4A1 could be a promising therapeutic target in the treatment of stroke.

**Trial registration number:** N/A

## AS32-007

### LOCAL APPLIED SLOW-RELEASING GROWTH DIFFERENTIATION FACTOR 11 (GDF11) REDUCES FOCAL CEREBRAL ISCHEMIA-REPERFUSION INJURY BY ENHANCING NEUROGENESIS AND SUPPRESSING ANGIOGENESIS

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**Background and Aims:** Growth differentiation factor 11 (GDF11) is a member of the transforming growth factor beta 1 (TGF- $\beta$ 1) superfamily that reverses age-related neuron degeneration, improves proliferation of neuronal stem cells, and improve the cerebral vasculature. Recently, systemic GDF11 treatment meliorate vasculature in the hippocampus and cortex of old mice. However, GDF11 does not cross the brain blood barrier and the higher dose of GDF11 may have the deleterious effect.

**Methods:** In this study, we investigated the effects of local application and slow-releasing of GDF11 by fibrin glue on focal cerebral ischemia-reperfusion injury.

**Results:** We found that GDF11 improved cerebral infarction and sensorimotor function after cerebral I-R injury via Smad2/3 upregulation but FOXO3 downregulation. Oxidation of protein and lipid, as well as expression of iNOS and COX2, were reduced by GDF11 administration after 1-day focal cerebral I-R injury. In addition, GDF11 protected hippocampal neuron and subventricular neural stem cell against I-R injury, but suppressed astrocyte activation. Astonishingly, endothelial cells were whittled down in peri-infarcted site. By systematic profiling, some mRNA associating with neurogenesis were increasing and the mRNA associating with anti-angiogenesis were more than pro-angiogenesis in GDF11 treated brain.

**Conclusions:** Our data suggest that local application and slow-releasing of GDF11 in infarcted brain effectively decreased the damage of I-R injury via anti-oxidation, anti-inflammation, and pro-neurogenesis as previous reports. However, we also found GDF11 reduced the vasculature in the brain subjected to I-R damage. The dose and the manner of GDF11 administration should be applied prudently to avoiding potentially devastating effects.

**Trial registration number:** N/A

## AS32-027

### CONTRIBUTION OF ARACHNOID CELLS IN ARTERIAL STENOSIS OF MOYAMOYA DISEASE SUGGESTED BY EX VIVO FUNCTIONAL ASSAY

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**Background and Aims:** In our previous study, the cross-interaction between cerebral arteries and arachnoid cells was suggested based on a series of the transcriptome analysis combined with cell culture assay of primary cultured rodents and human cells. From these findings, we hypothesized that arachnoid cells of Moyamoya disease (MMD) should have an fundamental affect on MMD's intrinsic pathogenesis, and contribute the progression of carotid stenosis. To verify this notion, we performed the tube formation assay using MMD arachnoid cells in combination with endothelium.

**Methods:** We collected arachnoid membranes from adult patients including MMD patients ( $n=8$ , age: 42~70years), non MMD (nMMD) cerebral arterial stenosis patients with bypass surgery ( $n=8$ , age 38~67 years), and un-ruptured aneurysmal (uAN) patients ( $n=8$ , age: 44~75 years) for comparison. Using these surgical specimens, we prepared primary cultured arachnoid cells and performed tube formation assay. We measured expression levels of angiogenesis-specific genes by qPCR. To observe arachnoid cell's effect on endothelial cells, we performed the tube formation assay with mixed cells of arachnoid cells and Human Umbilical Vein Endothelial Cells (HUVECs). The diameter of formed tubes was measured by NIH ImageJ system.

**Results:** Transcriptome profile from tube formation assay showed the significant difference in angiogenesis related genes, among uAN, MMD/nMMD and HUVECs group. The tube formation assay of mixed cultured cells demonstrated that MMD group showed the significant diameter narrowing, comparing to uAN or nMMD group.

**Conclusions:** This ex vivo study showed the potential of arachnoid cells involvement in progressive carotid stenosis of MMD, suggesting a new target for MMD therapy.

**Trial registration number:** N/A

## AS32-041

### IN CHRONIC HYPOXIA, GLUCOSE AVAILABILITY AND HYPOXIC SEVERITY DICTATE THE BALANCE BETWEEN HIF-1 AND HIF-2 IN ASTROCYTES

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**Background and Aims:** Levels of the hypoxia inducible transcription factors (HIF-1 and HIF-2) are increased in hypoxic conditions and impact the neuroprotective properties of astrocytes. In this study we explore the balance of HIF-1 and HIF-2 signaling in astrocytes during chronic (1–7 days) of hypoxia and the effects of these conditions on neuron apoptosis.

**Methods:** Primary Astrocytes were obtained from wild-type, HIF-1 $\alpha^{F/F}$  ESRcre mice and HIF-2 $\alpha^{F/F}$  ESRcre mice. HIF-1 $\alpha$  and HIF-2 $\alpha$  expression were detected by Western Blot, RT-PCR and ELISA. Neuron apoptosis was analyzed by TUNEL assay. The one-way or two-way ANOVA followed by Tukey's multiple comparisons was used for multiple comparison.

**Results:** During exposure to chronic moderate hypoxia (2% O<sub>2</sub>) and plentiful glucose (10mM), HIF-2 and EPO abundance increases from day 1 to 7. However, when glucose availability is limited (2mM), both HIF-2 and EPO abundance are suppressed during moderate hypoxia. In contrast to HIF-2, HIF-1 target expression increases in chronic moderate hypoxia and limited glucose. Astrocytes pretreated with chronic moderate hypoxia (2% O<sub>2</sub>; 7 days) prior to acute severe hypoxia (0.5% O<sub>2</sub>; 24 h) inhibited neuron apoptosis under 10mM glucose; while under 2mM glucose, apoptosis of neurons in coculture with astrocytes pre-treated with 2% O<sub>2</sub> prior to 0.5% O<sub>2</sub> dramatically increased.

**Conclusions:** Both hypoxic severity and glucose abundance regulate the balance of HIF-1 and HIF-2 activity in astrocytes, leading to diverse effects on neurons. These results could have important implications on the adaptive or pathological role of astrocytes during chronic hypoxia and ischemia.

**Trial registration number:** N/A

## AS32-042

### EVALUATION OF NEUROPROTECTIVE EFFECTS OF DIHYDROMYRICETIN IN EXPERIMENTAL MODEL OF ISCHEMIC STROKE

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**Background and Aims:** Ischemic stroke still remains third leading cause of death worldwide. The only approved pharmacological treatment is rtPA which may cause reperfusion injury. After thrombolysis, next target is to decrease reperfusion injury by neuroprotection. Dihydromyricetin (DHM), a flavonoid, has shown to be neuroprotective based on its anti-oxidant, anti-inflammatory and anti-apoptotic activities. Hence, this study was planned to evaluate the effects of DHM in experimental model of ischemic stroke.

**Methods:** In male Wistar rats (260–290g), middle cerebral artery was occluded for 90 minutes using silicon coated monofilament (Doccol suture) followed by reperfusion for 3 days. DHM (2 doses: 50 & 100 mg/kg) was administered immediately and 2 hr after reperfusion followed by single dose every 24 hr for next 2 days. Neuroprotective effects were evaluated by neurological deficit score, motor-incoordination by grip strength and rota rod. The % infarct was calculated using MRI and TTC staining.

**Results:** Middle cerebral artery occlusion (MCAo) induced impaired neurological deficit score, time spent on rota rod and grip strength were normalised significantly ( $p < 0.05$ ) with DHM 100 mg/kg dose. TTC staining revealed significantly reduced infarct size with DHM ( $20.11\% \pm 3.4\%$  of ipsilateral area,  $p < 0.05$ ) as compared to MCAo group ( $40.04\% \pm 4.7\%$ ). Further, complementary to TTC results, MRI data also showed significant reduction in infarct with DHM (100 mg/kg). DHM 50 mg/kg did not show any significant improvement in any parameter.

**Conclusions:** Results showed sub-acute DHM treatment improves neuro-behavioural outcomes and infarct damage after ischemic stroke. The results suggest the neuroprotective potential of DHM in ischemic stroke model.

**Trial registration number:** N/A

## AS32-010

### HYPOXIC POSTCONDITIONING ACTIVATES WNT/B-CATENIN PATHWAY AGAINST TRANSIENT GLOBAL CEREBRAL ISCHEMIA THROUGH DKK1 INHIBITION AND GSK-3B INACTIVATION

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**Background and Aims:** The Wnt/β-catenin pathway plays an essential role in cell survival. Although postconditioning with 8% oxygen can alleviate transient global cerebral ischemia (tGCI)-induced neuronal damage in hippocampal CA1 subregion in adult rats as demonstrated by our previous studies, little is understood about the role of Wnt/β-catenin pathway in hypoxic postconditioning (HPC)-induced neuroprotection.

**Methods:** This study tried to investigate the involvement of Wnt/β-catenin pathway in HPC-induced neuroprotection against tGCI and explore the underlying molecular mechanism thereof.

**Results:** We observed that HPC elevated nuclear β-catenin level, as well as increased Wnt3a and decreased Dkk1 expression in CA1 after tGCI. Accordingly, HPC enhanced the expression of survivin and reduced the ratio of B-cell lymphoma 2 (Bcl-2)-associated X protein (Bax)/Bcl-2 following reperfusion. Moreover, our study has shown that these effects of HPC were abolished by lentivirus-mediated overexpression of Dickkopf-1 (Dkk1), and that the overexpression of Dkk1 completely reversed HPC-induced neuroprotection. Furthermore, HPC suppressed the activity of GSK-3β in CA1 after tGCI, and the inhibition of GSK-3β activity with SB216763 increased the nuclear accumulation of β-catenin, upregulated the expression of survivin, and reduced the ratio of Bax/Bcl-2, thus prevented delayed neuronal death after tGCI. Finally, the administration of LY294002, an inhibitor of phosphatidylinositol 3-kinase (PI3K), increased GSK-3β activity, and blocked nuclear β-catenin accumulation, thereby decreased survivin expression, and elevated Bax/Bcl-2 ratio after HPC.

**Conclusions:** These results suggest that the activation of Wnt/β-catenin pathway through Dkk1 inhibition and PI3K/Akt pathway-mediated GSK-3β inactivation contributes to the neuroprotection of HPC against tGCI.

**Trial registration number:** N/A

## AS32-011

### NEUROPROTECTION OF HYPOXIC POSTCONDITIONING AGAINST GLOBAL CEREBRAL ISCHEMIA THROUGH ENHANCING PINK1/PARKIN-INDUCED MITOPHAGY IN ADULT RATS

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**Background and Aims:** Hypoxic postconditioning (HPC) confers effective neuroprotection on hippocampal CA1 neurons against transient global cerebral ischemia (tGCI), but the underlying mechanisms need to be further explored. PINK1/Parkin-induced mitophagy is reported to participate in cerebral ischemia, whose role remains controversial. In

this study, we explored the role and underlying mechanism of PINK1/Parkin-induced mitophagy in HPC-mediated neuroprotection after tGCI.

**Methods:** HPC was performed with 8% O<sub>2</sub>+92% N<sub>2</sub> 24 h after 10 min tGCI induced by a four-vessel occlusion method in adult male Wistar rats. The level of mitophagy was measured by the reduction of TIM23 and TOM20. The total and mitochondrial level of PINK1 and Parkin in CA1 were measured by immunohistochemistry and western blot after tGCI and HPC.

**Results:** Compared to tGCI group, HPC significantly decreased the level of TIM23 and TOM20. There were no significant differences of PINK1- and Parkin-positive cells among sham-operated, tGCI and HPC groups. The protein level of PINK1 and Parkin in CA1 exhibited similar trends. Nevertheless, the mitochondrial level of PINK1 in CA1 was increased in HPC group after tGCI. Moreover, HPC enhanced Parkin translocation from cytoplasm to mitochondria in CA1 after tGCI.

**Conclusions:** HPC significantly promotes mitochondrial clearance after tGCI, which might result from PINK1/Parkin-induced mitophagy.

**Trial registration number:** N/A

## AS32-012

### RHODIOLA SACRA INDUCES NEUROPROTECTION AGAINST TRANSIENT GLOBAL CEREBRAL ISCHEMIA VIA ACTIVATING AMPK/NRF2 PATHWAY IN RATS

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**Background and Aims:** Rhodiola sacra (RS) is a widely-used pharmaceutical component with multiple functions, including anti-oxidation, anti-inflammation, anti-aging, etc. However, it is unclear whether RS reduces neuronal death in hippocampal CA1 after transient global cerebral ischemia (tGCI) and how RS offers neuroprotection against tGCI.

**Methods:** A four-vessel occlusion method was used to induce tGCI in Wistar rat. Rats were randomly divided into sham-operated group, tGCI group or RS group. RS-preconditioning (RS0) was conducted before tGCI for 28d, including RS0(1.2, 1.2g/kg/d) and RS0(2.4, 2.4g/kg/d). RS-post-conditioning was conducted for 7 d right after tGCI, RS1(1.2, 1.2g/kg/d) and RS1(2.4, 2.4g/kg/d), or 24h after tGCI, RS2(2.4, 2.4g/kg/d). RS was administered from 28 d before tGCI to 7d after tGCI in combined-conditioning group, RS3(2.4, 2.4g/kg/d). Neuronal injury and astrocyte activation were measured with Nissl, FJ-B, NeuN and GFAP staining. The levels of MDA, AMPK, p-AMPK, Nrf2 and HO-1 in CA1 were tested. Furthermore, co-immunoprecipitation was used to detect p-AMPK-Nrf2 interaction.

**Results:** Compared to tGCI group, RS0(2.4), RS1(2.4) and RS3(2.4) groups showed more survived neurons and less activated astrocytes in CA1. MDA level was increased after tGCI, whereas suppressed in RS0 (2.4), RS1(2.4) and RS3(2.4) groups. In contrast, HO-1 and Nrf2 proteins were increased in RS0(2.4), RS1(2.4) and RS3(2.4) groups after tGCI. Furthermore, p-AMPK was increased after tGCI and further upregulated in aforementioned groups.

**Conclusions:** RS-preconditioning or/and -postcondintioning induce effective neuroprotection in CA1 against tGCI, which may depend on the activation of AMPK-Nrf2 pathway to suppress oxidative stress.

**Trial registration number:** N/A

## AS32-026

### MELATONIN REDUCES BRAIN DAMAGE AFTER ISCHEMIC STROKE IN DIABETIC RATS

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**Background and Aims:** To determine whether administration of melatonin would be neuroprotective against ischemic stroke in diabetic rats.

**Methods:** Type 1 diabetes mellitus (T1DM) and Type 2 diabetes mellitus (T2DM) were induced by streptozotocin alone and a combination of high-fat diet with streptozotocin, respectively. Middle cerebral artery occlusion (MCAO) was performed in T1DM, T2DM, and non-diabetic (non-DM) rats and reperfusion was allowed for 24 or 72 hours before the rats were assessed and sacrificed. Melatonin or vehicle was administered at 30 minutes before ischemia in the group of 24-hour reperfusion, and at 30 minutes before ischemia, 24 hours and 48 hours after reperfusion in the group of 72-hour reperfusion.

**Results:** Compared with non-DM controls, T1DM increased the relative infarct volume by 17.7% and 46.7% ( $P < 0.05$ ) after MCAO followed by 24-hour and 72-hour reperfusion, respectively; while the infarct volume did not increase in T2DM rats. A single injection of melatonin at 5mg/kg or 10mg/kg reduced the relative infarct volume by 19.7% and 25.6%, respectively ( $P < 0.01$ ) in T1DM rats after 24-hour reperfusion when compared with the vehicle controls. The neurological performance also improved ( $P < 0.05$ ). After 72-hour reperfusion, multiple injections of melatonin (5mg/kg) lowered the relative infarct volume by 29.4% ( $P < 0.01$ ), reduced the edema ratio by 58.0% ( $P < 0.01$ ) and improved the neurological performance in T1DM rats compared with the vehicle controls. In T2DM rats, melatonin treatment (5mg/kg) reduced the relative infarct volume by 24.45% ( $P < 0.05$ ) and 27.6% after 24-hour or 72-hour reperfusion, respectively.

**Conclusions:** Melatonin has a neuroprotective effect against ischemic stroke in diabetic rats.

**Trial registration number:** N/A

## AS32-022

### LT3001 REDUCED BLOOD BRAIN BARRIER (BBB) LEAKAGE AFTER STROKE USING MIDDLE CEREBRAL ARTERY OCCLUSION (MCAO) MODEL IN RATS

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**Background and Aims:** LT3001 is a novel small synthetic molecule with multiple pharmacological activities. It was safe and well tolerated in healthy volunteers in a recently completed Phase I study. Previously we had reported that LT3001 improved stroke outcome in rats and monkeys using embolic stroke model. Emerging evidence showed that infarct expansion is associated with the destruction of BBB after AIS. To investigate the possible underlying mechanism of reduction of infarct size and swelling ratio by LT3001, the effect of LT3001 on BBB integrity was studied in Wistar rats underwent MACO surgery.

**Methods:** The MCAO surgery was performed 3 hours before treatment. Animals received intravenous infusion of vehicle, rtPA or LT3001. Evans blue dye (EB) 4% was administrated 1 hour after treatment, allowed to circulate for 20 hours, then removed by cardiac perfusion. Brain infarction, swelling, and the total amount of EB dye remained in the brain were quantified.

**Results:** The result was summarized in the table below.

(Mean±SD)	Vehicle	rtPA	LT3001
Brain infarction (%)	50.28±11.02	43.23±11.03	25.49±14.21
Brain swelling (%)	24.86±12.47	20.70±2.67	16.65±3.14
Brain EB (µg/g brain)	4.91±1.26	5.26±2.30	3.74±2.12

**Conclusions:** LT3001 decreased BBB leakage post-AIS onset in MCAO rats. Preservation of BBB integrity could result in the reduction of brain infarction, brain swelling, and in turn attenuated neural damage post-AIS. Further investigation is warranted for LT3001's potential use in the treatment of AIS clinically.

**Trial registration number:** N/A

## Genetics, 'Omics And Biomarkers

### AS33-029

#### NEXT GENERATION SEQUENCING BASED GENE PANEL FOR ENHANCED RAPID DIAGNOSIS OF MONOGENIC PEDIATRIC STROKE

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**Background and Aims:** Pediatric stroke is a rare but highly penetrant disease. Risk factors are different in children and adult, being genetic background more relevant in pediatric than in adult stroke.

**Methods:** We present a group of 38 patients undergone full clinical and neuro-radiological assessments, suffering from perinatal (28.9%) or pediatric (71.1%) idiopathic arterial ischemic stroke (AIS). The patients, selected based on single AIS with idiopathic cerebral/systemic arteriopathy, multiple AISs with/without arteriopathy, were tested by means of a customized Next Generation Sequencing based gene panel including 15 genes associated with known genetic diseases likely presenting with AIS (Table 1).

Table 1 statistics of our molecular study

GENES	ABCC6, ACTA2, ATP7A, CBS, CECR1, COL4A1, ELN, GLA, HTRA1, JAG1, NFI, NOTCH3, PCNT, SAMHD1, SLC2A10
AMPLICONS	441
TARGET SIZE	59.891 Kbp
TARGET BASES ANALYZABLE (DESIGN COVERAGE)	58.453 Kbp (98.35%)
#PATIENTS ANALYZED	38
MEAN COVERAGE/SAMPLE	356,61X
MEAN VARIANT CALLED/SAMPLE	144

**Results:** Fifteen out of 38 patients resulted positive for variants in one or more of the genes analyzed. The analysis led to a definite genetic diagnosis of Pseudoxanthoma Elasticum patient and one COL4A1-related disorder, while results were negative in 23 patients and controversial in the rest.

**Conclusions:** Therefore, the complexity of the different clinical phenotypes sharing an AIS event (s) is not fully accounted for by the genes tested in the present study, though diagnoses achieved were very useful to manage the corresponding patients. A wider gene panel or the use of Whole Exome Sequencing would be better suited to explain a greater proportion of the pediatric AIS occurrence.

**Trial registration number:** N/A

### AS33-045

#### BLOOD BIOMARKERS TO GUIDE THERAPEUTIC HYPOTHERMIA IN ISCHEMIC STROKE. RESULTS FROM THE EUROHYP-I STUDY

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**Background and Aims:** Therapeutic hypothermia is a promising candidate for stroke treatment. However, some adverse events, such as infections, might complicate stroke outcome. We aimed to assess whether blood biomarkers might be associated with the therapeutic benefit or adverse events of hypothermia.

**Methods:** The EuroHYP-I study (EudraCT number 2012–002944-25) was a randomized multicenter clinical trial comparing the efficacy of therapeutic hypothermia initiated within 6 hours after stroke vs. best medical treatment (BMT). Blood samples were obtained at three time-points; baseline (before hypothermia initiation), within the first hour after rewarming, and 72 hours after stroke. A panel of 27 biomarkers including matrix metalloproteinases (MMPs), cardiac, inflammatory-immunity and glial markers was measured and correlated with the therapeutic effect of hypothermia and with hypothermia-induced complications.

**Results:** From the included patients, 54 (27-therapeutic arm, 27-BMT arm) had blood samples for biomarker measurement. MMPs and cardiac markers were slightly modified by treatment. Elevations on some inflammatory-immunity markers were noted in therapeutic arm, such as CRP, IL-6, IL-8, TNF-R1, PCT, copeptin or LBP. Results were barely changed when excluding from the analysis those patients who developed infections. Raised levels of copeptin, PCT, IL-8 or LBP were associated with further infections just in therapeutic arm. Hypothermia treatment was associated with reduced levels of GFAP at 72 hours ( $p = 0.046$ ).

**Conclusions:** Although limited by the sample size, our results point to the usefulness of blood biomarkers to guide hypothermia in acute stroke for predicting adverse events such as infections. In addition, GFAP might constitute a surrogate marker for the efficacy of hypothermia.

**Trial registration number:** NCT01833312

### AS33-049

#### FAMILIAL SNEDDON'S SYNDROME REVISITED: THE NATURAL HISTORY OF DEFICIENCY OF ADENOSINE DEAMINASE 2

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**Background and Aims:** The association that exists between livedo racemosa (LR) and stroke is known as Sneddon's syndrome (SnS). Deficiency of adenosine deaminase 2 (DADA2) is a recently described auto-inflammatory disorder presenting mainly in childhood. It is an autosomal recessive inherited disease, caused by mutations in the ADA2 gene.

Vasculopathy ranging from LR to polyarteritis nodosa (PAN) and life-threatening ischemic and/or hemorrhagic stroke dominate the clinical features of DADA2. Most patients have been treated with anti-TNF Inhibitors. Until now, the long-term natural history of this disease in an adult population is largely unknown.

**Methods:** We present five members of a nine sibling-family with Sneddon's Syndrome (SNS) and DADA2 due to a CECRI mutation (compound heterozygous mutation p.[T119A];[G142S]) and describe their follow-up during the last 18 years without any Disease Modifying Therapies (DMT).

**Results:** All five patients had long-lasting LR with a proximal ascending pattern involving the legs and trunk, leg ulcerations and recurrent fevers that fluctuated with the seasons developing during the second decade of life. All but one suffered from small vessel ischemic and/or hemorrhagic strokes starting in early adulthood. One of the patients died when he was 42 due to a brain hemorrhage. All 4 patients just started on Etanercept on January 2019.

**Conclusions:** We describe the long-term natural history of a family with DADA2 with a later onset of disease and a SNS phenotype.

**Trial registration number:** N/A.

### AS33-005

#### THE RING FINGER PROTEIN 213 VARIANT AND PLAQUE CHARACTERISTICS, VASCULAR REMODELING, AND HEMODYNAMICS IN PATIENTS WITH INTRACRANIAL ATHEROSCLEROTIC STROKE: A HIGH-RESOLUTION MRI AND HEMODYNAMIC STUDY

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**Background and Aims:** Intracranial atherosclerotic stroke is prevalent in Asians. We hypothesized that patients with the *Ring Finger protein 213* (*RNF213*) variant, a susceptibility locus for moyamoya disease in Asians, have different neuroimaging characteristics in terms of the vessel wall and hemodynamics.

**Methods:** We analyzed consecutive patients with ischemic events in the middle cerebral artery (MCA) distribution and relevant plaques of the distal internal carotid artery or proximal MCA on high-resolution MRI (HR-MRI). Patients with carotid/cardiac sources of embolism or moyamoya disease were excluded. HR-MRI features (e.g., outer vessel diameters and plaque characteristics) and fractional flow (as measured by adjusted signal intensity ratio on time-of-flight MR angiography [MRA]) were compared between *RNF213* p. Arg4810Lys variant carriers and non-carriers.

**Results:** Among 144 patients included, 44 (29.9%) had the *RNF213* variant. Clinical characteristics, including age, sex, and vascular risk factors, were not significantly different between *RNF213* variant carriers and non-carriers. However, the outer vessel diameter was smaller in *RNF213* variant carriers than in non-carriers ( $p < 0.0001$  for MCA of relevant stenosis,  $p < 0.0001$  for contralateral side, and  $p < 0.001$  for basilar artery). Other HR-MRI features, including plaque morphology, were not significantly different. Fractional flow was diminished in patients with smaller diameter intracranial arteries with a similar degree of stenosis.

**Conclusions:** The *RNF213* variant may be associated with vasculogenesis but not with atherogenesis. Patients with this variant had small intracranial arteries predisposing hemodynamic compromise in the presence of intracranial atherosclerosis. In addition to anti-atherosclerotic strategies, further studies are warranted to develop novel therapeutic strategies against *RNF213* vasculopathy in Asians.

**Trial registration number:** N/A

### AS33-020

#### A GENOME WIDE ASSOCIATION STUDY IN PATIENTS WITH INTRACRANIAL ATHEROSCLEROSIS

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**Background and Aims:** Large-artery intracranial-atherosclerosis (ICAs) is a major cause of stroke worldwide. Genome-Wide-Association studies (GWAs) have identified 6 loci associated with large-artery stroke. However, no GWAs has been performed to identify genetic variants associated with ICAs. Our aim is to find genetic risk factors associated with ICAs using GWAs.

**Methods:** We analyzed 107 patients with ICAs (94.6%symptomatic) and 316 population-based controls and replicated the results in two cohorts from the SIGN (444 and 1,270 stroke patients attributed to intracranial and extracranial atherosclerosis, respectively, and 25,643 controls).

Genetic analysis was performed using HumanCoreExome (Illumina). For quality controls (QC), imputation and association analysis we used PLINK, R, IMPUTE2 and SNPTEST following previous recommendations. We included sex, age and principal-components as covariates.

For significant polymorphisms, we used GTEx to find eQTLs and SOMASCAN to find associations with protein levels (1,305 proteins in 52 plasma subjects).

**Results:** After QC, we analyzed 8,047,349 single-nucleotide polymorphisms (SNPs). One locus at 18q22 (with three independent SNPs) was associated ( $P < 10^{-8}$ ) with the presence of ICAs. This locus was

replicated in an independent cohort from the SiGN study ( $p\text{-value} = 0.009$  for the top SNP). The  $p\text{-value}$  for the SNP in the discovery and replication joint analysis was  $1.83 \times 10^{-8}$ . There was no evidence for association with extracranial-atherosclerosis. This locus is located 2,000kb upstream a prostaglandin-reductase gene previously associated with VEGF levels. The independent polymorphisms on the locus were associated with VEGFA mRNA and protein levels.

**Conclusions:** We found a locus associated with ICAs that has been replicated in an independent population. Moreover, the SNPs associated with ICAs are associated with VEGF, related angiogenesis.

**Trial registration number:** N/A

## AS33-027

### EFFECT OF POLYMORPHISMS IN VKORC1 AND CYP2C9 VARIANTS ON ACENOCOUMAROL MAINTENANCE DOSE, STROKE RECURRENCE AND BLEEDING EVENTS USING A GENOME-WIDE ASSOCIATION STUDY

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**Background and Aims:** Acenocoumarol is an oral anticoagulant used for secondary prevention in stroke patients. Polymorphisms in VKORC1 and CYP2C9 regions have been found in candidate-gene studies and in one Genome-Wide Association study (GWAs) to be associated with acenocoumarol maintenance dose. The aim of this study is to analyze whether significant genetic variants on these genes from the previous GWAs are associated with stroke recurrence and bleeding events in a Spanish population.

**Methods:** We included 83 cardioembolic stroke patients from the SEDMAN Study from 11 Spanish hospitals and were one-year followed-up. They were genotyped using HumanCoreExome (Illumina) and imputed using 1000Genomes. For quality controls and association analysis we used PLINK, R, IMPUTE2 and SNPTEST following previous recommendations. We used as covariates sex, age and principal components. Lability was included in a sub-analysis. We analyzed 49 polymorphisms significantly associated with acenocoumarol maintenance dose in the previous GWAs.

**Results:** 14 variants, 10 in VKORC1 and four in CYP2C9 were associated with acenocoumarol maintenance dose ( $p < 0.05$ ). Eight and twelve patients had a recurrent stroke or any bleeding event, respectively. Seven of the 14 polymorphisms were also associated ( $p = 0.007$  for the most significant) with stroke recurrence (including the four CYP2C9 variants). In the sub-analysis considering lability, three variants were associated with bleeding events (top SNP  $p = 0.006$ ).

**Conclusions:** Variants in VKORC1 and CYP2C9 regions, previously associated with acenocoumarol maintenance dose, are relevant in a Spanish cohort. Some of these variants are also associated with stroke recurrence and bleeding events. These results confirm the plausible use of personalized medicine if VitaminK-antagonists are selected as anticoagulant.

**Trial registration number:** N/A

## WITHDRAWN

**AS33-003****GENETIC VARIATION OF ANTITHROMBIN III IS DOMINATING IN CHINESE ADULT PATIENTS WITH CRYPTOGENIC CEREBRAL VENOUS SINUS THROMBOSIS****H. Ding<sup>1</sup>, Y. Xie<sup>1</sup>, M. Cui<sup>1</sup>, Q. Yang<sup>1</sup> and Q. Dong<sup>1</sup>**<sup>1</sup>Huashan Hospital, Neurology, Shanghai, China

**Background and Aims:** The causes of cerebral venous sinus thrombosis (CVST) is various. Hereditary thrombophilia has been found at frequencies of about 23.7% in the causes of CVST. Seldom Chinese CVST patients have genetic testing. The common variant genes in Chinese patients may be different with Caucasian.

**Methods:** A comprehensive etiological examination of CVST patients had been carried out since June 2015. Next-generation sequencing (NGS) technology was used to test peripheral blood for cryptogenic CVST patients. The genome analysis panel was a sub-exome gene detection including over 5000 genes. The genome analyzer was Hiseq2500 (Illumina company).

**Results:** One hundred CVST patients were confirmed by the end of December 2017, 30 (30%) patients with unknown etiology.<sup>11</sup> (11%) patients had no gene mutation. 14 (14%) cases among the remaining 19 persons detected gene variation associated with thrombophilia (table 1). Other genes such as PTCH1, COL4A2 variation found in other five patients, however, there were no articles reported their associations with CVST.

Tab1. Genetic variation in Chinese adult patients with cryptogenic CVST

Gene mutation	Cases
Antithrombin III (AT-III) gene SERPINC1	4
HRG	2
MTHFR	2
PROC	1
Prothrombin combined PROS1 mutation	1
Factor V combined PROS1 mutation	1
THBD	1
THPO	1
JAK2	1

**Conclusions:** 30% of the adult patients with CVST in China had none identified causes. Among them 42% patients had hereditary thrombophilia. AT-III gene SERPINC1 heterozygous mutation was the most common genetic variation, which was different from the prevalence of Factor V and prothrombin mutations in Caucasian.

**Trial registration number:** N/A**AS33-007****EDUCATION PROTECTS AGAINST CORONARY HEART DISEASE AND STROKE INDEPENDENTLY OF COGNITIVE FUNCTION: EVIDENCE FROM MENDELIAN RANDOMIZATION****A. Efstatiadou<sup>1</sup>, D. Gill<sup>1</sup>, K. Cawood<sup>2</sup>, I. Tzoulaki<sup>1</sup> and A. Dehghan<sup>1</sup>**<sup>1</sup>Imperial College London, Department of Epidemiology and Biostatistics-School of Public Health, London, United Kingdom; <sup>2</sup>United Kingdom Government, Her Majesty's Treasury, London, United Kingdom

**Background and Aims:** There is evidence that higher educational attainment protects against cardiovascular disease. However, it is not known whether such an effect is related to cognitive function.

**Methods:** We performed conventional two-sample Mendelian randomization (MR) analyses to investigate the effect of educational attainment and cognitive function respectively, on risk of CHD and ischemic stroke. Additionally, we used multivariable MR to adjust for the effects of cognition and educational attainment in the respective analyses.

**Results:** In conventional MR, there was evidence that educational attainment is causally associated with both CHD and stroke risk (CHD: OR 0.63 per 1-standard deviation [SD] higher educational attainment; 95% confidence interval [CI] 0.60 to 0.67; p-value =  $2.01 \times 10^{-16}$ , stroke: OR 0.76; 95% CI 0.69 to 0.83; p-value =  $9.43 \times 10^{-10}$ ). This effect persisted after adjusting for cognition in multivariable MR (CHD: OR 0.69; 95% CI 0.62 to 0.77; p-value =  $2.58 \times 10^{-10}$ , stroke OR 0.70; 95% CI 0.59 to 0.83; p-value =  $3.27 \times 10^{-5}$ ). Cognition had an apparent effect on CHD risk in conventional MR (OR 0.80; 95% CI 0.74 to 0.86; p-value =  $2.26 \times 10^{-8}$ ), however after adjusting for educational attainment, this was markedly attenuated (OR 0.98; 95% CI 0.82 to 1.17; p-value = 0.81). Cognitive function did not have any notable effect on the risk of developing ischemic stroke, with (OR 0.97; 95% CI 0.86 to 1.09; p-value = 0.58) or without adjustment for educational attainment (OR 1.11; 95% CI 0.85 to 1.45; p-value = 0.46).

**Conclusions:** This study provides evidence to support that it is educational attainment and not cognitive function that protects against CHD and ischemic stroke risk.

**Trial registration number:** N/A**AS33-008****GENETICALLY DETERMINED SERUM URATE AND RISK OF NEUROVASCULAR DISEASE****A. Efstatiadou<sup>1</sup>, D. Gill<sup>1</sup>, F. McGrane<sup>2</sup>, T. Quinn<sup>2</sup> and J. Dawson<sup>2</sup>**<sup>1</sup>Imperial College London, Epidemiology and Biostatistics, London, United Kingdom; <sup>2</sup>University of Glasgow, Cardiovascular & Medical Sciences, Glasgow, United Kingdom

**Background and Aims:** Serum urate has been implicated in neurological and vascular disease. However, associations from observational studies may be attributed to confounding factors and reverse causation. The aim of this study was to use Mendelian randomization in targeted investigation of a causal effect of urate on neurological and vascular outcomes.

**Methods:** We performed conventional and sensitivity Mendelian randomization analyses to investigate the effect of serum urate on cognitive performance, Alzheimer's disease, coronary heart disease, myocardial infarction, systolic blood pressure, and ischemic stroke and its main etiological subtypes.

**Results:** After exclusion of potentially invalid genetic instruments, higher serum urate was associated with lower cognitive performance (odds ratio per 1mg/dl increase in serum urate 0.98; 95% confidence interval 0.96 to 0.99; p-value = 0.02) and higher systolic blood pressure (odds ratio 1.03; 95% confidence interval 1.01 to 1.05; p-value = 0.01), with all Mendelian randomization methods having consistent estimates. The previously observed genetic association between higher urate and increased coronary heart disease and myocardial infarction risk was also corroborated. There was no apparent Mendelian randomization association between urate with Alzheimer's disease and any type of ischemic stroke.

**Conclusions:** This study provides genetic evidence to support that higher serum urate levels may cause lower cognitive function, higher systolic blood pressure, and higher risk of coronary heart disease and myocardial infarction. Further study in the form of clinical trials is required to explore such possible causal effects.

**Trial registration number:** N/A

**AS33-009****IRON MEASURED IN NASAL EXUDATE AS A NEW AND USEFUL BIOMARKER IN THE DIFFERENTIAL DIAGNOSIS OF PATIENTS WITH ACUTE STROKE**

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**Background and Aims:** Differential diagnosis between ischemic and hemorrhagic stroke in prehospital setting is one of the major challenges of neurovascular research. Several biomarkers have been studied, but attempts to date have focused on determining their blood levels. Recently, cerebral lymphatic drainage towards the nostrils has been discovered, and this fact gives us the chance of studying nasal exudate looking for biomarkers of neural damage. We sought to determine whether iron levels in nasal exudate could determine the ischemic or hemorrhagic nature of the acute stroke.

**Methods:** We studied iron nasal exudate levels in 33 ischemic and 43 hemorrhagic stroke patients. All patients underwent neurological examination assessed by National Institutes of Health Stroke Scale (NIHSS), brain computed tomography (CT) to differential diagnosis of stroke subtype, laboratory tests and measure of iron levels in nasal exudate.

**Results:** The iron levels in nasal exudate were higher in hemorrhagic stroke patients. The area under the receiver operating characteristic (ROC) curve for ischemic-hemorrhagic stroke discrimination was 0.896 (0.823-0.970, cut point of 0.095 milliMolar, sensitivity 90%, specificity 76%)

**Conclusions:** Our findings suggest that iron levels in nasal exudate may be useful in prehospital setting for differential diagnosis between ischemic and hemorrhagic damage in acute stroke patients. And they also open a potential field for studying biomarkers

**Trial registration number:** N/A

**AS33-041****EVALUATION OF CIRCULATING miRNAs AS POTENTIAL BIOMARKERS OF VULNERABLE PLAQUE IN PATIENTS WITH CAROTID STENOSIS**

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**Background and Aims:** Carotid stenosis is one of the most prevalent and significant causes of stroke. The identification of vulnerable plaque biomarkers would permit the identification of high and low risk patients, allowing a better selection of patients to indicate surgical or intensive medical treatment. The usefulness of circulating miRNAs as vulnerable plaque biomarkers has not been too explored. Our aim was to analyse plasma levels of selected miRNAs described as differentially expressed in symptomatic or asymptomatic plaques.

**Methods:** Circulating RNA was extracted from citrated-plasma samples of symptomatic ( $n = 19$ ), progressive-asymptomatic ( $n = 16$ ) and stable-asymptomatic ( $n = 12$ ) patients using the mirVana miRNA Isolation kit and cel-miR-54-3p and cel-miR-39 as spike-in. After reverse transcription and preamplification, miR-16-5p, miR-93-5p, miR-191-5p and miR-24-3p were evaluated as endogenous controls and miR-100-5p, miR-133a-5p, miR-143-3p and miR-494-3p as potential biomarkers using specific TaqMan™ Advanced MicroRNA Assays. Statistical differences between

groups were assessed by ANOVA or Kruskall-Wallis test, as appropriate.  $P < 0.05$  was considered significant.

**Results:** The four analysed miRNAs as endogenous controls except for miR-16-5p were found to have significantly different plasma levels between groups. The analysis of the potential biomarkers (miR-100-5p, miR-133a-5p, miR-143-3p and miR-494-3p) and the miRNAs excluded as endogenous controls (miR-93-5p, miR-191-5p and miR-24-3p) with the miR-16-5p as normaliser showed that none of them have significant different plasma levels between the different profile of patients.

**Conclusions:** None of the analysed miRNAs seems to be a potential biomarker able to differentiate subtypes of patients with carotid stenosis. Further studies, increasing number of patients, will be conducted to validate these results.

**Trial registration number:** N/A

**AS33-031****EPIGENOMIC AGE IS ASSOCIATED WITH LEUKOARAIOSIS VOLUME IN STROKE PATIENTS, IRRESPECTIVE OF CHRONOLOGICAL AGE**

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**Background and Aims:** White matter hyperintensity or leukoaraiosis (LK), is a radiological sign of cerebral small vessel disease and is considered as a good marker of brain aging. However, aging is not only due to chronological age, there are age-related DNA-methylation changes in multiple CpG sites across the genome that can be used to estimate the epigenomic age or biological age (b-Age). We seek to analyze if the possible association between LK and b-Age.

**Methods:** We included 254 individuals with acute ischemic stroke assessed in Hospital del Mar (Barcelona). Demographic and clinical data, chronological age (c-Age), anthropometric data, and vascular risk factors (VRF) were registered. Biological age (b-Age) was estimated with Hannum algorithm, based on DNA methylation in 65 CpGs. Age-Acceleration (AgeDif) was calculated by subtracting c-Age from b-Age. LK variable was obtained in a semiautomatic volumetric measurement in FLAIR sequence of MRI.

**Results:** Bivariate analyses for LK showed significant associations with c-Age and b-Age (both  $p < 0.001$ ) and also with AgeDif (cc:-0.158,  $p = 0.012$ ). When included in a multivariate linear regression model all the variables associated in bivariate analyses, AgeDif remained independently associated (beta:0.138;  $p = 0.038$ ), despite containing c-Age in adjustment. Hypertension ( $p = 0.009$ ), diabetes ( $p = 0.016$ ) and smoking habit ( $p = 0.022$ ) kept significance as well.

**Conclusions:** Volume of LK is associated with b-Age measured, by DNA methylation in a cohort of stroke patients. It was also associated with Age-Acceleration, irrespective of c-Age. These data supports that healthy aging might modulate LK-burden accumulated throughout life.

**Trial registration number:** N/A

**AS33-023**

**SENESCENCE-INDUCED PROMOTER  
METHYLATION CHANGES IN  
ATHEROSCLEROSIS-RELATED GENES IN  
VASCULAR ENDOTHELIAL AND SMOOTH  
MUSCLE CELLS**

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**Background and Aims:** We investigated whether promoter methylation changes occurred in atherosclerosis-related genes after in-vitro senescence of human vascular endothelial and smooth muscle cells.

**Methods:** We induced in-vitro replicative senescence by subcultures of 3 human vascular endothelial (EC) and 3 smooth muscle cell lines (SMC) from 3 to 15 passages. Using DNA extracted from the 5th, 10th, and 15th passages of the total 6 EC and SMCs, we evaluated promoter methylation status for 5 genes (*AIRE1*, *ALOX12*, *FANK1*, *NETO1*, and *SERHL2*) profiled from carotid endarterectomy plaques. Passage dependent-methylation differences of the 5 genes were compared between the 5th, 10th, and 15th passages of the 3 EC and 3 SMC using analysis of variance (ANOVA) tests.

**Results:** Of the tested genes, *ALOX12* ( $p = 0.009$ ), *FANK1* ( $p = 0.038$ ), *NETO1* ( $p = 0.023$ ), and *SERHL2* ( $p = 0.0003$ ) showed significant passage-dependent increase of promoter methylation, even though *FANK1*, *NETO1*, and *SERHL2* has less than 10% of promoter methylation. Only *AIRE1* showed no subsequent changes of promoter methylation by advancing passage. ( $p = 0.005$ ). to 15 ( $p < 0.001$ ).

Table. Promoter methylation changes by advancing passage (methylation %  $\pm$  SD)

Passage No.	<i>AIRE1</i>	<i>ALOX12*</i>	<i>FANK1**</i>	<i>NETO1**</i>	<i>SERHL2*</i>
5	11.7 $\pm$ 2.5	23.4 $\pm$ 7.8	6.7 $\pm$ 1.2	7.7 $\pm$ 2.2	3.5 $\pm$ 0.4
10	14.1 $\pm$ 4.3	31.6 $\pm$ 10.5	8.9 $\pm$ 2.5	11.3 $\pm$ 3.6	4.8 $\pm$ 1.0
15	15.7 $\pm$ 8.0	39.8 $\pm$ 12.3	8.0 $\pm$ 1.2	12.7 $\pm$ 4.9	6.1 $\pm$ 1.6

\* $p < 0.001$ , \*\* $p < 0.05$

**Conclusions:** *ALOX12* showed significant passage-dependent increase of the promoter methylation after replicative senescence of vascular EC and SMC. This finding suggested that *ALOX12* in vascular EC and SMC negatively influence to the atherosclerosis development.

**Trial registration number:** N/A

**AS33-010**

**THE ASSOCIATION OF HEMOSTASIS SYSTEM GENES WITH THE DEVELOPMENT OF ISCHEMIC STROKE IN MEN WITH EARLY ONSET OF THE DISEASE**

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**Background and Aims:** The etiology and pathogenesis of the ischemic stroke (IS) in young people is differ from those in older age group. The results of research devoted to the effect of the polymorphisms of

hemostasis system genes on the risk of development an IS are ambiguous. The aim of our research is to study an influence of polymorphisms hemostasis system genes on the risk of ischemic stroke (IS) in patients of the Slavic population under the age of 50 years.

**Methods:** Seventy three males (aged 23–49 years) with IS and 186 healthy males (aged 19–49 years) were examined. The diagnosis of stroke was confirmed by neuroimaging (CT or MRI) in all patients. Polymorphic alleles of *GPIBA*, *F2*, *F5* were studied by a real time polymerase chain reaction using the TaqMan technology.

**Results:** An analysis of the *GPIBA -5T/C* polymorphism showed that it was associated with the risk of IS in young men. The -5C allele and the genotypes -5T/C and -5C/C ( $p = 0.02$ ; OR = 1.84; CI [1.13; 2.99]) indicated an elevated the risk of IS. However, no significant association between the *F5 G1691A* polymorphism and the *F2 G20210A* polymorphism and the risk of IS was observed ( $p > 0.05$ ).

**Conclusions:** Our findings suggest that the *GPIBA -5T/C* polymorphism is associated with the risk of IS in “young” men, whereas the *F5 G1691A* and the *F2 G20210A* polymorphisms are not associated with the risk of IS in this group.

**Trial registration number:** N/A

**AS33-036**

**ASSOCIATIONS OF CIRCULATING LEVELS OF DICKKOPF-1 AND SCLEROSTIN WITH CARDIOVASCULAR EVENTS: RESULTS FROM THE PROSPECTIVE BRUNECK STUDY**

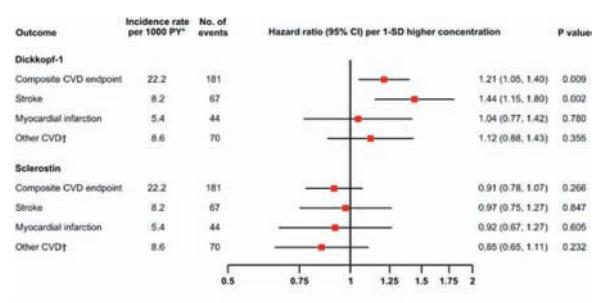
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**Background and Aims:** Dickkopf-1 and sclerostin have been implicated in vascular calcification and atherogenesis. We aimed to quantify the association between circulating levels and incident cardiovascular disease (CVD) in the general population.

**Methods:** Circulating serum levels were measured in 707 participants of the prospective population-based Bruneck Study (2000 examination). Incident CVD events were recorded that occurred between 2000 and 2016. The combined CVD endpoint subsumed ischemic and hemorrhagic stroke, myocardial infarction, angina pectoris, transient ischemic attack, peripheral vascular disease, or revascularization procedures. Cox regression was used to estimate hazard ratios adjusted for age, sex, systolic blood pressure, C-reactive protein, triglycerides, total cholesterol, high-density lipoprotein cholesterol, body mass index, estimated glomerular filtration rate, smoking, diabetes mellitus, previous CVD, and intake of platelet aggregation inhibitors.

**Results:** Over a median 15.6 years of follow-up, 181 incident CVD events were recorded. Mean circulating level was 44.5 pmol/L for dickkopf-1 (SD 14.7) and 47.1 pmol/L for sclerostin (SD 17.5). The hazard ratios for CVD risk per one standard deviation higher circulating level were 1.21 (95% confidence interval: 1.05–1.40;  $P = 0.009$ ) for dickkopf-1 and 0.91 (0.78–1.07;  $P = 0.266$ ) for sclerostin. The association of dickkopf-1 was primarily driven by a 1.44-fold risk for stroke (1.15–1.80;  $P = 0.002$ ), whereas no increase in risk was observed for myocardial infarction (1.04; 0.77–1.42;  $P = 0.780$ ) or for other CVD events (1.12; 0.88–1.43;  $P = 0.355$ ).



**Conclusions:** Elevated circulating levels of dickkopf-1 were associated with a higher risk for incident CVD in the general population, particularly for stroke. The underlying mechanistic role of dickkopf-1 in CVD deserves future investigation.

**Trial registration number:** N/A

### AS33-037

#### APOLIPOPROTEIN E E4 ASSOCIATES TO AGE OF ISCHEMIC STROKE ONSET BUT NOT TO FUNCTIONAL OUTCOME

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**Background and Aims:** Results from studies on APOE genotype and ischemic stroke (IS) outcome are conflicting. We evaluated whether APOE associates with IS outcome, severity and age at onset, within a large international meta-analysis; the Genetics of Ischaemic Stroke Functional Outcome (GISCOME).

**Methods:** This study comprises 6,165 patients within GISCOME with information on modified Rankin Scale (mRS) score at 3 months post-stroke. We derived APOE allele status ( $\varepsilon 2$ ,  $\varepsilon 3$ ,  $\varepsilon 4$ ) by combining information on the minor alleles of single nucleotide polymorphisms rs7412 and rs429358. Effects of  $\varepsilon 4$  and  $\varepsilon 2$  on outcome (dichotomized as mRS $>2$  versus mRS  $\leq 2$  and ordinal analysis of the full mRS scale), age and stroke severity (baseline NIHSS) were estimated separately in comparison to the most common  $\varepsilon 3/\varepsilon 3$  genotype.

**Results:** We found no evidence of association between the  $\varepsilon 4$  allele and IS outcome, adjusting for age and severity ( $P>0.21$  for both dichotomized and ordinal mRS). There was, however, an inverse association between the  $\varepsilon 4$  allele and age at stroke (adjusted  $\beta = -1.8$ ,  $P = 0.00017$ ). This association was significant in both sexes. The  $\varepsilon 2$  allele was independently associated with poor functional outcome (mRS $>2$ ) in men (odds ratio [OR] 1.47,  $P = 0.008$ ), but not in women (OR 0.87,  $P = 0.44$ ).

**Conclusions:** This is the largest meta-analysis on APOE genotype and IS outcome to our knowledge. We found a lower age at stroke onset in  $\varepsilon 4$  carriers and a worse functional outcome in male  $\varepsilon 2$  carriers. Even larger

studies are warranted to further investigate the effects of APOE alleles on IS outcome in different age and sex strata.

**Trial registration number:** N/A

### WITHDRAWN

### AS33-018

#### RARE EXONIC VARIATIONS IN YOUNG ISCHEMIC STROKE

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**Background and Aims:** The incidence rate of ischemic stroke over the world at young age is rising, 10–30% are young adults in the age group between 18–45 years. High penetrance with large effects of rare exonic variants were observed in many complex early onset diseases. Young ischemic stroke may be elucidated by occurrence of rare exonic variations. This is the first study from India up to best of our knowledge to specifically addresses the genetic causality of young ischemic stroke through Whole exome sequencing. To identify rare exonic variations among young onset ischemic stroke through whole exome sequencing.

**Methods:** This study is preliminary findings of an approved project by Indian Council Of Medical Research (ICMR), government of India. Young (18–40ys) patients classified by TOAST recruited after obtaining consent from neurological OPD/WARD. DNA isolation was done by phenol chloroform method. Out of 100 sample size 35 samples were sequence using Whole Exome Sequencing on illumina X TEN. SENTIEON used for variant calling. The identified variants were annotated using VARIMAT.

**Results:** Whole exome analysis, panel of 352 genes were pile up from publically available database. Dominant model, MAF  $\geq 0.01\%$ , 25 variants were identified as disease causing by SIFT, POLYPHEN2 and MUTATION TASTER tools. Three genes rs397516456 in TNNT2, rs34889882 in HBB and frameshift deletion variant in NOTCH3 were found to be pathogenic.

**Conclusions:** Our preliminary analysis identified three reported pathogenic and 15 novel high penetrating with large effect rare variants among young Ischemic stroke. Precise conclusion can be derived after the completion of final sample size.

**Trial registration number:** N/A

### AS33-025

#### CONNECTIVE TISSUE DISEASE IN SPONTANEOUS CERVICAL ARTERY DISSECTION: A PROTEOMICS APPROACH

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**Background and Aims:** Spontaneous cervical artery dissection (sCAD) is a frequent cause of stroke in the young. The high incidence of sCAD in inherited connective tissue disorders like Marfan or vascular Ehlers-Danlos syndrome indicates the importance of connective tissue and extracellular matrix (ECM) aberrations. Previous studies have so far only described unspecific subclinical connective tissue changes by electromicroscopy in part of patients with sCAD.

**Methods:** In the ReSect-study all patients with sCAD treated at the Innsbruck University Hospital since 1996 (n=259) were invited to attend a standardized follow-up examination. In a subgroup of patients and healthy controls, skin punch biopsies were taken. ECM protein abundance was then evaluated through a modern quantitative proteomics approach (liquid chromatography-mass spectrometry [LC-MS]).

**Results:** Out of 130 patients and 30 healthy controls, a subgroup of 50 age and sex matched subjects were selected and divided into 4 groups concerning the presentation of sCAD [(1) late recurrence (2) multiple at initial event (3) singular (4) health controls]. As no difference was seen between groups 2, 3 and 4 these groups were pooled. 29 and 61 proteins showed q-values below 0.05 and 0.1 respectively when comparing group 1 to all others. Out of those 61 ECM proteins 11 could be identified that are potentially linked to subclinical connective tissue disorders or play a major part in the structural integrity of connective tissue.

**Conclusions:** Subclinical connective tissue disease might be evident in patients with recurrent sCAD. Follow up studies should focus on this group of patients. Eleven proteins of interest could be identified but need further validation.

**Trial registration number:** N/A

### AS33-016

#### INFLAMMATORY AND HEMOSTASIS BLOOD BIOMARKERS PREDICT THE CLINICAL OUTCOME OF STROKE PATIENTS TREATED BY THROMBOLYSIS/THROMBECTOMY

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Inflammatory and hemostasis blood biomarkers predict the clinical outcome of stroke patients treated by thrombolysis/thrombectomy;

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**Background and Aims:** In ischemic stroke, the lack of blood flow triggers local inflammation and vascular injury, which further promotes tissue remodeling and angiogenesis. The aim of this study was to test whether biomarkers of inflammation, hemostasis, vascular injury, and tissue remodeling at admission could be informative to stratify stroke patients for their clinical outcomes.

**Methods:** We included 143 consecutively stroke patients treated by thrombolysis/thrombectomy. Blood was sampled at admission: 21 biomarkers related to inflammation (MPO, Osteopontin, CCL2/MCP-1, Adiponectin, Resistin, CD40L), hemostasis (uPA/Urokinase, alpha2-macroglobulin, Serpin-C1/Antithrombin-III, Serpin-E1/PAI-1, Kallikrein-6/Neurosin, CD40L), endothelium activation (VCAM-1, ICAM-1, CD31/PECAM-1, CD40L, Neuropilin-1), and tissue remodeling (Osteopontin, MMP-2, MMP-3, MMP-9, MMP-13, Cathepsin S, Cystatin C, Neuropilin-1) were assayed by a quantitative Luminex multiplex technic.

**Results:** Initial NIHSS was correlated to higher levels of uPA/Urokinase ( $p = 0.0037$ ), suggesting the role of hemostasis in initial stroke gravity. mRS > 1 at 3 months was correlated to higher levels of tissue remodeling-related (Cathepsine S,  $p = 0.0201$ ) and endothelial activation (VCAM-1,  $p = 0.0048$ ) biomarkers. Hemorrhagic transformation was correlated to higher levels of Cathepsine S, a tissue remodeling marker, ( $p = 0.0088$ ) and higher levels of Resistin ( $p = 0.0390$ ) and lower levels of CD40L ( $p = 0.0305$ ), two inflammatory biomarkers. In patients treated by thrombectomy, CD40L was inversely correlated to recanalization ( $p = 0.007$ ), suggesting that their inflammatory status at entry was determinant for their response to endovascular treatment.

**Conclusions:** Initial NIHSS is related to early hemostasis response, whereas, initial inflammatory response, endothelial activation and tissue remodeling biomarkers significantly impact three-month outcome and hemorrhagic transformation. Interestingly, in thrombectomy, recanalization is more successful in patients with lower levels of inflammation biomarkers

**Trial registration number:** N/A

### AS33-034

#### ASSOCIATION BETWEEN P-SELECTIN -1981 G/C GENE POLYMORPHISM AND RISK OF INTRACEREBRAL HEMORRHAGE IN NORTH INDIAN POPULATION: A CASE-CONTROL STUDY

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**Background and Aims:**

**Background:** Genetic factors may play a role in the susceptibility of Intracerebral Hemorrhage (ICH) stroke. The evidence regarding the role of P-selectin -1981 G/C gene polymorphism and risk of ICH is very limited.

**Aims:** To investigate an association between the P-selectin -1981 G/C gene polymorphism and risk of ICH in north Indian population.

**Methods:** It was a hospital-based case-control study conducted in the Department of Neurology, All India Institute of Medical Sciences, New Delhi, India from 2014 to 2018. The diagnosis of ICH was made on the basis of clinical decisions followed by NCCT-head. Genotyping was performed by using the SNaPshot technique. The entire statistical analysis was conducted in STATA version 13.0 software.

**Results:** A total of 250 ICH cases and 250 age-sex matched healthy controls were recruited in the study. The distribution of -1981 G/C genotype was consistent with Hardy-Weinberg Equilibrium (HWE) in the ICH case and control groups. After conducting the conditional logistic regression analysis, the mutant C allele was found to be significantly associated with the risk of ICH (OR 2.21; 95% CI 1.12 to 4.57; p < 0.01) under the allelic model of inheritance. However, no significant association was observed under the dominant (OR 1.61; 95%CI 0.80 to 3.22; p = 0.17) model.

**Conclusions:** Our study gives preliminary evidence of an association between the mutant 'C' allele of P-selectin -1981 G/C gene polymorphism and risk of ICH in north Indian population. However, more studies with adequate sample size are required to validate our findings.

**Trial registration number:** N/A

### AS33-013

#### COMBINED TRANSCRIPTOMIC-PROTEOMIC ANALYSIS OF BRAIN TISSUE IN HEREDITARY SMALL VESSEL DISEASE

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**Background and Aims:** Cerebral small vessel disease (SVD) is an important cause of stroke and vascular cognitive impairment, leading to subcortical ischemic vascular dementia. As a hereditary form of SVD with early onset, CADASIL (cerebral autosomal dominant arteriopathy with subcortical infarcts and leukoencephalopathy) represents a pure form of SVD. To date, underlying molecular mechanisms linking vascular pathology and subsequent neuronal damage in SVD are incompletely understood.

**Methods:** We performed comparative transcriptional profiling microarray and proteomic analyses on post-mortem frontal lobe cortical and white matter (WM) specimen from 2 CADASIL patients and 5 non-diseased control subjects in order to discover dysregulated pathways potentially involved in the development of tissue damage in CADASIL.

**Results:** Frontal WM was the most affected region by dysregulated genes and proteins. Despite high numbers of changed genes (4533) and proteins (516) found altered in CADASIL compared to controls, there was only a low correlation between results obtained with both -omic analyses. We observed some mRNAs and their corresponding proteins to be concomitantly differently expressed. These genes and proteins differentially expressed were associated with enhanced hypoxia, but also unsuspected biological functions such as ribosome biogenesis or RNA splicing machinery.

**Conclusions:** We found genes and proteins showing significant expression changes in frontal WM in hereditary SVD, associated with RNA metabolism and splicing. It is possible that aberrations in the control of gene expression might contribute to the initiation and/or progression of the pathology of the disease. These pathways may thus be potential targets for therapeutic interventions.

**Trial registration number:** N/A

### AS33-039

#### CIRCULATING BIOMARKERS AND BLOOD-BRAIN-BARRIER LEAKAGE: RESULTS FROM THE REPERFUSION INJURY IN ISCHEMIC STROKE (RISK) STUDY

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**Background and Aims:** to evaluate the effect of circulating inflammatory mediators and matrix metalloproteinases (MMP) on blood-brain-barrier (BBB) leakage in the acute phase of stroke.

**Methods:** observational prospective single-centre hospital-based study that included consecutive acute ischaemic stroke patients treated with intravenous thrombolysis, endovascular treatment or both. Circulating MMP and inflammatory biomarkers were taken before and after 24 hours from acute interventions. We assessed pre-treatment BBB leakage with CT perfusion by using Ktrans within the ischaemic area. We evaluated independent associations between BBB leakage and biomarkers quartile levels at baseline, 24 hours and their relative variations [ $(\Delta = 24\text{hours level}-\text{baseline level})/\text{baseline level}$ ] adjusting for age, sex, baseline stroke severity and onset to treatment time.

**Results:** We included 79 patients, mean ( $\pm \text{SD}$ ) age was  $75.9 (\pm 11.6)$ , 41 (52%) males, median (IQR) NIHSS was 17 (11-23). Endovascular treatment alone was performed in 38 (48%) patients, intravenous thrombolysis in 21 (27%) patients, and 20 patients (25%) received both treatments. We did not find any significant association between baseline biomarker values and BBB leakage. BBB leakage was correlated with 24h EMMPRIM levels ( $p = 0.24$ ,  $p = 0.032$ ), 24h-IL-12 ( $p = 0.27$ ,  $p = 0.024$ ), and with  $\Delta$ EMMPRIM levels ( $p = 0.23$ ;  $p = 0.052$ ). In ordinal regression analysis, after adjustment for potential confounders, BBB leakage was not associated with 24h EMMPRIM levels ( $OR = 3.09$ ;  $CI = 0.96-10.07$ ), but remained associated with  $\Delta$ EMMPRIM levels ( $OR = 6.17$ ;  $95\% CI = 1.50-25.41$ ) and 24h-IL-12 levels ( $OR = 5.72$ ;  $95\% CI = 1.51-21.71$ ).

**Conclusions:** Early BBB leakage was associated with 24-hours variation in EMMPRIM and IL12 levels. Our results support a possible link between BBB disruption and consequent inflammatory cascade in acute ischaemic stroke.

**Trial registration number:** N/A

### WITHDRAWN

**Introduction:** Carrying different ApoE polymorphism could have an impact in stroke recurrence and cognitive impairment.

**Objective:** To establish the impact of ApoE gene polymorphism with stroke recurrence and cognitive impairment.

**Methods:** This was an observational, longitudinal prospective and retrospective study of a cohort of 217 patients. We included patients from an initial cohort of ApoE polymorphism and its association with ischemic and hemorrhagic stroke at the National Institute of Neurology and Neurosurgery in Mexico City from 2006. Patients who had follow up in the past 5 years were contacted after 12 years from their first evaluation. Demographic characteristics, Rankin score, NIHSS scales, MRI, and ApoE results were assessed and new neurocognitive evaluation was applied. For the comparison of the categorical variables, the two-tailed chi-square statistic was used.

**Results:** Fifty patients were included, 38 with ApoE 3.3, 9 with ApoE 4.3, 2 with ApoE 3.2 and 1 with ApoE 4.4. Nineteen (38%) of the patients had a recurrence, 100% ( $n = 1$ ) of the ApoE 4 had a recurrence ( $p = 0.270$ ). Twenty-one (42%) developed cognitive impairment, predominating ApoE3 ( $p = 0.893$ ).

**Conclusions:** Conclusion Recurrence of stroke and cognitive decline are not modified by the different ApoE genotypes. Patients with ApoE4 led the list of recurrence, but no statistically significant difference was found.

**Trial registration number:** N/A

## WITHDRAWN

### AS33-040

#### COL4A1 NOVEL MISSENSE MUTATION CAUSING RECURRENT SPONTANEOUS INTRACEREBRAL HAEMORRHAGE AND ENCEPHALOPATHY

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**Background and Aims:** Spontaneous intracerebral haemorrhage (ICH) comprise 10–15% of strokes, being hypertension the most important risk factor (RF) in deep regions. 25% of ischemic strokes are attributed to small vessel disease (SVD). Causes of brain SVD: amyloidosis, CADASIL/CARASIL, Fabry, TREX1, FOXC1 or COL4A1 mutations, some of them associated with microbleeds or vigorous ICH. We present a woman with history of ICHs and characteristic MRI affection.

**Methods:** We examined a 57-year-old woman with unexplained recurrent ICHs. RF: ex-smoker. Antecedent of right eye enucleation secondary to head trauma and left retinopathy. Family history: mother: perinatal hemiparesis. Young sister: ICH with leukoencephalopathy in MRI (CADASIL study negative). Son: perinatal hemiparesis and seizures. She underwent brain CT, extensive laboratory work-up, echocardiogram, brain MRI and molecular genetic analysis of COL4A1.

**Results:** CT: right basal ganglia ICH and confluent periventricular/subcortical white matter disease. MRI: also showed microbleeds in corona radiata and left centrum semiovale. Echocardiogram and laboratory work-up was anodine. Analysis of COL4A1 showed she's a carrier of mutation c.4642T>G (p. Cys1548Gly) which is novel, and no reported as polymorphisms in database.

**Conclusions:** Dominant mutations in COL4A1 cause deep ICH associated with a large spectrum of renal, ocular and skeletal anomalies. Severity of brain parenchyma bleeding is highly variable (within and between families), ranging from asymptomatic microbleeds to life-threatening ICH. Diagnosis of COL4A1 disorder should be suspected in cases with compatible clinics/neuroradiology even in the absence of family history due to de novo mutation can be present. Because of the lack of specific therapy, vascular risk factors must be strictly controlled.

**Trial registration number:** N/A

### AS33-015

#### ASSOCIATION BETWEEN MATRIX METALLOPROTEINASES-9 (C1562T) GENE POLYMORPHISM AND RISK OF INTRACEREBRAL HEMORRHAGE IN NORTH INDIAN POPULATION: A CASE-CONTROL STUDY

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**Background and Aims:** MMP-9 is an inflammatory mediator of proteolytic enzymes family which has multiple roles in extracellular matrix remodelling; BBB degradation and breakdown of vessel wall integrity may contribute to the pathophysiology of ICH. Genetic variation of MMP-9 promotor polymorphism has been linked with elevated risk of ICH.

To investigate the relationship between (*MMP-9-C1562T*) gene polymorphisms and risk of ICH in North Indian population.

**Methods:** In this present case-control study, genotyping was performed by MALDI-TOF MassARRAY method for 250 patients and 250 age-sex matched controls. Frequency distribution of genotypes and alleles were compared between cases and controls by using conditional logistic regression. We also estimated the serum MMP-9 levels using ELISA method in serum sample of ICH cases.

**Results:** Mean age of patients and controls were  $54.9 \pm 12.8$  and  $55.5 \pm 12.8$ ; 35.2% were female. A total of 109 (43.6%) deaths were observed at three months. Frequency distribution of alleles consistent with HVVE. Conditional logistic regression analysis showed a significant association between *MMP9* gene polymorphism and risk of ICH under dominant model ( $OR = 1.72$ ; 95%CI 1.18 to 2.50;  $p < 0.005$ ) and after adjusting co-variates ( $OR = 1.87$ ; 95%CI 1.14-3.07;  $p < 0.01$ ) but not in recessive model. T allele was significantly higher in ICH cases ( $OR, 1.62$ ; 95% CI, 1.15-2.28;  $P < 0.003$ ). ICH cases had higher risk of mortality with elevated MMP9 level at baseline compared to alive group patients ( $513.7 \pm 133.9$  vs  $470 \pm 132.942.9$ ;  $p < 0.004$ ).

**Conclusions:** *MMP9 (C1562T)* gene polymorphism significantly associated with increased risk of ICH in North Indians and also there is an association between serum MMP9 level and mortality after ICH.

Trial registration number: N/A

## AS33-024

### THE FREQUENCY OF RELATED GENE MUTATIONS ASSOCIATED WITH THROMBOPHILIA IN ISCHEMIC STROKE PATIENTS: A STUDY FROM CENTRAL REGION OF IRAN

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**Background and Aims:** The role of hereditary factors including genetic polymorphisms of thrombophilia in ischemic stroke (IS) patients is a challenging point. The aim of this study was to evaluate the frequency of genetic polymorphisms of thrombophilia in patients with IS.

**Methods:** In an analytical observational study, randomly 63 IS patients from multiple referral hospital were selected. Genomic DNA was extracted from whole blood using CVD Strip Assays and Dot and slot blotting of DNA Identified the most relevant genetic variations to estimate the risk for cerebrovascular Diseases. We analyzed the heterozygous and homozygous variants of the following gene polymorphisms using CVD A kit from CVD Strip Assays lab that included eight genes (Apo B R3500Q, Apo E E2 / E3 / E4, FGB -455G>A, HPA1 a/b, ACE I/D, eNOS-786T>C, eNOS 894G>T, LTA 804C>A).

**Results:** Data of 63 patients with confirmed IS (mean age 67.9 years; 23 females and 40 males) were evaluated. The prevalence of polymorphism of the genes studied were as follows: Polymorphism of ACE I/D:82/5%, Polymorphism of FGB -455G>A:76/2%, Polymorphism of LTA 804C>A:71/4%, Polymorphism eNOS 894G>T:52/4%, Polymorphism eNOS-786T>C:12/7%, Polymorphism Apo B R3500Q:33/3%, HPA1 a/b:31/7, Apo E (E2E2:54%, E2E3:3/2%, E2E4:9/5%, E3E3:14/3%, E3E4:15/9%, E4E4:1/6%). also, the relationship between the studied genes and all of the risk factors was not significant.

**Conclusions:** Genetic Polymorphisms Frequency of Thrombophilia in IS Patients of Iran seems to be somewhat different from the western countries.

Trial registration number: N/A

## AS33-017

### SERUM TAU FRAGMENTS IN ACUTE STROKE

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**Background and Aims:** Serum tau has been suggested as a promising biomarker in stroke, however, serum tau is only measurable in 30–50% of the patients. In this pilot study, we aimed to test if tau fragments can be detected in serum from acute stroke patients.

**Methods:** Using solid phase competitive ELISA, two tau fragments (tau-A and tau-C) were measured in serum originating from the Clinical Stroke Research Units Biobank at Rigshospitalet, Copenhagen. Serum was tested in 3 groups of each 16 patients (hemorrhagic strokes (NIHSS 1–10), mild (NIHSS 1–3) and severe ischemic stroke (NIHSS 7–15)) and 16 healthy age and sex matched controls. Difference between groups were tested with a t-test. The study was approved by the ethics committee.

**Results:** Tau-A was detected in 61 of 64 samples (95%), and tau-C in 63 of 64 samples (98%). Tau-A levels were higher in patients with hemorrhagic stroke (mean difference 95% CI 38.53–3.80,  $p = 0.020$ ) and severe ischemic stroke (mean difference 95% CI 35.80–1.40,  $p = 0.036$ ) compared to healthy controls. No difference was found between patients with ischemic and hemorrhagic strokes. Tau-C levels did not differ between groups. None of the tau fragments were related to cerebral small vessel disease, age or sex.

**Conclusions:** Tau fragments were detected in 95–98% of the samples. Tau-A levels were higher in the severe ischemic and hemorrhagic stroke patients compared to healthy controls. Tau fragment levels could not differentiate between ischemic and hemorrhagic etiology. The cause of the tau increase in stroke and its possible importance as a biomarker must be further investigated.

Trial registration number: N/A

## AS33-011

### GENETIC MARKERS OF HEREDITARY THROMBOPHILIA IN CEREBRAL VENOUS THROMBOSIS PATIENTS OF THE SVERDLOVSK REGION

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**Background and Aims:** Cerebral venous thrombosis (CVT) is a rare cerebrovascular syndrome based on impaired venous circulation due to thrombotic occlusion of the sinuses or veins of the brain. Important in diagnosing the causes is genetic research.

**Methods:** From 2011 to 2018 all CVT patients admitted to the Comprehensive Stroke Center of the Sverdlovsk Region were screened for hereditary thrombophilia. Research thrombophilia method Real-time-PCR. High risk of thrombosis was considered allele 20210A, F2 II F5.

**Results:** Among 94 patients with CVT 88 cases had genetic markers of hereditary thrombophilia. 8 patients did not perform genetic tests. Mutations of the allele 20210A and F2 were found: 20210 G → A in 11 (9.7 %) cases, F5: 1691 G → A 8 (7.0 %), F7: 10976 G → A 33 (29.0 %), F13: G → T 33 (29.0 %), FGB: 455 G → A 36-(31.7 %), ITGA2: 807 C → T 65 (57.2 %), ITGB3: 1565 T → C 19 (16.7 %), PAI-I: 675 5G → 4G82 (72.2 %). High risk of thrombosis was in 21 (18.5 %) patients.

**Conclusions:** In the Sverdlovsk region polymorphisms of the PAI-I: 675 and ITGA2: 807 genes are more common, compared to mutations of the

20210A, F2 and F5 alleles, which may be a regional feature leading to the development of CVT.

**Trial registration number:** N/A

## WITHDRAWN

**Objective:** To determine the role of IL-6 and LTA as biomarkers for diagnosing acute Ischemic Stroke (IS) and differentiating it from healthy controls within 48 hours of stroke onset

**Methods:** A hospital-based case-control study conducted in Department of Neurology, All India Institute of Medical Sciences, New Delhi, India from 2017 to 2018. Serum samples were collected within 48 hours of IS onset and biomarker levels were assayed using Enzyme Linked Immuno Sorbent Assay (ELISA) method. Optimal cut-off points were determined using Receiver Operating Characteristic (ROC) curve. All the statistical analysis was conducted in STATA version 13.0 software.

**Results:** A total of 70 acute IS patients and 70 age-sex matched healthy controls were recruited. Mean age of cases was  $50.32 \pm 1.68$  and controls was  $51.97 \pm 1.71$ . Logistic regression analysis showed a significant association between IL-6 levels and risk of IS (OR 2.87; 95% CI 1.28 to 6.44) and had a sensitivity of 54% and specificity of 71% in differentiating IS from controls. However, no significant association was found between LTA levels and risk of IS (OR 0.88; 95% CI 0.44 to 1.74).

**Conclusions:** Our study suggests that IL-6 might have the potential to be used as a biomarker for IS diagnosis. However, large prospective studies are warranted to improve the sensitivity and specificity of the biomarker.

**Trial registration number:** N/A

## AS33-033

### ASSOCIATION OF E-SELECTIN S128R GENE POLYMORPHISM WITH THE RISK OF INTRACEREBRAL HEMORRHAGE IN NORTH INDIAN POPULATION: A CASE–CONTROL STUDY

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#### Background and Aims:

**Background:** Intracerebral hemorrhage (ICH) accounts for 22–35 % of strokes in Asian population and its pathophysiology is regulated by a combination of lifestyle, environmental and unclear genetic risk factors. Sequence variations in genes involved in inflammatory system are known to contribute to the risk of stroke.

**Aims:** To determine an association between the E-selectin S128R gene polymorphism and risk of ICH in north Indian population.

**Methods:** A hospital-based case-control study conducted in the Department of Neurology, All India Institute of Medical Sciences, New Delhi, India from 2014 to 2018. Genotyping was performed by using the SNaPshot technique. Adjusted logistic regression analysis was conducted by adjusting for hypertension, diabetes mellitus, smoking, heavy alcohol intake, sedentary lifestyle and family history of stroke. All the statistical analysis was conducted in STATA version 13.0 software.

**Results:** A total of 250 ICH cases and 250 age-sex matched healthy controls were recruited in the study. The mean age of ICH cases was  $54.98 \pm 12.89$  and of controls was  $55.57 \pm 12.84$ . Adjusted conditional logistic regression analysis observed a significant association between S128R polymorphism of E-selectin gene and risk of ICH (OR 2.07; 95% CI 1.08 to 3.98;  $p < 0.02$ ) under the allelic model of inheritance. However, no significant association was observed under the allelic (OR 1.37; 95%CI 0.87 to 2.17;  $p = 0.20$ ) model.

**Conclusions:** Our study suggests that E-selectin S128R gene polymorphism is independently associated with the risk of ICH. Our findings might be helpful in identifying individuals at an increased risk of developing ICH.

**Trial registration number:** N/A

## AS33-028

### DETERMINATION OF INTERLEUKIN-6 AND LYMPHOTOXIN ALPHA AS BIOMARKERS FOR THE DIAGNOSIS OF ACUTE ISCHEMIC STROKE : A HOSPITAL BASED CASE-CONTROL STUDY

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#### Background and Aims:

**Introduction:** Biomarkers have been sought to improve the diagnosis of stroke. Ischemic event causes release of inflammatory cytokines such as Interleukin-6 (IL-6) and Lymphotoxin alpha (LTA) from immune cells of brain tissues.

**AS33-044****GENOME-WIDE ASSOCIATION STUDY AND EXOME SCREEN OF ISCHEMIC STROKE PHENOTYPES IN THE NORWEGIAN HUNT-STUDY**

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**Background and Aims:** Ischemic stroke has a partly genetic basis, and previous genome-wide association studies (GWAS) have identified several specific risk loci. We performed three GWAS of ischemic stroke phenotypes in the ethnically homogenous, population-based Nord-Trøndelag Health Study (HUNT), Norway in order to validate previous findings, identify population-specific genetic risk loci, and to examine rare, exonic, functional variants not targeted by standard GWAS.

**Methods:** In total 71,860 participants from the population-based HUNT Study, Norway were genotyped using the Illumina HumanCoreExome array. Data were imputed with reference to 2,201 whole-genome sequences HUNT samples and to the Haplotype Reference consortium release 1.1, yielding >20 million variants for analysis. Based on diagnoses from hospital discharge and the Norwegian Stroke Register we identified 4,818 cases hospitalized with ischemic stroke. These were analyzed against 24,599 controls who were  $\geq 70$  years of age and did not self-report or have hospital admission for stroke. We subsequently performed separate analyses for cases with ( $n = 937$ ) and without ( $n = 3,681$ ) atrial fibrillation (AF).

**Results:** Previously reported risk loci for ischemic stroke showed association also in our study, validating previous reports. The strongest association was found for ischemic stroke with AF (rs2634074 on chromosome 4,  $p = 3.71 \times 10^{-10}$ ), a locus previously associated to AF. We also identified several novel, potentially population-specific risk loci. No rare, genotyped, exonic variant reached genome-wide significance ( $p < 5 \times 10^{-8}$ ).

**Conclusions:** We validated previously reported genetic risk loci for ischemic stroke, and discovered several novel, potentially population specific risk loci. These will need to be replicated in independent studies.

**Trial registration number:** N/A

**AS33-006****UNTARGETED METABOLOMICS REVEAL DIAGNOSTIC BIOMARKER SET FOR THE ACUTE PHASE OF ISCHEMIC STROKE**

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**Background and Aims:** Blood biomarkers might support the diagnosis and improve our pathophysiological understanding of acute ischemic stroke (IS). Falling downstream of genetic and environmental variation, metabolites provide the most integrated and dynamic view of the phenotype. We thus set out to determine the circulating metabolome associated with acute IS and to establish a set of metabolites with high diagnostic utility for acute IS.

**Methods:** We performed non-targeted metabolomic profiling in a discovery sample of 75 IS patients and 73 healthy controls (HC) and an independent validation sample of 40 IS patients, 40 HCs, and 33 patients with stroke mimics using a UPLC-MS/MS<sup>2</sup> platform. Serum samples in patients were collected at hospital arrival (D1) and the next morning (D2). We systematically explored metabolic alterations at a global, pathway, and individual level using z-scores, clustering, multivariate linear regression, and classification models.

**Results:** A comparison of z-scores for the 509 detected metabolites revealed larger global variability in IS patients compared to HC. Principal component analysis showed a metabolic shift at D1 that was even more pronounced at D2. The most significantly affected metabolic pathways in acute IS were 'fatty acid biosynthesis', 'steroid hormone biosynthesis', and 'synthesis and degradation of ketone bodies'. We established a set of 6 metabolites that differentiated patients with IS from stroke mimics with an AUC of 0.74 at D1 and 0.85 at D2. This set was superior to routine multimodal computed tomography.

**Conclusions:** Circulating metabolites hold promise for the exploration of stroke pathophysiology and for differentiating IS from stroke mimics early after stroke.

**Trial registration number:** N/A

**WITHDRAWN**

**AS06-116**

**ALTEPLASE USE AMONG LARGE VESSEL OCCLUSION PATIENTS GOING FOR ENDOVASCULAR THERAPY INSIGHTS FROM AN INTERNATIONAL MULTIDISCIPLINARY SURVEY**

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**Background and Aims:** We sought to assess how often practitioners choose to give alteplase to eligible patients with large vessel occlusion (LVO) who are going for endovascular therapy (EVT).

**Methods:** An international web-based survey was sent to practitioners in 38 countries to assess their decision-making toward selecting the management approach for LVO strokes in real-world. Ten case scenarios were randomly presented to each respondent from a pool of 22 cases. We investigated how often alteplase would be offered to EVT-eligible patients and what factors influenced the decisions not to give alteplase.

**Results:** 603 physicians (mean age of 44 (SD 8.5) years, 83.5% men, 53.6% neurologists, 28.7% neuro-interventionists, 13.3% neurosurgeons, 4.7% other) participated. In cases with no alteplase contraindication, the median number of respondents who chose to give combined alteplase plus EVT was 64% while EVT alone was 81%. When respondents chose to proceed with EVT therapy, alteplase was given 80% of the time (range 25–94%). Seven scenarios received significantly lower decisions to give alteplase than the cohort median (range 15% to 50%, p < 0.001 for Chi-square comparison of the proportions of alteplase plus EVT in each scenario vs cohort median). These scenarios described patients with large extent of ischemic change (ASPECTS of 2, 3, and 4; 3/7, 43%), mild clinical deficits (2/7, 28.6%), patient age > 90 years or cognitive comorbidities (2/7, 28.6%).

**Conclusions:** Alteplase is routinely favored to be given to most EVT candidates by our respondents. The extent of ischemic changes was a dominant factor in not giving alteplase to EVT eligible patients in our survey.

**Trial registration number:** N/A

**AS06-099**

**THE USE OF PRE-HOSPITAL STROKE PATHWAY EXCLUSIONS IN A LARGE UK CENTRALISED ACUTE STROKE SYSTEM: ANALYSIS OF A LARGE LINKED PRE-HOSPITAL AND HOSPITAL DATASET**

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**Hyperacute Management – Excluding Clinical Trial Results**

**AS06-111**

**REAL-WORLD APPLICATION OF FLAIR NEGATIVE MRI IN THE TREATMENT OF UNKNOWN ONSET STROKE**

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**Background and Aims:** Treatment of FLAIR-negative stroke in patients presenting in an unknown time window has been shown to be safe and effective. However, implementation can be challenging due to the need for hyper-acute MRI screening. The NIH stroke team has been screening and treating patients with FLAIR negative stroke outside of a clinical trial since the closure of the MR WITNESS study in 2016. The purpose of this study was to review the real-world application of this practice.

**Methods:** Patients presenting from 3/1/16 to 8/22/18 in a time window < 4.5 hours from symptom discovery but > 4.5 hours from last known normal were included if they had an MRI. Quantitative assessment based on MR WITNESS and visual assessment based on WAKE-UP were used to grade the FLAIR images. Thrombectomy patients were excluded.

**Results:** During the study period, 136 stroke patients presented and were imaged in the specified time window. Of these 17 (12.5%) received tPA. Three patients had hemorrhage on 24-hour follow up; none had an increase in NIHSS ≥ 4. Of the 119 patients who were screened but not treated, 18 (16%) were eligible based on quantitative assessment and 55 (46%) were eligible based on visual assessment. However, in all cases there were identifiable exclusions based on trial parameters. During the study period, 301 patients were treated with standard tPA. Thus, by using MRI to treat FLAIR-negative stroke, tPA utilization was increased by 5.6%.

**Conclusions:** Screening stroke patients in an unknown time window with MRI is practical in a real-world setting and increases tPA utilization.

**Trial registration number:** N/A

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**Background and Aims:** In our large regional centralised acute stroke system, FAST positive patients collected by ambulance are diverted to one of 3 hyperacute stroke units (HASUs). If onset is >48 hours and/or the patient is unstable (based on pre-specified criteria) they are diverted to the nearest Emergency Department (ED) instead. We sought to determine the diagnoses and clinical characteristics of those excluded and whether treatment for stroke would potentially be delayed.

**Methods:** We extracted data for consecutive patients conveyed by ambulance with suspected stroke to our HASU between 01/08/2015-28/02/2017. Patients for whom our HASU is co-located with their nearest ED were compared with those diverted from out-of-area (OOA). The local cohort provides an unselected population and the OOA cohort were only brought if no exclusions were present or exclusions were not needed.

**Results:** 4216 were identified and data were complete for 2571 OOA patients and 924 local patients. 350 (13.6%) of OOA patients and 227 (24.6%) had at least one pathway exclusion present. Of patients with exclusions, 140 (40%) OOA patients and 75 (33%) of local patients had a final diagnosis of stroke with a median onset-to-arrival time of 88 min (IQR: 55–179 min) and 93.5 min (IQR: 64–211 min), respectively. The most common exclusions were FAST negative (but stroke suspected), seizure activity and respiratory rate >30.

**Conclusions:** Nearly a quarter of suspected strokes meet pathway exclusions and 30–40% of these have a final diagnosis of stroke. Most present in time for hyperacute treatments thus a review of current pathway exclusions may be required.

**Trial registration number:** N/A

## AS06-091

### INTEROBSERVER AGREEMENT WITH TELESTROKE NEUROLOGISTS FOR CORTICAL SIGN SCREENING BY EMERGENCY MEDICINE PHYSICIANS SUPERVISED BY TELESTROKE NURSES

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**Background and Aims:** In our telestroke network prior to the involvement of a teleneurologist, bedside Emergency Medicine physicians (EMPs), supervised by remote telestroke nurses, screen suspected acute stroke patients for the cortical signs of Visual Field deficit, Aphasia, Neglect, Gaze preference and Dense hemiparesis (FANG-D). The agreement between these EMP screens to the cortical findings of telestroke neurologists is unknown.

**Methods:** We conducted a retrospective study of suspected acute stroke patients to determine the agreement (Cohen's kappa) between the FANG-D screen elements, as assessed by EMPs supervised by telestroke nurses, to the corresponding elements of the National Institutes of Health Stroke Scale assessed subsequently by a teleneurologist.

**Results:** We analyzed 627 patient visits with completed FANG-D assessments from August 2018 to January 2019 among 618 patients. Forty-five percent ( $n = 281$ ) of patients were male. Mean patient age was 63.5 (SD 15.5) years. Kappa values were as follows: visual field deficit 0.41 (95% CI 0.30–0.52), aphasia 0.55 (95% CI 0.47–0.62), neglect 0.32, (95% CI 0.17–

0.47), gaze preference 0.57, (95% CI 0.45–0.69), dense hemiparesis 0.57 (95% CI 0.50–0.64).

**Conclusions:** Between bedside EMPs, supervised remotely by telestroke nurses, and telestroke neurologists, we found minimal agreement for assessing neglect and weak agreement for assessing visual field deficit. These data suggest that LVO screens performed via telemedicine including neglect and visual field deficit may be the least reliable.

**Trial registration number:** N/A

## AS06-072

### IMPACT OF A NEW CODE STROKE PROTOCOL IN TIME DELAYS AND FUNCTIONAL OUTCOME OF PATIENTS IN A TERTIARY HOSPITAL

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**Background and Aims:** Our aim was to test the impact of the implementation of a new thrombolysis or “Code Stroke” protocol for patients with stroke in a tertiary hospital.

**Methods:** In our hospital the Code Stroke protocol was recently restructured in order to provide more coordinated multidisciplinary care and therefore reduce the door to needle time (DNT). The main changes were: data provided from ambulance prenotification, alteplase injection in the CT room immediately after non-contrast CT, non-wait for laboratory tests (except point of care in patients taking acenocumarol) and evaluate the results. All staff was trained intensively. An observational study was conducted comparing the DNT, and functional outcome of patients before and after the new protocol implementation (Sep 2017–April 2018 vs April-2018-Sep-2018).

**Results:** 340 patients were attended (mean age 69, 23 (IQR 61–80), 42% female, 81% ischemic strokes, 54% before the new protocol). 86 thrombolysis were performed (31%), and 65 thrombectomies (23%). After the new protocol implementation, a reduction in DNT was observed (43 min vs 37), especially in those who received alteplase in the CT room (70% of subjects, 27 min). There was also an improvement in patient outcome (mRS 0–2 65% vs 73%). A Student t-test showed lower DNT in patients with mRs 0–2. The logistic regression model showed an independent association between DNT and good outcome (OR 1.9 CI 1.02–4.0).

**Conclusions:** The new Code Stroke protocol significantly reduced the DNT, with an effective impact on patient outcome.

**Trial registration number:** N/A

## AS06-030

### A COMPARISON OF HYPOPERFUSION LESION VOLUMES ON CT PERfusion DERIVED FROM DIFFERENT SOFTWARE PROGRAMS

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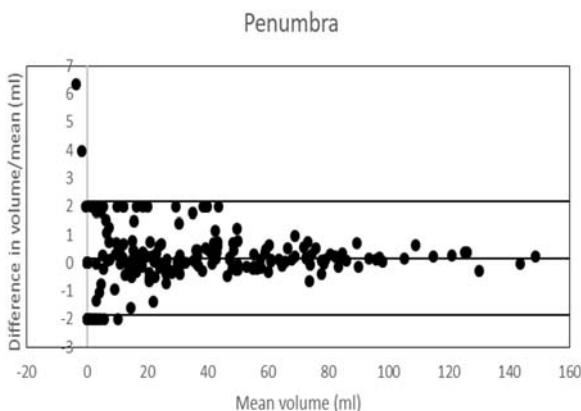
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**Background and Aims:** CT Perfusion [CTP] post-processing estimates hypoperfused tissue volumes. We compared volume estimates from two commonly used software platforms.

**Methods:** We analysed CTP data from a database of patients recruited prospectively who underwent CTP within 6 hours of stroke onset. Penumbra was defined as delay time [DT]>3 seconds or Tmax>6 seconds and ischaemic core as DT>3 seconds or Tmax>6 seconds and relative cerebral blood flow [CBF] <30%, using MiStar and RAPID. Absolute and percentage differences between core and penumbra volumes were calculated. Bias and 95% limits of agreement were calculated by the Bland-Altman method. Agreement on presence of "target mismatch" criteria (core < 70ml, penumbra>15ml) was calculated.

**Results:** In 244 CTP examinations, core volume bias was 1ml (95% limits of agreement -21 to 22ml) and penumbra bias 13ml (-69 to 95ml). After eliminating outliers, core bias was 1ml (-12 to 14ml) and penumbra bias 7ml (-31 to 46ml), 20% (-200% to 239%). Agreement was better at larger volumes (Figure). "Target mismatch" criteria were met by 107 (44%) patients by both MiStar and RAPID. 12 (5%) were eligible by MiStar but not RAPID and 32 (13%) by RAPID but not MiStar. Overall agreement was 62%.



**Conclusions:** Two commonly used software packages for post-processing of CT perfusion exhibited small mean bias in core volume estimates and larger bias in penumbra volume estimates -particularly at small volumes, but individual results varied widely. In this data set, more patients would have been eligible for trial participation with the RAPID analysis.

**Trial registration number:** N/A

## WITHDRAWN

### AS06-068

## EARLY IMPROVEMENT AFTER ADMINISTRATION OF TISSUE PLASMINOGEN ACTIVATOR ON A MOBILE STROKE UNIT OCCURS WITH TREATMENT WITHIN THE FIRST TWO HOURS FROM LAST KNOWN NORMAL

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**Background and Aims:** Earlier treatment with intravenous tissue plasminogen activator (tPA) is associated with improved clinical outcomes. Mobile stroke units (MSU) can speed treatment with tPA for stroke patients. We explored the effect of earlier MSU treatment with tPA on clinical presentation to the emergency department (ED).

**Methods:** Patients treated with tPA on three MSUs participating in the Benefits of stroke treatment using a Mobile Stroke Unit Compared to Standard Management by Emergency Medical Services (BEST-MSU) study were included. Baseline scores on the National Institutes of Health Stroke Scale (NIHSS) were compared to scores upon ED arrival across different time epochs using paired t-tests. Time from last known normal

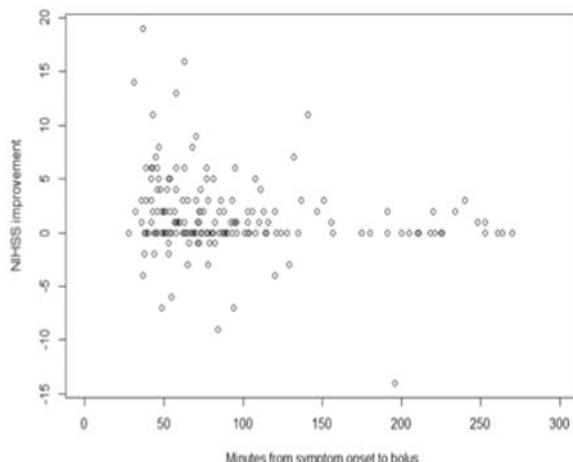
(LKN) to tPA bolus (table 1) and MSU on-scene arrival time to tPA bolus (table 2) were analyzed.

**Results:** One hundred ninety-one patients were treated with tPA. Improvement in NIHSS scores was associated with tPA treatment within two hours of LKN (figure 1) and within 40 minutes from MSU arrival on-scene. Nineteen patients (10%) had absence of significant deficits upon ED arrival.

Table 1: NIHSS comparison by LKN to tPA-bolus time					
Times (min)	Baseline NIHSS, mean (SD)	ED arrival NIHSS, mean (SD)	Improvement, N (%)	P-value	NIHSS 0 or 1, N (%)
Entire group (N=191)	10.54 (7.75)	9.1 (7.93)	94 (49%)	<0.001	19 (9.95%)
0-60 (N=69)	11.64 (8.5)	9.33 (8.48)	41 (59%)	<0.001	9 (13.04%)
60-120 (N=86)	9.66 (7.33)	8.55 (7.53)	40 (47%)	<0.001	9 (10.47%)
120-180 (N=15)	14.6 (8.05)	13.13 (9.65)	7 (47%)	0.15	1 (6.67%)
>180 (N=21)	7.62 (4.8)	7.76 (5.62)	6 (29%)	0.85	0 (0%)

Table 2: NIHSS comparison by MSU on-scene to tPA-bolus time					
Times (min)	Baseline NIHSS, mean (SD)	ED arrival NIHSS, mean (SD)	Improvement, N (%)	P-value	NIHSS 0 or 1, N (%)
Entire group (N=189)	10.57 (7.79)	9.12 (7.97)	94 (50%)	<0.001	19 (10.05%)
<20 (N=50)	11.1 (7.59)	9.38 (7.78)	21 (42%)	0.02	3 (6%)
20-30 (N=91)	10.65 (8.15)	9.38 (8.3)	45 (49%)	<0.001	11 (12.09%)
30-40 (N=36)	10.03 (7.23)	8.03 (7.19)	23 (64%)	0.01	5 (13.89%)
>40 (N=12)	9.42 (8.14)	9.33 (9.1)	5 (42%)	0.87	0 (0%)

Figure 1. Association of NIHSS improvement and LKN to tPA bolus



\*Higher numbers indicate more improvement

**Conclusions:** In patients treated with tPA on a MSU, early clinical improvement mainly occurs with treatment within the first two hours from LKN.

**Trial registration number:** ClinicalTrials.gov Identifier: NCT02190500

## AS06-009

### ADMISSION GLYCEMIA IS NOT A PREDICTOR OF PROGNOSIS FOR ALL ISCHEMIC STROKE PATIENTS TREATED BY MECHANICAL THROMBECTOMY

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**Background and Aims:** Admission hyperglycemia is a penumbra-modifying factor that is associated with poor functional outcome in acute ischemic stroke (AIS) patients treated with intravenous rt-PA and/or mechanical thrombectomy (MT). Insulin therapy failed to demonstrate a clinical benefit and the question of patient selection remains under debate. We assessed the relationship between admission glycemia (AG) and functional outcome in AIS treated by MT according to both penumbra characteristics and reperfusion status.

**Methods:** We performed an analysis of a previously published multi-center registry of consecutive AIS ( $\text{NIHSS} \geq 10$ ) due to MCA occlusion treated by MT ( $\pm$  tPA). To evaluate the association between AG and the 3-month functional outcome ( $\text{mRS} \leq 2$ ), univariable and multivariable analyses were used. Subgroup analyses were performed according to both clinical-ASPECTS Mismatch (CAM2) and the complete recanalization (CR) status (mTICI 2b/3).

**Results:** 216 AIS patients were included (Age 68.43[58.12-77.95], NIHSS 18[15-21]). 104/216(48.15%) patients had  $\text{mRS} \leq 2$  at 3 months. AG was an independent predictor of functional outcome (/100 mg/dL OR: 0.10 [0.03-0.37]) after adjusting for potential cofounders. Subgroups were formed by combining CAM2 and CR. Among these, AG was found to be a predictor of functional outcome only in CAM2+/CR+ and specifically when recanalization was early.

**Conclusions:** This study highlights the fact that the relationship between AG and prognosis is not homogeneous for all patients and indicates that AG has a deleterious effect on the ischemic penumbra, thus explaining its statistical association with functional outcome. Stroke neuroprotection by targeting hyperglycemia should be considered in acute stroke patients with mismatch and early CR.

**Trial registration number:** N/A

## AS06-037

### ACUTE ISCHAEMIC STROKE TREATMENT AT AORN CARDARELLI, NAPLES. A RETROSPECTIVE ANALYSIS OF THE FIRST 250 PATIENTS

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**Background and Aims:** The widespread availability of acute stroke treatments has historically been patchy especially in the South of Italy. Here we present the analysis of the first year of acute ischaemic stroke treatment at AORN Cardarelli Hospital, Naples, Italy.

**Methods:** Data regarding the first 250 consecutive patients (female 49.6%) undergone reperfusion treatments since August 2017, to December 2018. We analysed: 1) number and percentage of patients admitted to our ward treated with acute therapies; 2) pre-hospital and in-hospital delays; 3) early outcome defined as the DeltaNIHSS score

between admission and discharge; 4) complications. A subgroup analysis demonstrates trends in time.

**Results:**

	2017	2018
Number of treated patients	39(28.2%)	211(45.1%)
IVT	29(74.3%)	116(55%)
Bridging	2(5.1%)	54(25.6%)
Primary EVT	8(20.5%)	41(19.4%)
Prehospital delay (IQR)	71 min (53–149)	100 min (67–142)
Basal NIHSS(IQR)	14(11–16)	12(7–18)
Door-to-needle time (IQR)	107(88–172)	80(59–111)
Door-to-Groin time (IQR)	191(150–260)	138(117–186)
Discharge NIHSS(IQR)	7(3–14)	3(0–10)
Wake-up/unwitnessed	1(2.5%)	24(11.3%)

Delta-NIHSS between admission and discharge was statistically significant ( $p < 0.05$ ).

The year 2018 was divided in 4 trimesters.

	Jan-March	Apr-June	July-Sept	Oct-Dec	
Door-to-needle	117	87	63	78	$p < 0.05$
Door-to-Groin	167	140	126	135	Pns

**Complications:**

SICH	15(6%)
Fatal ICH	7(2.8%)
Angioedema	1(0.5%)
Arterial dissection	1(0.9%)
Arterial perforation	1(0.9%)

90-days-mRS was available for 30% of patients: of them, 54.8% were independent (mRS 0–2), whereas 30% were dead.

**Conclusions:** This analysis showed the increase in the number of patients treated with acute reperfusion therapies since August 2017. Accordingly, the in-hospital delays progressively and significantly lowered. Further lowering of in-hospital delays and patients' loss at follow-up are the coming objectives

**Trial registration number:** N/A

## AS06-017

### ENDOVASCULAR THROMBECTOMY WITH SECOND GENERATION STENT RETRIEVERS IN OCTOGENARIANS WITH ACUTE ISCHEMIC STROKE: A PROSPECTIVE COHORT STUDY AND META- ANALYSIS OF OBSERVATIONAL STUDIES

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**Background and Aims:** Elderly patients account for 30% of acute ischemic stroke (AIS) but are under-represented in randomized controlled trials of endovascular thrombectomy (EVT). To date, meta-analysis of "real world" observational studies focusing on 90-day outcomes between patients  $\geq 80$  and  $< 80$  years are limited to small numbers

undergoing EVT with older generation devices. We aim to determine good outcomes (mRS 0–2) and mortality rates by meta-analysis of observational studies using second generation stent retrievers in patients treated with EVT for AIS  $\geq 80$  compared with  $< 80$  years.

**Methods:** Comprehensive literature search was performed for observational studies for inclusion in a meta-analysis of 90-day outcomes and mortality rates in patients receiving EVT for AIS. A retrospective analysis of outcomes from a prospectively collected patient cohort who received EVT for anterior circulation AIS at our institution over 2.5-years is compared with and included in the meta-analysis. Prognostic factors in our elderly group are determined.

**Results:** We analyzed 2387 patients ( $\geq 80$  years, n = 649;  $< 80$  years, n = 1738) from 14 studies including our study ( $\geq 80$  years, n = 71;  $< 80$  years, n = 110). 28% of our elderly and 30% of the meta-analysis elderly cohort achieved good 90-day functional outcomes compared to 55% and 52%, respectively of younger patients. 27% of our elderly and 26% of the meta-analysis elderly cohort died compared to 16% and 15%, respectively of younger patients. Higher baseline NIHSS correlated with poor prognosis in the elderly.

**Conclusions:** EVT has less favorable outcomes in elderly patients. However, results are better than historical AIS outcomes providing further support for EVT in the elderly.

**Trial registration number:** N/A

## AS06-096

### SAFETY AND EFFECTIVENESS OF INTRAVENOUS THROMBOLYSIS IN ACUTE STROKE PATIENTS WITH PRE-EXISTING DISABILITY

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**Background and Aims:** Recombinant tissue plasminogen activator (rt-PA) is safe and effective in acute ischemic stroke (AIS) for selected patients. Nevertheless, AIS patients with pre-existing physical disability or severe dementia are frequently excluded from reperfusion therapy. The aim of our study was to investigate rt-PA effectiveness and safety in AIS patients with pre-existing disability (mRS  $\geq 2$ ).

**Methods:** We have studied 30 AIS patients with mRS  $\geq 2$  treated with rt-PA. Clinical outcome in term of intracerebral hemorrhage, mortality, NIHSS and mRS, as well as  $\Delta$ NIHSS was evaluated in three disability groups (mRS = 2; 3; 4 and 5).

**Results:** Age and NIHSS at admission were not significantly different among groups. Mortality was lower in the pre-morbid mRS 2 (15.9%) and mRS 3 groups (22.7%) than in the pre-morbid mRS 4 and 5 group (45.4%). In survived patients, median  $\Delta$ NIHSS% was lower in the mRS 4 and 5 group (-9.5%) than in the mRS 2 and 3 groups (-61.3% and -87.4%, respectively), although not statistically significant. The 231 subjects with rankin  $< 2$  who underwent rt-PA therapy in the same period showed lower mortality rate (4.5%), lower SICH (5%), lower mRS at discharge (median 1; range 0–6) and similar  $\Delta$ NIHSS% (-77%).

**Conclusions:** The results of this study showed that patients with mRS 2 and 3 may benefit from thrombolytic therapy with a moderate risk of SICH and mortality.

**Trial registration number:** N/A

**AS06-100**

**PREDICTORS FOR SEEKING LOW COMPLEXITY EMERGENCY UNITS INSTEAD OF COMPREHENSIVE STROKE CENTERS IN BRAZIL**

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**Background and Aims:** In the acute stroke setting, early symptoms identification and rapid transport to a stroke center can define treatment and prognosis. In the last decade, hundreds of low complexity Emergency Care Units (called UPA 24h) were launched in Brazil. Distributed throughout larger cities, they are designed to provide care for patients with acute low complexity complaints. In Fortaleza (northeast Brazil), although there is a well-organized comprehensive stroke center, UPA 24h are the second institutions most sought by patients with stroke symptoms. Unfortunately, a first evaluation at UPA 24h is associated with a decline of up to 50% in the chance of treatment with thrombolysis for patients with acute ischemic stroke. This study aimed to evaluate predictors for seeking care for acute stroke at UPA 24h besides home proximity in the fifth largest Brazilian city.

**Methods:** Data were prospectively collected from consecutive patients admitted to 31 hospitals in Fortaleza with acute stroke from February 3 to December 31, 2014. We traced all pathways since symptom onset to hospital arrival.

**Results:** A total of 3,052 patients ( $66.1 \pm 15.6$  years; 51% men) were evaluated. Female sex (OR 1.34;  $P = 0.03$ ), not calling EMS (OR 2.27;  $P < 0.001$ ), having headache at onset (OR 1.37;  $P = 0.04$ ) and being transported by their own means (OR 3.06;  $P < 0.001$ ) were independent predictors of UPA 24h utilization.

**Conclusions:** Our data suggest that sex, having a headache at onset, EMS activation and prehospital transportation are predictors for seeking low complexity emergency units in the acute stroke care setting.

**Trial registration number:** N/A

**AS06-117**

**ENDOVASCULAR TREATMENT IN POSTERIOR CIRCULATION VS ANTERIOR CIRCULATION STROKE: EXPERIENCE IN AN ENDOVASCULAR CAPABLE CENTER**

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**Background and Aims:** While mechanical thrombectomy (MT) combined with intravenous thrombolysis (IVT) has established clear benefits for large vessel occlusion in anterior circulation stroke, the evidence on basilar artery occlusion (BAO) is still limited. We compared complications and functional outcomes of MT in BAO with anterior circulation occlusion.

**Methods:** Retrospective analysis of consecutive patients presenting anterior circulation stroke and BAO who were treated with MT in an Endovascular Capable Center between May 2016 and September 2018.

Data on the characteristics of demographic, clinic, of imaging, complications and functional outcome were collected.

**Results:** Of 290 patients treated with MT, 20 (7%) had BAO. The median baseline National Institute of Health Stroke Scale (NIHSS) was lower among patients with BAO (12 [7-16] vs 17 [12-20],  $p = 0.0324$ ). Onset-groin puncture median time (minutes) was greater in BAO group (356 [310-662] vs 245 [185-360];  $p = 0.0301$ ). No intracranial hemorrhage was found in BAO (0% vs 22%,  $p = 0.0177$ ). The frequency of pneumonia during admission was higher in patients with BAO (35% vs 15%,  $p = 0.0312$ ). No differences were found in functional independence (modified-Rankin score  $\leq 2$ ; 52% vs 55%,  $p = 0.4558$ ) and mortality (21% vs 15%,  $p = 0.4558$ ) at 90 days.

**Conclusions:** No differences were found in the efficacy and safety outcomes between BAO and anterior circulation strokes treated with MT, although the rate of pneumonia was higher and the onset-groin-puncture time longest in the first group. Our data supports the benefit of endovascular treatment with regards to this devastating disease, however further evidence is needed by randomized clinical trials.

**Trial registration number:** N/A

**AS06-085**

**A MODEL TO EVALUATE INITIAL STROKE SEVERITY USING PARAMETERS REQUIRING MINIMAL TRAINING FOR ACUTE ISCHEMIC STROKE PATIENTS**

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**Background and Aims:** We tested whether adding two dysarthria and facial weakness, (PASS2+) to the three parameters of Prehospital Acute Stroke Severity (PASS) scale could improve the estimation of initial stroke severity in the emergency room.

**Methods:** We used five PASS2+ parameters (age/month, gaze, and arm weakness, dysarthria, and facial weakness) and National Institute of Health Stroke Scale (NIHSS) score prospectively collected from consecutive 509 ischemic stroke patients, who arrived at emergency room within 72 hours of the onset of symptoms. We developed two regression models to equate the correlation that the PASS parameters and the PASS2+ parameters each have with the actual NIHSS score of individual patients. The performances of the PASS and the PASS2+ were compared to see which model produces results closer to the NIHSS evaluation of stroke severity.

**Results:** We acquired regression model equations with the 3 PASS parameters ( $NIHSS = 1.91 + [\text{age}/\text{month}] \times 6.72 + [\text{gaze}] \times 4.66 + [\text{Arm weakness}] \times 3.03$ ) and the 5 parameters ( $NIHSS = 1.36 + [\text{age}/\text{month}] \times 7.01 + [\text{Arm weakness}] \times 2.69 + [\text{gaze}] \times 4.41 + [\text{dysarthria}] \times 0.92 + [\text{facial weakness}] \times 0.99$ ). The results showed that the PASS 2+ ( $r = 0.752$ ,  $p = 0.001$ ) has a higher correlation with the initial NIHSS evaluation than the PASS ( $r = 0.715$ ,  $p < 0.001$ ).

**Conclusions:** Improvement using PASS2+ parameters in estimation stroke severity would allow personnel to perform a more effective triage for acute stroke patients in the emergency room.

**Trial registration number:** N/A

**AS06-083****PREDICTING DIFFICULT RECANALIZATION BY MULTIPLE-PHASE COMPUTED TOMOGRAPHY ANGIOGRAPHY IN ACUTE LARGE ARTERY OCCLUSION PATIENTS****C. Chien<sup>1</sup>, I. Lee<sup>1</sup>, F.C. Chang<sup>2</sup> and C.J. Lin<sup>1</sup>**<sup>1</sup>Taipei Veterans General Hospital, Neurological institute, Taipei City, Taiwan R.O.C, <sup>2</sup>Taipei Veterans General Hospital, Radiology department, Taipei City, Taiwan R.O.C

**Background and Aims:** Endovascular mechanical thrombectomy is currently the treatment of choice for acute ischemic stroke with large vessel occlusion (LVO). However, LVO associated with intracranial arterial stenosis (ICAS) is a genuine challenge especially in Asian population. Early recognizing the presence of ICAS is crucial and difficult. We compared the procedural and clinical outcomes of endovascular treatment in LVO patients with and without ICAS.

**Methods:** We retrospectively reviewed consecutive acute ischemic stroke patients with LVO who underwent endovascular treatment with stent retriever and/or contact aspiration. Patients were divided into ICAS [+] groups or ICAS[-] group based on multiphase computed tomography angiography (CTA). The rate of achieving a substantial reperfusion (modified thrombolysis in cerebral infarction, mTICI = 2b-3) and a favorable clinical outcome (90-day modified Rankin scale, mRS = 0-2) were compared between two treatment groups.

**Results:** Among 74 patients included, 10 patients (13.5%) were classified as ICAS[+] and 64 patients (86.5%) were ICAS[-]. None of ICAS[+] patients had a substantial reperfusion while 44 ICAS[-] patients did after the procedures. (ICAS[+] vs ICAS[-] = 0% vs 68.8%,  $p < 0.001$ ). The rate of having a favorable outcome was 30% and 35.9% in ICAS[+] and ICAS[-] group, respectively. ( $p = 0.757$ ). Death and symptomatic intracranial hemorrhage were not significantly different between two groups.

**Conclusions:** It is difficult to achieve substantial reperfusion in ICAS associated LVO. Multiphase CTA for early recognition of ICAS associated LVO is both efficient and affordable method compared to magnetic resonance angiography or digital subtraction angiography.

**Trial registration number:** N/A**AS06-003****MELATONIN PROTECTS AUTOPHAGY-LIKE CELL DEATH CEREBELLAR PURKINJE CELLS FOLLOWING ASPHYXIAL CARDIAC ARREST THROUGH ATTENUATION OF OXIDATIVE STRESS VIA MT2 RECEPTOR****J.H. Cho<sup>1</sup>, J.K. Seo<sup>1</sup>, H.J. Lim<sup>1</sup>, J.B. Moon<sup>1</sup>, T.G. Ohk<sup>1</sup> and M.H. Won<sup>2</sup>**<sup>1</sup>Kangwon National University School of Medicine, Emergency Medicine, Chuncheon-si, Republic of Korea; <sup>2</sup>Kangwon National University School of Medicine, Neurobiology, Chuncheon-si, Republic of Korea

**Background and Aims:** Although multiple reports using animal models have confirmed that melatonin appears to promote neuroprotective effects following ischemia/reperfusion-induced brain injury, the relationship between its protective effects and the activation of autophagy in cerebellar Purkinje cells following asphyxial cardiac arrest and cardiopulmonary resuscitation (CA/CPR) remains unclear.

**Methods:** Rats used in this study were randomly assigned to 6 groups as follows; vehicle-treated sham-operated group, vehicle-treated asphyxial CA/CPR-operated group, melatonin-treated sham-operated group, melatonin-treated asphyxial CA/CPR-operated group, melatonin plus (+) 4P-PDOT (a MT2 melatonin receptor antagonist)-treated sham-operated

group and melatonin+4P-PDOT-treated asphyxial CA/CPR-operated group.

**Results:** Our results demonstrate that melatonin (20 mg/kg, ip, 1 time before CA and 4 times after CA) significantly improved the survival rates and neurological deficits compared with the vehicle-treated asphyxial CA/CPR rats (survival rates  $\geq 40\%$  vs 10%). We also demonstrate that melatonin exhibited protective effect against asphyxial CA/CPR-induced Purkinje cell death. The protective effect of melatonin in the Purkinje cell death following asphyxial CA/CPR paralleled a dramatic reduction in superoxide anion radical, intense enhancements of CuZn superoxide dismutase (SOD1) and MnSOD (SOD2) expressions, also a remarkable attenuation of autophagic activation (LC3 and Beclin-1), which is MT2 melatonin receptor-associated. Furthermore, the protective effect of melatonin was notably reversed by treatment with 4P-PDOT.

**Conclusions:** This study shows that melatonin conferred neuroprotection against asphyxial CA/CPR-induced cerebellar Purkinje cell death by inhibiting autophagic activation by reducing expressions of reactive oxygen species, while increasing expressions of antioxidative enzymes, and suggests that MT2 is involved in the neuroprotective effect of melatonin in cerebellar Purkinje cell death induced by asphyxial CA/CPR.

**Trial registration number:** N/A**AS06-012****A DIVERSE NETWORK OF THROMBECTOMY-CAPABLE STROKE CENTER IN NTWC****K.Y.L. Chow<sup>1</sup>; NTWC Committee on Acute Ischemic Stroke service review**<sup>1</sup>New Territories West Cluster- Hospital Authority of Hong Kong, Acute Stroke Unit- Department of Medicine & Geriatrics- Tuen Mun Hospital-New Territories West Cluster- Hospital Authority, Hong Kong, China

**Background and Aims:** The increasing use of endovascular thrombectomy (EVT) to treat acute ischemic stroke (AIS) patients that stroke center Tuen Mun hospital enhanced a hub-and-spoke model to support regional hospitals in the same cluster of Pok Oi (POH) and Tin Shui Wai hospital (TSWH). A major step is a parallel processing model, patients with an acute clinical presentation of a stroke eligible for EVT will simultaneously undergo CT angiography to confirm and localize the large vessel occlusion (LVO), receive IV-tPA, and undergo EVT preparation and decision through cluster-based expertise discussion.

**Methods:**

- Data collected from 17/7/2016 to 16/7/2018 by TMH stroke nursing team
- Local practice and key guidelines review and fast triage tool (RACE score) to identify LVO. Special cases and problems arise for debriefing, set up web-based expertise discussion group via HA chat. Strategy on execution by quarterly data analysis.

**Results:** There were total 2822 AIS patients admitted to TMH ASU and data retrieved and compared by two periods: 17/7/2016 to 16/7/2017 and 17/7/2017 to 16/7/2018. After enhancement, a total of 73.2% of patients increased (366 to 634) for potential IV/IA intervention screening. Of which, two times increased from POH and TWSH (161 to 328). There was 83% of patients (18 to 33) increased for EVT performed. The door-to-CTA time is shortened by 48%. Average Door-To-Groin time decreased from 179 to 133 minutes.

**Conclusions:** For instance, Thrombectomy capable centers should exist within stroke systems of care and might serve an unmet regional need. Capacity to plan, deliver and evaluate high-quality acute stroke services is essential.

**Trial registration number:** N/A

**AS06-048****SAFETY AND EFFECTIVENESS OF REPERFUSION THERAPY IN OVER 90-YEAR-OLD PATIENTS WITH ACUTE ISCHEMIC STROKE**

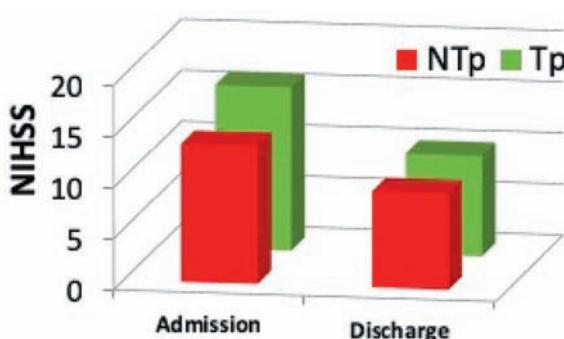
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**Background and Aims:** The global population aging will accelerate in the coming decade. The 30% of stroke patients are older than 80. Findings regarding i.v. rt-PA and mechanical thrombectomy in aged patients lead to uncertainty. This observational study aims to evaluate safety and effectiveness of reperfusion therapies in over 90-year-old patients with acute ischemic stroke.

**Methods:** We retrospectively evaluated ischemic stroke patients, consecutively admitted to our stroke unit, aged over 90 and divided in two groups: treated (Tp) and not treated (NTp). Primary end-points were variation of NIHSS from admission to discharge, hemorrhagic transformation, and 3-month mRS. Secondary end-points were the length of hospitalization and in-hospital mortality.

**Results:** Over 72 patients included, 21 were treated with rt-PA, 5 with mechanical thrombectomy, and 3 with bridging therapy. We found no differences in cardiovascular risk factors between the two groups. We found a clinical improvement in both groups, with the Tp group showing a significant more improvement compared to the NTp group (Figure 1:  $\Delta$ NIHSS 5,76 DS 5,35 vs 2,8 DS 4,91;  $p < 0,05$ ). Fourteen patients developed hemorrhagic transformation, 2 in the Tp group and 12 in the NTp group ( $p < 0,025$ ). The half of the Tp group had a 3-month mRS  $\leq 3$ . Tp group had a higher length of stay (9,24 DS 5,19 vs 8,88 DS 4,69;  $p = 0,762$ ). In-hospital mortality in NTp groups almost double the Tp group (30,2% vs 17,2%;  $p = 0,166$ ).



**Conclusions:** In our cohort, reperfusion therapy was safe and effective. We suggest not to rule out the treatment on the basis of the sole age criteria.

**Trial registration number:** N/A

**AS06-026****ENDOVASCULAR TREATMENT WITHIN 24 HOURS IN ACUTE LARGE VESSEL OCCLUSION STROKES AND LOW NIHSS**

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**Background and Aims:** Recent studies demonstrated efficacy of thrombectomy in selected patients who have salvageable brain between 6 and 24 hs after symptoms onset. We aimed to evaluate the clinical outcomes of acute ischemic stroke due to large vessel occlusion (LVO) and NIHSS score  $\leq 10$  undergoing endovascular treatment (EVT) within 24 hs.

**Methods:** We retrospectively analysed our prospectively maintained database of patients with LVO strokes of the anterior and posterior circulation with NIHSS  $\leq 10$  who underwent EVT within 24 hs. The primary outcome was defined as good outcome (modified Rankin Scale score 0–2) at day 90. Secondary outcomes included a successful reperfusion (defined as a modified Thrombolysis in Cerebral Infarction scale 2b/3) and mortality at day 90. Safety outcome was symptomatic intracranial hemorrhage (sICH).

**Results:** We included 61 patients. The mean age was  $67 \pm 14$  (SD), with 31 male patients. Median baseline NIHSS was 7 (IQR 5–8); median time from symptom onset to groin puncture was 296 min (IQR 202–455). Twenty-three patients (38 %) were treated beyond 6 hours after symptoms onset. The rate of mRS  $\leq 2$  was 79 %. Successful reperfusion was achieved in 75 %. Mortality rate at 90 days and sICH were 7 %.

**Conclusions:** This study suggests that EVT within 24 hs after symptoms onset is safe and feasible for LVO strokes presenting with NIHSS  $\leq 10$ . Future controlled studies are warranted.

**Trial registration number:** N/A

**AS06-007****THE TREATMENT FOR M2 OCCLUSION: A RETROSPECTIVE ANALYSIS OF A SINGLE CENTER EXPERIENCE**

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**Background and Aims:** We tried to evaluate the efficacy of endovascular treatment (EVT), either alone or combined with intravenous thrombolysis (IVT) compared to IVT alone, in patients with acute M2 occlusion.

**Methods:** We performed a retrospective analysis of consecutive patients admitted to our Unit between 2006 and 2018 with M2 occlusion divided in two groups, those receiving IVT and those receiving EVT.

**Results:** We included 173 patients in the IVT group and 33 in the EVT group. Patients in the IVT group had lower mean NIHSS at admission (10.9 vs 13.4  $p = 0.045$ ). NIHSS improvement at 24 h was more important in patients treated with IVT. The IVT group had higher functional independency at three months (68% vs 45%,  $p = 0.015$ ), whereas symptomatic ICH (sICH) rate was higher in the EVT group (4.6% vs 15.2%,  $p = .005$ ). All 5 patients in the EVT group who developed sICH received IVT, none was treated with thromboaspiration.

**Conclusions:** Patients treated with IVT had better outcome at three months. A bias is represented by the fact that patient in EVT group had higher NIHSS ad admission. On the other hand, the higher improvement of NIHSS after IVT entails a good response to such treatment with lower complications, such as sICH more common in the EVT group. The higher rate of complications with EVT and the overall good response to IVT might represent a limitation to EVT in M2 occlusion: a careful case-by-case evaluation is necessary and advanced imaging may help.

**Trial registration number:** N/A

## AS06-027

### ENDOVASCULAR TREATMENT OF ACUTE ISCHEMIC STROKE. A SINGLE CENTER EXPERIENCE IN BUENOS AIRES, ARGENTINA

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**Background and Aims:** Endovascular treatment (EVT) has become the standard of care for acute ischemic stroke (AIS) with proximal large vessel occlusions (LVO). However, it is still unknown whether these results can be generalized to clinical practice. We aim to perform a retrospective review of patients who received EVT up to 24 hs and assess safety and efficacy in everyday clinical practice.

**Methods:** We performed a retrospective analysis, from January 2013 to December 2017, on 139 consecutive patients with anterior circulation LVO strokes up to 24 hs from symptoms onset who received EVT at our Institution. The primary outcome measured was a modified Rankin Scale (mRS)  $\leq 2$  at 90 days. Secondary outcomes included a successful reperfusion, defined as a modified Thrombolysis in Cerebral Infarction (mTICI) scale 2b/3, mortality rate at 90 days and symptomatic intracranial hemorrhage.

**Results:** The mean age was  $67.5 \pm 15.0$ , with 51.8% female patients. Median baseline NIHSS was 14 (IQR 8–18); median time from symptom onset to groin puncture was 331 min (IQR 212–503). Forty-five patients (32.4%) were treated beyond 6 hours after symptoms onset. The rate of mRS  $\leq 2$  was 47.5 %. Successful reperfusion was achieved in 74.8%. Mortality rate at 90 days was 18.7 % and symptomatic intracranial hemorrhage was 7.9 %.

**Conclusions:** EVT presents high rates of recanalization and good functional outcomes with few complications in LVO strokes within 24 hours according to International recommendations.

**Trial registration number:** N/A

## AS06-069

### CLINICIAN-LED TRAIGE ON THE MELBOURNE MOBILE STROKE UNIT

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**Background and Aims:** The Melbourne Mobile Stroke Unit (MSU) is unique in Australia and dispatch specificity is key to optimal utilisation. We explored whether MSU clinicians could accurately determine stroke probability pre-arrival, based purely on preliminary dispatch information from emergency services call-takers.

**Methods:** The MSU doctor and nurse prospectively assigned a “stroke probability” rating of high/medium/low for consecutively dispatched cases on the Melbourne MSU from 21/May/2018-17/Jan/2019. The rating was based on patient/bystander information provided to the MSU by emergency services call-takers. User discretion was permitted with “high” ratings generally including limb weakness +/- cortical signs, “low” isolated/non-localising symptoms and “medium” in-between. The rating was compared to on-scene MSU/paramedic diagnosis. Low likelihood ratings were compared to medium/high to determine sensitivity for thrombolytic-eligible cases.

**Results:** A stroke probability rating was assigned to n = 686 patients: 483(70.5%) low, 147(21.2%) medium and 56(8%) high. The MSU was cancelled prior to arrival by primary paramedic crews in 11% high cases, 44% medium, 72% low. Of n = 392 known diagnoses, stroke/TIA was diagnosed by the MSU/primary paramedics in 37/51(73%) high likelihood patients, 46/98(47%) medium and 45/242(19%) low (Chi-square p < 0.001). MSU thrombolysis was given in 9(18%), 8(8%), 4(2%) high/medium/low probability cases respectively (Chi-square p < 0.001). The negative predictive value for thrombolysis in low-likelihood patients was 0.91. Positive predictive value for thrombolysis in high/medium likelihood patients was 0.20.

**Conclusions:** Using initial information from emergency services call-takers is a novel strategy for MSU teams to predict stroke likelihood with reasonable accuracy. Improving MSU dispatch specificity would allow the service to have greater availability for higher priority cases.

**Trial registration number:** N/A

## AS06-054

### INITIATING MECHANICAL THROMBECTOMY PROCEDURE FOR ACUTE STROKE TREATMENT: THE REAL LIFE OF A REGIONAL STROKE CENTER

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**Background and Aims:** Mechanical thrombectomy (MT) has become the gold standard treatment for acute ischemic strokes (AIS) due to large vessel occlusion. MT is almost entirely delivered by established teams in large interventional neuroradiology centers. Access to such centers often induces a delay in time from symptoms to reperfusion, especially when AIS patients arrive initially in primary care centers.

The aim was to assess the feasibility of installing MT in a regional center and to assess the performance of the procedure during the first year of realization.

**Methods:** Data from the prospectively maintained database of patients undergoing MT for AIS at the A. Paré Hospital (Mons, Belgium) between the 6thNov2017 and the 5thNov2018 were reviewed. Demographic, procedural, and outcome variables were collected.

**Results:** Availability of MT was organized in two phases: firstly during office hours and secondarily 24/7. Emergency care pathway reorganization and availability of on-call staff were the most challenging steps of MT installation. During the first 12 months of availability in our center, MT was performed in 23 cases. Five patients were transferred specifically for MT to our center from another stroke center. Average door to groin was 96 +/- 46 min. Average groin to reperfusion was 43 +/- 22 minutes. Efficient reperfusion (TICI score  $\geq 2b-3$ ) was achieved in 90.9% (20/22 cases, no thrombus identified in one patient).

**Conclusions:** Initiating MT for AIS reperfusion in a regional center is challenging but possible. Well organized small teams can achieve recommended door to groin times and high reperfusion rates even within the first year of their practice.

**Trial registration number:** N/A

**AS06-011**

**PRESENTATION OUTSIDE OFFICE HOURS DOES NOT INFLUENCE TREATMENT TIMES FOR REPERFUSION THERAPY FOR ACUTE ISCHEMIC STROKE IN THE GREATER AMSTERDAM AREA**

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**Background and Aims:** Presentation outside office hours has been associated with increased treatment times for intravenous thrombolysis (IVT) in patients with acute ischemic stroke (AIS). Limited data suggest that such "off-hours effect" also exists for endovascular treatment (EVT). We investigated the presence of an off-hours effect in a well-organized acute stroke care region in the Netherlands.

**Methods:** Retrospective, observational cohort study of consecutive patients with AIS who received reperfusion therapy (IVT or EVT) in the 'Greater Amsterdam Area' (IVT: 2009–2015, EVT: 2014–2016). Office hours were defined as presentation during weekdays (excluding National Festive days) between 8AM-5PM. Primary outcome was door-to-treatment time (door-to-needle [DNT] for IVT, door-to-groin [DGT] for EVT). For DGT, we used the door of the first hospital. Secondary outcomes included in-hospital mortality and symptomatic intracranial hemorrhage (sICH). We performed multivariable linear and logistic regression analyses and used multiple imputation to account for missing values.

**Results:** Of patients treated with IVT and EVT, respectively 59% (2450/4161) and 61% (239/395) presented outside office hours. Median DNT was slightly longer outside office hours (32 vs. 30 minutes, aB 2.4, 95% CI 0.6-4.1). Presentation outside office hours was not associated with a longer DGT (median 130 minutes for both groups, aB 5.1, 95% CI -7.8-18.1). Likewise, we found no difference in DGT for transferred patients (aB 4.5, 95% CI -9.4-18.4) or directly presented patients (aB 7.7, 95% CI -14.3-29.7). In-hospital mortality and sICH rate also did not differ.

**Conclusions:** Presentation outside office hours did not lead to longer treatment times for reperfusion therapy in patients with AIS.

**Trial registration number:** N/A

**AS06-118**

**ROLE OF PERfusion CT SCAN IN ACUTE ISCHEMIC STROKE WITHIN 6 HOURS AFTER SYMPTOMS ONSET**

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**Background and Aims:** CT-perfusion (CTP) has a growing role in evaluating stroke. It can be performed easily following non-contrast CT and has advantages of accessibility and speed. Differentiation of salvageable ischemic penumbra may help identify patients most likely to benefit from reperfusion therapies. However, its utility within the first 6 hours after stroke has been controversial.

**Methods:** We retrospectively analyzed patients admitted to our stroke unit (tertiary center) during 2017. We collected data obtained from initial imaging (Alberta Stroke Program Early CT Score (ASPECTS), arterial occlusion revealed by CT angiography (CTA), perfusion mismatch) and clinical data.

**Results:** A total of 521 patients were admitted to our stroke unit during 2017. 168 met inclusion criteria (patients with acute neurological symptoms who were conducted multiparametric CT scan with less than six hours from onset). Mean time from symptom onset to CT imaging was 1.5 hours. 9% of patients had a non contrast CT ASPECTS < 7 on arrival. 13.69% did not have any arterial occlusion revealed by CTA but showed perfusion alterations. Reperfusion therapies were performed in 78% (67.26% rtPA, 34.52% thrombectomy, 23.21% thrombectomy + rtPA). In 14 patients (8.33%) CT perfusion helped in clinical decision making. 3 patients were stroke mimics, and 11 patients had a non contrast CT ASPECT 5–6 on arrival. In these cases significant penumbra to core mismatch was used as selection criteria and helped decision making (6 patients underwent thrombectomy).

**Conclusions:** CTP can help decision making in small group of patients, especially in those cases with non contrast CT ASPECT 5–6 despite a short time after stroke and also in stroke mimics.

**Trial registration number:** N/A

**AS06-063**

**PARAMEDIC USE AND EFFICACY OF PRE-HOSPITAL VAN ASSESSMENT TO DETECT LARGE VESSEL OCCLUSION STROKE**

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**Background and Aims:** Pre-hospital identification of large vessel occlusion (LVO) strokes is important for better patient triage to mechanical thrombectomy (MT) stroke centers and to improve treatment times. Vision Aphasia Neglect (VAN) is a pre-hospital LVO screening tool that tests arm weakness and cortical signs to detect LVO.

**Methods:** VAN training was performed for San Antonino paramedics who then used VAN for all stroke alerts from June 2017 to December 2018. Pre-hospital VAN and hospital NIHSS scores were collected from three MT stroke centers. Accuracy of VAN screened patients with LVO was analyzed for positive predictive value (PPV), sensitivity, negative predictive value (NPV), specificity, and overall accuracy versus NIHSS. Stroke mimics and hemorrhages were included. LVO was confirmed by CTA/MRA.

**Results:** Of 93 EMS activated stroke alerts, 79 had both pre-hospital VAN and hospital NIHSS. 32 LVOs were confirmed of which 14 underwent MT. Three LVOs were VAN negative of which two had distal M3/M4 MCA occlusions and one had a chronic LVO; none underwent MT. The PPV, sensitivity, NPV, specificity, and overall accuracy were similar for VAN and NIHSS (Table).

	VAN	NIHSS $\geq 6$
PPV	76%	70%
Sensitivity	91%	94%
NPV	84%	92%
Specificity	34%	47%
Accuracy	57%	67%

**Conclusions:** In this prospective, multi-center EMS validation study, the pre-hospital VAN performed similar to hospital NIHSS. VAN can be effectively implemented by EMS to triage LVOs in the field and is a good surrogate for NIHSS $\geq 6$ .

**Trial registration number:** N/A

## AS06-067

### SHORTCOMINGS OF THE VAN SCREENING TOOL FOR IDENTIFYING LARGE VESSEL OCCLUSIONS IN THE PREHOSPITAL SETTING – IMPLICATIONS FOR FURTHER RESEARCH AND CARE

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**Background and Aims:** Recent EMS validation study in San Antonio, USA evaluated the true sensitivity and specificity of the Vision Aphasia Neglect (VAN) screen to identify LVO in prehospital setting and found comparable accuracy compared to NIHSS  $\geq 6$ . Because it is used in the field to bypass hospitals for higher level of care, VAN's performance with stroke mimics is important in stroke systems of care.

**Methods:** VAN training was performed for San Antonio paramedics who then used VAN for all stroke alerts from June 2017 to December 2018. Pre-hospital VAN and hospital NIHSS scores were collected from three mechanical thrombectomy stroke centers and compared for overall accuracy. Stroke mimics and hemorrhages were included. LVO was confirmed by CTA/MRA.

**Results:** Of 93 EMS activated stroke alerts, 79 had both pre-hospital VAN and hospital NIHSS. 32 LVOs were confirmed. Of the 60 VAN positive cases, 31 (52%) did not have a large vessel occlusion, and 18 (30%) were confirmed stroke mimics that included 11 (18%) intracerebral hemorrhages. Other less common stroke mimics were seizure and complex migraine.

**Conclusions:** In this prospective EMS validation study, approximately one third of VAN positive cases were confirmed stroke mimics. Although pre-hospital VAN does not differentiate stroke mimics, ICH was the most common and often transferred to higher level centers as standard of care. VAN may be improved by adding specific questions about common stroke mimics but in its current form, performs well for hospital bypass protocols.

**Trial registration number:** N/A

## AS06-065

### DISCREPANCY BETWEEN NATIONAL INSTITUTE OF HEALTH STROKE SEVERITY SCALE (NIHSS) AND FINAL INFARCT SIZE AFTER ACUTE ISCHEMIC STROKE

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**Background and Aims:** Evidence derived from recent clinical trials show that, if initiated within 24 hours and continued for 30 days, combination therapy of Aspirin and Clopidogrel (DAPT) improves outcomes by lowering risk of subsequent ischemic events in patients with Acute Minor Ischemic Stroke (AMIS) (NIHSS  $\leq 3$ ) and Transient Ischemic Attack (TIA). Studies have shown that after acute ischemic stroke (AIS), NIHSS score and the size of ischemic infarct seen on neuroimaging predict stroke severity and are important determinants of hemorrhagic transformation (HT). In our study we intend to show that after ischemic stroke there can be potential discrepancy between NIHSS score and infarct size/volume estimated on early repeat neuroimaging.

**Methods:** For the purpose of this study we used a 10-point quantitative topographic CT scan score, the Alberta Stroke Program Early CT Score (ASPECTS), to estimate the size/volume of ischemic infarct on follow-up CT scans of 25 patients with recent AIS. Evidence shows that an ASPECTS of  $\leq 7$  predicts increase in dependency and death as well as a risk of HT. We also calculated their NIHSS score in the sub-acute phase, to re-assess severity of established stroke.

#### Results:

Table 1.

Group	NIHSS score	ASPECTS	No. of patients
1	$\leq 4$	$\geq 8$	12
2	$\leq 4$	$\leq 7$	5
3	$> 4$	$> 7$	8

Table 1. Our data identified three groups of patients:

- Based on **Low NIHSS score and high ASPECTS**, DAPT in this group will be appropriate and safe.
- Based on **low NIHSS score**, this group qualifies for DAPT but the **low ASPECTS** predicts increased risk of HT and thus more harm.
- As this group was not included in the DAPT clinical trials, it is unclear if patients with **high NIHSS score and high ASPECTS** will derive benefit from combination antiplatelet therapy. However, in view of **high ASPECTS** they will likely be at low risk of HT.

**Conclusions:** Our data shows that in patients with recent AIS, there can be discrepancy between NIHSS score and infarct size/volume on follow-up scans, both of which are predictive of HT and poor outcomes. In our opinion, to minimize risk of hemorrhagic complications in these patients, the size of infarct on follow-up neuroimaging should also be taken into consideration when deciding to continue DAPT for 30 days.

**Trial registration number:** N/A

## AS06-010

### AUDIT ON CT ANGIOGRAPHY USAGE IN A&E IN THE ERA OF THROMBECTOMY

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**Background and Aims:** Mechanical thrombectomy is superior to medical management of ischaemic stroke caused by large vessel occlusion (LVO). Emergency screening with CT angiogram (CTA) is required to identify LVO suitable for thrombectomy. This audit aimed to assess:

- If all suitable patients were screened for thrombectomy by CTA

2. If CTA were performed inappropriately, and if there was any harm as a result.

**Methods:** Using SSNAP data, we identified patients with confirmed ischemic stroke from September to October 2017, who were eligible for thrombectomy, i.e. presented within 6 hours of onset and pre-stroke modified Rankin score (mRS) less than 3.

Using data from the neuroradiology department, we identified all the CTA carried out as part of initial thrombectomy screening in the same period.

**Results:** Of the 120 patients with confirmed ischemic stroke, all 62 who were potential candidates for thrombectomy, were screened by CTA. Of 133 patients who had CTA in the same period for initial thrombectomy screening in A&E, 36 were inappropriate, and could have been avoided. There was no persistent renal dysfunction as a result.

**Conclusions:** This audit demonstrated at St George's Hospital 100% patients eligible for thrombectomy were screened with CTA. 27% of CTA carried out were inappropriate and could have been avoided. Results were reviewed with the stroke team. Further education on thrombectomy protocol and stroke mimics were disseminated to minimize unnecessary CTA.

**Trial registration number:** N/A

## AS06-082

### DO PATIENTS TAKE LONGER TO ARRIVE ON A SPECIALIST STROKE UNIT IN WINTER? DATA FROM THE NATIONAL STROKE REGISTRY FOR ENGLAND, WALES AND NORTHERN IRELAND

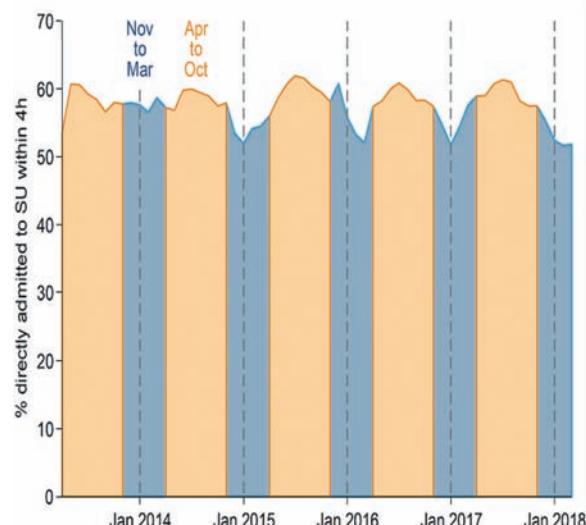
**G. Dunn<sup>1</sup>, V. McCurran<sup>1</sup>, H. Alex<sup>1</sup>, K. Stanley<sup>1</sup>, C. Wolfe<sup>1</sup>, M. James<sup>2</sup>, A. Rudd<sup>1</sup>; The SSNAP Collaboration**

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**Background and Aims:** Direct admission to a dedicated stroke unit (SU) is a vital intervention for acute patients, those who receive care on a SU are more likely to be alive, independent, and living at home one year after stroke (Cochrane Review, 2013).

**Methods:** Data from the Sentinel Stroke National Audit Programme (SSNAP), a national quality register were analysed for the 5 years from April 2013–March 2018. SSNAP collects over 95% of hospital admissions for acute stroke in England, Wales and Northern Ireland.

**Results:** Data were included for 397,298 patients admitted to 218 stroke units over 5 years. The admission rate within 4 hours of hospital arrival averaged 60%, but with a mean difference of 8% between winter and summer (Fig.1); the most pronounced difference being between summer and winter 2015 with a 10% difference. The median time to stroke unit arrival over the 5 year period was 3 hours 39 minutes.



Source: SSNAP 2013–2018

Fig.1

**Conclusions:** Our national registry data show a significant seasonal variation in timely access to specialist stroke care, with a maximum amplitude of 10% between summer and winter periods that equates to at least 9,000 affected patients. Given the broad applicability of SU care in preventing death and disability after stroke, systems of care should concentrate on eliminating poor access to specialist care at times of winter pressures and hospital overcrowding.

**Trial registration number:** N/A

## AS06-055

### PATIENTS PRESENTING WITH BASILAR ARTERY OCCLUSION (BAO) – EXPERIENCE FROM ST GEORGE'S HOSPITAL STROKE SERVICE, SOUTH WEST LONDON, UK

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**Background and Aims:** Basilar artery occlusion (BAO) is associated with high fatality if not recanalized and severe disability in those who survive. Consensus on optimum management is unclear. We assessed all accepted BAO cases, since commencement of our 24/7 stroke thrombectomy service.

**Methods:** All referred patients accepted for thrombectomy at our unit are entered onto a comprehensive database. Clinical, imaging, process and outcome data for all patients with BAO accepted from July 2016 to December 2018 were reviewed.

**Results:** 24/402 (5.9%) patients accepted by our service had BAO. 6 presented directly to our Emergency Department. 18 were referred from external sites. Median age 55.5 years. 14 received thrombolysis (onset to TPA range 94–280 minutes, median 174 minutes). 18 patients proceeded to angiogram. 16 underwent mechanical thrombectomy (onset to recanalization range 227–1428 minutes, median 416 minutes). 2 patients had no thrombectomy target. mTICI 2b or 3 was achieved in 12/16.

3-month mRS was available for 23 patients, and all who proceeded to angiogram or thrombectomy. Overall, 11/23 patients (48%) achieved

independent outcome (mRS 0–2 at 3-months). 8/18 who proceeded to angiogram and 6/16 who had thrombectomy achieved independent outcome. 7/23 (30%) did not survive. Of these, 6/7 were referrals from external sites. 5/16 who had thrombectomy did not survive.

**Conclusions:** Thrombectomy in BAO constitutes a small part of overall workload in a 24/7 service. Independent outcomes are achievable. Ongoing randomized controlled trials will provide clearer patient selection guidance in this challenging group.

**Trial registration number:** N/A

## AS06-123

### TELESTROKE IN LATIUM (ITALY): THE RESULTS OF THE FIRST 2-YEARS EXPERIENCE

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**Background and Aims:** According to 2018 AHA Guidelines, the use of Telestroke should be supported by healthcare institutions to ensure adequate 24/7 care of acute stroke patients.

The Latiun Region, a large Italian region around Rome, is divided in 4 areas for Stroke management. Our Stroke Unit (SU – Policlinico Umberto I) serves as Hub reference for the northeast region. Since 2016, 2 hospitals (Tivoli and Palestrina) are connected with our SU through Telemedicine system (video teleconference and DICOM image transfer). We present the first experience of Latiun Telestroke.

**Methods:** From October 2016 to December 2018, 40 patients have been evaluated in Telestroke (31 from Tivoli, 9 from Palestrina).

**Results:** Median age was 76.5 years. Twenty-five patients were women (sex ratio 0.62). EV thrombolysis has been performed in 22 patients (55%). In 4 cases, the treatment has been completed with thrombectomy once arrived in Hub. Four patients have been treated with thrombolysis and thrombectomy after transfer in Hub. Reasons for non indicating tele-thrombolysis were: time window over (17%), contraindications to rt-PA (12.5%), stroke mimic (7%), TIA (7%). Median baseline NIHSS was 14.7. modified Rankin Scale 0–2 was obtained in 49% of patients at 3 months. We do not observed symptomatic hemorrhagic transformation. Median Door To Needle Time was 137 minutes, Door In Door Out Time 171.3 minutes.

**Conclusions:** In spite of temporal indicators, these results are promising: – we observed an increasing number of calls from Spoke Hospitals, and we obtained good results in terms of efficacy and safety after EV thrombolysis in Telestroke setting.

**Trial registration number:** N/A

## AS06-024

### THE ROLE OF BASELINE BLOOD PRESSURE IN EARLY-TERM OUTCOMES IN REPERFUSION TREATMENT PATIENTS IN PARAGUAY. A MULTICENTER STUDY

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**Background and Aims:** Baseline Blood Pressure have been related with several outcomes in stroke patients. In Paraguay, the rate of Hypertension in ischemic stroke is around 80%. We aim to determine the impact of Baseline Blood Pressure in iv-tPA treated patients in early-term outcomes in a south-american population.

**Methods:** Observational, multicenter study. Data was collected from a stroke reperfusion treatment registry in Paraguay, from January-2015 to

November-2018. The recorded outcomes were; Major clinical improvement (MCI) at 5 days or discharge (decrease of >8 points from baseline NIHSS, or a NIHSS of 0–1) and symptomatic Hemorrhagic Transformation (sHT).

**Results:** From 92 patients, the mean age was  $64.4(\text{DS} \pm 12.1)$ , median baseline NIHSS was 17(IQR10-21). Fifty-one percent had a MCI, sHT was observed in 4.3%. NIHSS at 5-day or discharge was correlated with baseline NIHSS( $r = 0.597 p < 0.001$ ) and inversely with ASPECTS( $r = -0.423, p < 0.001$ ). A U-shaped relationship was observed with baseline Systolic Blood Pressure (bSBP). For MCI, lower bSBP( $p = 0.006$ ), and higher ASPECTS ( $p = 0.043$ ) were associated in the univariate analysis. Due to the U-shaped observed, the patients group with bSBP between 134–161 mmHg (percentile 20–60) shows better rates of MCI than the group out of this range (75% Vs 45.4%  $p = 0.019$ ). In the multivariate analysis adjusted to baseline NIHSS and ASPECTS have shown that bSBP between 134–161 mmHg as the only independent variable associated a MCI(OR:14.2 IC:1.01-200.2  $p = 0.049$ ).

**Conclusions:** In our environment, a restricted range of baseline SBP is a predictor of MCI in reperfusion treatment patients, even more powerful than baseline NIHSS. Blood pressure management at admission is crucial to achieve a good outcome in those patients.

**Trial registration number:** N/A

## AS06-046

### EFFICACY AND SAFETY OF THROMBOLYSIS IN PATIENTS WITH WAKE-UP STROKE

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**Background and Aims:** Efficacy and safety of reperfusion treatment in acute ischemic stroke was widely studied in known onset stroke patients, while the data on real world experience with rt-PA in Wake-up stroke (WUS) patients is limited. Even though WUS is observed in up to 25% of ischemic stroke patients, in clinical practice WUS patients are generally not treated with reperfusion therapy. The aim of this study was to investigate the efficacy and safety of thrombolysis in patients with WUS.

**Methods:** We retrospectively analyzed the clinical and imaging data of WUS patients admitted to our Stroke Unit between March 2014 and March 2017. We evaluated the outcome of rt-PA treated and non-treated WUS patients in terms of NIHSS and mRS at discharge, sICH as well as mortality.

**Results:** We studied 114 WUS patients (60 treated with rt-PA; 54 non-treated). Age, NIHSS, mRS, ASPECT at admission and time from last seen to admission were not significantly different between treated and non-treated patients. In the treated group NIHSS at discharge was significantly lower (median 1; range 0–21) compared to the non-treated (median 4; range 0–20). The number of patients with mRS 0–2 was significantly higher in the treated group compared to the non-treated (57% vs. 37%), while mortality and sICH did not differ.

**Conclusions:** The main finding of this study is that WUS may benefit from rt-PA showing improvement in clinical outcome in terms of NIHSS and mRS at discharge, without additional risks.

**Trial registration number:** N/A

## AS06-058

### CT PERFUSION AND EEG ASSESSMENT IN HYPER-ACUTE ISCHEMIC STROKE

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**Background and Aims:** The combined use of perfusion neuroimaging and electroencephalography (EEG) may provide a better clinical picture of neurovascular coupling of the injured area in acute ischemic stroke. The aim of this study was to assess stroke-related topographic EEG changes during the earliest phase of ischemic stroke and to compare them with hypoperfusion identified by Computed Tomography perfusion (CTP).

**Methods:** We studied 11 patients with ischemic stroke, who underwent both CTP and EEG recordings within 4.5 hours from symptom onset. The acquisition of EEG signals was performed bedside and within 1 hour after CTP scan, without delaying reperfusion treatment, using @64 channels Wi-Fi Be Plus LTM amplifier and 19 channel 10-20 Ag/AgCl electrodes wireless prewired headset. Topographic representation of power for each band was calculated and compared with hypoperfusion areas estimated by CTP maps, calculated with deconvolution algorithm.

**Results:** Predominance of slow delta frequencies was found in all patients. The main finding is the agreement between slow rhythms hemispheric prevalence on EEG maps and cerebral hypoperfusion area identified using CTP.

**Conclusions:** This preliminary study showed that the combined use of CTP and EEG in hyper-acute ischemic stroke may be useful in clinical practice and provide better clinical insight about functional and metabolic aspects of brain involvement.

**Trial registration number:** N/A

## AS06-057

### WE CAN DO A LOT FOR BETTER MANAGEMENT OF ACUTE STROKE WITHOUT MONEY

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**Background and Aims:** Long time to acute treatment of stroke and low rate of intravenous thrombolysis (IVT) and endovascular treatment (EVT) in Slovakia at the end of 2016 were the reason for change for Slovak stroke society.

**Methods:** New national guidelines for treatment of acute stroke were prepared and signed by Ministry of Health, network of 43 stroke centers for IVT and 8 centers for EVT have been created, collaboration with rescue services was improved, intrahospital management was changed (in the majority of hospitals administration of thrombolysis directly in the CT department has been initiated, rescue services are waiting for the result of CTAG which determines further triage to endovascular intervention. Quality control has become an essential part of this

process. National stroke registry is mandatory for all stroke centers in Slovakia.

**Results:** We compared the data from National stroke registry in 2015, 2016, 2017 and 2018 (Tab. I). Door-to-needle time (DNT) in 23 hospitals was < 30 min.

Tab. I

	2015	2016	2017	2018
N(patients)	10 276	10 890	11 556	9 718
Ischemic stroke	7 836	8 405	8 837	7 549
IVT	11.8%	13.6%	16.9%	19.1%
EVT	2.5%	3.5%	4.6%	7.0%
DNT	50 min*	47 min*	50 min	40 min

IVT – intravenous thrombolysis, EVT – endovascular treatment, DNT – door-to-needle time

\*Data from SITS (only few hospitals, usually the best)

**Conclusions:** We increased the rate of IVT and shortened DNT without special money, only with better management and enthusiasm. For further improvement of the rate of EVT we shall need also financial support and radiologists.

**Trial registration number:** N/A

## AS06-023

### EFFICACY AND SAFETY OF MECANICAL THROMBECTOMY FOR ANTERIOR CIRCULATION ACUTE ISCHEMIC STROKE IN PATIENTS ON ANTICOAGULATION

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**Background and Aims:** Evaluate the efficacy and security of mechanical thrombectomy (MT) for anterior circulation acute ischemic stroke (AIS) on anticoagulated patients in a tertiary hospital.

**Methods:** We performed a retrospective study of prospectively acquired data of patients undergoing MT (stent retriever) in our center on a 6-year period (2012–2018), comparing anticoagulated and non-anticoagulated patients. No treatment was given for high-defined international normalized ratio (INR>3). Neurological deficit was scored using National Institutes of Health Stroke Scale (NIHSS) and 90-day clinical outcome using modified Rankin Scale (mRS) with a score 0–2 for good outcome. Recanalization was rated using Thrombolysis in Cerebral Infarction (TICI) scale. Symptomatic intracerebral hemorrhage (SICH) was assessed according to the ECASS-II criteria.

**Results:** Out of 389 patients treated with MT, 107 (27.5%) patients (52.3% females, mean age  $76.8 \pm 9.5$  years ( $p = 0.009$ )) were on anticoagulation therapy (AT). 76% were on vitamin K antagonist (median international normalized ratio (INR) = 1.86, range 1.08-4.61) and 16% on direct oral anticoagulants. 92.5% had a previous mRS  $\leq 2$  ( $p = 0.104$ ). NIHSS at admission was 15.9 points ( $p = 0.271$ ). Successful recanalization (TICI 2b-3) was achieved in 103 patients (96.3%) on AT and 263 (93.3%) non-anticoagulated patients ( $p = 0.214$ ). SICH after MT was detected in 7 patients (6.5%) on AT and 11 (3.9%) non-anticoagulated patients ( $p = 0.198$ ). Good outcome at 90 days was present in 61.3% of non-anticoagulated patients and 53.3% of anticoagulated patients ( $p = 0.145$ ). Mortality at 90 days showed no statistical difference (17.8% on AT vs 12.2%,  $p = 0.079$ ).

	Non-AT patients	AT patients	p
Female (n, %)	142 (50.4%)	56 (52.3%)	0.363
Age (years, mean $\pm$ SD)	72.7 ( $\pm$ 12.6)	76.8 ( $\pm$ 9.5)	0.009
Hypertension (n, %)	183 (64.9%)	76 (71.0%)	0.126
Hyperlipidemia (n, %)	124 (44.0%)	51 (47.7%)	0.256
Diabetes Mellitus (n, %)	53 (18.8%)	22 (20.6%)	0.346
Smoking (%)	36 (12.8%)	10 (9.3%)	0.175
Ischemic Cardiomyopathy (n, %)	51 (18.1%)	28 (26.2%)	0.038
INR value	-	1.86 (1.08-4.61)	-
Admission NIHSS (median $\pm$ SD)	15.1 ( $\pm$ 6.9)	15.9 ( $\pm$ 6.4)	0.271
Previous mRS $\leq$ 2 (n, %)	267 (94.7%)	99 (92.5%)	0.104

AT: anticoagulation therapy; SD: standard deviation; NIHSS: national institutes health stroke scale; mRS: modified Rankin scale

	Non-AT patients	AT patients	p
Intravenous r-TPA	83 (29.4%)	4 (3.7%)	<0.001
Onset to recanalization interval (mean $\pm$ SD)	242 ( $\pm$ 56)	255 ( $\pm$ 78)	0.156
ASPECTS (mean $\pm$ SD)	8.9 ( $\pm$ 1.3)	8.9 ( $\pm$ 1.2)	0.912
Successful Recanalization (TICI $\geq$ 2b) (n, %)	263 (93.3%)	103 (96.3%)	0.214
ICH	47 (16.7%)	24 (22.4%)	0.095
sICH	11 (3.9%)	7 (6.5%)	0.198
Other hemorrhagic complications (n, %)	14 (5.0%)	7 (6.5%)	0.270
mRS $\leq$ 2 at 90 days (n, %)	173 (61.3%)	57 (53.3%)	0.145
Mortality at 90 days (n, %)	34 (12.2%)	19 (17.8%)	0.079

AT: anticoagulation therapy; SD: standard deviation; ICH: intracranial hemorrhage; sICH: symptomatic intracerebral hemorrhage; mRS: modified Rankin scale



**Conclusions:** MT seems to be a secure and efficacious therapy in anti-coagulated patients with an AIS.

**Trial registration number:** N/A

## AS06-115

### DEVELOPMENT OF ENDOVASCULAR THROMBECTOMY IN AUSTRIA 2013–2017

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**Background and Aims:** Randomized controlled trials showed an overwhelming benefit of combining endovascular mechanical thrombectomy (EVT) with IV-rtPA over IV-rtPA alone. However, data deriving from large registries analyzing EVT in daily clinical practice are scarce.

**Methods:** We analyzed data of all patients who underwent EVT for large vessel occlusion (LVO) enrolled into the nationwide Austrian Stroke Unit Registry from 2013 to 2017. Recanalization rates were classified according to the Thrombolysis in Cerebral Infarction Scale (TICI) and functional outcome measured by the modified Rankin Scale (mRS).

**Results:** From 2013–2017, 1876 patients underwent EVT for LVO (median age = 73, 51% female, median NIHSS = 16); 9.5% of patients

had prior disability before the index-event (mRS > 1). Time intervals were comparable to previous randomized studies, the recanalization rate (TICI 2b/3) was 76%. Rate of symptomatic intracranial bleeding decreased from 10% in 2013 to 3.2% in 2017. After 3 months 40% of patients were functionally independent (mRS 0–2) and 26% had died. Rates of EVT increased in patients  $\geq$  80 years and for patients with mild deficit over time ( $\geq$  80 years: EVT-rate 2013 = 23.7%, 2017 = 32%; NIHSS  $\leq$  10: 2013 = 13.2%, 2017 = 18.9%). Compared to patients  $<$  80 years, those  $\geq$  80 had a 3-fold increased rate of pre-stroke disability ( $\geq$  80 years: mRS 0–1 = 18.6%;  $<$  80: mRS 0–1 = 6.1%) and higher rates of vascular risk-factors. Compared to younger patients, outcome was worse in elderly patients:  $\geq$  80 years: mRS 0–2 = 21.7%,  $<$  80: mRS = 46.5%. Of patients with mild/moderate deficit undergoing EVT 62% remained functionally independent.

**Conclusions:** Rates of EVT in Austria are increasing. Outcome was comparable to published randomized studies despite higher rates of elderly patients and higher premorbid functional impairment.

**Trial registration number:** N/A

## AS06-101

### IMPROVING THE REFERRAL PATTERN FOR THROMBECTOMY BY ANALYSING PATIENTS WHO ARE UNSUITABLE FOR THROMBECTOMY ON ARRIVAL AT THE ENDOVASCULAR CENTRE

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**Background and Aims:** To report the experiences of a regional thrombectomy centre for patients transferred for thrombectomy but deemed unsuitable on arrival.

**Methods:** Patients are transferred from 24 centres throughout the country. Data was analysed on patients from 2017–2018 transferred for thrombectomy including those deemed unsuitable on arrival. Analysis included NIHSS at presentation, ASPECTS and collateral assessment based on initial imaging, IV thrombolysis and occlusion site. The time from imaging in the referring institution to repeat imaging on arrival to the thrombectomy centre was noted. Reasons for patients not being suitable for thrombectomy were recorded.

**Results:** A total of 99 out of 609 patients were transferred but deemed unsuitable for thrombectomy. The median age was 71 (30–94), median NIHSS was 15 with an ASPECTS of 9. 13% had poor collaterals on CT Angiography defined as  $<$  50%. 47% underwent thrombolysis. The median time from imaging in the referring institution to repeat imaging in the thrombectomy centre was 4:08hrs (00:43–15:10hrs). Reasons for patients being unsuitable for thrombectomy included established infarct (n = 25), vessel recanalisation/no vessel occlusion on repeat imaging (n = 30), clinical improvement (n = 21), non-occlusive stenosis/thrombus (n = 9), no vascular access (n = 8), haemorrhage (n = 5) with one patient transferred for observation.

**Conclusions:** For those patients who improved or recanalised, this is a positive finding. Otherwise, this data provides valuable insights into the transfer of patients for thrombectomy who are deemed unsuitable on arrival. Improvements in access to specialised neuroradiology services, automated imaging and faster initial assessment and transfer of patients could prevent futile transfer with less burden on transport services.

**Trial registration number:** N/A

**AS06-053****TRAINING PARAMEDICS IN FULL-SCALE NIHSS – A PILOT STUDY**

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**Background and Aims:** Prehospital recognition of acute stroke often fails to identify patients in need of prompt treatment. The National Institute of Health Stroke Scale (NIHSS) is widely used by neurologists. Simplified prehospital stroke scales have significantly lower validity than the NIHSS. This study aimed to investigate feasibility in NIHSS training among paramedics.

**Methods:** Eight paramedics and four neurologists scored ten unique acute stroke cases using a smartphone application for NIHSS-scoring and paper NIHSS, respectively. Vibrant markers with scripted histories presented cases to the participants. Paramedics had a 1-day training-session with an electronic learning module and supervised practical training. We used Bland-Altman's limits of agreements (LoA) to assess if there was clinically acceptable agreement between paramedics and neurologists. Linear regression was applied as a sensitivity analysis to adjust for an observed non-uniformity of the data.

**Results:** Cases had a median (range) NIHSS 5 (2–17). On average the paramedics scored 1.56 patients points higher than the neurologists, with corresponding 95% LoA from -4.14 to 7.26. There was a tendency towards higher discrepancies for higher NIHSS scores. Linear regression on the differences in NIHSS between paramedics and neurologists showed a 20 % increase for greater values.

**Conclusions:** Despite its alleged complexity, the full version of NIHSS may be used by paramedics. Whether prehospital NIHSS and use of the eSTROKE-application leads to higher recognition of stroke by paramedics will be tested in the planned ParaNASPP trial.

**Trial registration number:** N/A

**AS06-113****OVERNIGHT AMBULANCE DIRECT TO SCAN PROTOCOL IMPLEMENTATION SIGNIFICANTLY REDUCES DOOR TO SCAN TIMES FOR HYPERACUTE STROKE**

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**Background and Aims:** SSNAP measures quality and organisation of stroke care in the UK. Domain I.1 looks at the number of patients scanned within 1 hour of arrival at hospital. Local performance has improved significantly, in part related to innovative "direct to scan protocols" in extended working hours, although challenges include the reduced level of medical staffing and radiographer support at these times. Outside of normal working hours, stroke consultant support is via telemedicine.

**Methods:** We set up a new process, in close collaboration with the regional ambulance service, which allows a single point of access referral and triggers cascaded urgent voice pager alert to the Hospital Out of Hours team (HOOH), portering staff radiographer and stroke nurse practitioner. We ran a direct to scan overnight pilot to assess safety and efficacy of this system and recorded all consecutive referrals

**Results:** In the first month there was a significant reduction in door to scan time from a mean of 47 minutes to 12 minutes.

**Conclusions:** This accelerates urgent assessment of possible stroke to facilitate emergency treatment in the hyperacute stage. This significant reduction is an important step in improving 24/7 access to high quality hyperacute stroke care. Whilst our service does not currently offer 24/7 thrombectomy, this pilot protocol has now been implemented as a standard care process with maintained very rapid direct to scan times.

**Trial registration number:** n/a

**AS06-093****ANALYSIS OF THE LOGISTICS OF THE THROMBOLYTIC TREATMENT IN STROKE CENTERS IN CZECH REPUBLIC – RESULTS OF A QUESTIONNAIRE STUDY**

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**Background and Aims:** Efficacy of the thrombolytic treatment is highly time-dependent. The logistics of acute stroke care differs across stroke centers but reasons are not well understood. The aim of our study was to investigate how different logistical thrombolytic pathways in stroke centers affect door-to-needle time.

**Methods:** Details about logistical processes in Czech stroke centers from January 1, 2017 to March 31, 2018 were obtained by a questionnaire. If centers reported reorganization in their logistics during study period, they were analyzed twice as if they were two centers with different logistics. The results of the questionnaire study were analyzed by descriptive statistics. The dependent variable for the analysis was DNT $\leq$ 30 minutes.

**Results:** Of all 45 stroke centers in Czech Republic, 37 (82%) centers responded and 6 centers reported reorganization in their acute stroke

care. Median DNT $\leq$ 30 minutes was achieved in 33 centers and DNT>30 minutes in 10 centers. 13 (30%) centers reported direct patient transport into CT scanner, 16 (37%) reported one transport and 14 (33%) two transports before initiation of intravenous thrombolysis. Median DNT $\leq$ 30 minutes was achieved in 100% centers with a direct admission of patients to a CT scanner, in 65% with admission to an emergency department and in 63% with admission to an outpatient office. Median DNT was 18 minutes in centers without any transports, 23 minutes with one transport and 35 minutes with two transports ( $p=0.0002$ ).

**Conclusions:** Centers with direct patient admission and initiation of intravenous thrombolysis in the CT scanner had shortest door-to-needle time since transports significantly delayed thrombolytic treatment.

**Trial registration number:** N/A

## AS06-035

### SUPERVISED MACHINE LEARNING METHOD FOR CLASSIFYING STROKE AND NON-STROKE PATIENTS FROM MEDICAL RECORDS: PROOF OF CONCEPT

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**Background and Aims:** Diagnosis of patients as stroke and non-stroke can be difficult in the Emergency Department. This step can help ambulance officers and Emergency Physicians to expedite care of stroke patients for time-critical therapy such as recombinant tissue plasminogen activator (TPA) and endovascular clot retrieval (ECR). In this study, a supervised machine learning approach is implemented to compare models for classifying stroke and non-stroke patients using their ambulance assessment notes.

**Methods:** Ambulance records of patients admitted to the Monash Medical Centre Stroke Unit over a 3-month period were collected, labelled, pre-processed and split into training and testing subsets. Models for text classification were built and compared using a variety of machine learning tools: Random Forest, Support Vector Machine (SVM), Generalised Linear Model (GLM) and Naïve Bayes.

**Results:** The data contained ambulance notes of 126 patients of which 8.46% were diagnosed as 'non-stroke'. The positive class in this analysis was 'non-stroke'. Random Forest was the overall best performing model with a ROC of 0.76 and specificity of 1.0, followed by GLM, SVM and Naïve Bayes respectively (Figure 1). Variable importance for the Random Forest model showed that terms 'motor', 'fatigue', 'perceptions', 'hallucinations', 'behavioural' and 'tinnitus' made the largest contribution to predicting non-stroke from stroke patients (Figure 2).

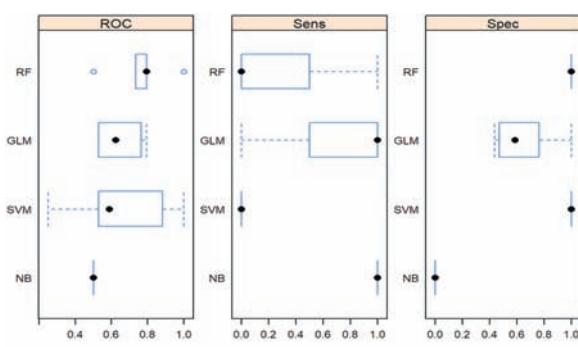


Figure 1: Model comparison

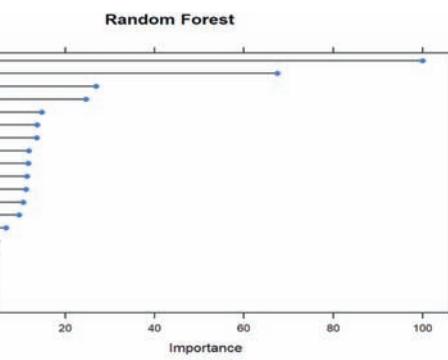


Figure 2: Variable importance

**Conclusions:** This analysis demonstrates the use of machine learning methods for supervised text classification for prediction of stroke from non-stroke patients. This model can be further developed with larger sets of data for safe implementation in the clinical setting where it can assist with prediction of stroke.

**Trial registration number:** N/A

## AS06-020

### THERAPY AND OUTCOME OF PATIENTS WITH LARGE VESSEL ANTERIOR CIRCULATION OCCLUSION AND MINOR NEUROLOGICAL DEFICITS

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**Background and Aims:** Therapy in patients with minor neurological deficits and large vessel occlusion remains debated.

**Methods:** Patients included in our prospective registry at the Bernese stroke center between 01/2004-04/2018 with large vessel occlusion in anterior circulation and NIHSS  $\leq$ 5 on admission were analysed in this study. Therapy modality dependent neurological deterioration (NIHSS worsening compared to admission) and outcome was analysed by intention-to-treat. Baseline variables differing in between-two-group-comparisons were adjusted.

**Results:** Among 185 patients (44% women; median age 67.4y), 52.4% received conservative (including 26.8% secondary reperfusion) therapy, 12.4% primary IV-thrombolysis alone and 35.1% primary endovascular therapy (+/-IV-thrombolysis). 3-months neurological deterioration occurred in 95 (51.4%) of patients. Survival and symptomatic intracranial haemorrhages ( $n=6$ ) were similar between groups. Primary IV-thrombolysis alone vs. conservative therapy had better 3-months outcomes: excellent (54.5% vs. 30.8%); adjusted-OR 6.02; adjusted- $p=0.004$ ; favourable (81.8% vs. 63.7%); adjusted-OR 7.64; adjusted- $p=0.011$ ; better 3-months mRS shift; adjusted-OR 6.25; adjusted- $p=0.001$ ; less 3-months neurological deterioration; adjusted-OR 0.17; adjusted- $p=0.011$  and less 3-months aphasia; adjusted-OR 0.09; adjusted- $p=0.002$ . Primary endovascular therapy (+/-IV-thrombolysis) vs. conservative therapy had better 3-months outcome: excellent (54.7% vs. 30.8%); adjusted-OR 5.09; adjusted- $p=0.002$ ; better 3-months mRS shift; adjusted-OR 3.14; adjusted- $p=0.003$ ; less 3-months neurological deterioration; adjusted-OR 0.25; adjusted- $p=0.006$  and less 3-months aphasia; adjusted-OR 0.23;

adjusted-p = 0.003, hemianopia:adjusted-OR 0.27;adjusted-p = 0.039 and extinction/inattention:adjusted-OR 0.28;adjusted-p = 0.036, but showed 4 symptomatic intracranial haemorrhages. Primary IV-thrombolysis alone vs. primary endovascular therapy (+/-IV-thrombolysis) did not differ significantly.

**Conclusions:** Our study suggests an effectiveness of primary IV-thrombolysis alone and primary endovascular therapy (+/-IV-thrombolysis) respectively over primary conservative therapy. There is an unmet need for randomized controlled trials, investigating therapy safety of primary endovascular therapy (+/-IV-thrombolysis) and comparing primary IV-thrombolysis alone vs. primary endovascular therapy (+/-IV-thrombolysis) in this patient group.

**Trial registration number:** N/A

## AS06-018

### RATE OF STROKE IN PATIENTS WITH ACUTE ONSET ISOLATED APHASIA

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**Background and Aims:** Aphasia in stroke is common and disabling often accompanied by other symptoms. Isolated aphasia (IA) is a frequent presentation in the emergency department. Only one study has addressed the rate of stroke in IA and found it to be an infrequent diagnosis (0/21 patients had infarction, 3/21 patients discharged with possible TIA). Further, IA has shown to be a predictor for stroke mimics. The aim of the current study is to evaluate the rate of true stroke in patients with IA treated in the telestroke network in Bavaria (TEMPIS).

**Methods:** The TEMPIS teleconsultation registry was screened for patients with acute IA between 2017–04–01 and 2018–10–31. Patients with persisting deficits during teleconsultation were included. Patients with subtle lateralizing symptoms missed in the teleconsultation but reported later by the onsite physician and patients with incomplete neuroradiological workup (i.e. receiving no MRI when CT was inconclusive) were excluded. Of the remaining, relevant patient characteristics and final diagnosis was collected and analyzed.

**Results:** Of 8165 patients, 90 met inclusion criteria. In 43% (39 patients) stroke was radiologically confirmed. 28% (25 patients) were discharged with TIA, 29% (26 patients) had stroke mimics (metabolic disorders, epilepsy, tumor, inflammation, neurodegeneration, subdural hematoma, global amnesia). In seven of the 26 patients with TIA an differential diagnosis was considered, also. Patient characteristics did not significantly differ between the groups.

**Conclusions:** Acute IA was most commonly caused by stroke. However, stroke mimic rate is higher than in general stroke collective. Reliable predictors identifying stroke mimics in this population are needed.

**Trial registration number:** N/A

## AS06-031

### SIMULATION-BASED TEAM-TRAINING IN ACUTE STROKE: IS IT SAFE TO SPEED UP?

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**Background and Aims:** In acute ischemic stroke (AIS) rapid treatment with intravenous thrombolysis (IVT) is crucial for good outcome. We

implemented in situ simulation-based team-training, leading to significant reduction of median door-to-needle time in real patients with AIS (27 to 13 minutes p < 0.001). In this study the aim was to assess if patient safety indicators, i.e. stroke mimics and symptomatic intracranial hemorrhage (sICH), were influenced by faster treatment.

**Methods:** In a population-based setting, 684 consecutive patients with suspected AIS were treated with IVT between 2014 January 1st and 2018 December 31st. 2017 February 1st we introduced weekly in situ simulation-based team-training involving the whole stroke treatment chain. IVT treated patients before and after 2017 February 1st were defined as control group and study group, respectively. Stroke mimics were identified due to results of diagnostic work up (Table 2 and 3). sICH were diagnosed according to the ECASS II classification. Number of patients with stroke mimics treated with IVT and number of patients with sICH after IVT were compared between the two periods.

	Before ST (n=399)	After ST (n=285)	p
Age (mean, range)	69 (22 – 97)	66 (24 – 99)	<b>0.021</b>
Sex (female)	177 (44.4%)	135 (47.4%)	0.43
Hypertension	172 (43.1%)	105 (40.2%)	0.46
Diabetes	48 (12%)	37 (13%)	0.42
Atrial fibrillation	50 (12.5%)	30 (10.5%)	0.69

Table 1: Demographic variables and cerebrovascular risk factors. ST = simulation-training

**Results:** After implementation of simulation-training, patients with stroke mimics increased (p = 0.06). Among the different mimic groups, epilepsy and vertigo increased significantly (Table 2 and 3). Number of patients with sICH did not increase. Discharge NIHSS score dropped significantly after introduction of simulation-training.

	Before ST (n=399)	After ST (n=285)	p
NIHSS at admission (mean, range)	5.68 (0 – 29)	5.21 (0 – 38)	0.36
NIHSS at dismissal (mean, range)	1.91 (0 – 25)	1.16 (0 – 26)	<b>0.023</b>
Symptomatic ICH	1 (0.3%)	1 (0.4%)	0.81
Stroke mimics	57 (14.3%)	56 (19.7%)	<b>0.06</b>
mRS 3 month (mean, range)	1.77 (0 – 6)	1.5 (0 – 6)*	0.13

Table 2: Patient outcome before and after ST. \*n=265. ST = simulation-training

	Before ST (n=399)	After ST (n=285)	p
Epilepsy	2 (0.5%)	8 (2.9%)	<b>0.009</b>
Psychiatric	5 (1.3%)	1 (0.4%)	0.26
Migraine	6 (1.5%)	5 (1.8%)	0.67
Symptom diagnosis	20 (5%)	20 (7.3%)	0.18
Vertigo	7 (1.8%)	15 (5.5%)	<b>0.006</b>
Other	9 (2.3%)	2 (0.7%)	0.16
Intoxication	2 (0.5%)	1 (0.4%)	0.84
Facial palsy	3 (0.8%)	0	0.17
Infectious disease	3 (0.8%)	2 (0.7%)	0.97

Table 3: Stroke mimic categories before and after ST. ST = simulation-training

**Conclusions:** Weekly simulation-training of the stroke-chain in AIS seemed to be safe. There was a non-significant increase in the number of stroke-mimics treated with IVT. The number of sICH was not influenced and NIHSS at discharge decreased during the study period.

**Trial registration number:** N/A

**AS06-029****DEVELOPMENT OF A NEW TOOL TO IDENTIFY LARGE VESSEL OCCLUSION**

**M.J. Hsieh<sup>1</sup>, S.C. Tang<sup>2</sup>, L.K. Tsai<sup>2</sup>, Y.H. Lin<sup>3</sup>, C.W. Lee<sup>3</sup>, S.J. Yeh<sup>2</sup>, W.C. Chiang<sup>4</sup>, M.H.M. Ma<sup>4</sup> and J.S. Jeng<sup>2</sup>**

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<sup>3</sup>National Taiwan University Hospital, Department of Medical Imaging, Taipei, Taiwan R.O.C; <sup>4</sup>National Taiwan University Hospital Yun-Lin Branch, Department of Emergency Medicine, Yun-Lin County, Taiwan R.O.C

**Background and Aims:** Prediction tools have been proposed to identify patients with large vessel occlusion (LVO), but no tool can achieve both high sensitivity and high specificity. The aims of our study were to develop a new tool to identify patients with LVO and to compare it with other prediction tools.

**Methods:** We used the stroke registry of a comprehensive stroke center to develop the prediction tool. We included patients with ischemic stroke who arrived at the emergency department within 6 hours of symptom onset. We excluded patients whose National Institutes of Health Stroke Scales, which were evaluated by the neurologists, were not available and those who did not receive computed tomographic angiography or magnetic resonance angiography of brain before intravenous thrombolysis or endovascular thrombectomy was performed. Receiver operating curve (ROC), sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of the new tool were analyzed.

**Results:** LVO was detected in 419 of 1231 patients (34.0%). The new 5-item tool, which contained items of commands, horizontal eye movement, visual field test, facial palsy and leg motor function, had good capacity to identify patients with LVO (area under ROC 0.83). The area under ROC of other 9 existed prediction tools ranged from 0.77 to 0.83. A score of the new tool  $\geq 3$  had sensitivity 0.79, specificity 0.78, PPV 0.65, and NPV 0.88 for identifying patients with LVO.

**Conclusions:** The new 5-item tool has good accuracy to identify patients with LVO. Prospective validation is required.

**Trial registration number:** N/A

**AS06-079****EARLY RECURRENT STROKE IN PATIENTS RECEIVING MECHANICAL THROMBECTOMY**

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<sup>2</sup>National Taiwan University Hospital, Radiology, Taipei, Taiwan R.O.C

**Background and Aims:** Mechanical thrombectomy for acute ischemic stroke is a proven technique effective in selective patients. This study described the incidence and clinical characteristics of early recurrent stroke (ERS) in patients receiving mechanical thrombectomy from a single center in Taiwan.

**Methods:** We retrospectively reviewed patients who had acute ischemic stroke and received mechanical thrombectomy from January 2015 to September 2018 at National Taiwan University Hospital. ERS was defined as newly developed neurological deficit localized to a different vascular territory and not caused by hemorrhage within the 21 days after the onset of index stroke. Good functional outcome was defined as modified Rankin Scale  $\leq 2$  at 3 months after stroke.

**Results:** During the period, 200 patients (mean age  $71.62 \pm 12.34$  years, male 49.0%) received mechanical thrombectomy. 17 patients (mean age  $65.0 \pm 15.54$  years, male 35.3%) developed ERS (8.50 %, 95% confidence interval 5.39- 13.39 %.) The stroke etiologies of those with ERS were cardioembolism in 10 (58.8 %) patients, active cancer with positive disseminated intravascular coagulation profiles in 4 patients (23.5%),

catastrophic antiphospholipid syndrome in 1 (5.9%) patient, and large artery atherosclerosis in 2 (11.8%) patients. 10 (58.8 %) of them received repeated mechanical thrombectomy, all achieving successful revascularization and none developed symptomatic hemorrhage. The patients with and without ERS had comparable percentage of good functional outcome (23.5% versus 43.1%,  $p = 0.171$ ).

**Conclusions:** ERS was not rare in stroke patients previously treated with mechanical thrombectomy, and repeated mechanical thrombectomy could be effective and feasible in subjects with ERS.

**Trial registration number:** N/A

**AS06-124****SIMILAR RESULTS IN PATIENTS TREATED WITH MECHANICAL THROMBECTOMY ALONE VS COMBINED TREATMENT**

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<sup>1</sup>Complejo Hospitalario Universitario Insular Materno Infantil, Neurology, Las Palmas de Gran Canaria, Spain; <sup>2</sup>Universidad de Las Palmas de Gran Canaria, Mathematics, Las Palmas de Gran Canaria, Spain; <sup>3</sup>Complejo Hospitalario Universitario Insular Materno Infantil, Vascular and Interventional Radiology, Las Palmas de Gran Canaria, Spain

**Background and Aims:** Intravenous thrombolysis (IVT) prior to mechanical thrombectomy (MT) improves the functional outcome in patients with acute ischemic stroke secondary to large vessel occlusion (LVO) in the anterior circulation. Results are conflicting as to whether IVT facilitates MT, and data in non-IVT-eligible patients treated with MT alone are limited. Our aim was to compare the safety and the efficacy of these two therapeutic strategies.

**Methods:** Retrospective analysis of consecutive patients presenting acute anterior circulation stroke due to LVO who were treated with MT in an Endovascular Capable Center between May 2016 and September 2018. IVT was performed on those patients who were eligible. Data on the characteristics of demographic, clinic, of imaging, site of occlusion, complications and functional outcome were collected.

**Results:** 288 patients were analyzed, 118 (41%) treated with combined IVT + MT and 170 (59%) with MT alone. The MT alone group showed an older proportion of patients (71 [62-80] vs 68 [58-77],  $p = 0.026$ ). No differences were found in intracranial hemorrhage (20% vs 25%,  $p = 0.3841$ ), functional independence (modified-Rankin score  $\leq 2$ ; 52% vs 55%,  $p = 0.4558$ ) and mortality (21% vs 15%,  $p = 0.4558$ ) at 90 days. The rate of PH-2 hemorrhage was higher in combined therapy (20% vs 25%,  $p = 0.3841$ ) than in MT alone, although there were no significant differences found.

**Conclusions:** No differences were found in the efficacy and safety outcomes between combined treatment and MT alone, either globally or stratified by site of occlusion. Randomized controlled trials are needed to provide more evidence about the additional benefit of IVT before TM.

**Trial registration number:** N/A

**AS06-015****IMPLEMENTATION OF A STROKE TEAM IMPROVED HYPERACUTE MANAGEMENT OF ISCHEMIC STROKE IN A MAXIMUM-CARE HOSPITAL**

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**Background and Aims:** Time from symptom onset to vessel recanalization is the most important factor for a favorable outcome in patients with acute ischemic stroke. Interdisciplinary teamwork in a so-called “stroke team” might shorten time-critical steps in the clinical work-up of reperfusion treatment. In this study, we investigated the effect of stroke team implementation in a large maximum-care hospital.

**Methods:** From July 2017 to December 2018, all patients with ischemic stroke treated with endovascular therapy, systemic thrombolysis or both were consecutively registered. In January 2018, a fixed stroke team algorithm and a particular stroke team training was implemented (intervention). Data from the pre-intervention phase were compared with those of the post-intervention period (unpaired t test,  $p < 0.5$  significance level, IBM SPSS statistics).

**Results:** In patients with systemic thrombolysis, the median door-to-needle time (DNT) was 61.0 min (IQR 46.0-81.0 min,  $n = 133$ ) before intervention. DNT significantly decreased by nearly 40% to 36.0 min (IQR 27.0-50.0 min,  $n = 243$ ) after stroke team implementation ( $p < 0.001$ ). The percentage of patients who received thrombolysis within 30 minutes after hospital arrival increased from 7.0 % (10/133) before to 28.0% (68/243) after intervention.

**Conclusions:** Time is of critical importance in hyperacute stroke management. Our data show that the stroke team algorithm offering clear responsibility assignment and fixed task allocation is a suitable tool to optimize process times of systemic thrombolysis in the emergency unit. We conclude that quality of care in patients with acute ischemic stroke benefits from the implementation of specialized stroke teams.

Trial registration number: N/A

## AS06-095

### CHANGES IN THE QUALITY OF CARE IN POLISH STROKE UNITS REPORTING TO RES-Q REGISTRY

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**Background and Aims:** The Registry of Stroke Care Quality (RES-Q) incorporated in Angels Initiative was designed to facilitate quality monitoring of acute stroke care and implemented in Poland since 2017. Previous analyses have shown that Polish stroke units participating in RES-Q perform markedly better than the national average. Our aim was to investigate whether RES\_Q reporting centres have additionally improved between year 2017 and 2018.

**Methods:** This is a retrospective analysis of Polish patients reported to the RES-Q registry from January 2017 to December 2018. Only centres that contributed  $\geq 15$  patients in each year were included.

**Results:** Out of 175 Polish stroke unit 15 reported patients both in year 2017 ( $n = 749$ ) and year 2018 ( $n = 2241$ ). We found no differences in the proportion of acute ischaemic strokes (90% vs 89%), age (median 72 vs 73 years), proportion of women (47% vs 48%), baseline stroke severity (median NIHSS 6 vs 6) and length of hospital stay (9 vs 9 days). Proportion of ischaemic strokes treated with intravenous thrombolysis (23% vs 20%) and door-to-needle time (median 42.5 vs 37.0 min) did not change significantly. However, there was a decrease in screening for dysphagia (83% vs 78%,  $p = 0.004$ ), particularly  $< 24$  hours from admission (78% vs 73%,  $p = 0.005$ ).

**Conclusions:** Despite evident room for improvement the group of 15 RES-Q reporting Polish stroke units did not increase their average performance from year 2017 to year 2018. It emphasizes that reporting quality needs clear feedback from the central registry and each participating centre should actively use this feedback to improve.

Trial registration number: N/A

## AS06-076

### GEOGRAPHICAL VARIATION IN THE DECISION TO PROCEED WITH ENDOVASCULAR TREATMENT UNDER CURRENT AND IDEAL PRACTICE SETTINGS ACROSS WORLD REGIONS: RESULTS FROM AN INTERNATIONAL MULTIDISCIPLINARY STUDY

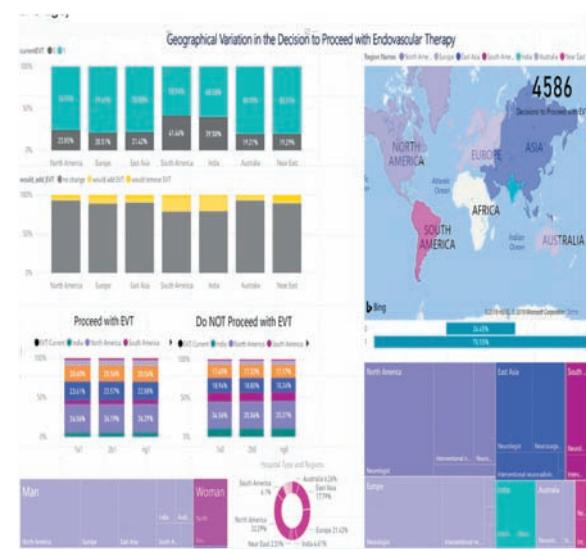
**N. Kashani<sup>1</sup>, M. Almalmekhlafi<sup>2</sup>, G. Saposnik<sup>3</sup>, A. Podlasek<sup>1</sup>, A.T. Wilson<sup>4</sup>, M. Foss<sup>2</sup>, B. Menon<sup>2</sup>, M. Hill<sup>2</sup> and M. Goyal<sup>1</sup>**

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**Background and Aims:** We sought to determine if regional factors influence the decision to perform endovascular therapy.

**Methods:** We conducted a multidisciplinary (607 physicians from 38 countries) web-based survey of clinicians involved in acute stroke care participants were presented with 10 randomly assigned case scenarios from a pool of 22 cases to indicate their current practice management decision and their decision under “ideal” conditions.

**Results:** Overall, 75.5% decided to proceed with endovascular therapy in their current setting. Regions with lower than average EVT decisions were South America (58% of 24 respondents) and South Asia (60.5% of 24 respondents), compared to 78% in remaining regions. Respondents from South America were younger than the average (37.3 versus 44.8,  $p < 0.001$ ) and had fewer years in practice (9.4 vs. 14.2,  $p < 0.001$ ). Respondents in those countries were also found to treat less EVT cases annually on average (14.31 in South Asia, 17.2 in South America, vs. 38 cases cohort average). Clinicians in South America and South Asia were most likely to add EVT in an ideal practice setting (18% and 19.5% vs. 6.9% global average).



**Conclusions:** Geographical differences exist in EVT decisions reflecting local center volumes and clinician age and experience.

Trial registration number: N/A

**AS06-078**

**THE DECISION TO PROCEED WITH ENDOVASCULAR TREATMENT IN PATIENTS WITH CO-MORBIDITIES AND LOWER FUNCTIONAL STATUS AT PRESENTATION: INSIGHTS FROM AN INTERNATIONAL MULTIDISCIPLINARY SURVEY**

**N. Kashani<sup>1</sup>, M. almekhlafi<sup>2</sup>, G. Saposnik<sup>3</sup>, A. podlasek<sup>4</sup>, A.T. Wilson<sup>4</sup>, M. Foss<sup>2</sup>, B. Menon<sup>2</sup>, M. Hill<sup>2</sup> and G. Mayank<sup>1</sup>**

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**Background and Aims:** We sought to determine the impact of serious patient co-morbidities such as end stage cancer, COPD and heart failure, and dependent living in a care facility in the decision to proceed with endovascular therapy (EVT).

**Methods:** We conducted a multidisciplinary (607 physicians from 38 countries) survey of Neurosurgeons (13.3%), Radiologists (28.7%), and Neurologists (53.6%) in an effort to understand perceptions around patient comorbidities. The participants were presented with randomly assigned scenarios with varying patient characteristics such as living in a nursing home, heart failure with COPD and dialysis dependent renal disease, and end stage prostate cancer with metastatic disease. Proportion of respondents who decided to proceed with EVT were determined and compared to determine if presence of comorbidities would deter the treating physicians from patient selection. Characteristics deemed most important to the decision were calculated using mixed effects logistic regression.

**Results:** Of the presented case scenarios, 14% included patients with comorbidities at presentations. Respondents chose to pursue endovascular therapy in 75.48% of the scenarios, similar to 75.55% in scenarios without these co-morbidities. Baseline NIHSS (OR 6.7; 95% CI 4.8-9.5), ASPECTS (OR 9.4; 95% CI 7.4-11.9), and occlusion location (OR 0.12; 95% CI 0.08-0.17) were deemed most relevant characteristics. There were no significant differences amongst treating specialties in the selection of EVT candidates.

**Conclusions:** Presence of comorbidities and dependent living condition (without cognitive impairment) were less relevant when compared to baseline stroke severity, extent of ischemic changes, and occlusion location in choosing EVT as treatment option in patients with LVO and acute ischemic stroke.

**Trial registration number:** N/A

**AS06-041**

**MANAGEMENT OF ELEVATED BLOOD PRESSURE IN ACUTE SPONTANEOUS INTRACEREBRAL HEMORRHAGE – EXPERIENCE AND CHALLENGES IN A BUSY DISTRICT GENERAL HOSPITAL IN THE UNITED KINGDOM**

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**Background and Aims:** Intracerebral haemorrhage (ICH) accounts for about 15% of strokes. Elevated blood pressure associated with ICH may lead to hematoma expansion and poor outcome. There are no definite guidelines in relation to ideal anti-hypertensive agents in the acute phase of ICH and usage vary amongst units. We looked at our current practice with regards to this. The UK Royal College of Physicians 2016

recommendations and Trust Guidelines for the management of high blood pressure in patients with acute ICH were considered as standard.

**Methods:** We retrospectively reviewed all patients with intracerebral bleed admitted over 6 months (1 Jan-30 Jun 2018) to stroke unit. The parameters recorded and exclusion criteria are detailed in Table 1.

Table 1

Parameters Recorded	Exclusion Criteria
Blood pressure on admission	GCS 5 or less
Average blood pressure within 1st 6 hours and then over next 24 hours	Large haematoma and expected death
Antihypertensive medications used	Structural cause for the haematoma
Frequency of observations in ED and Stroke Unit	Immediate surgery to evacuate the haematoma planned
	Delayed presentations

**Results:** Total number of Patients with ICH in the 6 month period was noted to be 31. After exclusion, 24 case note analysis are detailed in Table 2. A range of BP lowering medicines were used in the acute phase (Figure 1).

Table 2

Results	
Total number of patients	31
Total number of case notes reviewed after applying exclusion criteria	24
Male patients	13
Female patients	11
BP > 150 systolic on arrival	15
BP control within 1 <sup>st</sup> 6 hours	
< 140/80	13
> 140/80	11 out of 15 (73%)
BP control in 24 hours	
< 140/80	18
> 140/80	6 out of 15 (40%)

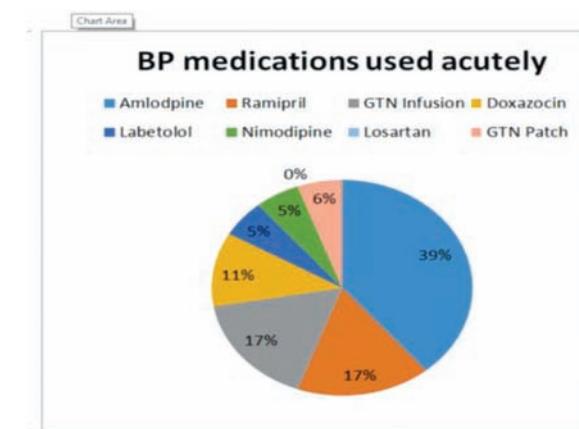


Figure 1

**Conclusions:** A number of antihypertensives are being used in our hospital with Amlodipine being the most preferred option. Poor awareness was noted amongst ED doctors on a spot survey although they may be involved in first line of care especially out of hours. There was also no set guidance for nursing staff with regards to frequency of BP measurement after ICH. Further research is warranted with regards to understanding of BP management in ICH which remains the least treatable form of stroke.

**Trial registration number:** N/A

**AS06-102****ENDOVASCULAR TREATMENT OF ACUTE ISCHEMIC STROKE: FIRST YEAR DATA OF A STROKE NETWORK STRATEGY IN ISTANBUL**

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**Background and Aims:** Institutional and geographical limitations are major barriers for implementation of treatment in acute ischemic stroke (AIS). Stroke networks aims to increase effectiveness.

**Methods:** We herein present the first-year results of Brain Angiography and Stroke Centers (BASC) network that is constituted by three strategically located comprehensive stroke centers that uses RAPID technology in Istanbul. Data of 837 AIS patients, admitted between October 2017 and September 2018 were prospectively recorded. The results of 249 patients who underwent endovascular treatment (EVT) were analyzed.

**Results:** The mean age was 68 years (male:54%, Age>80 years:18.9%). The mean onset-to-door (ODT) time was 425 min (median 255 min). Sixty-six percent of the patients presented in the first 6 hours and 314 patients underwent cerebral DSA as intention to treat. In the EVT group, the mean NIHSS score was 14(+/-6)(NIHSS ≥10: %75,6), and 20% of these patients admitted after 6 hours of onset. The M1, M2-M3 segment and tandem occlusion rate were 47%, 15% and 17%, respectively. The mean door-to-femoral puncture and femoral puncture-to-recanalization time were 75(+/-107) and 57(+/-40) minutes, respectively. First pass recanalization, mTICI 2c3 and 2b3 ratio were 44%, 56% and 88%, respectively. Mean NIHSS score on discharge was 7(+/-7). The good prognosis (3-months mRS 0-2) and the mortality rate was 41% and 24%, respectively. The rate of symptomatic hemorrhage (SITS-MOST) was 6.4%.

**Conclusions:** The presence of an effective stroke treatment network facilitates access of appropriate patients to EVT treatment. Despite late admission due to referral effective geographical dispatch and optimization of intra-hospital workflow led to good outcome figures.

**Trial registration number:** N/A

**AS06-103****LARGE VESSEL OCCLUSION WITH LOW NIHSS SCORE: WHAT TO DO?**

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**Background and Aims:** There is insufficient evidence to treat patients with acute ischemic stroke (AIS) with a low NIHSS score (LNS) in the presence of large vessel occlusion (LVO). Our aim was to assess the characteristics of patients with/without endovascular treatment (EVT) in patients with LNS.

**Methods:** Brain Angiography and Stroke Centers (BASC) network that is constituted by three strategically located comprehensive stroke centers that uses RAPID technology and provide services for Istanbul. Data of patients with LNS defined as NIHSS<6 and LVO who were admitted consecutively between October 2017 and September 2018 were assessed. In these patients LVO was demonstrated with BTA/MRA or DSA.

**Results:** Out of 837 AIS patients that were prospectively recorded 316 presented with LNS, 91 had LVO and 27 patients received EVT (LNS-EVT). When compared with medical group, LNS-EVT had no difference in demographics, infarct characteristics (volume, presence of mismatch) and IV thrombolysis rate. There were significantly more M1 (37% vs 9,4%; p:0.005) occlusions in the LNS-EVT group. Hemorrhagic complications were 3,7% and 1,8% (p:1), good outcome (3-months mRS 0-2) 58% and 54% (p:0.816) and mortality were 12% and 9% (p:0.7) in LNS-EVT and medical patients, respectively.

**Conclusions:** Similar outcome in EVT and medical arm can cautiously suggest that EVT may be safe and beneficial in LNS patients but randomized comparison is needed.

**Trial registration number:** N/A

**AS06-107****ENDOVASCULAR TREATMENT OF ACUTE ISCHEMIC STROKE: THE EFFECT OF DIRECT VS SECONDARY TRANSPORT TO A COMPREHENSIVE STROKE CENTER NETWORK**

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**Background and Aims:** Primary transport (PT) with prenotification is thought to be the preferred method of dispatch for stroke patients. Our aim was to study the impact of secondary transport (ST) from non-comprehensive settings.

**Methods:** Brain Angiography and Stroke Centers (BASC) network is constituted by three comprehensive stroke centers and provide services for Istanbul. All STs are effectuated with prior notification to a single telephone number. Prospective data of patients admitted in the first 6 hours between October 2017 and September 2018 was evaluated to analyze the impact of ST on outcome.

**Results:** Data included 520 patients and 51% were ST. They were younger (ST: 66 vs PT:70; p: 0.001) with lower disability (pre-stroke mRS 0-2 ST: 99% vs PT: 89%; p: 0.003). There was no difference between ST and PT in terms of other demographic characteristics, admission NIHSS, presence and location of vascular occlusions, treatment and working-hours referral rates. Mean onset-to-door time was 134 and 223 min in PT and ST, respectively (p:> 0.0001). Door to end of image (p: 0.001) and end of image-to-femoral puncture time (p: 0.001) were significantly shorter in the ST group. Good outcome (mRS 0-2) at 3-months was significantly higher in the ST group (51,7 vs 40,7%; p:0.016). Age (p:0.0001) and ST (p:0.008) were significantly correlated with good outcome in the multivariate analysis.

**Conclusions:** Secondary transport may lead to overselection; ST patients are young with lower disability and despite late admission, have better intra-hospital workflow parameters due to pre-notification.

**Trial registration number:** N/A

**AS06-098****IDARUCIZUMAB ADMINISTRATION IN EMERGENCY SITUATION – THE MUNICH REGISTRY OF REVERSAL OF PRADAXA® IN CLINICAL ROUTINE (MR REPAIR)**

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**Background and Aims:** Idarucizumab (Praxbind<sup>®</sup>) is a humanized antibody fragment reversing the anticoagulating effect of Dabigatran (Pradaxa<sup>®</sup>). In 01/2016 Idarucizumab received drug approval in Germany. The Munich Registry of Reversal of Pradaxa in clinical routine (MR REPAIR) summarizes all Idarucizumab use in hospitals with neurological departments.

**Methods:** All 6 hospitals with neurological departments in Munich, a city with about 1.3 million inhabitants in Southern Germany contributed to MR REPAIR. From 01/2016 to 01/2019 all patients treated with Idarucizumab were included to an observational registry retrospectively (01/2016-02/2017) or prospectively (03/2017-01/2019). Primary endpoints were frequency and indications of Idarucizumab use, and clinical outcome evaluated with the modified Rankin score (mRS) at day 90.

**Results:** In total 32 patients were included. A majority of 28 patients (88%) had been treated at tertiary care hospitals. Idarucizumab was administered for the following indications: intracranial bleeding (17 patients, 53%), ischemic stroke (7 patients, 22%), gastrointestinal bleeding (3 patients, 9%), femoral fracture, aortic dissection, abdominal trauma, hemicraniectomy and ileus (1 patient respectively, 3%). Additional coagulation management was performed in 7 patients (22%). 10 patients (31%) underwent emergency surgery. 7 patients (22%) received Idarucizumab before systemic thrombolysis due to ischemic stroke and 3 patients (9%) received mechanical thrombectomy. On day 90 (follow-up currently available for 25/32 patients, 78%), 5 patients had a good (mRS 0–2, 16%) while 18 had a poor outcome (mRS 4–6, 56%).

**Conclusions:** Idarucizumab was administered mostly for neurological and neurosurgical indications at tertiary care hospitals at an annual rate of about 10 patients. 3-months outcome was only poor.

Trial registration number: N/A

**AS06-106****RELATIVE FREQUENCY OF ACUTE ORBITOPATHY COMPLICATING MECHANICAL THROMBECTOMY : A RETROSPECTIVE STUDY OF 250 PATIENTS**

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**Background and Aims:** Case reports and anecdotal experience have suggested the acute orbitopathy as a possible complication following mechanical thrombectomy (MT) for anterior circulation acute ischemic stroke. With increasing use of MT, we aimed to estimate the relative frequency of acute proptosis after MT and to describe possible underlying etiology.

**Methods:** We performed a retrospective single-center study of 250 anterior circulation MT cases (thrombectomy group) compared to 250 intracranial aneurysm coiling cases (control group). Changes in proptosis and extra-ocular muscle (EOM) diameter were evaluated by two independent raters on preprocedural and 24-hour postprocedural non-contrast cerebral CT scans.

**Results:** In the thrombectomy group, six patients (2.4%) developed acute ipsilateral proptosis at 24 hours with associated EOM thickening. Only one patient out of 6 reported clinical symptoms of transient diplopia and ipsilateral exophthalmos. In the control group, no case of acute proptosis or EOM thickening was found [risk difference = 2.4% (95% confidence interval: 0.5, 4.3); p = 0.0303. Interrater agreement among both readers was nearly perfect (kappa 0.903, 95%CI 0.726, 1.000).

**Conclusions:** Acute orbitopathy consisting of proptosis and extra-ocular muscle thickening after MT is not infrequent (2.4%) but most cases remain asymptomatic. Possible etiologies include contrast toxicity or orbital ischemia and may be part of the orbital infarction syndrome (OIS) spectrum that is usually seen in reaction to hypoperfusion or micro-emboli.

Trial registration number: N/A

**AS06-050****PRECLINICAL TRIAGE CONCEPT OF LARGE VESSEL OCCLUSION STROKE (LVOS) PATIENTS SIGNIFICANTLY REDUCES INHOUSE TREATMENT TIMES**

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**Background and Aims:** Time delays significantly affect neurological outcome of stroke patients with large vessel occlusion. Different concepts addressed inhouse process optimizations to reduce door -groin times, but so far only few concepts addressing prehospital workflow and the prehospital/hospital interface to reduce treatment times have been reported.

**Methods:** We examine the effect of changed prehospital stroke logistics in patients with suspected LVOS and symptom onset < 6h. FAST-ED Score (field assessment stroke triage for emergency destination) applies as preclinical diagnostics. A score ≥ 4 is used as cut off for suspected LVOS. In patients with FAST-ED ≥ 4 preclinically preparation for possible ivrtPA and thrombectomy is completed on the field and the treating stroke neurologist is contacted via direct line. In house a direct transfer to the angiosuite (One-Stop management), or MDCT (multidetector

computed tomography) if angiosuite is occupied and structured handing over with the complete stroke team is done.

**Results:** Onset to groin time was 99 min. (64–286 min. [min-max]) with LVOS logistics compared to 133 min. (55–415 min.;  $p>0.05$ ) prior to this in total population. Median door-groin time was 30min (22–61 min.) for LVOS compared to 49 min. (16–81 min.,  $p=0.0366$ ) for total population and 35 min. (16–64 min.;  $p<0.05$ ) for One-Stop-subgroup.

**Conclusions:** Changing preclinical and interface logistics of LVOS patients leads to significant shorter treatment times, possibly improving patient outcome.

**Trial registration number:** N/A

## AS06-090

### WHITE MATTER HYPERINTENSITY IN ACUTE ISCHEMIC STROKE: THE “SILENT INFLUENCER”

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**Background and Aims:** White matter hyperintensity (WMH) represents a marker of chronic and apparently “silent” cerebrovascular injury that may be associated with higher susceptibility to acute ischemic injury. We sought to evaluate whether in patients with acute ischemic stroke (AIS) increased WMH burden may have an influence on ischemic penumbra volume, clinical and infarct progression, and unfavourable outcome.

**Methods:** We prospectively studied AIS patients presenting within 9 hours of symptom onset. WMH, PWI-DWI mismatch, and infarct volumes were measured using semi-automated volumetric method. Mismatch volume was defined as the difference between baseline MTT and DWI volume. Modified Rankin Scale score at 3 months of 3 to 6 indicated an unfavorable outcome.

**Results:** Overall, 489 patients (43.4% females; mean[SD] age 70.1[15.1]; median[IQR] NIHSS 6[3-13]; 40.7% treated with IV t-PA) had a median [IQR] WMHv of 3.40[1.40-9.51] cm<sup>3</sup>. As regard to main outcome measures in acute stroke, at univariate analyses higher WMHv was significantly associated with early neurological deterioration ( $\geq 4$  points at the NIHSS or death at 24 hrs), 3-month unfavorable functional outcome and death, while a lower WMH burden correlated with higher mismatch and mismatch salvage volumes ( $P<0.05$  for all). In multivariate analyses, regardless the treatment with IV thrombolysis, WMHv resulted as independent predictor of mismatch volume (B -0.59, 95%CI 0.03,-1.12;  $P=0.031$ ), with a borderline statistical significance for mismatch salvage volume (B -0.58, 95%CI -1.173,0.023;  $P=0.059$ ), and of 3-month functional outcome (OR 1.43, 95%CI 1.001, 2.04;  $P=0.049$ ).

**Conclusions:** Measuring WMH burden with automated software in the acute setting and its inclusion in risk scores might be helpful to better stratify AIS patients for improving prediction of brain tissue fate and clinical outcome.

**Trial registration number:** N/A

## WITHDRAWN

### A STUDY OF DECOMPRESSIVE CRANIECTOMY IN ACUTE STROKE

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**Background and Aims:** Decompressive craniectomy is life saving emergency surgery in patients with stroke with mass effect and midline shift. Sparse data are available from India regarding outcome of patients who underwent this surgery for stroke.

**Methods:** Retrospective study of case records of consecutive patients with stroke who underwent decompressive craniectomy between January 2001 to December 2011.

**Results:** 97 patients underwent decompressive craniectomy. Mean age  $41.5 \pm 15.2$  years; 53 males. Risk factors included hypertension (22.7%), diabetes mellitus (10.3 %), smoking (34 %), alcohol ( 29.9 %). Majority presented with altered sensorium (87.6%), headache (62.9%), vomiting (59.7%), seizures (47.4%) and pupillary asymmetry (36%). Large artery thrombosis (46.4%), venous thrombosis (41.2%), hemorrhagic causes (11.3%) major causes of stroke; Ischemic stroke (87.7%) common than haemorrhagic (11.3%). midline shift on CT brain noted in 91.8%. When compared with survivors, patients who died had lower median (interquartile range) Glasgow Coma Scale (GCS) values at admission ( $p=0.003$ );and at 24 hours after surgery ( $p=0.003$ ); longer duration of ventilation after surgery ( $p=0.001$ ); 15 (15.5%) patients died. Of 40 venous thrombosis patients, 28 (70%) showed complete recovery with no focal neurological deficit.

**Conclusions:** Decompressive craniectomy is life saving emergency surgery in patients with venous thrombosis. Lower GCS at admission,24 hours after surgery, need for prolonged mechanical ventilation following surgery are prognostic markers of death.

**Trial registration number:** NA

## WITHDRAWN

### CT PERFUSION AND EEG STUDY IN ACUTE ISOLATED APHASIA DUE TO SEIZURE-RELATED STROKE MIMICS

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**Background and Aims:** Among the clinical manifestations of stroke mimic, an isolated speech impairment is one of the most challenging for etiopathogenic diagnosis. In the most of cases isolated aphasia is caused by an ischemic event or seizure. The role of perfusion neuroimaging and EEG in stroke mimic differential diagnosis is still debated. We aimed to investigate perfusional and EEG pattern of isolated aphasia to better differentiate vascular and epileptic etiology in emergency setting.

**Methods:** We retrospectively analyzed the clinical, neuroimaging and EEG data of patients with isolated aphasia admitted to our Stroke Unit between January and September 2017. We included the patients with confirmed ischemic infarction or mimic stroke with seizure etiology on follow-up, who underwent CT perfusion evaluation within 4.5 and EEG assessment within 24h from symptom onset. Mean Transit Time asymmetry (MTTasymmetry) between ROI placed in the anatomical area compatible with clinical presentation and contralateral ROI was investigated in order to evaluate perfusion abnormalities.

**Results:** Out of 8 mimic stroke patients with seizure etiology, hyperperfusion on CTP (MTTasymmetry  $<-10\%$ ) and sharp EEG waves were

observed in 5 patients, while in 3 patients a slight hypoperfusion (MTTasymmetry<20%) and slow EEG rhythms were detected. 19 of 22 ischemic stroke patients presented hypoperfusion with MTTasymmetry above the stroke threshold (MTTassimetry>45%), while in other three cases the hypoperfusion was moderate (MTTasymmetry>20%) but under the threshold. All ischemic stroke patients presented slower EEG rhythms.

**Conclusions:** The main finding of this study is the identification of different patterns of clinical and neuroimaging aspects of isolated aphasia in acute phase.

**Trial registration number:** N/A

## AS06-092

### SAFETY AND EFFICACY OF REPERFUSION THERAPIES FOR ACUTE ISCHEMIC STROKE PATIENTS WITH ACTIVE MALIGNANCY – A SINGLE CENTER EXPERIENCE

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**Background and Aims:** Epidemiological correlations between active malignancy (AM) (i.e. presence of malignant tumor, metastasis and/or current chemo and radiotherapy), and acute ischemic stroke are well established. However, the effect of reperfusion therapies, particularly mechanical thrombectomy (MT), has been barely investigated in patients with acute ischemic stroke and AM. We aim to evaluate safety and efficacy of reperfusion strategies in such patients.

**Methods:** We performed a case-control analysis comparing patients with AM and acute ischemic stroke (AM group) to a group of cancer-free patients with acute ischemic stroke (control group). All enrolled patients underwent reperfusion therapies (i.e. intravenous thrombolysis, MT, intravenous thrombolysis plus MT). Main outcomes were 3-month functional independence (mRS≤2), successful reperfusion (TICI≥2b), 3-month mortality and symptomatic intracranial hemorrhage.

**Results:** 24 patients with AM and acute ischemic stroke (mean age: 69 ± 10.1) were individually matched to 24 control patients (mean age: 70.7 ± 9.3). In both groups, 50% of patients were treated with MT, 46% with intravenous thrombolysis and 4% with intravenous thrombolysis plus MT. No difference was found in successful reperfusion, 3-month functional independence and symptomatic intracranial hemorrhage. However, a slight but not statistically significant difference in 3-month mortality between the two groups was reported (29.1% in AM group vs 12.5% in control group).

**Conclusions:** Reperfusion therapies for acute ischemic stroke patients with AM seem to be safe and effective, suggesting that such an approach could be a reasonable option in the acute setting. However, larger studies are warranted to better optimize the therapeutic strategy in these patients.

**Trial registration number:** N/A

## AS06-008

### MECHANICAL THROMBECTOMY IN UNKNOWN TIME-OF-ONSET STROKE. 237 CASE EXPERIENCE IN A TERTIARY CARE CENTER

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**Background and Aims:** New guidelines establish that acute stroke mechanical thrombectomy (MT) can be performed up to 24 hours after last seen normal, providing a significant infarct volume is ruled out with perfusion neuroimaging.

Our objective is to know if the prognosis differs in patients undergoing mechanical thrombectomy (MT) with unknown time of onset (MT\_UT) vs known time of onset (MT\_KT) in our center.

**Methods:** Select all patients treated with MT from January 2014 to July 2018 in Hospital La Fe.

For both MT\_UT and MT\_KT groups, demographic characteristics, cardiovascular risk factors, ASPECTS-TC, perfusion mismatch, and outcome (NIHSS pre MT and at discharge, mRS at discharge and at three months, mRS >3 at three months, death) were analysed.

**Results:** 237 patients where included; 50 were MT\_UT —of them 29 being wake up strokes (58%). MT\_KT and MT\_UT patients were comparable in terms of age, sex, cardiovascular risk and stroke severity (initial NIH: MT\_KT: 16.40, MT\_UT: 17.13, p = 0.354). Both previous intravenous fibrinolysis were 36%. ASPECTS-TC: MT\_KT 8.45, MT\_UT 7.76, p = 0.112. Perfusion mismatch: MT\_KT 75.93, MT\_UT 75.56, p = 0.966. Discharge NIH: MT\_KT 8.524, MT\_UT 8.815, p = 0.838. Mortality at three months: MT\_KT 25%, MT\_UT 32%, p = 0.853. mRS >3 at three months: MT\_KT 45.6% vs MT\_UT 55.8%, p = 0.237.

**Conclusions:** Patients treated in our center with either wake up or unknown time of onset strokes had similar baseline characteristics, clinico-radiological presentation, mortality and functional outcome than strokes treated with a known time of onset. Currently used perfusion softwares could sufficiently determine good candidates for MT beyond 6 hours.

**Trial registration number:** We are not describing clinical trial results.

## AS06-016

### DISTAL INTRA-ARTERIAL SIGN DETECTED BY ARTERIAL SPIN LABELING MR IMAGING CAN PREDICT OUTCOME IN MECHANICAL THROMBECTOMY FOR ACUTE ISCHEMIC STROKE

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**Background and Aims:** Endovascular therapy has emerged as the management of patients with acute ischemic stroke (AIS). However, further imaging-based approaches may widen the selection of the patients and contribute to improved clinical outcomes. We reported that distal intra-arterial sign (IAS) on arterial spin labeling (ASL) indicated collateral flow

in patients with AIS. The purpose of this study was to assess the association between distal IAS and outcomes in patients with successful mechanical thrombectomy.

**Methods:** Among 910 patients who presented with AIS at our institution from January 2012 to March 2016, 106 patients (11.6%) underwent mechanical thrombectomy. Image data were included in this study if (1) preoperative ASL MR imaging was performed and (2) successful reperfusion (TICI 2b/3) was achieved. Correlation between distal IAS which indicates the collateral flow and modified Rankin Scale (mRS) at 90 days was retrospectively studied.

**Results:** A total of 53 patients with a mean age of 75 years and median National Institutes of Health Stroke Scale (NIHSS) of 14 were analyzed. Functional independence (mRS 0–2) at 90 days was 91% in the distal IAS positive group when compared with 38% in the distal IAS negative group ( $P = 0.0001$ ). Eleven patients without distal IAS in the anterior circulation resulted in mRS 3–6. Negative distal IAS is a strong predictive value of poor outcome (mRS 3–6) at 90 days.

**Conclusions:** The presence of distal IAS is strongly associated with better outcome at 90 days after AIS. We provide the evidence that good clinical outcome following successful reperfusion is collateral-dependent as well as time-dependent.

**Trial registration number:** N/A

## AS06-032

### REPRODUCING DAWN RESULTS IN REAL LIFE BASED ON CLINICAL-ASPECTS MISMATCH: AN EXPLORATORY ANALYSIS

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**Background and Aims:** The DAWN trial demonstrated the effectiveness of late endovascular treatment (EVT) in acute ischemic stroke (AIS) patients selected on the basis of a clinical-core mismatch. We retrospectively explored if a clinical-ASPECTS mismatch was associated with clinical benefit after late EVT.

**Methods:** In the ASTRAL registry (2003–2017), we reviewed all consecutive AIS patients admitted 5–24 hours after last proof of good health, with admission NIHSS  $\geq 10$  and internal carotid artery or M1 occlusion. We defined DAWN-like patients in the presence of clinical-ASPECTS mismatch (NIHSS  $\geq 10$  and ASPECTS  $\geq 7$ ; or NIHSS  $\geq 20$  and ASPECTS  $\geq 5$ ). We assessed the effect of late EVT in the clinical-ASPECTS mismatch positive and negative groups, using ordinal shift analysis of the 3 months modified Rankin Scale (mRS), and adjusting for age, pre-stroke mRS, admission NIHSS, onset to arrival time and ASPECTS.

**Results:** The included 168 patients had a median age of 68.0 years (IQR = 25.1), admission NIHSS of 19(7) and baseline ASPECTS of 6(4). Ninety-one (54.2%) patients presented the clinical-ASPECTS mismatch, of whom 39 (42.9%) received EVT. Among 77 (45.8%) patients without clinical-ASPECTS mismatch, EVT was performed in 11 (14.3%) patients. In the adjusted analysis, late EVT was significantly associated with better outcome in the presence of clinical-ASPECTS mismatch ( $aOR = 3.09$ ; 95%CI:1.25-7.87) but not in its absence ( $aOR = 1.99$ ; 95%CI:0.41-9.89).

**Conclusions:** In our exploratory adjusted analysis of late-arriving patients, EVT seems effective in the presence of clinical-ASPECTS mismatch, but not in its absence. If confirmed in randomized trials, this

finding could support the use of an ASPECTS-based selection for late EVT decisions, obviating the need for advanced imaging.

**Trial registration number:** N/A

## AS06-052

### ENDOVASCULAR THROMBECTOMY BEYOND 6 HOURS IN ACUTE ISCHEMIC STROKE WITH PROXIMAL ANTERIOR VESSEL OCCLUSION: REAL-LIFE EXPERIENCE IN A TERTIARY HOSPITAL

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**Background and Aims:** The effect of endovascular thrombectomy performed beyond 6 hours after the onset of ischemic stroke has been established in 2018 with clinical trial evidence for anterior territory. We present our real-life experience in a tertiary hospital during the period 2016–2019.

**Methods:** Retrospective analysis from a prospective record in our comprehensive stroke center on patients with acute ischemic stroke and proximal anterior territory occlusion treated with thrombectomy after they were last known to be well who had remaining ischemic brain tissue that was not yet infarcted on multimodal imaging beyond 6 hours.

**Results:** So far we have recorded data on 50 patients (56% women, median age:69, RIQ:57,75-76). 26 patients fulfilled inclusion criteria for DAWN trial, 18 patients for DEFUSE-III trial. 62%(31) were detected upon awakening. Median baseline NIHSS-score was 16. Median ASPECTS-score in cranial-CT was 8 (RIQ:7-9), median mismatch, 70% (RIQ:50-80%). 80%(40) had middle-cerebral-artery occlusion and 20% (10) distal internal-carotid-artery occlusion. 30%(15) had previously been treated with intravenous alteplase at standard dose. Recanalisation TICI-2B-3A was achieved in 88%(44). Only 1 patient suffered symptomatic intracranial hemorrhage. The 90-day rate of functional independence was 64%. A higher proportion of patients with mRS>2 at 90 days were older ( $p = 0.016$ ), presented higher baseline NIHSS-score ( $p = 0.045$ ), higher puncture-recanalisation time ( $p = 0.022$ ), and less proportion of atrial fibrillation ( $p = 0.03$ ).

**Conclusions:** In our experience, endovascular treatment beyond 6 hours is associated with good 90-day disability outcomes in well-selected patients with acute ischemic stroke and proximal anterior vessel occlusion. Atrial fibrillation, older age, baseline NIHSS-score, and longer groin-puncture time were associated with poor prognostic.

**Trial registration number:** N/A

## AS06-006

### OUTCOMES OF ENDOVASCULAR TREATMENT IN ACUTE ISCHEMIC STROKE PATIENTS WITH CURRENT MALIGNANCY

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**Background and Aims:** The role of endovascular recanalization in the treatment of cancer patients with acute stroke remains elusive. Our study aimed to investigate the clinical and imaging outcomes of endovascular recanalization treatment in patients with acute large vessel occlusion stroke who had active cancer.

**Methods:** We reviewed prospectively collected data for ischemic stroke from our stroke registry from January 2011 to September 2016. Acute stroke patients with large artery occlusion in the anterior circulation who had active cancer were identified. Baseline clinical characteristics and postprocedural and long-term clinicoradiological outcomes were evaluated. A good outcome was defined as a 90-day modified Rankin Scale score of 0 to 2. Outcomes were also compared with those of non-malignancy patients who had received endovascular therapy during the same period.

**Results:** A total 378 ischemic stroke patients received endovascular treatment, of whom 27 had current malignancy. In patients with current malignancy, a low baseline NIHSS score and male sex were associated with functional independence at 90 days. When comparing with non-malignancy patients, no significant differences in the proportions of patients with symptomatic intracranial hemorrhage and good functional outcome were found in the malignancy patients.

**Conclusions:** Endovascular treatment might be a feasible therapeutic option for acute ischemic stroke patients with current malignancy when candidates are selected carefully. Future large-scale prospective studies are necessary.

**Trial registration number:** N/A

## AS06-022

### IMPROVING THE RACE SCALE BY ADDING PRE HOSPITAL CLINICAL FACTORS TO DISTINGUISH BETWEEN LARGE VESSEL OCCLUSION AND HEMORRHAGIC STROKE PATIENTS

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**Background and Aims:** As 25–30% of patients with a RACE scale > 4 at pre-hospital level have hemorrhagic stroke, we aimed to improve the predictive value of the RACE scale by adding clinical factors to distinguish between acute ischemic stroke (AIS) with large vessel occlusion (LVO) and intracranial hemorrhage (ICH).

**Methods:** From a government-mandated, prospective registry of Stroke Code activations in Catalonia (CICAT), we studied patients with suspicion of LVO (RACE score >4). Additional clinical factors were evaluated at the pre-hospital setting were age, blood pressure, glycemia levels, history of atrial fibrillation, anticoagulants intake, vomiting and level of consciousness (LOC). Factors independently associated with LVO were determined by a logistic regression analysis. Proportion of patients with LVO or ICH were determined for different combinations of pre-hospital clinical factors.

**Results:** A total of 668 patients were included (46% AIS with LVO, 25% AIS without LVO, 23% hemorrhage and 6% mimic). Factors independently associated to LVO were systolic blood pressure < 160 (OR 1.84, IC95% 1.31-2.58), atrial fibrillation (1.71, IC95% 1.18-2.47) and preserved LOC (OR 6.39, IC95% 1.41-28.92), but not vomiting or anticoagulants. The ratio of LVO (46%) / ICH (23%) shifted towards a higher rate of LVO for patients with atrial fibrillation (58%/16%) and towards a higher rate of ICH for patients with altered LOC (12%/65%), vomiting (32%/47%) and blood pressure >160 (36%/37%).

**Conclusions:** We identify some pre-hospital clinical factors that may increase the predictive value of the RACE scale to distinguish LVO and hemorrhagic stroke patients. They should be considered when designing pre-hospital transfer triage tools.

**Trial registration number:** N/A

## AS06-066

### COMPUTER MODELLING OF CLOT RETRIEVAL-EFFECT OF DIFFERENT OCCLUSION PATTERNS ON FLOW IN CIRCLE OF WILLIS

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**Background and Aims:** Endovascular clot retrieval transformed treatment of patients with large vessel occlusion. There are still several unanswered questions with clot retrieval: safety of advancing catheter along internal carotid artery (ICA) in setting of ipsilateral middle cerebral artery (MCA) occlusion given the different configuration of the Circle of Willis (CoW). This study takes advantage of our earlier work in creation of computer model of cerebral circulation, based on the anatomical works of Rhiton.

**Methods:** The arterial branches were created as connected pipes with laminar flow. The models were created with different configuration of CoW. Further we simulated the movement of catheter along the artery by imposing increasing stenosis in the ICA.

**Results:** In the setting of left MCA occlusion, there is recruitment of the CoW vessels (Acom and left posterior communicating artery (PCom). This compensatory flow preserve flow in the left anterior cerebral artery (ACA) but not MCA branches. In the setting of right ICA occlusion and left MCA occlusion, there is preserved flow in the ACA branches and recruitment of the CoW vessels (doubling of flow in the left PCom) at low left ICA stenosis but flow in PCom collapsed as the stenosis in the ICA increased ( $\geq 50\%$ ). This result was observed for CoW configurations: bilateral fetal PCA or absent ACA and bilateral PCA.

**Conclusions:** In simulated model, compensatory flow collapse under certain clot retrieval scenarios and unusual configuration of Circle of Willis.

**Trial registration number:** N/A

## AS06-114

### DECOMPRESSIVE HEMICRANIECTOMY FOR MALIGNANT MCA STROKE IN MODENA REGISTRY: FIRST RESULTS

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**Background and Aims:**

**Background:** MCA malignant cerebral infarction is associated with a very high mortality. It can be treated by Decompressive Hemicraniectomy (DH), that reduces mortality over 50% in the acute phase, determining an increase in moderate-to-severe disability in the

surviving patients, as compared to patients receiving medical treatment (1,2,3).

**Aims:** In this preliminary analysis we want to evaluate mortality and clinical outcome by modified Rankin Scale (mRS) of patients with malignant cerebral infarction treated by DH.

**Methods:** This is a single center registry of MCA malignant infarction treated by DH and consecutively enrolled. Anamnestic, clinical, timing and neuroimaging pre and post intervention characteristics were collected. Follow-up assessment by mRS was at 3 months and 1 year after surgery.

**Results:** a total of 31 patients were registered. Comparing the data of the clinical outcome at 1 year of a pooled analysis of three European randomized clinical trials (HAMLET, DECIMAL, DESTINY I), the overall mortality of our group was found to be higher (28.2% vs 22%), especially in late intervention ( $>36$ h) and low GCS ( $<10$ ). Among the survivors our patients presented clinical outcomes similar to the trials one (mRS = 3: 30% vs. 29%; mRS = 4: 32% vs. 31%) (1,2,3).

**Conclusions:** DH in the treatment of malignant brain infarcts has changed the natural history of this disease in terms of mortality and functional outcome. Our study partly confirm the results of the meta-analysis, but also showed that late intervention and a low GCS both pre and hemicraniectomy are associated with a higher mortality.

Trial registration number: N/A

## AS06-051

### DEVELOPMENT OF A STROKE MIMIC PREDICTIVE SCALE IN THE EVALUATION BY TELESTROKE SYSTEM

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**Background and Aims:** Stroke mimics (SM) represent a challenge in the evaluation of acute stroke by Telestroke System (TS), supposing up to one third of all cases. NIHSS scale might not be helpful enough to detect SM by TS. Therefore, it would be useful to have predictive tools to make a correct diagnosis.

Our objective is to evaluate the prevalence and variability of SM in our population and to search for a predictive model of SM when evaluating a patient by TS.

**Methods:** We included consecutive patients excluding TIAs. We analyzed demographic variables, stroke-associated variables and diagnosis. To create our scale, we selected the best model from all possible equations, and then we established the SM risk prediction using logistic regression, we calculated the AUC and performed external and internal validation processes (cross-validation).

**Results:** 215 patients were included. 52 patients (24.19%) were SM, receiving the following diagnosis: Functional: 9(17.31%), Seizure: 8 (15.38%), Migraine: 7(13.47%), Non-specific speech disorder: 4(7.69%), Dizziness/Syncope: 2(3.84%), Peripheral facial palsy: 2(3.84%), Encephalopathy: 2(3.84%), Space-occupying lesion: 2(3.84%), Unknown: 16(30.76%). The next variables were included in our scale: age ( $\times 0.1$ ) – epilepsy (3) + NIHSS( $\times 0.3$ ) + facial palsy (3) + SBP( $0.3 \times 10$  mmHg). Our model AUC was 0.87(95% CI 0.81-0.93). In the internal validation process the pseudo-R<sup>2</sup> was 0.337 and in the external validation the AUC was 0.89(95% CI 0.79-0.98). The total score of our scale was associated with a diagnosis of stroke with an OR 1.58(95% CI 1.37-1.82).

**Conclusions:** Our scale might be a good predictive tool for SM in the diagnostic evaluation by TS.

Trial registration number: N/A

## AS06-077

### EFFICACY OF MECHANICAL THROMBECTOMY IN STROKE ACCORDING TO AN ADMISSION PROGNOSTIC SCORE

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**Background and Aims:** Most of the randomized clinical trials that demonstrated the efficacy of mechanical thrombectomy (MT) used narrow inclusion criteria, but more patients may benefit from the treatment. In this study, we measured the effect of MT on medical care in patients with different prognostic profiles at admission.

**Methods:** Single-center cohort of consecutive patients ( $n=652$ ) with proximal occlusions in the carotid territory. Patients were categorized according to quartiles of a prognostic score that included all variables associated to the degree of recovery in patients not treated with thrombectomy (admission NIHSS, age, collaterals, level of occlusion, ASPECTS, infarct core on first imaging, atrial fibrillation). We measured the interaction between the prognostic score and MT on functional outcome (primary outcome measure) and infarct growth (secondary outcome measure). The safety outcomes were mortality and symptomatic intracranial hemorrhage.

**Results:** There was no interaction between the prognostic score and MT on functional outcome, and there was a significant ( $p < 0.001$ ) interaction between the prognostic score and the effect of MT on infarct growth, which was significantly smaller with MT in patients in the upper quartile of the prognostic score (indicating worst prognostic factors). MT was associated with lower mortality than medical care only in patients in the upper quartile, and the rates of intracranial hemorrhage were similar across different prognostic scores in both treatment arms.

**Conclusions:** MT is superior to medical care in patients with different prognostic indicators at baseline, and the tissue saving effect may be even more pronounced in patients with the worst prognostic factors.

Trial registration number: N/A

## AS06-043

### SELECTION OF ANTERIOR CIRCULATION ACUTE STROKE PATIENTS FOR MECHANICAL THROMBECTOMY

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**Background and Aims:** The use of mechanical thrombectomy (MT) for acute ischemic stroke (AIS) patients has increased with a parallel burden in procedural costs. We tested whether a new prognostic score could identify patients who are unlikely to benefit from MT.

**Methods:** patients from our endovascular stroke registry were assessed for imaging and clinical outcome measures and randomly divided into two subsets for derivation and validation. We created a new prognostic score based on clinical and radiological prognostic factors of poor outcome (mRS score  $>2$ ) from the derivation cohort. Receiver Operating Characteristics curve analysis and the area under the curve (AUC) were used to assess the discrimination ability of the score. The score was then validated and compared to the MR PREDICT score.

**Results:** The derivation cohort included 270 and the validation cohort 116 patients. After multivariate logistic regression analysis pre-stroke mRS, age, admission glycemia, admission NIHSS, collateral Flow, Clot Burden Score, Alberta Stroke Program Early CT score were used to create a new prognostic scoring system called Tor Vergata Stroke

Score (TVSS). TVSS revealed a good prognostic accuracy with an AUC of 0.825 [95%CI: 0.77–0.88] in the derivation cohort and an AUC of 0.820 [95% CI, 0.74–0.90] in the validation cohort. When compared to the MR PREDICT score TVSS demonstrated higher accuracy however not statistically significant (0.80 vs 0.78;  $P = 0.26$ ).

**Conclusions:** TVSS seems to be a reliable tool for selection of AIS candidates for MT and optimization of transfer to comprehensive stroke centers.

**Trial registration number:** N/A

## AS06-105

### IDENTIFICATION OF FACTORS ASSOCIATED WITH SLOWED INTER-HOSPITAL TRANSFER IN TREATMENT OF LARGE VESSEL OCCLUSION: REAL-WORLD DATA FROM A METROPOLITAN ‘DRIP AND SHIP’ PATHWAY

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**Background and Aims:** Efficacy of mechanical thrombectomy for large vessel occlusive stroke is critically time dependent. We investigated factors that affected inter-hospital transfer times from our primary stroke centre (PSC) to a linked off-site mechanical thrombectomy treating centre (MTC).

**Methods:** Consecutive patients transferred from our PSC to the MTC between March 2018 and January 2019 were retrospectively analysed. Baseline clinical data, key time metrics and work-flow factors were included.

**Results:** 43 patients were identified. 36 patients had anterior circulation stroke and 7 patients had basilar artery occlusion. Median age was 76 (Interquartile range [IQR], 67–85) and presentation National Institute of Health Stroke Scale 16 (IQR 14–20). Median Door to Needle (DTN) was 34 minutes (IQR 24–44). 27 patients (63%) underwent thrombolysis. Good recanalisation (mTICI >2a) was achieved in 32 patients (74%). Median PSC to MT Door to Groin puncture (DTGP) time was 131 mins (IQR 100–162) with a Door In/Door Out (DIDO) time at PSC of 81 mins (IQR 57–105). In multivariate analyses, anterior circulation stroke ( $p = 0.003$ ) and retention of ambulance crew ( $p = 0.042$ ) were associated with shorter DIDO and DTGP. In-hours transfer significantly shortened DTGP time ( $p = 0.035$ ) but not DIDO ( $p > 0.05$ ). Anaesthetic strategy, administration of thrombolysis and ambulance transfer time to MTC did not significantly impact DIDO or DTGP ( $p > 0.05$ ).

**Conclusions:** Shorter transfer times were associated with in-hours working, ambulance retention and anterior circulation stroke. PSC and MTC work flow optimisation can have significant effects on reducing transfer times. Further work investigating effect of workflow on patient outcomes is in progress.

**Trial registration number:** N/A

## AS06-064

### REGULAR SIMULATION-TRAINING IN ENDOVASCULAR TREATMENT OF STROKE PATIENTS SIGNIFICANTLY REDUCES TREATMENT TIMES

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**Background and Aims:** In acute stroke, rapid treatment is crucial for good patient outcome, especially in stroke caused by large vessel occlusions (LVO). We introduced regular simulation-training as part of a continuous quality improvement initiative in LVO-stroke patients receiving endovascular treatment (EVT). The objectives were to assess whether simulation-training can reduce the in-hospital times used in LVO-stroke patients treated with EVT and to analyze staff participants' experiences.

**Methods:** In the intervention period from November 2017 through December 2018 a total of 25 weekly in-situ stroke simulation team-training sessions were completed. We used former stroke patients as role-players except in the angio-suite where a simulation manikin (SimMan Vascular™) was used. We enrolled 110 consecutive acute LVO-stroke patients treated with EVT at our institution in the period from January 2016 to December 2018 in our analysis, comparing the before-QI-group ( $n = 60$ ) and after-QI-group.

**Results:** Patient characteristics are presented in table I. Overall median CT-to-groin-puncture time was reduced from 56 (range 21–161) to 42 minutes (range 18–112);  $p \leq 0.001$ , and door-to-reperfusion time was reduced from 146 (range 68–400) to 109 minutes (range 56–253);  $p \leq 0.001$ . No significant changes in onset-to-reperfusion time or patient outcomes were found (Table 2). Participants found the simulation sessions useful, self-reporting a median usefulness score of 9 (range 2–10) on a Likert scale from 1–10.

Table 1 Patient characteristics

	Jan 2016 – Oct 2017 Before QI n=60	Nov 2017 – Dec 2018 After QI n=50	p-value
Age, median (range)	76.5 (32–92)	73.5 (37–93)	0.78
Sex, (female)	32 (53)	26 (52)	0.73
Hypertension	38 (63)	25 (52)	0.23
Diabetes	6 (10)	6 (12)	0.74
Atrial fibrillation	24 (40)	20 (40)	0.99
History of stroke	9 (15)	7 (14)	0.89
History of heart attack	11 (18.3)	10 (20)	0.83
IVT treatment	41 (68.3)	37 (74)	0.51
NIHSS at admission, median (range)	17.5 (0–27)	16 (3–38)	0.65

Data is shown as: n;count (%)

Abbreviations: QI, quality improvement; NIHSS, National Institute of Health Stroke Scale

Table 2: Time intervals and clinical patient outcomes

	Jan 2016 – Oct 2017 Before QI n=60	Nov 2017 – Dec 2018 After QI n=50	p
Door-reperfusion (min)	146 (68–400)	108.5 (56–253)	≤0.001
CT-groin-puncture (min)	56 (21–161)	42 (18–112)	≤0.001
Onset-to-reperfusion-time (min)	216 (76–651)	202 (11–789)	0.39
NIHSS at admission	17.5 (0–27)	16 (3–38)	0.65
NIHSS after EVT	13 (0–38)	10 (0–38)	0.19
NIHSS at dismissal	4 (0–24)	6 (0–24)	0.92
mRS after 3 month	3 (0–6)	4 (0–6)	0.29

Data is shown as: median (range)

Abbreviations: QI, quality improvement; NIHSS, National Institute of Health Stroke Scale; mRS, modified Rankin Scale; EVT, endovascular treatment

**Conclusions:** Weekly in-situ simulation-based team-training led to significant reduction of CT-to-groin-puncture and door-to-reperfusion times. Simulation-based team training seems to be a useful tool to reduce in-hospital treatment times for LVO-stroke patient eligible for EVT.

**Trial registration number:** N/A

### AS06-033

#### STRATEGIES FOR SHORTENING REPERFUSION TIME METRICS

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**Background and Aims:** Describe the strategies implemented in our stroke center to reduce reperfusion times in acute stroke.

**Methods:** Prospective registry of reperfusion time metrics [door-to-needle (DtN) and Door-to-groin (DtG) times] from 2011–2018.

**Results:** In this period we have treated 986 patients with rtPA and 948 with endovascular therapies. rtPA Group characteristics: Mean age 72 +/- 13y.o, 54%Men, baseline NIHSS 16[11-20]. Endovascular group: 75 +/- 14y.o, 49.5%Men, baseline NIHSS 8[5-13].

Our initial median DtN time was 44min, DtG 80min.

In 2012, we implemented a video-monitoring system to identify delays in the beginning of rtPA, to guide and teach the personnel involved in emergencies. This measure helped to detect delaying situations and potentially avoidable before rtPA bolus (as written informed consent, blood test, electrocardiogram, chest x-ray, transcranial Doppler). We achieved a DtN of 39min.

In 2015, we implemented the direct transfer of patients from the ambulance to the CT(Code-CT) with immediate interpretation of the neuro-imaging by a trained stroke neurologist and rtPA bolus in the CT by a mobile nurse of the Stroke Unit. It drastically reduced our median DtN to 36min without compromising patients safety.

In 2016, we also implemented the direct transfer of patients from the ambulance to the angiosuite (Code-Angio), achieving a DtG of 48min. Our current DtN is 27min and DtG 46min. Even our reperfusion rate is increasing year after year, those strategies together with the experience and involvement of professionals, have shown a significant reduction of our DtN 28,3% and DtG 56,6%.

**Conclusions:** Strategies implemented at our stroke center have shown a progressive and significant reduction of reperfusion time metrics.

**Trial registration number:** N/A

### AS06-042

#### EARLY ARTERIAL REOCLUSION AFTER SUCCESSFUL THROMBECTOMY: PREDICTORS AND PROGNOSTIC VALUE

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**Background and Aims:** About half of acute stroke patients treated with mechanical thrombectomy (MT) do not show clinical improvement despite successful recanalization. Early arterial reocclusion (EAR) may be one of the causes that explain this phenomenon. We aimed to analyze the predictors and clinical relevance of EAR after successful MT.

**Methods:** A consecutive series of patients treated with MT from a prospective single-center acute stroke reperfusion registry were retrospectively reviewed. Specific inclusion criteria for this analysis were 1/ successful recanalization after MT (mTICI = 2b-3) and 2/ the availability of a pre-treatment perfusion-CT and follow-up MRI. EAR was defined as TIMI = 0-1 in the follow-up Angio-MRI. Multivariate regression models were used to analyse the predictors of reocclusion, as well as its association with infarct growth, final infarct volume and clinical outcome at 90 days (ordinal distribution of the modified-Rankin scale scores).

**Results:** Overall, 197 patients fulfilled inclusion criteria, from whom 11 (6%) suffered EAR. In univariate analysis, EAR was associated with non-cardioembolic etiology ( $p = 0.04$ ), better pre-treatment collaterals ( $p = 0.045$ ), and recanalization beyond 4.5h from stroke onset ( $p = 0.05$ ). According to outcome variables, EAR was associated with greater infarct growth ( $p = 0.001$ ), greater final infarct volume ( $p = 0.002$ ) and worse clinical outcome ( $p = 0.019$ ). In multivariate analysis controlled by confounders (including age, baseline NIHSS/glucose/collaterals, cardioembolism and time to recanalization), EAR was independently associated to worse clinical outcome (OR = 4.6; 95%CI = 1.3-15.8;  $p = 0.016$ ).

**Conclusions:** Although uncommon, EAR might hamper the benefits of successful recanalization after MT. Further study is warranted to assess strategies aimed to prevent this complication.

**Trial registration number:** N/A

### AS06-062

#### IMPROVEMENTS IN IN-HOSPITAL DELAYS AFTER IMPLEMENTING A NEW STROKE PROTOCOL: DO THEY LAST?

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**Background and Aims:** Procedure modifications in stroke care protocol achieve significant improvements in in-hospital delays, nevertheless their persistency in time is unpredictable. We aim to evaluate the effect of such modifications in our hospital's "code stroke" (CS) protocol over a 2-year period.

**Methods:** We collected data from consecutive stroke patients treated with intravenous thrombolysis (IVT) in the last 5 years. In 2017, we introduced a modified CS protocol based on the "Helsinki model" and conducted several training activities for all involved healthcare

professionals. We analysed the new protocol results throughout 2017 and 2018 and compared them with data from 2014–2016.

**Results:** Of a total of 136 included patients, 75 were treated according to the new CS model. We obtained a significant reduction in door-to-needle time (DNT) from 57 to 42.5 min ( $p < 0.05$ ). We improved the percentage of patients treated within the first 60, 30 and 20 min of hospital arrival, from 62.3%, 14.7% and 6.5% to 84.0%, 49.3% and 29.3% respectively. Patients admitted as out-of-hospital CS obtained a significant lesser DNT than those admitted as in-hospital CS during the first year of the new CS (21.64 vs 39.43 min,  $p < 0.001$ ), however there were no significant differences in its second year (36.45 vs 52.50 min,  $p = 0.180$ ).

**Conclusions:** The improvements achieved with procedure modifications in CS protocols may be hard to maintain. Discontinuing feedback briefings, absence of CS training for new personnel, uncoordinated changes in the emergency department, and lack of motivation could explain these 2018 results and should be points to address in the future.

**Trial registration number:** N/A

## AS06-034

### A SURVEY OF EUROPEAN STROKE ORGANISATION MEMBERS' EXPERIENCE OF THE MANAGEMENT OF POST-STROKE SEIZURES

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**Background and Aims:** Post-stroke seizures are a complication of stroke and can adversely affect mortality and morbidity for the patients. Currently, few guidelines exist for management of post-stroke seizures, and the evidence base for these guidelines is not robust.

This survey aims to look at stroke clinicians' experience of post-stroke seizures. **Methods:** A questionnaire was sent out in November 2018 via SurveyMonkey to 876 members of the European Stroke Organisation. It consisted of 18 questions used to ascertain respondents' experience of: seizure incidence, type, relationship with vascular territory of stroke, and treatment regime.

**Results:** 90 responses were received from 38 different countries, with 92% of respondents working in hospitals with a dedicated stroke unit. Seizures were diagnosed clinically supported by electroencephalography in 77% of respondents' hospitals. Haemorrhagic stroke was more frequent (7–12%) than ischaemic stroke (0–6%) in patients with seizures, with partial seizures being the most common type (52%). Only 6% of respondents gave prophylactic anti-epileptic medication following haemorrhagic stroke, but 79% started anti-epileptics after a first seizure following ischaemic stroke and 100% following a haemorrhage. In status epilepticus Intravenous diazepam was most frequently used (39%). Levetiracetam was the preferred medication in secondary prevention of seizures, with 85% of respondents using this. The length of time for which secondary prevention was continued varied from 3 months to lifelong.

**Conclusions:** In conclusion, despite a poor evidence base and few inconsistent guidelines there appears to be uniformity in the diagnosis and management of post-stroke seizures amongst the surveyed ESO members.

**Trial registration number:** N/A

## AS06-059

### CASE REPORTS ON USE OF HYPNOTHERAPY WITH IMAGERY IN PATIENTS PRESENTING WITH FUNCTIONAL STROKE

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**Background and Aims:** 5 – 6.8% of patients presenting with acute stroke are functional disorder. Presently, the evidence of hypnosis is not robust. This is a case report of patients treated with hypnotherapy for functional stroke symptoms other than limb weakness or sensory impairments.

**Methods:** Successive patients with a clinical diagnosis of functional stroke supported by normal MRI imaging were offered hypnotherapy. It was provided by a single stroke physician trained in the technique.

**Results:** 21 patients were included in the case series. The female: male ratio was 17:4 and the mean (range) NIHSS score was 3 (1–9). 10 patients had visual deficit. Out of these 10 patients, 1 had homonymous hemianopia with 90 degree of vision on bilateral visual field chart, one of the patients had generalised constriction of visual field, 2 patients have flashing light in their visual field, rest 6 had generalised burring of vision. 10 patients had speech abnormalities. 2 out of the 10 patients had primary presentation of with speech abnormality, one of these two patients were mute. 3 patients presented with ataxia, none of them had any significant limb weakness. 17 out of the 21 patients had full response with improvement of NIHSS and MRS to 0. 3 patients had partial response. One patient who didn't respond, the depth of hypnosis achieved was inadequate. They maintained improvement of symptoms at 3-month follow-up.

**Conclusions:** In this case series, hypnotherapy was successful with rapid and sustained recovery of functional symptoms and depth of hypnosis is an important predictor.

**Trial registration number:** N/A

## AS06-122

### A SURVEY ON USE OF ORAL ANTICOAGULANTS IN PATIENTS WITH ISCHAEMIC STROKE AND ATRIAL FIBRILLATION

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**Background and Aims:** In patients with ischemic stroke and atrial fibrillation (AF), determining optimal timing of anticoagulation for secondary prevention is of challenge. Current ESC guidelines recommend initiation of anticoagulation in AF patients 1–12 days post stroke, depending on stroke severity. However, the evidence base for these guidelines are not robust.

This survey aims to look at stroke clinicians' experience of managing ischaemic stroke in patients with atrial fibrillation (AF).

**Methods:** A questionnaire was sent out in November 2018 via SurveyMonkey to 848 members of the European Stroke Organisation. It consisted of 12 questions to ascertain respondents' experience of timing the initiation of anticoagulation therapy and treatment regime in patients with AF whom suffer ischemic stroke.

**Results:** 122 responses were received with 76% of respondents working in secondary care and the majority of respondents (73%) dealing with

approximately more than 60 AF patients annually. Novel oral anticoagulants (NOACs) were first choice of therapy in 92%. There was a large variability in results regarding the timing of initiation of oral anticoagulation (OAC), ranging from 8–12 days (30%), 2 weeks (27%) and 3–5 days after onset (18%). Despite this inconsistency, size of infarct was the principal determining factor (52%). Contrastingly, in patients with haemorrhagic transformation there was wide variation on the time of initiation of oral anticoagulants.

**Conclusions:** There is uniformity in the use of NOACs as first choice in management of AF patients with ischaemic stroke. However, there is variability in the precise timing of initiation of OAC, although decisions are determined primarily by infarct size.

**Trial registration number:** N/A

## AS06-112

### ELIGIBILITY AND SAFETY OF MECHANICAL THROMBECTOMY FOR ACUTE ISCHEMIC STROKE IN PATIENTS USING DIRECT ORAL ANTICOAGULANTS

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**Background and Aims:** Direct oral anticoagulants (DOACs) are increasingly being prescribed. Compliant patients are excluded from iv-tPA and solely rely on mechanical thrombectomy for revascularization. DOAC-use may be related to development of small emboli causing distal occlusions potentially inaccessible for mechanical thrombectomy. We aimed to assess eligibility for mechanical thrombectomy and risk of post-procedure intracerebral hemorrhage in acute stroke patients on DOACs compared to those not on DOACs.

**Methods:** For this retrospective single-center study on prospectively collected data, we selected consecutive acute ischemic stroke patients presenting between 2016–2018. We compared the relative frequency of proximal occlusions (up to first order vessel segments) versus distal occlusions (second order segments and beyond), mechanical thrombectomy, and post-procedure intracerebral hemorrhage for DOAC-users and non DOAC-users using Chi-square.

**Results:** 60/499 (12%) acute stroke patients were on a DOAC and 439/499 (88%) were not on a DOAC (mean NIHSS 13 and 11 respectively, p = 0.15). 38/60 (63%) DOAC-users had an intracranial occlusion versus 268/439 (61%) of the non DOAC-users (p = 0.76). Of these, 30/38 DOAC-users (79%) had a proximal occlusion compared to 168/268 non DOAC-users (63%, p = 0.05). 23/60 (38%) DOAC-users underwent mechanical thrombectomy versus 142/439 (32%) non DOAC-users (p = 0.36). None of the DOAC-users and five of the non DOAC-users had post-procedure intracerebral hemorrhage (p = 0.07). The mean 24h-NIHSS was similar for DOAC-users as for non DOAC-users (9 and 8 respectively, p = 0.72).

**Conclusions:** DOAC-users have more often a proximal occlusion than non DOAC-users with a similar proportion of patients being offered mechanical thrombectomy, though with a tendency towards a lower risk of post-procedure intracerebral haemorrhage.

**Trial registration number:** N/A

## AS06-001

### PRETREATED FUOCIDAN CONFERNS NEUROPROTECTION AGAINST TRAINSET GLOBAL CEREBRAL ISCHEMIC INJURY IN THE GERBIL HIPPOCAMPAL CA1 AREA VIA REDUCING OF GLIAL CELL ACTIVATION AND OXIDATIVE STRESS

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**Background and Aims:** Previous studies have shown that fucoidan displays protective effect against ischemia-reperfusion injury in some organs. However, few studies have been reported regarding the protective effect of fucoidan against cerebral ischemic injury and its related mechanisms.

**Methods:** In this study, we examined the neuroprotective effect of fucoidan against cerebral ischemic injury, as well as underlying mechanisms using a gerbil model of transient global cerebral ischemia (tGCI) which shows loss of pyramidal neurons in the hippocampal cornu ammonis 1 (CA1) area. Fucoidan (25 and 50 mg/kg) was intraperitoneally administered once daily for 3 days before tGCI.

**Results:** Pretreatment with 50 mg/kg of fucoidan, not 25 mg/kg fucoidan, attenuated tGCI-induced hyperactivity and protected CA1 pyramidal neurons from ischemic injury following tGCI. In addition, pretreatment with 50 mg/kg of fucoidan inhibited activations of resident astrocytes and microglia in the ischemic CA1 area. Furthermore, pretreatment with 50 mg/kg of fucoidan significantly reduced the increased 4-hydroxy-2-nonenal and superoxide anion radical production in the ischemic CA1 area after tGCI and significantly increased expressions of superoxide dismutase 1 (SOD1) and SOD2 in the CA1 pyramidal neurons compared with the vehicle-treated-group. Additionally, we found that treatment with diethylthiocarbamate (inhibitor of SODs) to the fucoidan-treated-group notably abolished the fucoidan-mediated neuroprotection in the ischemic CA1 area following tGCI.

**Conclusions:** These results indicate that fucoidan can effectively protect neurons from tGCI-induced ischemic injury through attenuation of activated resident glial cells and reduction of oxidative stress following increasing SODs. We strongly suggest that fucoidan can be used as a useful preventive agent in cerebral ischemia.

**Trial registration number:** N/A

## AS06-002

### MTOR MEDIATES NEURONAL DEATH FOLLOWING TRANSIENT GLOBAL CEREBRAL ISCHEMIA IN THE STRIATUM OF CHRONIC HIGH-FAT DIET-INDUCED OBESE GERBILS

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**Background and Aims:** The obesity and its related metabolic dysfunction exacerbates outcomes of ischemic brain injuries in some brain areas, such as the hippocampus and cerebral cortex when subjected to transient global cerebral ischemia (tGCI). The objective of this study was to investigate effects of obesity on tGCI-induced neuronal damage and inflammation in the striatum and to examine the role of mTOR which is involved in the pathogenesis of metabolic and neurological diseases.

**Methods:** Gerbils were fed with a normal diet (ND) or high-fat diet (HFD) for 12 weeks and then subjected to 5 min of tGCI. HFD-fed gerbils showed significant increase in body weight, blood glucose level, serum triglycerides, total cholesterol and low-density lipoprotein cholesterol without affecting food intake.

**Results:** In HFD-fed gerbils, neuronal loss occurred in the dorsolateral striatum 2 days after tGCI and increased neuronal loss was observed 5 days after tGCI; however, no neuronal loss was observed in ND-fed gerbils after tGCI, as assessed by neuronal nuclear antigen immunohistochemistry and Fluoro-Jade B histofluorescence staining. The HFD-fed gerbils also showed severe activated microglia and further increased immunoreactivities and protein levels of tumor necrosis factor-alpha, interukin-1beta, mammalian target of rapamycin (mTOR) and phosphorylated-mTOR in the striatum during pre- and post-ischemic conditions compared with the ND-fed gerbils.

**Conclusions:** These findings reveal that chronic HFD-induced obesity results in severe neuroinflammation and significant increase of mTOR activation, which could contribute to neuronal death in the stratum following tGCI. Abnormal mTOR activation might play a key role in mediating the obesity-induced severe ischemic brain damage.

**Trial registration number:** N/A

## AS06-080

### THE FACTOR ANALYSIS OF THE THERAPEUTIC HYPOTHERMIA EFFECTIVENESS IN CARDIOEMBOLIC AND ATHEROTHROMBOTIC STROKE SUBTYPES

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**Background and Aims:** Therapeutic hypothermia is one of the most perspective neuroprotection strategies. Therapeutic hypothermia with the use of cooling helmet device is superficial artificial hypothermia technique.

We analyzed the effectiveness of the therapeutic hypothermia in ischemic stroke for highlighting perspective groups of patients.

**Methods:** Total amount of patients was 107 acute ischemic stroke patients (hypothermia group -87 patients; control group – 20 patients). Inclusion criteria was acute ischemic stroke first 72 hours onset; NIHSS >4 points. Exclusion criteria was bradycardia, conducted thrombolysis or/ and thrombectomy. We used the cooling helmet device for hypothermia induction. The effectiveness of the therapeutic hypothermia was evaluated on 14 day of the stroke onset (mRS points).

**Results:** The effectiveness of the therapeutic hypothermia depends from time between stroke onset and the hypothermia induction ( $r = 0.43$ ). The therapeutic hypothermia was successful when it had been started before 48 h from stroke onset. mRS score in hypothermia group was  $2.58 \pm 1.92$ ; in control group — $4.25 \pm 1.61$  points ( $p = 0.0005$ ). The mortality rate in the hypothermia group was 9.1 %, and in control group it was 25%, ( $p = 0.0256$ ). The therapeutic hypothermia was effective both in atherothrombotic mRS  $1.83 \pm 1.58$  points) and cardioembolic (mRS  $3.34 \pm 1.96$  points) stroke subtypes, but it was more effective in the atherothrombotic subtype patients ( $p = 0.0002$ ). Hypothermia was more effective in anterior circulation stroke.

**Conclusions:** The effectiveness of the therapeutic hypothermia is reduced over time. The therapeutic window for this method is first 48 h from stroke onset. The therapeutic hypothermia reduce mortality and improve functional outcome in stroke patients on 14 day from stroke onset.

**Trial registration number:** N/A

## AS06-125

### ENDOVASCULAR THROMBECTOMY FOR PATIENTS WITH LARGE VESSEL OCCLUSION IN OCTA- AND NONAGENARIANS: RESULTS FROM AN INTERNATIONAL MULTIDISCIPLINARY SURVEY

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**Background and Aims:** Age is used as a proxy for poor candidacy for endovascular thrombectomy (EVT) leading to a less aggressive approach to treat the very old.

**Methods:** Using an international web-based survey, we asked practitioners regarding their EVT practices treating patients >80 years of age using randomly-allocated cases. Case scenarios (all within 4.5-hrs time-window) were: 1. 85-year-old with mild cognitive impairment, NIHSS 9, ASPECTS 6, M2 occlusion; 2. 88-year-old, NIHSS 14, ASPECTS 7, M2 occlusion; 3. 94-year-old, NIHSS 12, ASPECTS 7, M2 occlusion; 4. 99-year-old independent, NIHSS 18, ASPECTS 7, M1 occlusion.

**Results:** 603 participants (mean age 44.8 years, 83.6% males) from 38 countries participated. There were 53.6% neurologists, 28.7% interventionists neuroradiologists, 13.3% neurosurgeons and 4.5% from other disciplines. To each of the four scenarios, 45% random participants were allocated. The decision to proceed with EVT was chosen by 62%, 81.5%, 60.7% and 88% in scenario 1 to 4. Respondents practicing in higher case-volume centers favoured EVT in all 4 scenarios; participants' discipline, years of experience, and hospital setting (teaching vs not) had no influence on EVT decision. In multivariable analysis, participants from higher volume centers were likely to support EVT in all four scenarios (OR 1.007, 95% CI 1.003-1.011;  $P < 0.001$ ). Cognitive impairment resulted in lower EVT response (62% vs 77% without,  $P < 0.001$ ).

**Conclusions:** Older patients with proximal occlusions are likely to receive EVT in higher volume thrombectomy centers if otherwise eligible. This decision is however influenced by patients' baseline cognitive status.

**Trial registration number:** N/A

**AS06-071****IMPLEMENTATION OF MULTIFACETED QUALITY INITIATIVES WITH A TELEMEDICAL PRENOTIFICATION SYSTEM IN A RURAL AREA IN HYPERACUTE STROKE CARE****H. Soda<sup>1</sup>, P.A. Eder<sup>2</sup>, A. Rashid<sup>2</sup> and B. Griewing<sup>3</sup>**

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**Background and Aims:** Quality improvement collaboratives (QIC) has become an integral and permanent component of hyperacute stroke care and strives to bridge the gap between current practice and ideal practice. In addition to current guideline and literature best practice recommendations, we stepwise developed and integrated an innovative hyperacute stroke management system into routine care.

**Methods:** Our quality programme consists of 16-item multifaceted targeted implementation strategies. Next to the Helsinki model, our hyperacute stroke management system consist of digital on-scene assessment with the 4-item stroke scale, telemedical prenotification of predefined elements (including still picture and video of prehospital stroke assessment), single call activation of stroke team, integration of prehospital data into the hospital information system, continuous monitoring of cross-sectoral quality indicators, annually feedback within a workshop, and a community-based education campaign.



**Results:** Since the start of our QIC in 2005 till 2018 we observed a steady decrease of Door-to-Needle (from 61 min to 22 min) and Door-to-CT time (from 33 min to 8 min), as well as an increase of thrombolysis rate (from 7% to 31%). Video-transmission between ambulance and stroke unit further led to an increased precision of decisions while the patient is en route regarding stroke patient assessment, management and transport in real clinical routine care.

**Conclusions:** The implementation of an innovative telemedical prenotification system in a German rural area prompt the elimination of specific barriers to the initiation and delivery of stroke thrombolysis.

**Trial registration number:** N/A

**AS06-088****TELE-STROKE: PREHOSPITAL IDENTIFICATION OF PATIENTS WITH SUSPECTED STROKE USING ONSITE MOBILE TELEMEDICINE – RESULTS OF THE FEASIBILITY STUDY**

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**Background and Aims:** One of today's challenges in stroke medicine is to further decrease stroke-to-treatment-time. Our aim is to optimize pre-hospital triage using a video link connecting ambulances and a stroke specialist MD: (1st) to differentiate between acute stroke patients and stroke mimics and (2nd) to identify candidates for endovascular recanalization after large vessel occlusion (LVO). The latter could skip the time-consuming ER-admission and directly proceed to the hybrid-CT/CTA-angiosuite.

**Methods:** In this prospective cohort study, 95 subjects will be analyzed to prove feasibility of our local telstroke-concept using the RACE-Score (items: facial palsy, arm & leg motor function, head & gaze deviation, aphasia or agnosia) in authentic settings such as emergency department or ambulance (patient out-of-hospital, stroke doctor in the hospital). A VIDYO®-connection is established between a mobile device (I-Phone 6S®) out-of-hospital and a personal computer, run by the stroke professional in-hospital. A short briefing is followed by the neurological examination, all of which is recorded on an encrypted server.

Results of all telstroke-analysis will be independently re-assessed and compared to in-hospital results. Furthermore, RACE-Scores will be analyzed to define a cut-off-score based on ROC-curves for the two selections: (1) strokes out of the population of suspected strokes and (2) LVO out of the population of detected strokes.

**Results:** So far 64 patients have been recorded of which 59 matched the including criteria of which 31 strokes could be confirmed via neuroimaging.

Data collection not completed at date of abstract submission.

**Conclusions:** Data collection not completed at date of abstract submission.

**Trial registration number:** NCT03370094

**AS06-047****MECHANICAL THROMBECTOMY IN PATIENTS WITH MILD STROKE AND LARGE VESSEL OCCLUSION**

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**Background and Aims:** Mechanical thrombectomy (MT) is superior to medical management of ischaemic stroke caused by large vessel occlusion (LVO). We aim to assess the safety and efficacy of MT in patients with mild stroke and LVO, who were largely excluded from clinical trials.

**Methods:** Patients who had a pre-stroke modified Rankin scale (mRS)  $\leq 2$  and National Institute of Health Stroke Scale (NIHSS)  $\leq 7$  underwent MT were identified from our prospective database for patients treated with MT from May 2016 to Aug 2018. Successful recanalization was defined as modified treatment in cerebral ischaemia (mTICI) 2b/3. Favorable clinical outcome was defined as mRS 0–2 to 90 days.

**Results:** During the study period, 24 patients met the study criteria. 20 patients had an M1 occlusion, while 4 patients had a basilar artery occlusion.

18 patients had an mTICI of 2b/3 with 7 patients received thrombolysis; 15 of these patients had a favourable clinical outcome with no mortality in this group. 6 patients had an mTICI  $< 2b$  with 5 patients received thrombolysis; only 1 patient of these 6 patients had a favourable clinical outcome, with 1 patient died.

There were no complications of MT procedure or symptomatic intracerebral haemorrhages in this cohort of patients

**Conclusions:** Our study cohort had a good recanalization rate and favourable clinical outcomes which does not appear to change with or without thrombolysis. Our data suggests that MT is safe and effective in

patients presenting with a mild stroke syndrome. It may require further clinical trials to confirm these findings.

**Trial registration number:** N/A

## AS06-084

### **THERAPEUTIC HYPOTHERMIA FOR ACUTE ISCHEMIC STROKE PATIENTS: IS IT SAFE?**

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**Background and Aims:** General therapeutic hypothermia associates with such side effects like arterial hypotension, arrhythmias, increase of pneumonia rate. Selective craniocerebral therapeutic hypothermia is one of the superficial therapeutic hypothermia technique.

To investigate the impact of craniocerebral therapeutic hypothermia on mean blood pressure (MBP), heart rate, incidence of intrahospital pneumonia and sinusitis.

**Methods:** Total amount of patients was 107 acute ischemic stroke patients (hypothermia group -87 patients; control group – 20 patients). Including criteria was acute ischemic stroke first 72 hours onset; NIHSS >4 points. Excluding criteria was bradycardia, conducted thrombolysis or/and thrombectomy. We used standard stroke treatment protocol in both groups, the cooling helmet device for hypothermia group during 24 h. We measured MBP, heart rate before and after first 24 h. Intrahospital pneumonia and sinusitis rate was calculated on 7th day.

**Results:** Mean blood pressure before treatment was  $111,7 \pm 16,8$  mm Hg in hypothermia group,  $119,6 \pm 23,9$  mm Hg; control group ( $p = 0,08$ ), after 24 h it was  $104,2 \pm 14,9$  mm Hg in hypothermia group,  $106,0 \pm 16,1$  mm Hg in control group ( $p = 0,63$ ). Heart rate before treatment was  $83,4 \pm 16,8$  in hypothermia group,  $81,0 \pm 12,97$  in control group, after 24 h it was  $77,6 \pm 15,2$  in hypothermia group,  $77,8 \pm 13,6$  in control group ( $p > 0,05$ ). Intrahospital pneumonia rate was 13.8% in hypothermia group and 30% in control group ( $p = 0,08$ ). There was not any intrahospital sinusitis cases in both groups.

**Conclusions:** The therapeutic hypothermia with the use of cooling helmet does not depress on hemodynamic parameters and does not increase the number of pneumonia and sinusitis.

**Trial registration number:** N/A

## AS06-094

### **THE IMPACT OF IMPLEMENTING A “FAST-TRACK” ALGORITHM ON TIME TO TREATMENT AND OUTCOME IN PATIENTS WITH ACUTE ISCHEMIC STROKE DUE TO LARGE VESSEL OCCLUSION**

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**Background and Aims:** Clinical outcome of endovascular treatment in patients with acute ischemic stroke due to large vessel occlusion (LVO) is

largely dependent from the latency between stroke onset and reperfusion. Time-saving protocols for diagnostic work-up and treatment are therefore warranted. We aimed at assessing the impact of establishing a fast-track protocol for drip-and-ship-patients on door-to-groin-puncture times.

**Methods:** Retrospective, single-centre analysis of data from the Swiss Stroke Registry (SSR) of drip-and-ship stroke patients one year before and one and two years after establishing the protocol in July 2016. Primary outcome: door-to-groin-puncture time; secondary outcomes: NIH-SS at 24h, modified Rankin Scale (mRS) at 90 days and reperfusion status (TICI).

**Results:** A total of 99 patients were considered for this analysis. Baseline characteristics (age, NIH SS, preceding i.v. thrombolysis) were comparable across patient groups. Door-to-groin-puncture-time was lower within the first year after implementation of the protocol and further decreased in the second year, then reaching statistical significance (ANOVA:  $F(2,97) = 4,234$ ,  $p = 0,017$ ). In both years median door-to-groin puncture times were < 45 minutes, which is considered the therapeutic goal for drip-and-ship-patients. Reperfusion status was comparable in all three groups. There were no differences in NIH SS after 24h and in the mRS after 90 days.

**Conclusions:** The fast-track protocol reduced the door-to-groin-puncture-time. The reduction was approximately 10 minutes in the first and another 10 minutes in the second year.

**Trial registration number:** N/A

## WITHDRAWN

**AS06-040****PRE-HOSPITAL LARGE ANTERIOR VESSEL OCCLUSION RECOGNITION; AN INTER-RATER RELIABILITY STUDY**

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**Background and Aims:** Clinical efficacy of endovascular treatment (EVT) for ischemic stroke with large anterior vessel occlusion (LAVO) is strongly time dependent (time = brain). Therefore, several screening tools have been developed to streamline pre-hospital stroke triage to centres offering EVT. These tools, however, are largely unvalidated in a pre-hospital setting and have hitherto not been compared head-to-head for inter-rater reliability. In this study we aim to make this comparison in an experimental pre-hospital setting.

**Methods:** Practicing emergency medical service nurses reviewed films of 10 different cases of a professional actor simulating stroke (mimic) symptoms by scoring items using a web-based application. This application collected these scores to reconstruct the following previously published screening tools: the LAMS, RACE, PASS, CPSS, G-FAST and FAST-ED. Fleiss' Kappa in R was used to determine inter-rater reliability of each tool in a binary fashion.

**Results:** Each of 90 EMS nurses reviewed 3 random cases. Ten cases were excluded for technical reasons resulting in a total of 260 assessments. Kappa was highest for LAMS 0.90 (95%CI 0.83-0.97) followed by FAST-ED 0.83 (95%CI 0.60-1.00), G-FAST: 0.76 (95%CI 0.51-1.00), RACE: 0.75 (95%CI 0.45-1.00), CPSS: 0.72 (95%CI 0.55-0.90) and PASS 0.58 (95%CI 0.28-0.88).

**Conclusions:** LAMS and FAST-ED showed excellent inter-rater reliability, followed by G-FAST, RACE, CPSS and PASS.

**Discussion:** In an experimental pre-hospital setting, a high degree of inter-rater reliability can be achieved with various LAVO screening tools. These screening tools must be validated in a real clinical setting with additional testing for predictive value of the tools for LAVO.

**Trial registration number:** N/A

**WITHDRAWN****AS06-021****SAFETY AND EFFICACY OF ENDOVASCULAR TREATMENT IN ACUTE TANDEM OCCLUSIONS**

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**Background and Aims:** Safety and efficacy assessment of endovascular treatment in tandem lesions (TL) performed in our center during acute phase of ischemic stroke.

**Methods:** Anterior circulation ischemic strokes treated in our center from January 2017-December 2018 were prospectively included. Demographic data, safety and efficacy were analyzed

**Results:** Five hundred and ten patients were included. 25% (120) of the patients presented TL. 64 (50%) patients with TL received intravenous fibrinolysis. Sex male ( $p < 0.001$ ), younger age (65 vs 71 years old,  $p < 0.001$ ), wake-up stroke (26.1% vs 17.4%,  $p = 0.019$ ) and tobacco ( $p < 0.001$ ) were related to TL. Furthermore, TL presented lower rates of alcohol intake ( $p = 0.001$ ), prior clopidogrel administration ( $p = 0.036$ ) and atrial fibrillation ( $p < 0.001$ ). TICI 2b-3 (91.4% vs 89.5%), 90 days modified rankin scale 0-2 (61% vs 57.1%) and symptomatic intracranial hemorrhage (sICH) (5.8% vs 6%) rates were similar between tandem/no

tandem lesions groups, without statistically significant difference. TL showed better post-procedure recovery in terms of NIHSS (10 vs 13,  $p=0.014$ ). There were no significant difference in sICH rates among tandem/non-tandem subgroups despite intravenous antiplatelet and / or fibrinolytic therapy during endovascular treatment.

**Conclusions:** Endovascular treatment in the acute phase of ischemic stroke in TL does not show worse efficacy or safety results despite differences in antithrombotic therapy.

**Trial registration number:** N/A

## AS06-097

### MACHINE LEARNING ALLOWS EASY PREDICTOR RANKING IN CLINICAL STROKE MODELS

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**Background and Aims:** Clinically applicable prediction models gain importance in the stroke field. Next to their performance, information about the most important predictors is crucial. In the past, classic regression models were used. However, the interpretation of their coefficients for predictor ranking is unreliable. Modern machine learning methods such as boosted-decision-trees allow for high performance as well as easy to interpret predictor rankings. Thus, we compared this new method to regression methods for stroke outcome prediction.

**Methods:** From the 1000+ study, 408 patients with stroke were included. 3 months mRS (3M-mRS) was predicted and the following clinicoradiological predictors were used (excluding perfusion imaging): NIHSS, age, DWI-lesion-volume, sex, history of cardiac disease, hypercholesterolemia, diabetes and i.v. thrombolysis treatment. We trained a generalized linear model (GLM) – equivalent to logistic regression -, and a Catboost model, an implementation of boosted-decision-trees. We compared performance using the area-under-the-curve (AUC) and analyzed the ranking output of the Catboost model.

**Results:** The performance of both the GLM and the Catboost model were comparably high with an AUC of 0.80 and 0.81, respectively. The Catboost ranking identified the following predictors in descending order of their importance for 3M-mRS prediction: NIHSS, age, DWI-lesion-volume, thrombolysis, diabetes, sex, history of cardiac disease and hypercholesterolemia.

**Conclusions:** Catboost showed high performance for clinical stroke outcome prediction and provided an easy to read predictor ranking in accordance with the literature. In conclusion, boosted-decision-trees allow for high performance and easy to obtain and interpretable predictor rankings in stroke prediction models.

**Trial registration number:** N/A

## Imaging – Hyperacute

### AS10-048

### BLOOD FLOW CHARACTERISTICS IN THE VICINITY OF A THROMBUS IN ACUTE ISCHEMIC STROKE

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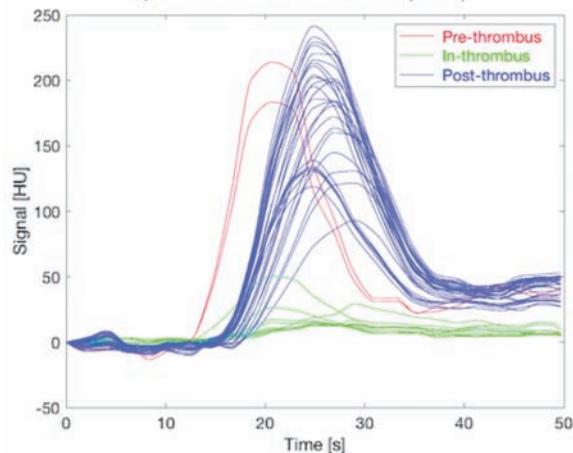
<sup>3</sup>University Medical Center Utrecht, Image Sciences Institute, Utrecht, The Netherlands; <sup>4</sup>University Medical Center Utrecht, Department of Radiology and Nuclear Medicine, Utrecht, The Netherlands; <sup>5</sup>Amsterdam University Medical Center – Location AMC, Department of Neurology, Amsterdam, The Netherlands

**Background and Aims:** Thrombus permeability has been associated with favourable patient outcome in acute ischemic stroke. Permeable thrombi allow the passage of residual fluid, which results in anterograde flow distal to the thrombus. Retrograde flow distal to a thrombus has been associated with collateral flow. We propose a method to further characterize flow characteristics in the vicinity of a thrombus. We identify antegrade and retrograde flow, quantify velocities, and characterize the intensity of time attenuation curves (TACs) on dynamic CTA.

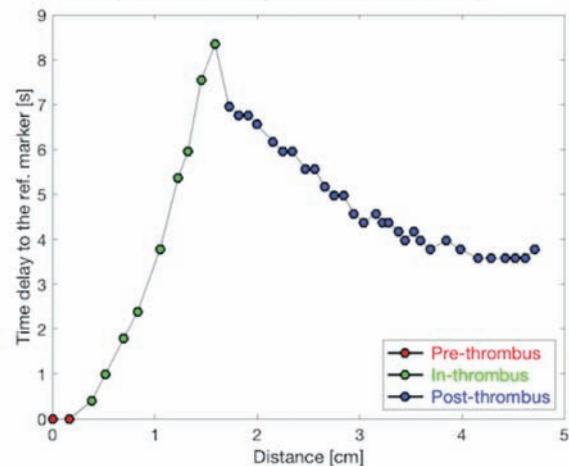
**Methods:** The dynamic attenuation of contrast intensity proximal to, within and distal to the thrombus, within the artery, was measured. We identified cases with antegrade and retrograde flow by comparing the time delay between TACs. Additionally, using TACs, we computed transit time and flow velocity within the thrombus. Contrast concentration was assessed by computing the area under the TAC.

**Results:** Analysis of 46 patients from the DUST trial and the Amsterdam UMC showed that 16 patients had anterograde flow and 10 patients had retrograde flow. In 5 patients, a combination of both flows was observed. The remaining 15 patients had an unclear flow pattern. Velocities in the thrombus ranged from 0 to 2 cm/s.

a) Time Attenuation Curves (TACs)



b) Flow direction - the positive and negative slopes reflect antegrade and retrograde flow, respectively.



**Conclusions:** Flow in the vicinity of thrombi differs significantly between patients. This finding could be of value in treatment decisions with regard to the use of IV-rtPA.

**Trial registration number:** N/A

## AS10-016

### CT PERFUSION AND E-ASPECTS AUTOMATED NONCONTRACT CT ISCHEMIC CORE VOLUMES: CORRELATIONS AND CLINICAL OUTCOME PREDICTION

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**Background and Aims:** The e-ASPECTS software (Brainomix, Oxford, UK) is a tool designed for the automated quantification of ASPECTS and ischemic core volumes on Non-Contrast CT (NCCT). We sought to compare the measurement of infarct volume and the clinical outcome prediction across NCCT e-ASPECTS versus RAPID (IschemiaView, Menlo Park, CA) CT perfusion measurements.

**Methods:** We reviewed our prospectively collected endovascular database at a tertiary care center between 9/2010- 11/2018. All patients with anterior circulation LVOS, available RAPID CTP maps, baseline NCCT Brainomix e-ASPECTS volumes and FIV, who achieved successful reperfusion (TICI 2c-3) were included.

**Results:** 479 patients met inclusion criteria. Median age was 67[59-76], median e-ASPECTS and CTP volumes were 31.4[17.2-49.6] and 2.7[0-13] respectively whereas median FIV was 22.5[9-54.6]. The correlation between e-ASPECTS and CTP ischemic core volumes was moderate ( $R=0.44$ ,  $p < 0.001$ ). Similarly, moderate correlations were observed between e-ASPECTS ischemic core and FIV ( $R=0.52$ ,  $p < 0.001$ ) and CTP core and FIV( $R=0.43$ ,  $p < 0.001$ ). Subgroup analysis showed that e-ASPECTS and CTP performance was similar in the early and late treatment ( $>6H$ ) windows. Multivariate analysis showed that both e-ASPECTS ischemic core volume (adjusted OR 0.983 95%CI[0.972-0.994,  $p = 0.002$ ] and CTP core volume (adjusted OR 0.985 95%CI [0.973-0.997],  $p = 0.015$ ) were independently and comparably associated with 90-day good outcome (mRS 0-2).

**Conclusions:** NCCT e-ASPECTS ischemic core volumes performed similarly to RAPID CTP core volume in estimating FIV and independently predicting 90-day functional outcomes. This could represent a great substitute in centers where access to advanced imaging is limited and make endovascular therapy available to a wider patient population.

**Trial registration number:** N/A

## AS10-054

### COLLATERAL GRADES OF THE WILLIS' CIRCLE PREDICTS CLINICAL OUTCOMES IN ACUTE INTRACRANIAL CAROTID ARTERY OCCLUSION BEFORE THROMBECTOMY

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**Background and Aims:** Endovascular mechanical thrombectomy (EMT) promised acute ischemic stroke (AIS) with proximal artery occlusion significant but variable improvement of outcomes. We investigated the clinical outcome of EVMT in intracranial carotid artery occlusion (ICAO) and predictors of a favorable outcome.

**Methods:** A total of 38 EVMTs of ICAO were analyzed. Primary collateral grades (PCG) based on the integrity of Willis' Circle was established to categorize the patients.(Figure 1) Favorable outcome as a modified Rankin scale (mRS)  $\leq 2$  at 90 days was the primary endpoint. The

influence of the following variables on outcome were investigated: demographics characteristics, vascular risk factors, severity of stroke, procedural of EVMT and PCG.

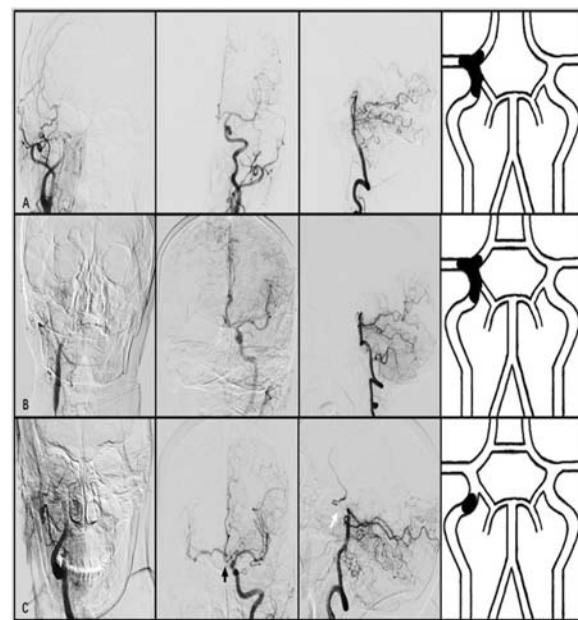


Figure 1. row A - PCG1, anterior communicating artery (AcoA) was absent, no matter ipsilateral posterior communicating artery (ipCoA) preserved or not; row B - PCG2, preserved AcoA with ipCoA absent; row C - PCG3, both AcoA and ipCoA preserved. Black arrow - AcoA, white arrow - ipCoA.

**Results:** The favorable clinical outcome at 90 days rated 31.6% (12/38). The rate of successful reperfusion i.e. modified thrombolysis in cerebral infarction (mTICI)  $\geq 2b$  was 65.8% (25 in 38). PCG was shown to be associated with clinical outcomes as 61.5% patients with PCG 3 achieved mRS  $\leq 2$  at 90 days, while this percentage was only 37.5% and 5.6% in patients with PCG 2 and PCG 1, respectively.

**Conclusions:** PCG based on the integrity of Willis' Circle had strong power to predict prognosis of AIS patients with ICAO in EVMT, favorable functional outcome favored in patients who preserved both Anterior Communicating Artery (AcoA) and ipsilateral Posterior Communicating Artery (PcoA).

**Trial registration number:** N/A

## AS10-004

### MRI-GUIDED THROMBOLYSIS FOR ISCHEMIC STROKE WITH TIME OF ONSET BEYOND 4.5 HOURS

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**Background and Aims:** We evaluate the efficacy and safety of intra-venous thrombolysis for acute ischemic stroke (AIS) patients with time of onset beyond 4.5 hours under the guidance of Multi-mode MRI.

**Methods:** A total of 433 AIS patients enrolled from July 2008 to April 2018. Acute Multi-mode MRI (DWI-T2WI mismatch) and standard dose of rt-PA was used to all patients. We divided patients into 2 groups: standard time window group (time of onset to treatment within 4.5 hours) and beyond time window group (onset to treatment time beyond 4.5 hours). Chi-square test was used to estimate the favorable outcome (modified Rankin Scale score  $\leq 1$ ), symptomatic intracranial

hemorrhage (SICH) and all-cause mortality at 90 days. Logistic regression models were used to detect predictors associated with favorable outcome in standard and beyond time window group.

**Results:** There are 286 patients in standard time window group and 147 patients in beyond time window group (4.5-12.0 hours). The favorable outcome (78.7% VS 76.9%,  $P = 0.668$ ), SICH (2.1% VS 2.0%,  $P = 1.000$ ) and all-cause mortality (0.7 % VS 1.4 %,  $P = 0.496$ ) were similar in standard and beyond time window group. Lower baseline fasting blood glucose ( $OR = 0.81$ , 95%CI 0.70-0.95) and baseline NIHSS score ( $OR = 0.79$ , 95%CI 0.73-0.85) were independent associated with favorable outcome in standard time window group. Lower baseline NIHSS score ( $OR = 0.78$ , 95%CI 0.68-0.88) was significant associated with favorable outcome in beyond time window group.

**Conclusions:** In patients with acute ischemic stroke with time window beyond 4.5 hours, intravenous alteplase guided by Multi-mode MRI was efficacy and safety.

**Trial registration number:** N/A

## AS10-022

### WHAT IS THE 'OPTIMAL' TARGET MISMATCH CLASSIFICATION FOR ACUTE ISCHEMIC STROKE?

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**Background and Aims:** To compare Perfusion Imaging Mismatch (PIM) and Clinical Core Mismatch (CCM) in ischemic stroke patients to identify the effect of these criteria on selected patient population characteristic and clinical outcomes.

**Methods:** Patients from INternational Stroke Perfusion Imaging Registry (INSPIRE) who received reperfusion therapy, had pre-treatment multimodal CT, 24-hour imaging were analysed. Patients were divided into 3 cohorts: endovascular thrombectomy (EVT), intravenous thrombolysis alone with large vessel occlusion (IVT-LVO), and intravenous thrombolysis without LVO (IVT-nonLVO). Patients were classified using 6 mismatch classifications: PIM- using 3 different measures to define perfusion lesion [Delay Time (DT), Tmax, or Mean Transit Time]; or CCM- mismatch between age-adjusted National Institutes of Health Stroke Scale and CTP core (defined as cerebral blood flow < 30% within the perfusion lesion defined in 3ways as above). We assessed eligibility rate for each mismatch classification and its ability to identify patients likely to respond to treatment.

**Results:** There were 994 patients eligible. PIM-DT had highest inclusion rate for both EVT (82.7%) and IVT-LVO (79.5%) cohorts. In EVT cohort, patients meeting PIM-DT classification, reperfusion was strongly associated

with achieving excellent outcome at day-90 (mRS 0-1, OR 4.75,  $P = 0.002$ ); there was no such association between reperfusion and excellent outcome in any of other PIM or CCM classifications (all  $p>0.05$ ). In IVT-LVO cohort, 54.8% of PIM-DT+ve patients achieved excellent outcome compared with 26.9% in non-mismatch patients following reperfusion ( $P = 0.027$ ).

**Conclusions:** PIM-DT was the best mismatch classification in large vessel occlusion patients, combining a high eligibility rate with better clinical response to reperfusion.

**Trial registration number:** N/A

## AS10-053

### INVESTIGATION OF EARLY REPERFUSION INJURY IN ANTERIOR CIRCULATION ISCHEMIC STROKE

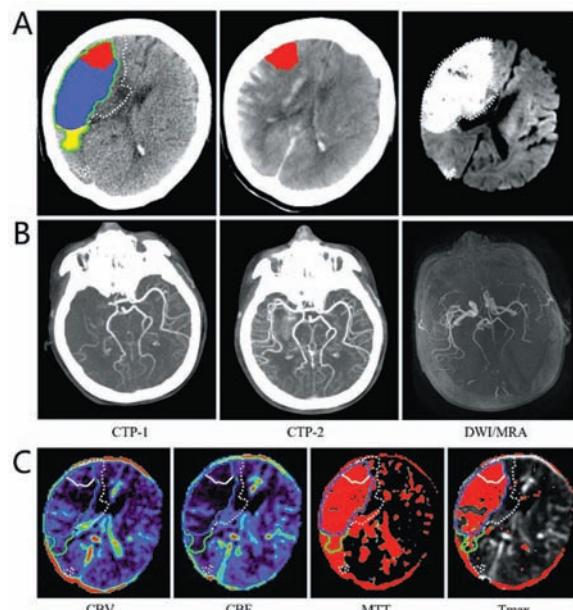
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**Background and Aims:** Early reperfusion therapy is an effective way to improve outcome of acute ischemic stroke (AIS) patients, yet it may result in secondary injury in reperfused cerebral tissue. We therefore investigated the relationship between dynamic changes of perfusion status and subsequent cerebral tissue injury in AIS patients receiving reperfusion therapy, in order to establish an imaging method for evaluating reperfusion injury and its clinical significance.

**Methods:** We performed a retrospective analysis of prospective collected data from consecutive AIS patients with anterior circulation artery occlusion who received reperfusion therapy. Patients underwent CTP at admission and immediately after therapy. Tmax > 6s was applied for the volumetric measurement of hypoperfusion areas. Reperfusion injury was defined as injury (infarct or hemorrhage) at 24h within the reperfusion region. Binary logistic analysis was used to analyze the association between degree of reperfusion injury (volume ratio of reperfusion injury region and reperfusion region) and the neurological outcome.

**Results:** A total of 77 patients were included in our study. Within the reperfusion region, 24.7% (IQR 5.6-64.1%) suffered reperfusion injury, with a reperfusion injury volume of 19.2 (IQR 3.5-53.4) ml. The cut-off point of baseline CBV for reperfusion injury was 15.32 ml/1000g (area under the curve, 0.843; 95% CI, 0.778-0.908), and this yielded a sensitivity of 71.4% and a specificity of 86.8%. The degree of reperfusion injury could independently predict poor outcome (OR, 1.459 per 10%; 95% CI, 1.141-1.865;  $P = 0.003$ ).



**Conclusions:** We established a quantitative imaging method for evaluating the reperfusion injury, and demonstrated its association with neurological outcome.

**Trial registration number:** N/A

## AS10-055

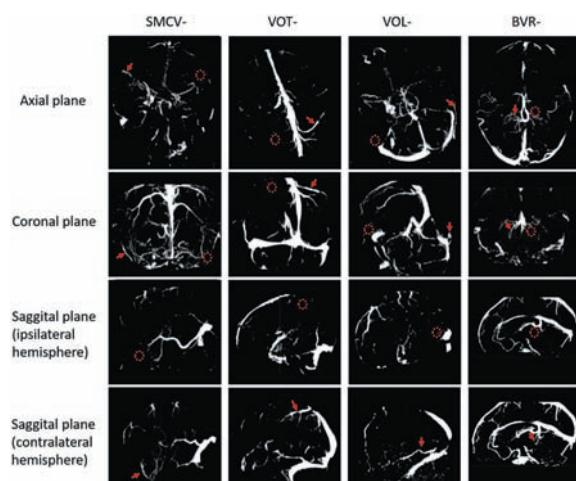
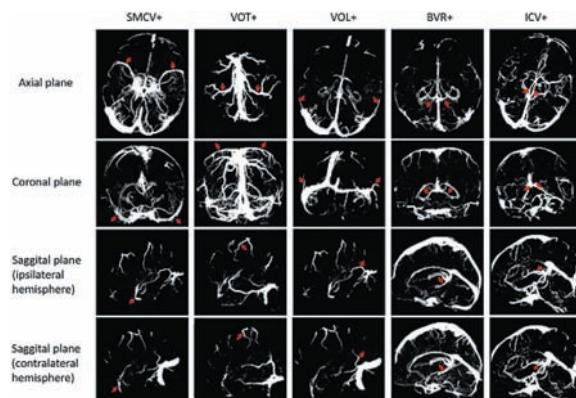
### INSUFFICIENT IPSILATERAL CEREBRAL VENOUS DRAINAGE IS ASSOCIATED WITH EARLY PERIHEMATOMAL EDEMA IN ACUTE INTRACEREBRAL HEMORRHAGE

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**Background and Aims:** Perihematomal edema (PHE) growth was correlated with poor outcome of intracerebral hemorrhage (ICH). To explore the relationship between insufficient ipsilateral cerebral venous drainage and the development of PHE and functional outcome in acute intracerebral hemorrhage (ICH) patients.

**Methods:** We retrospectively reviewed our prospectively collected database for patients with acute spontaneous supratentorial ICH and analyzed patients who underwent baseline computed tomographic perfusion (CTP) within 6 hours of onset and non-contrast CT at 24 hours. Absence filling of  $\geq 1$  of ipsilateral superficial middle cerebral vein, vein of Trolard, vein of Labbé, basal vein of Rosenthal and internal cerebral vein, evaluated on venous maps generated from baseline CTP (Figure 1 and 2), was identified as absent ipsilateral venous filling (AIVF). rPHE was calculated as the ratio of PHE volume to hematoma volume on follow-up CT.



**Results:** A total of 138 patients were included. Median absolute PHE volume on follow-up CT was 3.5 (1.0-9.3) ml and rPHE was 24.3 (9.0-49.4) %. AIVF was observed in 38 (27.5%) patients. Multivariate analysis showed AIVF was independently associated with large rPHE at 24 hours (OR 4.032, 95% CI 1.739-9.347,  $P < 0.001$ ). And Large PHE volume was independently associated with poor outcome (OR 1.109, 95% CI 1.009-1.218,  $P = 0.031$ ).

**Conclusions:** AIVF was observed in about 1/3 of acute ICH patients, which might be attributed to hypoperfusion after ICH and was strongly related to the development of PHE. Identification of cerebral venous filling status might be a promising image marker for PHE and potential therapeutic target in ICH.

**Trial registration number:** N/A

## WITHDRAWN

## AS10-064

### CT PERFUSION CHANGES WITHOUT ARTERIAL OCCLUSION IN ACUTE NEUROLOGICAL DEFICITS

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**Background and Aims:** Perfusion CT (pCT) has become established in most stroke centres as a critical imaging tool to differentiate penumbra

brain tissue from the infarct core. However, in the absence of arterial occlusion, interpretation of pCT may be challenging.

**Methods:** Retrospective, observational study analyzing patients admitted with acute neurological deficits (<24h) and pCT changes, without arterial occlusion, in our tertiary hospital (2017–2018). Patients were classified depending on pCT findings as hyperperfusion or hypoperfusion and clinical variables were analyzed.

**Results:** 53 patients were included, 7 with hyperperfusion and 46 with hypoperfusion, without significant differences in age or sex between groups. In patients hyperperfusion group, mean baseline NIHSS was  $6 \pm 5.6$ , and one patient received alteplase. NIHSS at discharge was  $1 \pm 1.7$ , and median mRS at 3 months was 0 (0–1). Two (28.6%) patients had a final diagnosis of stroke and 5 (71.4%) of seizures. In hypoperfusion group, mean NIHSS was  $4.9 \pm 4.9$ , and 15 (32.6%) patients received alteplase. No symptomatic bleeding was reported. Two patients experienced worsening of their symptoms (NIHSS>4). NIHSS on discharge was  $1.3 \pm 2.7$ , and median mRS at 3 months was 0 (0–4). Stroke was the final diagnosis in 39 (84.7%) patients, while migraine was in seven (15.2%).

**Conclusions:** In our experience, most patients with acute neurologic deficit without arterial occlusion and CTp changes had a good clinical outcome at 90 days, although a trend towards worse prognosis in hypoperfusion group was observed. Alteplase was safe in cases of hypoperfusion without vascular occlusion. CTp may be helpful differentiating stroke mimics (including seizures or migraine).

**Trial registration number:** N/A

## AS10-068

### CLOT DENSITY AND BURDEN ON ADMISSION CT AND CTA SCANS AND RECANALIZATION GRADE IN MECHANICAL THROMBECTOMY

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**Background and Aims:** Ischemic stroke (IS) is one of the major causes of death and disability and it is known that earlier recanalization leads to better outcomes.

In some patients more passages of the device are needed in order to open the vessel, despite the same technique and material.

We aimed to find if clot density/burden on the admission CT/CTA scans could predict recanalization.

**Methods:** Two-hundred consecutive patients with anterior circulation acute IS that underwent Mechanical Thrombectomy (MT) were reviewed and cardiovascular risk factors assessed.

Thrombus absolute and relative density on the admission CT scan were measured and the clot burden, using the Clot burden score (CBS), calculated.

Correlation between these factors and recanalization grade (TICI score) was determined.

**Results:** A correlation between higher absolute/relative density values of the clot and higher CBS and better recanalization grades was found.

**Conclusions:** Failure of recanalization during MT was related to thrombus characteristics (lower density and high burden) which may be related to its composition (fibrin vs red blood cells).

These measurements could be used in decision making in endovascular treatment approaches.

A study correlation between histology/density/size of thrombus is ongoing.

**Trial registration number:** N/A

## AS10-037

### REAL WORLD AVAILABILITY AND UTILIZATION OF CT PERfusion IN ACUTE ISCHEMIC STROKE

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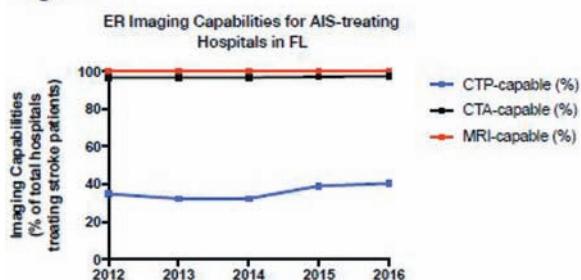
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**Background and Aims:** With the success of endovascular stroke therapy (EST), eligible acute ischemic stroke (AIS) patients must be appropriately screened. The real-world utilization and availability of CT Perfusion (CTP) is unknown.

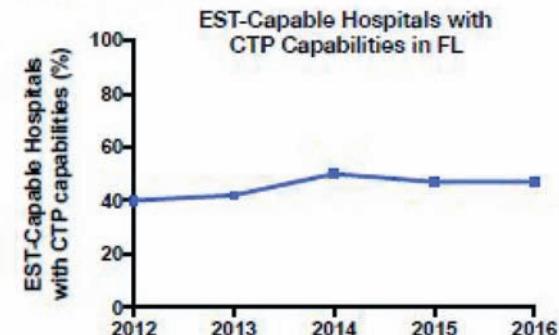
**Methods:** Patients with AIS were identified by validated diagnosis codes from all discharges from hospitals and Emergency Rooms (ERs) in Florida (FL, 2012 – 2016) and New York (NY, 2012–2014). The primary endpoint was ER imaging utilization, defined by corresponding billing codes. CTP or EST-capable hospitals were defined as those performing at least one CTP or EST in the corresponding calendar year.

**Results:** In the FL cohort, among 226,051 admissions for stroke at 285 hospitals, 14,920 (7%) received IV tPA and 3,026 (1.3%) received EST. Nearly all strokes were treated at CTA and MRI-capable ERs, but 139,316 (62%) were treated at non-CTP-capable hospitals (Figure 1). 28 (60%) of EST-capable hospitals were not CTP-capable, a trend that did not change over the study period (Figure 2). In the NY cohort, among 91,193 admissions for stroke at 225 hospitals, 71,333 (78%) were evaluated at non-CTP-capable centers. 30 (13%) of hospitals treating AIS patients were CTP-capable. CTP-capable centers were concentrated in urban areas, with significant annual stroke rates in non-urban areas without CTP (Figure 3).

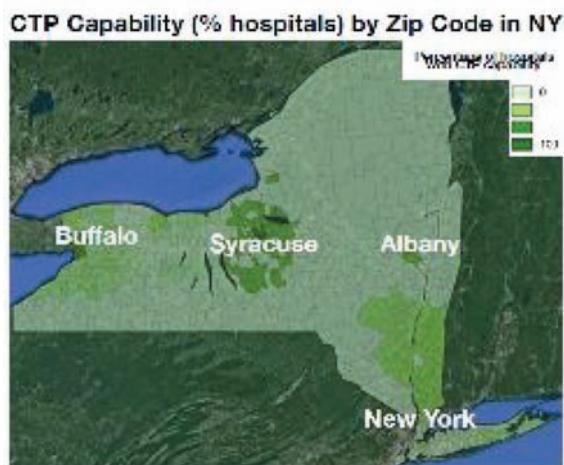
**Figure 1.**



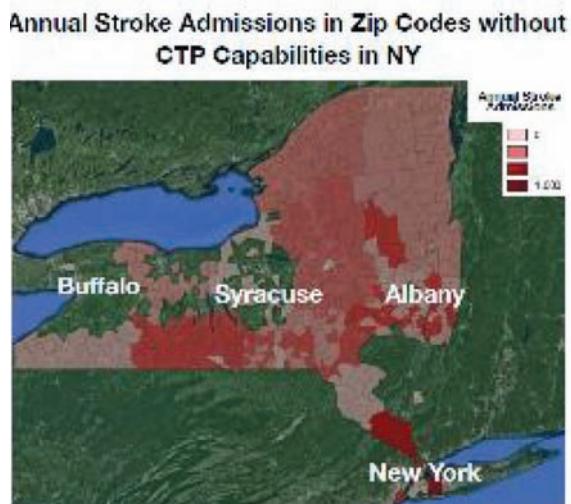
**Figure 2.**



## Figure 3a.



## Figure 3b.



**Conclusions:** In this large cohort study, the majority of AIS patients and ERs treating AIS did not have access to CTP; a finding that did not immediately increase following 2015 trials. The use and role of CTP may still be limited as a screening tool for EST.

Trial registration number: N/A

### AS10-038

#### ASSOCIATION OF AUTOMATED ASPECTS AND ISCHEMIC CORE VOLUME OF ANTERIOR CIRCULATION LARGE VESSEL OCCLUSION STROKE WITHIN 24-HOURS OF ONSET

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**Background and Aims:** Computed tomography (CT) and angiography play an important role in selecting large vessel occlusion (LVO) patients

for endovascular thrombectomy (ET). Addition of CT perfusion (CTP) or MRI is recommended per 2018 AHA guidelines for ET patient selection >6 hours from stroke onset but can delay time to reperfusion. We studied the association between automated CT ASPECTS and ischemic core volume in different subgroups.

**Methods:** Single-center retrospective review of all anterior circulation LVO patients who underwent advanced imaging within 24 hours of stroke onset between November 2014 and February 2017. We studied the distribution of automated ASPECTS (Brainomix) in relationship to ischemic core volume (RAPID; iSchemaView) across time of patient presentation.

**Results:** Of 124 patients meeting study criteria, 38% (47) had CTP and 62% (77) had MRI. 43% (53) of patients had core imaging within 6 hours of stroke onset. In the < 6 hours cohort, for ASPECTS bins 0–3, 4–6, and 7–10, median core volumes (IQR) were 99 (87–119), 95 (82–117), and 9.5 (0–40), respectively; ANOVA ( $F_{2,50} = 8.1$ ,  $p < 0.001$ ). In the 6–24 hours cohort, for ASPECTS bins 0–3, 4–6, and 7–10, median core volumes were 148 (115–211), 81 (32–99), and 8 (0–23), respectively; ANOVA ( $F_{2,68} = 21.4$ ,  $p < 0.001$ ). 91% of patients with ASPECTS 7–10 in 6–24 hour cohort had core < 70 ml (41 of 45 patients).

**Conclusions:** Automated ASPECTS quantification of non-contrast CT showed a moderate relationship with advanced imaging core volume. This would support a simplified imaging paradigm for optimal patient selection for ET.

Trial registration number: N/A

### AS10-060

#### IMPACT OF INFARCT TOPOLOGY ON OUTCOMES AFTER ACUTE ISCHEMIC STROKE DUE LARGE VESSEL OCCLUSION

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**Background and Aims:** Ischemic core volume is a well-established predictor of outcomes after acute ischemic stroke (AIS) caused by anterior circulation large vessel occlusion (ACLVO). Data regarding the impact of topology of infarcted brain tissue on outcomes are limited. We aim to study the impact of infarct topology on functional outcomes and early mortality after AIS.

**Methods:** Single-center retrospective review of ACLVO patients who presented within 24 hours of stroke onset (November 2014–February 2017). Topology distribution was defined using ASPECTS locations, classified as deep (caudate, internal capsule, insula, lentiform nucleus), M1–M3 and M4–M6. Proportional contributions toward stroke burden were calculated. Impact of ASPECTS distribution (e-ASPECTS; Brainomix) on mortality and functional outcome was investigated using regression analyses.

**Results:** 124 patients met study criteria. Mean age and ASPECTS were  $70.1 \pm 16$  years and  $7.5 \pm 2.3$ . 56% (70) received endovascular thrombectomy (ET) and 37% (35) achieved an mRS 0–2 at 90-days. 21% (26) and 38% (47) died within 14 and 90-days. Multivariable regression using age, sex, NIHSS, stroke laterality, total ASPECTS, ASPECTS-based topology and ET identified older age ( $p = 0.003$ ), left-side stroke ( $p = 0.01$ ), higher NIHSS ( $p = < 0.001$ ), absence of ET ( $p = < 0.001$ ) and lower proportion of M1–M3 involvement ( $p = 0.01$ ) as predictors of 14-day mortality. Higher proportion of M1–M3 involvement ( $p = 0.02$ , driven by M2  $p = 0.01$ ), younger age ( $p = < 0.001$ ) and ET ( $p = 0.003$ ) independently predicted favorable 90-day mRS.

**Conclusions:** Greater proportionate involvement of potentially clinically silent regions (M2) toward stroke burden is significantly associated with

mRS 0–2 at 90 days and reduced mortality after AIS. Further investigation to identify infarct topology-based markers of prognosis is warranted.

**Trial registration number:** N/A

## AS10-046

### INFLUENCE OF RECONSTRUCTION KERNEL AND SLICE THICKNESS ON AUTOMATED ASPECTS PERFORMANCE FOR DETECTION OF EARLY ISCHEMIC CHANGES ON NON-CONTRAST BRAIN COMPUTED TOMOGRAPHY SCANS

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**Background and Aims:** With the Alberta Stroke Program Early Computed Tomography Score (ASPECTS), 10 brain-regions are dichotomously scored on presence of ischemic stroke damage. Considerable variability in CT-scanner parameter settings is seen in clinical practice. Optimized parameters could improve the performance of ASPECTS software. We evaluated the influence of CT-scan parameter settings on computed ASPECTS (c-ASPECTS 2.0.1, Frontier, Siemens Healthineers, Forchheim, Germany).

**Methods:** Prospectively, patients with acute stroke symptoms received a Non Contrast CT-scan (Siemens Somatom Definition Edge). Thirty consecutive patients with middle cerebral artery (MCA) occlusion were included. c-ASPECTS were assessed in images with different Siemens CT reconstruction kernels (J30s/J37s/J40s and H20s/H30s/H31s) and slice thicknesses (2.0–5.0 mm). Ground truth ASPECTS was provided by an expert with unrestricted data access. Scans (J40s: 5.0 mm and J30s: 2.0 mm) were evaluated by four readers for ASPECTS. For every combination of parameters, we calculated the agreement of ground truth with c-ASPECTS and c-ASPECTS regions, respectively. Agreement of c-ASPECTS across all parameter combinations was assessed. Correlation of ground truth with readers and c-ASPECTS was calculated.

**Results:** Comparison of ground truth with c-ASPECTS and c-ASPECTS regions across all parameter combinations shows ICC's of 0.421–0.609 and agreement of 0.80–0.82, respectively. No significant differences were found between images reconstructed with different kernels or slice thicknesses. Agreement of c-ASPECTS across all parameter combinations shows an ICC of 0.936. Comparison of ground truth with readers and c-ASPECTS resulted in comparable correlations (ICC's of 0.541–0.811 and 0.519, respectively).

**Conclusions:** Reconstruction kernels and slice thicknesses do not significantly affect the performance of c-ASPECTS.

**Trial registration number:** N/A

## AS10-024

### DIFFUSION-WEIGHTED-IMAGING INFARCT VOLUME MEASUREMENT TOOLS SHOW DISCREPANCIES LEADING TO DIVERGING THROMBECTOMY DECISIONS

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**Background and Aims:** Recent clinical trials demonstrated the benefit of thrombectomy beyond 6 hours based on the automated measurement of infarct volume exclusively with the RAPID® software. We aimed to compare nine tools commonly used for the measurement of infarct volume and see whether they would lead to similar thrombectomy decisions based on the Diffusion-weighted-imaging or computerized-tomography-perfusion Assessment with clinical mismatch in the triage of Wake-up and late-presenting strokes undergoing Neurointervention with Trevo (DAWN) trial imaging inclusion criteria.

**Methods:** The diffusion-weighted-imaging (DWI) infarct volume of 36 patients was measured with 3 automated tools (including RAPID®) and 6 non-automated tools. The agreement for the measurements of DWI infarct volume and the resulting thrombectomy decisions were assessed with intraclass correlation coefficient (ICC) and Fleiss' Kappa (K) statistics.

**Results:** The correlation for the measurement of DWI infarct volume between all 9 tools was excellent (ICC>0.8). After dichotomization, agreement was substantial for any of the cut-point used in DAWN trial. Discrepancies involving at least one of the tools for thrombectomy decisions based on DAWN criteria occurred in more than 35% of cases. Compared with RAPID®, the use of any other tool for treatment decision based on DAWN criteria would have led to contradictory decisions in 6% to 19% of cases.

**Conclusions:** There are several currently available tools for the measurement of DWI infarct volume with excellent correlation. Despite the high agreement demonstrated in our study, frequent discrepancies between measurements in some dichotomized configurations led to frequent diverging thrombectomy decisions when applying DAWN criteria.

**Trial registration number:** N/A

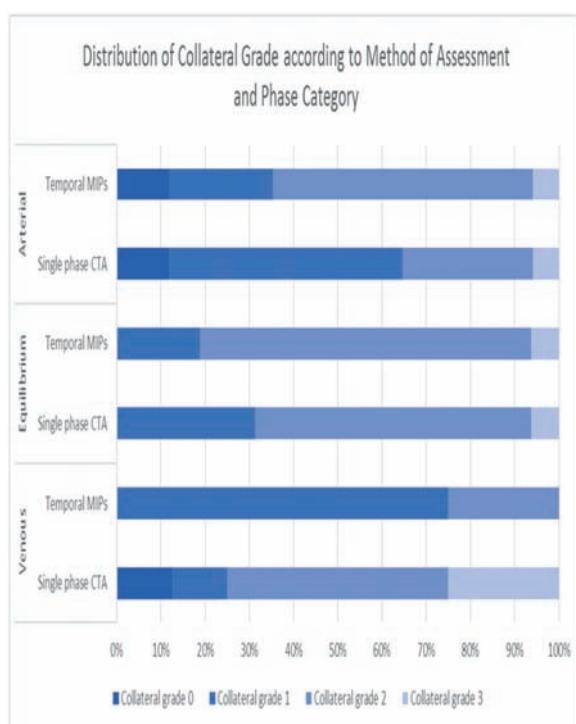
**AS10-044****AGREEMENT OF COLLATERAL GRADE SCORING BETWEEN SINGLE PHASE CT ANGIOGRAPHY (CTA) AND TEMPORAL MAXIMUM INTENSITY PROJECTIONS (MIPs)****S.Y. Foo<sup>1</sup>, M. Guarisco<sup>2</sup>, A. Sitaram<sup>2</sup> and K. Muir<sup>2</sup>**<sup>1</sup>Institute of Neurological Sciences, Neuroradiology, Glasgow, United Kingdom; <sup>2</sup>Imaging Centre of Excellence- University of Glasgow, Centre for Stroke and Brain Imaging Research, Glasgow, United Kingdom

**Background and Aims:** Single phase CT angiography (CTA) is widely available in acute ischaemic stroke (AIS) but phase of acquisition may affect collateral status determination. We aimed to compare collateral scoring between single phase CTA and multi-phase CTA created from temporal maximal intensity projections (MIPs) derived from CT perfusion (CTP) scans.

**Methods:** From a database of acute stroke patients imaged <6h after onset with both CTA and CTP, we selected cases with CTA-confirmed ICA or MI occlusions and retrograde collateral flow. Phase of CTA (arterial, equilibrium or venous) was determined for single phase CTA. MIPs were derived from CTP 4D-angiography. Collateral quality was scored independently by two readers using the method of Tan et al. Discrepancies were resolved by discussion.

We compared collateral grades on these two methods using Chi squared tests.

**Results:** Forty-one proximal occlusions with retrograde collateral flow were included. Patients had a mean age of 73.7 years and median admission NIHSS of 16. Single phase CTAs were categorised as arterial (n=17), equilibrium (n=16), or venous (n=8). Agreement of collateral grading between single phase CTA and temporal MIPs was fair for arterial and venous phase CTAs (Cohen's kappa (K) 0.242 and 0.2 respectively) and moderate for the equilibrium phase (K=0.673). Interobserver agreement for assessment of collateral grades on temporal MIPs was fair (K = 0.218, 0.346 and 0.31 for arterial, equilibrium and venous phases respectively).



**Conclusions:** Single phase CTA has moderate agreement with MIPs in the equilibrium phase, but only fair agreement for arterial or venous phases. Observer agreement for collaterals is fair.

**Trial registration number:** N/A

**AS10-045****TIMING OF COLLATERAL ENHANCEMENT IS ASSOCIATED WITH CLINICAL OUTCOMES****S.Y. Foo<sup>1</sup>, A. Sitaram<sup>2</sup>, M. Guarisco<sup>2</sup> and K. Muir<sup>2</sup>**<sup>1</sup>Institute of Neurological Sciences, Neuroradiology, Glasgow, United Kingdom; <sup>2</sup>Imaging Centre of Excellence- University of Glasgow, Centre for Stroke and Brain Imaging Research, Glasgow, United Kingdom

**Background and Aims:** Quality of collateral perfusion is associated with prognosis in anterior circulation proximal vessel occlusion. We hypothesized that timing of maximum intravascular attenuation would offer an index of collateral quality and have prognostic utility.

**Methods:** From a database of acute stroke patients imaged <6h after onset with both CT angiography (CTA) and perfusion (CTP), we selected CTA-confirmed proximal MI or ICA occlusions with retrograde collateral flow. The time of maximum attenuation in Hounsfield Units on 4D angiographic MIPs derived from CTP was measured in collateral vessels ipsilateral to the ischaemic hemisphere and referenced to time of maximal attenuation in the contralateral proximal MI. We assessed the association of time to maximal collateral attenuation, dichotomized into (i) ≤ 4 seconds and (ii) > 4 seconds, and median NIH Stroke Scale (NIHSS) change, major NIHSS improvement (score ≤ 1 or improvement by ≥ 8 at 24h) and day 90 mRS scores using linear and binary logistic regression respectively, adjusted for thrombolytic treatment and 24-h recanalisation status.

**Results:** Maximal attenuation was ≤ 4 seconds in 18/38 subjects and > 4 seconds in 20/38. Median admission NIHSS scores were 15 and 17 respectively, p = 0.6. Time to maximal collateral attenuation was associated with median 24-h NIHSS change, (p = 0.013) with a trend towards association with major NIHSS improvement (p = 0.069). No difference between groups for day 90 mRS 0–2 (p = 0.1) or mRS 0–1 (p = 0.165).

**Conclusions:** Shorter time to maximal collateral attenuation is associated with 24 hour neurological improvement and may offer an alternative index of collateral quality suitable for prognosis prediction.

**Trial registration number:** N/A

**AS10-009****OUTCOME OF INTRAVENOUS THROMBOLYSIS IN INFARCTS OF INFRAVENTRITIONAL LOCALIZATION IN THE WAKE-UP TRIAL**

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**Background and Aims:** We investigated the efficacy and safety of MRI-guided intravenous thrombolysis in unknown onset stroke in a subgroup of patients of the WAKE-UP trial presenting with infratentorial stroke.

**Methods:** The clinical and imaging data, demographic characteristics and effect of thrombolysis on outcome were compared between patients with infra- vs supratentorial stroke. The analysis of primary and secondary endpoints as in the original WAKE-UP trial analysis was repeated in the subpopulation of infratentorial stroke patients.

**Results:** Forty-eight out of 503 WAKE-UP patients (9.5%) presented with a stroke involving the pons, the medulla oblongata, the cerebellum or the mesencephalon. Infratentorial stroke patients were younger, more often male and had lower infarct volumes and NIHSS scores at baseline than supratentorial stroke patients. The treatment response was not significantly different between these two groups (test for interaction,  $p = 0.70$ ). In patients with infratentorial stroke, favourable outcome (mRS of 0–1 at 90 days) was observed in 12 out of 22 patients (54.5%) in the alteplase group and in 13 out of 25 patients (52.0%) in the placebo group (adjusted OR, 1.38; 95% CI 0.42–4.56;  $p = 0.59$ ). The primary safety endpoint (death or mRS 4–6 at day 90) occurred in 3 patients of the alteplase group (13.6%) and 3 patients in the placebo group (12.0%);  $p = 1.00$ .

**Conclusions:** Our results show no evidence for a difference in the safety or treatment effect of MRI-guided thrombolysis in unknown onset stroke between patients with infratentorial and supratentorial infarcts. WAKE-UP was not powered for demonstrating superiority in subgroup analyses.

**Trial registration number:** NCT01525290

## AS10-051

### HYPOPERFUSION VOLUME AFTER RECANALIZATION: ACCURATE PREDICTOR OF CLINICAL AND FUNCTIONAL OUTCOME AND CORRELATION WITH DEGREE OF RECANALIZATION

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**Background and Aims:** Some patients with large vessel occlusion (LVO) who achieve successful recanalization after endovascular treatment (EVT) do not experience good clinical evolution. Cranial computed tomography perfusion (CTP) immediately after EVT may constitute an accurate predictor after recanalization

**Methods:** Consecutive patients with LVO who achieved partial recanalization (mTICI $\geq$ 2A) after EVT underwent CTP within 1 hour. CTP parameters measured by RAPID® were evaluated and its association with dramatical clinical recovery (decrease of  $\geq$ 8 points from baseline NIHSS or NIHSS 0–2, DCR) at 24 hours, functional outcome at 3 months (measured by modified Rankin score (mRs))

**Results:** Seventy-seven patients were included, median NIHSS was 18 (12–21). Recanalization grade was mTICI2A in 8 (10%); mTICI2B in 31 (40%); and mTICI3 in 38 (50%). Median 24h infarct volume was 6cc (1–

31). Forty-four (57%) patients experienced DCR. Forty-four (57%) patients achieved good functional outcome. Median volume of Tmax  $>$  6seconds was the only CTP parameter correlated with degree of recanalization: mTICI2A 79cc (52–105), mTICI2B 18cc (0–38), mTICI3 0cc (0–9) ( $p < 0.01$ ). Patients without DCR and good functional outcome ( $n = 12$ , 16%) had similar volume of Tmax  $>$  6seconds than patients with DCR and good clinical outcome ( $n = 32$ , 42%) and lower than those patients without DCR and bad functional outcome ( $n = 17$ , 22%) (19cc vs 20cc vs 58cc, respectively,  $p < 0.01$ )

**Conclusions:** Hypoperfused volume on Tmax $>$ 6s after EVT correlated with mTICI degree of recanalization and predicted good functional outcome even in patients without early DCR

**Trial registration number:** N/A

## WITHDRAWN

NEUROVASCULAR CONDITION	UTILITY OF DECT	ADVANTAGES OF DECT
Immediate status post intra-arterial therapy for Middle cerebral artery M1 occlusion	Examples – 1 <sup>st</sup> Case- Massive subarachnoid contrast extravasation and hemorrhage, separated by DECT  2 <sup>nd</sup> Case- Contrast staining confirmed and removed on DECT, confirmed on follow up non-contrast CT Head  3 <sup>rd</sup> Case – Contrast staining and intravascular contrast removed on DECT and hemorrhage excluded. Confirmed on follow up non-contrast CT Head  4 <sup>th</sup> Case – Contrast staining confirmed and removed on DECT, subsequent hemorrhagic transformation on f/u DECT  5 <sup>th</sup> Case— Both contrast straining and hemorrhage present, separated on DECT	<u>Early differentiation of contrast vs hemorrhage to initiate therapy promptly</u>

NEUROVASCULAR CONDITION	UTILITY OF DECT	ADVANTAGES OF DECT
Acute Intracerebral Hemorrhage	3 Cases- spot sign confirmed. In 2 cases, hematoma expansion noticed  4 <sup>th</sup> Case – Underlying calcification confirmed on DECT with confirmation on follow up MRI	<b>Reliable identification of spot sign</b>
Aneurysm Recurrence	Aneurysm clip and bone removed with DECT. Better visualize aneurysm recurrence on MIP sequences	<b>Bone subtraction for better visualization of vascular malformations</b>
Post cardiac catheterization s/p PEA arrest	Contrast staining and intravascular contrast confirmed and removed with DECT. Hemorrhage excluded	<b>Better differentiation of contrast vs hemorrhage in acute situations</b>
Vascular Connective Tissue Disorder involving vertebral arteries with multiple dilations and dissections	Multiple dilation and dissection better visualized with bone subtraction of cervical spine	<b>Bone subtraction for better visualization of blood vessels</b>

**Results:** DECT is found to provide consistent results after reviewing the cases and correlating with follow up imaging. DECT plays a crucial role to differential contrast vs blood in post-thrombectomy and a potential to delineate the ischemic core by better visualization in low energy DECT (HU difference). With the help of three-material decomposition algorithm, DECT is found to have great utility in many acute neurovascular conditions.

**Conclusions:** DECT is an emerging imaging tool for many neurovascular conditions. All of the newer generation CT scanners are equipped with DECT. The current understanding of DECT among stroke community is lacking. There is also a need to apply texture analysis and machine learning algorithms to further refine DECT.

**Trial registration number:** N/A

## AS10-061

### STROKE OUTCOME PREDICTION IN PATIENTS WITH MCA-MI-OCCULSIONS USING NEURAL NETWORK ALGORITHMS

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**Background and Aims:** Even with similar vascular occlusions, stroke outcome varies substantially between individuals. So far, reliable prediction parameters for stroke outcome are lacking. In this study, we aim to contribute to acute stroke decision making by developing a prediction model for stroke outcome, as assessed by the mRS at 3 months.

**Methods:** Our study population comprises 227 stroke patients treated at the Inselspital Bern with acute ischemic stroke due to MCA-MI-occlusions who received either thrombolysis, thrombectomy or a combination of both. All patients had acute MRI assessment including perfusion imaging. As predictors, we used clinical risk factors and demographic variables as well as image features from diffusion and perfusion weighted MRI. Imaging data was postprocessed using Olea and automatically segmented into 10 ROIs in a total of 7 slices. Additionally, we performed manual segmentation of the lentiform nucleus and thalamus in one slice. We applied a random forest model to select the most important predictors which we used to train different neural network models.

**Results:** Preliminary results show that a model based on baseline variables alone yields better predictions than a model based on image features alone. However, the prediction baseline model can be improved by adding image features. Age and blood flow within the affected insular region seem to drive outcome prediction. Interestingly, at the age of around 78, we observe an abrupt increase for the likelihood of a bad outcome independent of all other covariates.

**Conclusions:** In a next step, we will use deep learning methods to extract more relevant image features.

**Trial registration number:** N/A

## AS10-029

### AUTOMATIC DETECTION OF LARGE VESSEL OCCLUSION ON CTA IN ACUTE ISCHEMIC STROKE

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**Background and Aims:** Identification of large vessel occlusion (LVO) in acute ischemic stroke (AIS) using CT angiography (CTA) is a crucial step before initiating mechanical thrombectomy (MT). e-CTA (Brainomix<sup>®</sup>, Oxford, UK) is an artificial intelligence-based software for CTA analysis.

**Methods:** CTAs of 144 AIS patients were selected of which 74 had an LVO confirmed by angiography. Ground truth was defined by an experienced interventional neuroradiologist with unrestricted clinical and imaging data access. LVO location was dichotomized into proximal, i.e. ICA

terminus and proximal M1 segment (45 patients) and peripheral, i.e. distal M1 and proximal M2 segments (29 patients). CTAs were independently analyzed by e-CTA and two blinded neuroradiologists, a consultant and a resident (reader 1 & 2, respectively).

**Results:** Accuracy of e-CTA was similar to both readers: 0.88 (0.81-0.92) versus 1.00 & 0.94 (0.88-0.97) for any occlusion and 0.90 (0.84-0.94) versus 1.00 & 0.95 (0.90-0.97), for proximal LVOs. Sensitivity of e-CTA for proximal LVO was 0.91, identical to reader 2 (see table).

1.00

	Scorer	Sensitivity	Specificity	Accuracy
Any occlusion	e-CTA	0.79 (0.68-0.87)	0.97 (0.91-1.00)	0.88 (0.81-0.92)
	Reader 1	1.00	1.00	1.00
	Reader 2	0.97 (0.90-1.00)	0.90 (0.82-0.96)	0.94 (0.88-0.97)
Proximal occlusion	e-CTA	0.91 (0.79-0.98)	0.90 (0.83-0.95)	0.90 (0.84-0.94)
	Reader 1	1.00	1.00	1.00
	Reader 2	0.91 (0.79-0.98)	0.97 (0.92-0.99)	0.95 (0.90-0.97)

**Conclusions:** e-CTA shows similar performance regarding LVO detection as compared to stroke imaging experts and thereby has the potential to facilitate and accelerate decision making in AIS.

**Trial registration number:** N/A

## AS10-011

### THE BLOOD PRESSURE PARADOX IN ACUTE ISCHEMIC STROKE

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**Background and Aims:** To explore the association of post-stroke baseline blood pressure (BP) with cerebral collateral flow and functional outcome in acute ischemic patients with large vessel occlusion/stenosis.

**Methods:** Patients identified with large vessel occlusion/stenosis with baseline multimodal computed tomography, follow-up imaging, and complete clinical profiles were included. A 90-day modified Rankin Scale of 0-1 was defined as an excellent functional outcome. Cerebral collateral flow was quantified by the volume ratio of tissue within the delay time>3 seconds perfusion lesion with severely delayed contrast transit (delay time>3s/delay time>6s).

**Results:** There were 306 patients included in this study. With every increase of 10mmHg in baseline systolic blood pressure, the odds of achieving an excellent functional outcome decreased by 12% in multivariate analysis (odds ratio OR 0.88, P = 0.048). Conversely, increased baseline blood pressure was associated with better collateral flow. In subgroup analysis of patients with major reperfusion, higher blood pressure was associated with decreased infarct growth and a better clinical outcome, and vice versa in patients without reperfusion.

The association between BP, mRS 0-1, infarct volume growth and DT>3s/DT>6s ratio in subgroup analysis (multivariate-adjusted)

BP and DT>3s/DT>6s <sup>a</sup>	Patients without reperfusion (n=204) <sup>b</sup>			Patients with reperfusion(n=68) <sup>c</sup>			P for interaction <sup>d</sup>
	Coefficient	95%CI	P	Coefficient	95%CI	P	
SBP per 10mmHg <sup>e</sup>	0.03 <sup>f</sup>	0.004 — 0.057	0.02	0.08 <sup>g</sup>	0.04 — 0.12 <sup>h</sup>	<0.001 <sup>i</sup>	0.02 <sup>j</sup>
DBP per 10mmHg <sup>e</sup>	0.03 <sup>f</sup>	-0.03 — 0.05 <sup>k</sup>	0.63	0.13 <sup>l</sup>	0.05 — 0.20 <sup>m</sup>	0.001 <sup>n</sup>	<0.001 <sup>o</sup>
MAP per 10mmHg <sup>e</sup>	0.03 <sup>f</sup>	-0.01 — 0.07 <sup>p</sup>	0.13 <sup>q</sup>	0.14 <sup>r</sup>	0.07 — 0.21 <sup>s</sup>	<0.001 <sup>t</sup>	<0.001 <sup>u</sup>
BP and infarct volume growth <sup>e</sup>	Coefficient	95%CI	P	Coefficient	95%CI	P	
SBP per 10mmHg <sup>e</sup>	0.01 <sup>f</sup>	0.007 — 0.013 <sup>v</sup>	<0.001 <sup>w</sup>	0.003 <sup>x</sup>	-0.003 — 0.008	0.85 <sup>y</sup>	0.091 <sup>z</sup>
DBP per 10mmHg <sup>e</sup>	0.01 <sup>f</sup>	0.006 — 0.016 <sup>aa</sup>	<0.001 <sup>ab</sup>	-0.014 <sup>ac</sup>	-0.023 — -0.004 <sup>ad</sup>	0.01 <sup>ae</sup>	<0.001 <sup>af</sup>
MAP per 10mmHg <sup>e</sup>	0.013 <sup>f</sup>	0.009 — 0.018 <sup>ag</sup>	<0.001 <sup>ah</sup>	-0.005 <sup>ai</sup>	-0.01 — -0.004 <sup>aj</sup>	0.26 <sup>ak</sup>	<0.001 <sup>al</sup>
BP and mRS 0-1 <sup>e</sup>	OR	95%CI	P	OR	95%CI	P	
SBP per 10mmHg <sup>e</sup>	0.84 <sup>f</sup>	0.72 — 0.99 <sup>am</sup>	0.03	0.95 <sup>an</sup>	0.71 — 1.29 <sup>ao</sup>	0.76 <sup>ap</sup>	0.30 <sup>aq</sup>
DBP per 10mmHg <sup>e</sup>	0.83 <sup>f</sup>	0.65 — 1.06 <sup>ar</sup>	0.14 <sup>as</sup>	1.78 <sup>at</sup>	1.004 — 3.15 <sup>au</sup>	0.048 <sup>av</sup>	0.04 <sup>aw</sup>
MAP per 10mmHg <sup>e</sup>	0.80 <sup>f</sup>	0.63 — 1.00 <sup>av</sup>	0.05 <sup>aw</sup>	1.38 <sup>ay</sup>	0.82 — 2.36 <sup>az</sup>	0.23 <sup>ba</sup>	0.052 <sup>bc</sup>

For patients without reperfusion, higher BP was associated with better collateral flow, but increased infarct volume growth, and decreased odds of mRS 0-1. <sup>d</sup>

For patients with reperfusion, higher BP was associated with better collateral flow, decreased infarct volume growth and increased odds of mRS 0-1. <sup>d</sup>

<sup>a</sup> Multivariate-adjusted for age, sex, baseline NIHSS, baseline glucose, history of hypertension, prior stroke, taking antiplatelet before admission, cause of stroke.<sup>b</sup>

<sup>c</sup> Adjusted for age, sex, baseline NIHSS, baseline glucose, history of hypertension, endovascular treatment, occlusion/stenosis of ICA/M1, baseline ischemic core volume, baseline ischemic penumbra volume, MRI vs NCCT.<sup>d</sup>

<sup>e</sup> Adjusted for age, sex, baseline NIHSS, history of hypertension, prior stroke, taking antiplatelet before admission, reperfusion therapy, ischemic core volume, PH2.<sup>f</sup>

Abbreviations: BP blood pressure; SBP systolic blood pressure; DBP diastolic blood pressure; MAP mean arterial pressure; DT delay time; mRS modified Rankin Scale; NIHSS National Institutes of Health Stroke Scale; ICA internal carotid artery; M1 M1 segment of middle cerebral artery; PH2 parenchymal hematoma type 2, NCCT Non-Contrast Computed Tomography, MRI Magnetic Resonance Imaging.<sup>g</sup>

**Conclusions:** Higher baseline blood pressure in acute ischemic stroke patients with large vessel occlusion/stenosis was associated with better collateral flow. However, for patients without reperfusion, higher baseline blood pressure was associated with increased infarct growth, leading to an unfavorable clinical outcome. The relationship between blood pressure and outcomes is highly dependent on reperfusion and active blood pressure lowering treatment may be inappropriate in acute ischemic stroke patients prior to reperfusion treatment.

**Trial registration number:** N/A

## AS10-023

### GLOBAL CEREBRAL INFARCTION DUE TO ACUTE CARDIOEMBOLIC ANTERIOR & POSTERIOR CIRCULATION OCCLUSION

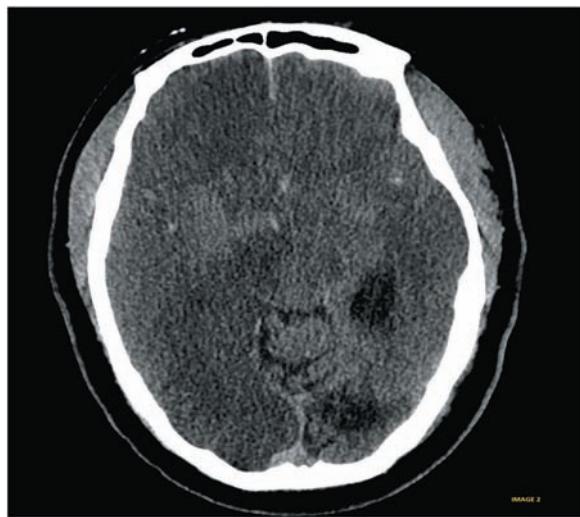
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**Background and Aims:** Acute, simultaneous occlusion involving the bilateral major arteries of the anterior and posterior cerebral circulation is extremely rare. According to available data, bilateral ICA occlusions can occur at a frequency of < 0.27% of all acute ischemic strokes, however concurrent basilar or PCA occlusion has only been once before reported in the literature. Such strokes clinically, can often be misleading in the initial stages, leading to delays in initiating appropriate management.

**Methods:** Case report of a patient with global cerebral infarction following acute occlusion of major arteries of the cerebral circulation.

**Results:** A 67-year-old man with known history of congenital hypertrophic cardiomyopathy and atrial fibrillation on warfarin was brought to the ED after being found unresponsive and comatose. His GCS on arrival was 3 with a sub-therapeutic INR of 1.5. CT head without contrast showed symmetric hyperdensity of the bilateral supraclinoid ICAs and the basilar artery (image 1). His CTA head and neck confirmed the findings of absence of flow in these arteries. As patient was about 5 hours from the LKW at the time of his arrival to the ED, IV tPA was deferred. Mechanical thrombectomy was attempted with futility due to extensive clot burden. Post-operatively, patient had progressive loss of brainstem reflexes and global cerebral infarction was observed on repeat imaging (image 2).



**Conclusions:** Cardioembolism can have devastating consequences and in rare situations, cause global infarction from an acute occlusion of all major cerebral vessels. Ideal management in such cases is still unclear and prognosis remains exceedingly poor.

**Trial registration number:** N/A

## AS10-057

### THROMBUS PERVERIOUSNESS IN ACUTE ISCHEMIC STROKE: A SYSTEMATIC REVIEW.

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**Background and Aims:** Thrombus perviousness estimates residual flow through a clot combining non-contrast CT and CTA images. Perviousness was reported to reflect thrombus histopathology, and may be associated with response to stroke treatment. We aimed to

summarize the available evidence on thrombus perviousness in relation to functional outcome after intravenous thrombolysis (IVT) and/or endovascular treatment (EVT), in addition to its relation with other radiological thrombus characteristics.

**Methods:** Two authors systematically searched PubMed and conference abstracts, using the search terms 'thrombus', 'perviousness', 'stroke', and synonyms. We included studies on thrombus perviousness in acute ischemic stroke in humans describing  $\geq 1$  of our outcome measures of interest. Outcomes of interest were 90-day functional independence (mRS 0–2), successful recanalization, angiographic reperfusion, and association of perviousness with thrombus length and occlusion location.

**Results:** Of 252 search results, 9 studies and 2 additional conference abstracts were included, describing 2,696 patients in total. All studies describing functional outcome after IVT ( $n = 5$ ) found a significantly positive relationship between perviousness and functional independence. Three studies reporting on functional independence after EVT showed positive yet non-significant associations. Patients with pervious thrombi more often showed recanalization on first angiography run or follow-up CTA in seven studies (predominantly after IVT; statistically significant in  $n = 4$ ). Studies reporting angiographic reperfusion after EVT showed non-significant ( $n = 2$ , thrombectomy) or significantly positive effects ( $n = 1$ , intra-arterial thrombolysis). Increased perviousness corresponded to decreased clot length ( $n = 3$ ) and more distal occlusion location ( $n = 3$ ).

**Conclusions:** Patients with pervious thrombi respond better to IVT. Effect of thrombus perviousness on outcome of EVT is, as of yet, inconclusive.

**Trial registration number:** N/A

## AS10-030

### CT-PERFUSION DATA FOR ISCHEMIC STROKE EVALUATION: PITFALLS OF AUTOMATED POST-PROCESSING

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**Background and Aims:** CT-perfusion (CTP) is increasingly used to determine acute ischemic stroke (AIS) patient eligibility for endovascular thrombectomy. However, automated post-processing of the data is subject to failure. We evaluated the prevalence of automated post-processing failures and their significance for AIS patient management.

**Methods:** Consecutive AIS patients undergoing CTP for thrombectomy triage between 2012 and 2018 were included. Primary outcome was automated post-processing failure, which was defined as the presence of perfusion abnormalities that were caused by artifacts as verified on follow-up imaging that accounted for any reperfusion. Secondary outcome was inaccurate infarct core or penumbra volumes and matching that might have affected thrombectomy eligibility. Causes of failures evaluated included: arterial input and venous output function selection, motion, streak artifact, and contrast bolus arrival. Associations between patient characteristics and post-processing failures were quantified with adjusted odds ratios (aOR) using binary logistic regression.

**Results:** 146 patients were included. 15 (10%) showed automated post-processing failures due to significant motion ( $n = 11$ , 73%), streak artifact ( $n = 2$ ; 13%), and poor contrast bolus arrival ( $n = 2$ ; 13%). Seven out of 15 failures (47%) showed inaccurate infarct volumes that would have affected thrombectomy eligibility. The clinical factor related to the failures was admission NIHSS (aOR: 2.2; 95% CI: 1.1–5.0;  $P < 0.05$ ).

**Table 1.** Patient characteristics

Characteristic	Total n=146	Failures n=15 (10%)	Non-failures n=131 (90%)
Age, years, mean±SD	72±15	72±14	72±15
Male sex, n (%)	72 (49)	11 (70)	60 (46)
Admission NIHSS, mean±SD	15±7	18±6	15±7
Time from symptom onset to CTP, minutes, median (Q1-Q3)	171 (65-377)	293 (113-566)	159 (65-354)
Intravenous tPA, n (%)	73 (50)	6 (40)	67 (51)
Endovascular treatment, n (%)	105 (72)	9 (60)	96 (73)

SD: standard deviation, NIHSS: NIH Stroke Scale, CTP: computed tomography perfusion, tPA: tissue plasminogen activator.

**Conclusions:** Failures occurred in 10% of the cases and were associated with higher stroke severity (NIHSS). Stroke experts should be aware of the pitfalls of automated post-processing CTP data and integrate their possibility in the decision-making process.

**Trial registration number:** N/A

## AS10-031

### LEPTOMENINGEAL COLLATERAL SUPPLY IN ISCHEMIC STROKE PATIENTS: A COMPARISON OF SINGLE-PHASE CT-ANGIOGRAPHY, MULTIPHASE CT-ANGIOGRAPHY, CT-PERFUSION AND DIGITAL SUBTRACTION ANGIOGRAPHY

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**Background and Aims:** Robust leptomeningeal collaterals correlate with good outcomes after endovascular treatment of acute ischemic stroke (AIS). We compared collateral assessment by single-phase and multi-phase CT-angiography (CTA) and dynamic CT-perfusion (CTP) to digital subtraction angiography (DSA).

**Methods:** Consecutive AIS patients who underwent CTP, CTA, and DSA prior to thrombectomy were included. All patients had occlusion of the internal carotid artery (ICA) or M1 or M2 segments of the middle cerebral artery. Single-phase images were extracted from CTA and multiphase images from CTP source data. Two observers scored the collaterals in a random and blinded manner. One observer assessed the DSA images, which served as the reference standard. Static and dynamic collateral scoring systems (modified ASITN) were used. Interobserver agreement was analyzed by calculating Cohen's weighted kappa. Concordance between CTP, CTA and DSA assessments was evaluated with the concordance correlation coefficient (CCC).

**Results:** 81 patients were included for analysis. Interobserver agreement for static assessments was 0.69 (95%-CI:0.56-0.79) for single-phase and

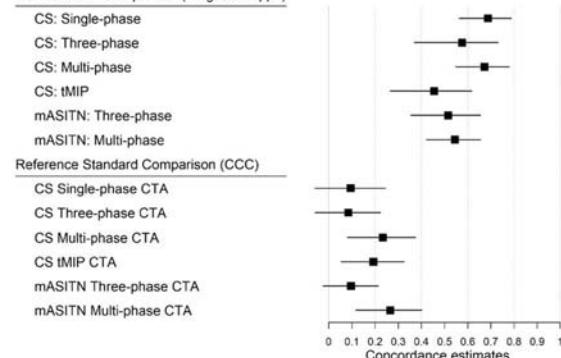
0.67 (95%-CI:0.55-0.78) for multi-phase images. Interobserver agreement for dynamic assessments was 0.52 (95%-CI:0.35-0.65) for three-phase images and 0.54 (95%-CI:0.42-0.65) for multi-phase images. CCC for the static assessments was 0.09 (95%-CI:0-0.24) for single-phase and 0.23 for multi-phase (95%-CI:0.08-0.37) images. CCC for dynamic assessments was 0.10 (95%-CI:0-0.21) for three-phase and 0.27 (95%-CI:0.12-0.40) for multi-phase images.

**Table 1.** Baseline characteristics, overall and stratified by availability of DSA. Categorical characteristics are summarized as counts and percentages (calculated out of non-missing values), and continuous characteristics are summarized as medians with 25<sup>th</sup> (Q1) and 75<sup>th</sup> (Q3) percentiles.

Characteristic	Total (n=81)	DSA (n=63, 79%)	No DSA (n=18, 21%)
Age, median (Q1-Q3)	75 (67-82)	74 (67-83)	76 (69-81)
Male sex, n (%)	31 (38)	22 (35)	9 (50)
Admission NIHSS, median (Q1-Q3)	15 (11-20)	14 (11-20)	20 (14-23)
Time from symptom onset to CTP, median (Q1-Q3)	127 (62-332)	115 (64-324)	195 (58-411)
Intravenous tPA, n (%)	42 (52)	32 (51)	10 (56)
Endovascular treatment, n (%)	73 (90)	60 (95)	13 (72)

NIHSS: National Institutes of Health Stroke Scale, CTP: computed tomography perfusion, tPA: tissue plasminogen activator.

#### Inter-reviewer Comparison (weighted kappa)



**Figure 1.** Estimated concordance correlation coefficients (CCC) and weighted kappa statistics with 95% confidence intervals. Confidence intervals for kappa statistics are based on 5,000 bootstrap resamples.

**Conclusions:** Collateral assessment on multi-phase CTP is more accurate than on static CTA, but concordance with DSA is poor.

**Trial registration number:** N/A

## AS10-033

### AUTOMATIC CLOT DETECTION IN NECT IMAGES OF ACUTE ISCHEMIC STROKE PATIENTS USING A CONVOLUTIONAL NEURAL NETWORK

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**Background and Aims:** We aimed to investigate if clots can be automatically detected in non-enhanced cranial CT (NECT) images using a deep learning approach. Afterwards, an observational study was conducted to compare the results to the capability of two neuroradiologists.

**Methods:** Thin slice NECT images of 185 patients with acute ischemic stroke due to proximal cerebral artery occlusion were registered with

the CT angiography (CTA) images scanned immediately after. On the CTA images, the contrast gap indicating the site of occlusion was marked with a 3D region of interest (ROI). A deep convolutional neural network (CNN) with 3 layers of convolutional filters followed by totally connected deep neural layers was trained to identify the ROI for every patient as defined in the NECT images for 150 stroke and 100 non-stroke cases without a predefined ROI. Using the remaining 35 stroke and 30 non-stroke scans, we measured ROC curves for correct site of occlusion identification.

**Results:** Training time for the CNN: 7 days, 3.5 hours.

Average time for a single inference case: 3 minutes, 35 seconds (+/- 45 sec.).

Area under the curve for identification of occlusion and its correct position in the test set: 0.893.

**Conclusions:** Therefore, proximal cerebral artery occlusions can be identified with high reliability using a pretrained deep CNN and thin slice NECT datasets.

The fact that the AUC for clot detection does not exceed 0.9 might be explained by the fact that in rather rare cases of intracranial stenoses, a hyperdense artery sign might not be detectable.

**Trial registration number:** N/A

#### AS10-058

### IMAGING SELECTION FOR ENDOVASCULAR THROMBECTOMY: PERfusion VERSUS NON-PERfusion IMAGING

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**Background and Aims:** Patient selection for endovascular thrombectomy (EVT) in acute ischemic stroke is currently primarily based on time criteria. Various imaging paradigms have been suggested to select patients for EVT. We aimed to assess perfusion versus non-perfusion imaging as selection method for EVT in daily clinical practice.

**Methods:** Review of a prospectively collected registry of anterior circulation stroke patients undergoing EVT at a tertiary center between July 2016 and November 2017. Patients were stratified based on baseline imaging into computed tomography perfusion (CTP) versus non-CTP (non-contrast computed tomography and computed tomography angiography only). Primary outcome was improved functional outcome, analyzed using multivariable ordinal logistic regression (mRS-shift analysis). Secondary outcome was functional independence (mRS 0–2).

**Results:** Of 203 included patients, 43 (21%) received additional CTP prior to EVT. Median age was 69 in both groups. Median baseline NIHSS was 18 (IQR15-20) in the CTP group versus 16 (IQR12-20) in the non-CTP group. Median onset to reperfusion time was 205 (IQR175-310) minutes versus 256 (IQR206-300) minutes ( $p = 0.03$ ). Median ischemic core volume in the CTP group was 20 (IQR15-33) ml. CTP selection was associated with a favorable 90-day mRS shift (acOR 2.1; 95%CI 1.1-3.8;  $p = 0.03$ ). Fifty-eight percent of the CTP and 39% of the non-CTP group achieved functional independence at 90 days (Figure 1).

**Conclusions:** Our results suggest that CT perfusion-based patient selection is associated with favorable mRS shift in patients undergoing EVT.

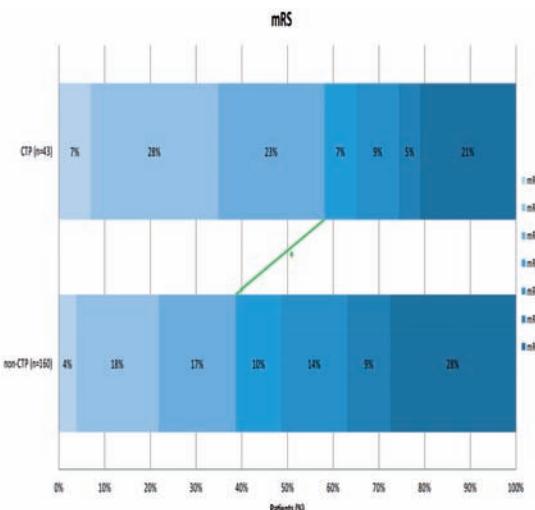


Figure 1. Modified Rankin Scale distribution for the CTP and non-CTP group

**Trial registration number:** N/A

#### AS10-008

### PROMINENT FLAIR VASCULAR HYPERINTENSITY IS A PREDICTOR OF UNFAVORABLE OUTCOME IN MILD ACUTE ISCHEMIC STROKE WITH LARGE ARTERY OCCLUSION

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**Background and Aims:** The aim was to evaluate the clinical significance of prominent fluid-attenuated inversion recovery (FLAIR) vascular hyperintensity (F VH) on the prognosis of mild acute ischemic stroke with middle cerebral artery (MCA) occlusion.

**Methods:** From our prospective stroke database, we identified consecutive stroke patients with initial National Institutes of Health Stroke Scale (NIHSS) scores of  $\leq 5$  and MCA occlusion on MR angiography within 24 hours of stroke onset. Prominent distal F VH was defined as an extension to more than one-third of the MCA territory. We compared clinical outcomes between prominent and non-prominent F VH groups in patients with and without reperfusion therapy.

**Results:** Of 112 participants (43 women, mean age,  $63.4 \pm 14.4$  years), prominent F VH was identified in 80 (71.4%) and was associated with F VH-diffusion weighted imaging mismatch. In 74 patients without reperfusion therapy, the prominent F VH group had more unfavorable outcome (a modified Rankin Scale score higher than 1) at 3 months than the non-prominent F VH group (44.4% vs 15.3%,  $P = 0.029$ ). In multivariate analysis, prominent F VH (odds ratio = 5.82; 95% confidence interval [CI], 1.25-27.2;  $P = 0.025$ ), higher NIHSS score (OR = 1.54; 95% CI, 1.06-2.24;  $P = 0.025$ ) and proximal MCA occlusion (OR = 8.94; 95% CI, 1.82-44.3;  $P = 0.007$ ) were independently associated with an unfavorable outcome. There was no association between prominent F VH and clinical outcome in reperfusion therapy group.

**Conclusions:** For acute stroke patients with mild symptoms and MCA occlusion who do not undergo reperfusion therapy, prominent F VH and proximal MCA occlusion may be independent predictors of an unfavorable outcome.

**Trial registration number:** N/A

**AS10-036****BASELINE BRAIN IMAGING SIGNS AND OUTCOMES IN THE ENCHANTED TRIAL**

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**Background and Aims:** The third International Stroke Trial (IST3) showed that some pre-existing and early radiological findings on baseline CT brain imaging of acute ischaemic stroke (AIS) were associated with important outcomes. We tested these findings in the alteplase-dose arm of the Enhanced Control of Hypertension and Thrombolysis Stroke Study (ENCHANTED).

**Methods:** The ENCHANTED trial assessed the effect of low- versus standard-dose alteplase in AIS. Blinded assessors coded baseline CT acute ischaemic signs (visible acute ischaemic lesion; acute ischaemic lesion hypoattenuation, extent, swelling; and hyperattenuated artery) and pre-existing signs (atrophy, leukoaraiosis and old stroke lesions). We assessed associations between imaging features and outcomes (death [at day 7 and 90], modified Rankin score [mRS] 0–2 at day 90 and symptomatic intracerebral haemorrhage (sICH)) using logistic regression.

**Results:** Amongst the 2916 patients included in this analysis, visible ischaemic lesion, hypoattenuation, large lesion, swelling and hyperattenuated arteries were associated with early death (OR (95% CI): 1.52 (1.06-2.18), 1.51(1.01-2.18), 2.67(1.52-4.71), 1.49(1.03-2.14) and 2.17(1.48-3.18) respectively) and negatively associated with mRS 0–2 (0.70(0.59-0.84), 0.74(0.62-0.90), 0.52(0.33-0.81), 0.70(0.58-0.84), and 0.63(0.5-0.79) respectively). Severe atrophy was inversely associated with early death [0.52(0.29-0.96)]. Atrophy [1.52(1.08-2.15)] and severe leukoaraiosis [1.74(1.2-2.54)] were associated with late death. Only hyperattenuated arteries were associated with sICH (IST3 definition) [1.71(1.01-2.89)]. No imaging features modified the effect of alteplase dose.

**Conclusions:** Our findings concur with IST-3 findings despite a different population (younger, more from Asia) and confirm that both pre-existing AND acute ischaemic imaging features contribute to early and late prognosis after ischaemic stroke.

**Trial registration number:** N/A

**AS10-056****READER RELIABILITY AND ACCURACY OF ACUTE BRAIN IMAGING INTERPRETATION IN THE ENCHANTED TRIAL: EFFECTIVENESS OF SPECIALIST TRAINING FOR NON-EXPERT READERS**

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Cardiovascular Sciences, Leicester, United Kingdom; <sup>5</sup>University of Sydney, Sydney Medical School, Sydney, Australia

**Background and Aims:** Ten non-expert readers centrally assessed all baseline brain imaging (mostly non-enhanced CT) for patients recruited to the alteplase-dose arm of the Enhanced Control of Hypertension and Thrombolysis Stroke Study (ENCHANTED). We provided specialist training and neuro-radiological oversight to the reading panel and tested reliability and accuracy of readers.

**Methods:** All readers completed pre-validated online training ([www.ed.ac.uk/edinburgh-imaging/access](http://www.ed.ac.uk/edinburgh-imaging/access)) before assessing ENCHANTED brain imaging. Scans were assessed blind to clinical data for a range of acute and chronic brain changes. For inter- and intra-reader reliability testing, 285 cases were double read by at least two different readers and 21 cases were double read by the same reader. For accuracy, two experienced neuro-radiologists provided a consensus gold standard for 53 randomly selected cases. We tested reader reliability and accuracy using Krippendorff's Alpha ( $\kappa$ -alpha) and interpreted the results with the Landis and Koch technique: 0.00-0.20 slight, 0.21-0.40 fair, 0.41-0.60 moderate, 0.61-0.80 substantial, and 0.81-1.00 almost perfect agreement.

**Results:** Inter-rater reliability was fair to moderate for most acute changes ( $\kappa$ -alpha 0.40 for identifying ischaemia and 0.44 for identifying hyperdense arteries, 0.36 for assessing swelling), atrophy and leukoaraiosis were more consistently assessed (0.49 for both). Intra-rater reliability was better with moderate to almost perfect agreement for acute changes (0.46-0.89). Accuracy was moderate to substantial for acute (0.49-0.64) but only fair to moderate for chronic changes (0.35-0.54)

**Conclusions:** With specialist training and expert neuro-radiology oversight, less experienced readers can deliver acceptably accurate and consistent brain imaging interpretation for the purposes of a major stroke trial.

**Trial registration number:** N/A

**AS10-041****24-HOUR WORSENING OF ARTERIAL PATENCY AFTER ISCHEMIC STROKE: ASSOCIATED FACTORS AND LONG-TERM PROGNOSIS**

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**Background and Aims:** Arterial recanalization in acute ischemic stroke, spontaneously or after treatment, is strongly associated with outcome. However, worsening of arterial patency in the acute phase has received little attention. We aimed at identifying factors associated with 24-hour worsening of arterial patency and its long-term prognosis.

**Methods:** Consecutive patients from the Acute STroke Registry and Analysis of Lausanne (ASTRAL) were with admission and 24-hour vascular imaging (computed tomographic or magnetic resonance angiography; window 12–48hours) were included. Worsening of arterial patency at this second time-point was defined as a new occlusion and/or significant stenosis, in any cervicocerebral artery, when comparing 24-hour with admission vessel imaging. Variables associated with worsening of arterial patency were assessed by logistic regression. The impact of arterial worsening in 3-months outcome was investigated with an adjusted modified Rankin Scale (mRS) shift analysis.

**Results:** Among 2152 included patients, 1387 (64.6%) received some form of acute revascularization treatment, and 65 (3.0%) experienced worsening of arterial patency. In multivariable analysis, worsening of arterial patency was independently associated with several clinical and imaging variables as shown in the table, but not with revascularisation treatment. Arterial worsening was strongly associated with an unfavourable shift in the distribution of functional outcomes on the mRS at 3-months (OR 5.97, 95%CI 3.64–9.79; p-value < 0.001).

	aOR (95% CI)	p-value
History of hypertension	0.45 (0.27–0.75)	< 0.001
Admission NIHSS	1.06 (1.02–1.10)	< 0.001
Intracranial stenosis	4.78 (2.03–11.25)	< 0.001
Extracranial stenosis	3.67 (1.95–6.93)	< 0.001
Good collaterals	3.71 (1.54–8.95)	< 0.001

aOR, adjusted odds ratio; CI, confidence interval; NIHSS, National Institutes of Health Stroke Scale.

**Conclusions:** Higher stroke severity, presence of intra- or extracranial stenosis and good collaterals seem to predict 24-hour worsening of arterial patency. Given its impact on long-term outcome, better methods to detect and prevent arterial worsening are needed.

**Trial registration number:** N/A

## AS10-043

### REOCCLUSION WITHIN 24 HOURS AFTER SUCCESSFUL MECHANICAL THROMBECTOMY: ASSOCIATED FACTORS AND LONG-TERM PROGNOSIS

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**Background and Aims:** Arterial recanalization and early reocclusion after successful recanalization are strong determinants of prognosis in acute ischemic stroke. We assessed associated factors and long-term prognosis of reocclusion after successful mechanical thrombectomy (MT).

**Methods:** Patients from the Acute STroke Registry and Analysis of Lausanne (ASTRAL), from January 2003 to August 2018, treated by successful MT (mTICI 2b-3) and with a 24-hour vascular imaging (computed tomographic or magnetic resonance angiography; window 12–48hours) were included. Reocclusion at this time-point was defined as a new intracranial occlusion within an arterial segment recanalized at the end of MT. Multivariate logistic regression was used to investigate factors associated

with reocclusion and its long-term clinical impact. In a 4:1 matched-cohort analysis, presence of residual thrombus/stenosis on final angiographic run post-MT was included as a variable in a second logistic regression for factors associated with reocclusion.

**Results:** Among 423 patients with successful recanalization, 28 (6.6%) showed 24-hour reocclusion. Factors independently associated with reocclusion in entire and matched cohorts are displayed in the table below. Residual thrombus/stenosis finding had a positive predictor value for reocclusion of 46.5% (95%CI 36.06%–57.28%). 24-hour reocclusion was highly associated with unfavourable outcome (adjusted-OR for modified Rankin Scale >2, 5.0; 95%CI 1.2–20.0).

Variables	Entire cohort		Matched cohort*	
	aOR (95%CI)	p-value	aOR (95%CI)	p-value
Smoking	-	n.s.	3.89 (1.19–12.73)	0.020
Preadmission statin therapy	0.27 (0.08–0.94)	0.040	0.13 (0.03–0.64)	0.010
Intracranial ICA occlusion	3.53 (1.50–8.32)	<0.001	Used for matching	-
Atherosclerotic stroke etiology	3.14 (1.34–7.37)	0.010	3.00 (0.99–9.06)	0.050
Number of devices passes	1.31 (1.06–1.62)	0.010	1.55 (1.15–2.08)	<0.001
Early transient reocclusion during MT	8.55 (2.14–34.09)	<0.001	-	n.s.
Residual thrombus fragment or stenosis <sup>#</sup>	Not assessed	-	15.57 (4.60–52.79)	<0.001

aOR, adjusted odds ratio; CI, confidence interval; ICA, internal carotid artery; MT, mechanical thrombectomy.

n.s., not significant; variable excluded from the model in the backward stepwise logistic regression.

\*Matched for most proximal arterial occlusion site and period of treatment (before or after year 2015).

<sup>#</sup>assessed in the post-recanalization final angiographic images

**Conclusions:** After successful MT, arterial reocclusion within 24-hours was independently associated with occlusion site, atherosclerotic mechanism, procedural difficulties, and residual thrombus or stenosis on the final angiographic run. Preadmission statin therapy seemed protective. Reocclusion had a major impact on long-term outcome highlighting the need to improve strategies to monitor and prevent it.

**Trial registration number:** N/A

## AS10-070

### RADIOLOGICAL EYE DEVIATION AS A PREDICTOR OF LARGE VESSEL OCCLUSION IN ACUTE ISCHAEMIC STROKE

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**Background and Aims:** Detection of large vessel occlusion (LVO) is required for endovascular therapy (EVT) in acute ischemic stroke (AIS) but CT angiography (CTA) is not always performed at primary stroke centers. Eye deviation on CT brain has been associated with improved stroke detection, but comparisons to angiographic status have been limited. This study sought to determine if radiological eye deviation was associated with LVO.

**Methods:** All AIS patients given intravenous thrombolysis who had acute CTA performed in 2 stroke centres were reviewed over 2013–2015 for the presence of LVO. Eye deviation was determined by two clinicians blinded to LVO status. Logistic regression was performed to determine which factors predicted LVO.

**Results:** 195 AIS patients with acute CTA were identified; 124 (64%) had LVO. Median age was 72 (IQR 64–82), median NIHSS was 12 (IQR 7–14). LVO patients had a higher NIHSS (15 vs 7, P < 0.01) and were more likely to have eye deviation on CT brain (71% vs 22.5%, P < 0.01). Logistic regression confirmed NIHSS score and eye deviation were associated with LVO, with odds ratios of 1.15 (per point) and 5.13

respectively. NIHSS  $\geq 11$  gave greatest sensitivity (78.5%) and specificity (76.1%) for LVO with a positive predictive value (PPV) of 84.7%. Eye deviation on CT was similar with sensitivity 71%, specificity 77.5% and PPV 84.6%.

**Conclusions:** Eye deviation on CT brain is strongly associated with LVO. Presence of eye deviation on CT brain should alert clinicians to probability of LVO and for formal angiographic testing if not already performed.

**Trial registration number:** N/A

## AS10-020

### MR VERSUS CT IMAGING FOR SELECTION OF MECHANICAL THROMBECTOMY IN ANTERIOR ISCHEMIC STROKE AND LARGE VESSEL OCCLUSION: EFFECTS ON CLINICAL OUTCOME AND WORK FLOW TIMES

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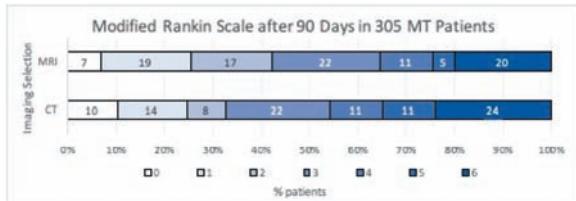
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**Background and Aims:** The optimal imaging strategy for selecting candidates for mechanical thrombectomy (MT) remains a matter of debate as its impact on clinical outcome is largely unknown from randomized trials. This study aimed to compare the clinical outcome of MT patients after selection by computed tomography (CT) or magnetic resonance imaging (MRI).

**Methods:** Prospective MT registry data from a large comprehensive stroke center (CSC) was analyzed in anterior circulation LVO patients. Primary endpoint was modified Rankin Scale (mRS, 0–2 vs. 3–6) after 90 days in CT/CTA- (CT group) versus MRI- (MRI group) patients hypothesizing equivalence. Secondary endpoints included workflow times. Subgroup analyses compared directly admitted (mothership) and transferred (drip-and-ship) patients.

**Results:** In 305 MT patients, clinical outcome was not equivalent between imaging groups (odds ratio for mRS 3–6, 0.58 [95% CI, 0.352–0.955], favoring MRI). A trend towards more favorable outcome in MRI (42.3%) compared to CT (32.6%;  $p = 0.082$ ) groups was noted which showed significance in mothership subgroup (48.9% vs. 28%,  $p = 0.023$ ). In-hospital workflow times were equal in mothership patients between CT and MRI groups (door to first angiographic series, 107.5 min versus 109.5 min [ $p = 0.445$ ]; door to recanalization, 148.5 min versus 159 min [ $p = 0.259$ ]). In drip-and-ship patients, second imaging at CSC compared to direct transfer to MT did not change favorable outcome irrespective of utilized imaging modality ( $p = 0.6$ –0.9).



**Conclusions:** Functional outcome was not equivalent between CT- and MRI-selected patients. Overall, MRI selection showed a trend for more favorable outcome which was significant in mothership patients. MRI did not significantly prolong in-hospital workflow.

**Trial registration number:** N/A

## AS10-065

### INFLUENCE OF CLINICAL-RADIOLOGICAL VARIABLES ON COLLATERALS. EXPERIENCE IN A CENTRE

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**Background and Aims:** In recent years, it has been shown that collaterals are a good prognostic marker, which correlates with other radiological studies and it is not associated with time. However, the influence of the different clinical variables on this marker has not been so thoroughly studied yet.

**Methods:** Retrospective observational study of patients recruited between November 2017 to December 2018 with secondary ischemic stroke. Occlusion of large anterior territory vessel (ICA, MCA segment M1 and M2) was demonstrated by angio CT (CTA) study. Collaterals were analyzed with visual scale. We carried out a descriptive analysis of the sample and univariate and multivariate analysis including different clinical variables to assess how they influence collaterals.

**Results:** 116 patients were recruited. 58.6% women, median age 72 years. 65.5% HBP, 46.6% hyperlipidemia, 31% diabetes. 94% previous Rankin 0–2. Median symptom onset-arrival time (SoaT) 113 min; mean systolic blood pressure 145mmHg; median glucose 118mg/dL; arrival NIHSS median 16, ASPECTS median 8. Occlusion MCA 75%. Cardioembolic etiology 51.7%. Good collaterals 65.5%. Significant differences were observed in the univariate analysis: So-aT ( $p = 0.03$ ), higher in patients with good collaterals (median 121 vs 79); arrival NIHSS ( $p < 0.001$ ), higher in group with poor collaterals (median 19 vs 13); ASPECTS ( $p < 0.001$ ), worse in patients with poor collaterals (median 6 vs 9). In the multivariate analysis the NIHSS ( $p = 0.003$ ), ASPECTS ( $p < 0.0001$ ) and the So-aT ( $p = 0.019$ ) were significant.

**Conclusions:** Higher scores in NIHSS and better ASPECTS are independent factors of bad and good collaterals, respectively. Collaterals could be time in acute ischemic stroke.

**Trial registration number:** N/A

## AS10-002

### DUAL-PHASE 16 SLICE CT ANGIOGRAPHY INCREASES DETECTION OF ANTERIOR CIRCULATION OCCLUSION

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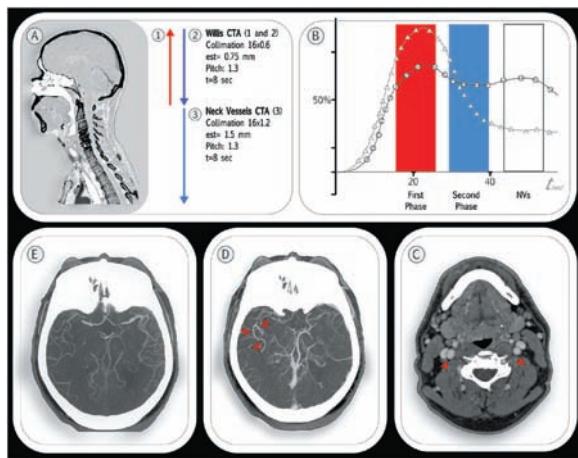
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**Background and Aims:** Recent data have shown that multiphase CT Angiography (m-CTA) improves diagnostic accuracy in the detection of distal vascular occlusion over single CTA (s-CTA). All is needed is that a high-speed multidetector CT (MDCT) scanner with  $\geq 64$  slices acquisitions obtain data in the late arterial, mid-venous and late venous phases. However, in a real world scenario, most Community Hospitals are not

privileged with such high technology (m-CTA and/or WB-CTP) and have to make do with lower speed MDCT scanners (< 64 detectors).

**Methods:** Our experience performing dual-phase CTA (d-CTA) on a 16 slice MDCT with a biphasic rate injection (Fig. 1A-B) is presented herein. A total of 33 consecutive patients with distal middle cerebral artery (MCA) occlusions admitted to our institution for acute ischemic stroke between January 2016 and June 2017 were evaluated by the d-CTA technique. The goal was to determine whether using d-CTA data could improve inter-rater agreement for the detection of distal MCA occlusion compared to single-phase CTA (s-CTA).



**Results:** There was a fair s-CTA inter-rater agreement ( $k = 0.39$ ) among the readers and a substantial agreement ( $k = 0.76$ ) for distal occlusion detection, when the d-CTA was used. We also observed the "delayed vessel sign" (figures D and E) with almost perfect agreement ( $k = 0.89$ ).

**Conclusions:** Although these preliminary results require further confirmatory studies, the authors are of the opinion that the proposed protocol, adapted to a low speed MDCT scanner, may well prove to be a cost/effective tool for those hospitals still awaiting more modern technology.

**Trial registration number:** NA

#### AS10-027

### QUANTITATIVE T2-CHANGES IN THE WHITE AND GREY MATTER OF LESIONS IN ACUTE ISCHAEMIC STROKE

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**Background and Aims:** The apparent diffusion coefficient (ADC) of cerebral water, as measured by MRI, decreases in ischaemia within minutes, making it suitable for delineating lesions in acute stroke patients. The  $T_2$  relaxation time, however, changes on a longer time-scale and is potentially informative of the extent of tissue damage and thus relevant to clinical decisions regarding treatment.

**Methods:** Acute ischaemic stroke patients within 9 hours of symptom onset underwent 3T MRI using multi-echo  $T_2$ , and ADC sequences.

Lesions were identified as those regions with  $ADC < 0.6 \times 10^{-3} \text{ mm}^2/\text{s}$ .  $T_2$  changes, as median ( $\Delta T_2$ ), were calculated by the Spherical Reference Method and, using a weighted linear regression, correlations with onset time were calculated for grey (GM) and white matter (WM).

**Results:** Thirty-eight acute stroke patients (ages 31 – 87 years, 25 thrombolysed) were recruited. Median ( $\Delta T_2$ ) was  $1.50 \pm 0.52$  and  $1.40 \pm 0.54 \text{ ms/h}$  in GM and WM respectively (Figure 1) and correlated significantly with onset-to-imaging time (GM:  $n = 27$ ,  $p = 3.62 \times 10^{-6}$ ; WM:  $n = 35$ ,  $p = 5.71 \times 10^{-6}$ ). Gradients for WM and GM were not significantly different.

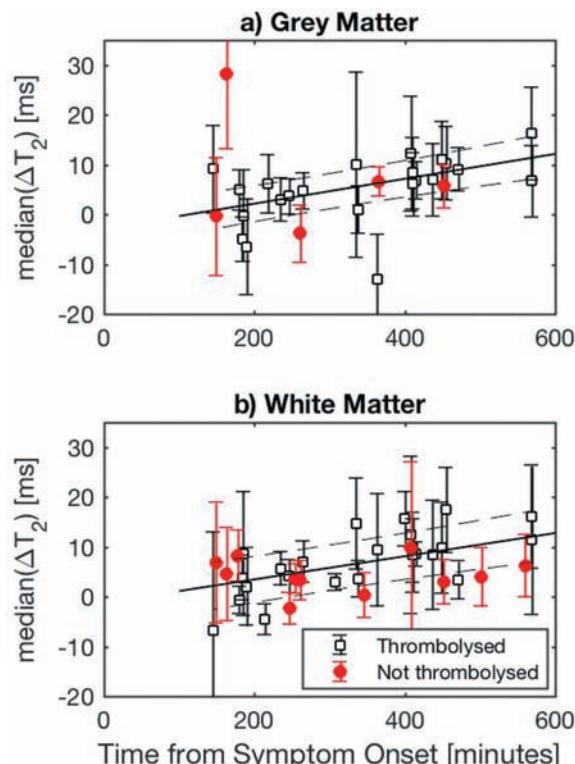


Figure 1. Median  $\Delta T_2$  as a function of symptom onset time, for (a) grey matter and (b) white matter. Fitted solid lines are weighted linear regressions.

**Conclusions:** Quantitative  $T_2$  changes in ADC-delineated lesions correlate with symptom onset to imaging time, offering an alternative imaging index of time since onset in lesions independently of contributions by chief brain tissue types.

Supported by The Dunhill Medical Trust (R385\_1114)

**Trial registration number:** N/A

#### AS10-019

### CORRELATION BETWEEN ASPECTS AND CORE VOLUME ON CT PERfusion: IMPACT OF TIME SINCE STROKE ONSET AND PRESENCE OF LARGE VESSEL OCCLUSION

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Radiology, Lausanne, Switzerland; <sup>4</sup>Stanford University and Medical Center, Department of Radiology- Neuroradiology Division, Stanford, USA

**Background and Aims:** Both ASPECTS and core volume on CT-Perfusion (CTP) are used to estimate infarct volume in acute ischemic stroke (AIS). To assess the potential value of ASPECTS for late EVT decisions, we aimed to determine the correlation between ASPECTS and CTP-core, depending on timing and presence of large vessel occlusion (LVO).

**Methods:** In the ASTRAL registry (2003-2017), we reviewed all AIS in the middle cerebral artery territory where standardized reconstructions of thresholded CTP were available (Philips® model). Correlation between ASPECTS and CTP-core was calculated for early (< 6hours) vs. late (6-24hours) delay since stroke onset, and presence or absence of LVO. Correlation coefficients and multiple linear regression models were used to test the strength of associations.

**Results:** The included 1046 patients had a median age of 71.4 years (IQR = 19.6), NIHSS of 12 (12), ASPECTS of 9 (3) and CTP-core of 13.6mL (52.3mL). The overall correlation between ASPECTS and CTP core was fair ( $\rho = -0.49$ ), but was significantly better in the late than early window ( $\rho = -0.57$  and  $\rho = -0.48$  respectively,  $p = 0.05$ ) and in the presence vs absence of LVO ( $\rho = -0.40$  and  $\rho = -0.20$  respectively,  $p < 0.01$ ). In the linear regression model, the independent association between ASPECTS and CTP-core was twice as strong in late arriving patients with LVO ( $\beta = -0.21$  per 10mL; 95%CI = (-0.27;-0.15)) than in the overall population ( $\beta = -0.10$ ; 95%CI = (-0.14;-0.07)).

**Conclusions:** The association between ASPECTS and CTP-core was significantly stronger in patients with longer delay from stroke onset and in presence of a LVO. This could support the use of ASPECTS as surrogate marker of CTP-core in late arriving AIS patients.

Trial registration number: N/A

## AS10-075

### CORRELATION BETWEEN COLLATERAL VESSELS, CT ANGIOGRAPHY PHASE, AND PENUMBRAL VOLUME IN ACUTE ISCHAEMIC STROKE

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**Background and Aims:** Reperfusion treatments in stroke aim to salvage the penumbral region whose viability is sustained by leptomeningeal collateral vessels. The acquisition timing of single phase computed tomographic angiography (CTA) may influence assessment of collateral quality. We investigated the relationship between CTA acquisition phase with core and penumbral volumes.

**Methods:** We undertook a retrospective review of cases of large artery occlusion and retrograde leptomeningeal collateral flow selected from a research imaging database of patients undergoing CTA and CT perfusion (CTP) < 6h after symptom onset. We used MISTAR to measure core and penumbral volume. Collaterals were scored by the Tan classification on CTA derived from maximal intensity projections of CTP, selected to be arterial, equilibrium or venous phase. Core and penumbra volumes for arterial, equilibrium and venous phase collateral scores were compared by one-way ANOVA.

**Results:** Data from 31 patients were included in the analysis. Core volumes were greater and penumbral volumes lower with lower

collateral scores, and vice versa but did not significantly differ by CTA acquisition phase (Table and Figure).

Collateral graded score	Stroke region	Arterial	Arteriovenous	Venous
0	Core	43.3 ± 43.9	74.3	NA
	Penumbra	16.5 ± 12.3	7.83	NA
1	Core	25.5 ± 24.6	34.8 ± 29.8	28.5 ± 26.7
	Penumbra	39.6 ± 25.5	33.2 ± 20.3	40.8 ± 34.7
2	Core	10.5 ± 11.2	12.2 ± 10.5	12.8 ± 15.5
	Penumbra	41.3 ± 32.5	43.5 ± 29.6	36.9 ± 23.9
3	Core	5.89 ± 3.97	2.3 ± 2.8	4.26
	Penumbra	44.8 ± 25.3	31.0 ± 42.2	60.9

**Conclusions:** Collateral score is related to volumes of core and penumbra on CT perfusion. We could not determine a significant relationship between CTA acquisition phase in this sample. Collateral scores should be reviewed in a larger cohort and use of multi-phase imaging compared to the above technique to confirm correlation.

Trial registration number: N/A

## AS10-040

### FASTEAST DETECTION OF ISCHEMIC PENUMBRA USING ASAP-ASL WITH SECURE AND COMPREHENSIVE 10MIN-MRI PROTOCOL INCLUDING CHEST MRA

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**Background and Aims:** In acute cerebral ischemia with large vessel occlusion, the brain imaging is extremely important in making decision whether to apply a mechanical thrombectomy. However, MRI protocol including a complicated technique may delay the start of the therapy. We have established a optimized and quick MRI protocol including ASL and chest-MRA.

**Methods:** Our MRI protocol consists of the following; Survey scan, DWI, ASAP-ASL, head-MRA, FALIR, T2\*WI, neck-MRA, and non-contrast chest-MRA. This MRI protocol is completed within 10min. We retrospectively analyzed the cases with acute onset of neurological symptoms.

**Results:** 169 consecutive patients were performed this MRI protocol after the onset. 54 patients were diagnosed as intracranial hemorrhage at the stage of survey scan and DWI. 44 patients were performed all the sequence, and undergone mechanical thrombectomy. DWI and ASL perfusion imaging clearly revealed irreversible cerebral infarction and ischemic penumbra in all of these patients within 3min from the start of the examination. In addition, 2 patients with type A aortic dissection were detected by chest MRA.

**Conclusions:** 169 consecutive patients were performed this MRI protocol after the onset of the neurological symptom. 54 patients were diagnosed as intracranial hemorrhage at the stage of survey scan and DWI. 44 patients were performed all the sequence, and undergone mechanical thrombectomy. DWI and ASL perfusion imaging clearly revealed irreversible cerebral infarction and ischemic penumbra in all of these patients within 3min from the start of the examination. In addition, 2 patients with type A aortic dissection were detected by chest MRA.

Trial registration number: N/A

**AS10-066**

## OUTCOME AFTER SUCCESSFUL ENDOVASCULAR TREATMENT IS NOT ALWAYS OPTIMAL IN PATIENTS WITH BEST CT PERFUSION PROFILE

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<sup>1</sup>Hospital Vall d'Hebron, Stroke Unit – Neurology, Barcelona, Spain;

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**Background and Aims:** Absence of ischemic core on baseline CT perfusion may define a subgroup of large-vessel occlusion (LVO) patients with differential characteristics and outcomes we aim to describe.

**Methods:** Consecutive anterior LVO stroke patients treated with mechanical thrombectomy were included. Ischemic core was identified with RAPID® software by a reduction in the relative cerebral blood flow <30% compared to normal tissue.

**Results:** From 165 patients evaluated, 55 (33.7%) presented no ischemic core on CTP, with a median admission NIHSS of 15(IQR 10–18) and median ASPECTS 10(IQR 9–10). Among the 87.3% patients with no ischemic core and a TICI2b-3 recanalization, median 24h-NIHSS was 2 (IQR 1–12.75), median 24h-infarct volume (IVol) was 1(IQR 0–8) cc but 21.8% had IVol $\geq$ 10cc; 60.5% achieved independency (mRS 0–2) at 3 months. Neuroimaging and clinical outcomes were significantly better than in patients with CTP-core >0. Amid patients with no ischemic core and TICI2b-3 recanalization, baseline NIHSS correlated mildly with mRS (0.357, p = 0.028), independent patients at 3 months were younger (61(55–76) vs 78(70–85), p = 0.024), had less atrial fibrillation (AFib) (13% vs 66.7%, p = 0.001), and received more frequently statins (43.5% vs 6.7% p = 0.014). Neither time from symptom onset to CT nor time to recanalization were associated to functional outcome. In a multivariate analysis, only AFib (OR 0.074; CI 0.012–0.45, p < 0.05) and previous statins (OR 10.9; CI 0.9–130;p = 0.058) were independent predictors of mRS 0–2.

**Conclusions:** A third of LVO-patients present no ischemic core on admission CTP. Even if their outcomes are better, previous history of AFib may predict worse functional outcome, and statins show a protective role.

**Trial registration number:** N/A

**AS10-042**

## AUTOMATED ACUTE INFARCT VOLUME AND COLLATERAL ASSESSMENT STRONGLY PREDICTS CLINICAL OUTCOME IN PATIENTS UNDERGOING MECHANICAL THROMBECTOMY

**J. Zamarro Parra<sup>1</sup>, G. Parrilla<sup>2</sup>, M. Espinosa de Rueda Ruiz<sup>1</sup>, G.V.N. Blanca<sup>1</sup>, D.P. José<sup>2</sup> and P.G. Diego<sup>1</sup>**

J. Zamarro M. Espinosa de Rueda B. García-Villalba J. Díaz-Pérez D. Páez-Granda; <sup>1</sup>H. Virgen de la Arrixaca, Radiology – Interventional Neuroradiology, Murcia, Spain; <sup>2</sup>H. Virgen de la Arrixaca, Neurology-Radiology- Interventional Neuroradiology, Murcia, Spain

**Background and Aims:**

**Background:** Mechanical thrombectomy has revolutionized the care of acute ischemic stroke patients with large vessel occlusion (LVO). The importance of imaging to select patients for intervention is increasingly recognized, but the specific criteria are debated. In this study we used artificial intelligence supported software to obtain automated estimations of Acute Infarct Volume (AIV) and Collateral Blood Flow (CoBF), and related those results to the clinical outcome.

**Methods:** 158 patients with LVO stroke undergoing mechanical thrombectomy underwent multimodal routine imaging at presentation with non-contrast computed tomography and CT-angiography, which was automatically analyzed using the e-Stroke Suite (Brainomix Ltd., Oxford, UK). e-ASPECTS derived AIV and e-CTA derived percentage CoBF were automatically quantified. Univariate and multivariate regression analyses, Akaike Information Criteria, and Area Under Receiver Operating Characteristic (AUROC) curves were used to quantify the effect of imaging and clinical characteristics on clinical outcome (modified Rankin 0–2).

**Results:** Univariate models showed that NIHSS, AIV and CoBF were strongly associated with good outcome with AUROCs of 0.75(0.67–0.82), 0.73(0.65–0.82), and 0.69 (0.61–0.78) respectively. Model fit was strongest for CoBF. Multivariate regression demonstrated persistently significant effects of both AIV and CoBF (p < 0.05). The combined model was highly predictive of good outcome, AUROC: 0.87(0.82–0.93).

**Conclusions:** Artificial intelligence supported software offers the opportunity to objectively measure imaging parameters. Automated acute infarct volume and collateral blood flow strongly correlate with clinical outcome in patients with acute stroke due to LVO.

**Trial registration number:** N/A

## WITHDRAWN

**AS10-010**
**ACUTE ONSET APHASIA ENIGMA: CT PERfusion AS A PREDICTOR OF STROKE MIMICS IN PATIENTS ELIGIBLE FOR REPERfusion THERAPY**

**S. Rudilloso<sup>1</sup>, A. Rodríguez<sup>1</sup>, S. Amaro<sup>1</sup>, L. Llull<sup>1</sup>, A. Renu<sup>1</sup>, V. Obach<sup>1</sup>, C. Laredo<sup>1</sup>, A. Vargas<sup>2</sup>, Á. Marín<sup>2</sup>, C. Angel<sup>1</sup> and X. Urra<sup>1</sup>**

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**Background and Aims:** Acute onset aphasia may be due to stroke but also to other causes. We studied the clinical and radiological predictors of stroke mimics (SM) in patients eligible for reperfusion therapy presenting with isolated acute aphasia.

**Methods:** In a unicentric cohort of 1166 patients evaluated for stroke reperfusion, 122 (10.5%) presented with isolated aphasia. CT-perfusion (CTP) was performed in 87 (74.4%) and follow-up MRI in 60 (51.3%). We collected the main clinical and radiological data, whether reperfusion therapy was delivered, and the final etiological diagnosis. We analyzed the factors predicting SM diagnosis.

**Results:** The final etiology was vascular in 51.7% of the patients (59 ischemic, four hemorrhagic) and SM in 54 (44.3%). Five patients (4.1%) were not categorized due to incomplete diagnostic assessment and were excluded from further analyses. Patients with SM had higher systolic blood pressure, higher admission NIHSS and lower discharge NIHSS. Altered perfusion (87.8% vs. 21.2%,  $p < 0.001$ ) and reperfusion treatment (29.7% vs. 9.4%,  $p = 0.01$ ) were more frequent in patients with vascular etiology (9.4% vs. 29.7%,  $p = 0.01$ ). Hypoperfusion was the most common pattern on CTP, and only 1 SM patient showed a vascular-like pattern. Six patients showed hyperperfusion (four seizures, two strokes). The adjusted OR of a normal CTP for predicting SM was 74 (95% CI, 10–538).

**Conclusions:** A normal CTP in patients with isolated aphasia is highly suggestive of SM, and vascular-like hypoperfusion pattern is anecdotal in non-vascular aphasia. Hyperperfusion is infrequent and unspecific, as it may indicate both hypermetabolism in seizures and stroke with spontaneous reperfusion.

**Trial registration number:** N/A

**AS10-034**
**IMAGING LEPTOMENINGEAL COLLATERALS BASED ON SIGNAL VARIANCE IN PERfusion MRI IN ACUTE LARGE VESSEL OCCLUSION: AN INDEPENDENT PREDICTOR OF CLINICAL OUTCOME**

**A. Seiler<sup>1</sup>, A. Lauer<sup>2</sup>, R. Deichmann<sup>3</sup>, U. Nöth<sup>3</sup>, J. Berkefeld<sup>2</sup>, E. Herrmann<sup>4</sup>, O.C. Singer<sup>5</sup>, W. Pfelschifter<sup>5</sup>, J. Klein<sup>6</sup> and M. Wagner<sup>2</sup>**

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**Background and Aims:** The assessment of leptomeningeal collateralization is of major importance in acute large vessel stroke as it is a determinant of both the amount of salvageable tissue and the progression rate of the ischemic process as well as a predictor of the clinical outcome

after reperfusion therapy. However, so far, the evidence of collateral scores obtained from clinical imaging data is limited. We therefore introduce a quantitative and observer-independent collateral index based on MR-perfusion-weighted imaging (PWI) data.

**Methods:** 55 patients with acute internal carotid and/or middle cerebral artery occlusion were included. Coefficient of signal variation maps were calculated from the PWI raw data time series. An intra-individual collateral vessel index (CVI-PWI) was calculated. The initial ischemic core volume was determined from diffusion-weighted imaging (DWI), applying an upper threshold of  $600 \times 10^{-6} \text{ mm}^2/\text{s}$  to apparent diffusion coefficient maps. Time-to-peak maps were used to delineate areas of hypoperfusion and determine the PWI/DWI mismatch as well as areas of severe hypoperfusion.

**Results:** CVI-PWI correlated significantly with the initial ischemic core volume ( $\rho = -0.459$ ,  $p = 0.0001$ ), the PWI/DWI mismatch ratio ( $\rho = 0.494$ ,  $p = 0.0001$ ) and the hypoperfusion intensity ratio ( $\rho = -0.286$ ,  $p = 0.035$ ) as an indicator of the severity of hypoperfusion. Significant correlations of CVI-PWI were found with NIHSS and mRS at discharge ( $\rho = -0.341$ ,  $p = 0.015$  and  $\rho = -0.305$ ,  $p = 0.023$ ). In multivariate logistic regression, CVI-PWI was an independent predictor of favourable outcome ( $p = 0.017$ ).

**Conclusions:** Signal variance-based CVI-PWI provides rater-independent information on the collateral supply and is suitable to assess leptomeningeal collateralization in acute stroke.

**Trial registration number:** N/A

**AS10-047**
**LARGE VESSEL ACUTE ISCHEMIC STROKE: PROGNOSTIC VALUE OF COLLATERALS VESSELS STATUS WITHIN THE THERAPEUTIC WINDOW FOR ACUTE TREATMENT**

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**Background and Aims:** Time from symptoms onset remain the major determinant for acute treatment decision in stroke. Nevertheless, some patients have a poor outcome even within the early time window. We aimed to describe the relationship between collaterals vessels status and acute treatment outcome in a cohort of acute ischemic stroke (AIS) with large vessels occlusion (LVO).

**Methods:** From our prospective database we selected patients with the following inclusion criteria: AIS within 6 hours from known symptoms onset, documented anterior circulation LVO, eligible to tPA and or thrombectomy according to current guidelines. Stroke outcome was measured at 90 days with mRS. Imaging features included baseline ASPECTS score, site of LVO and collateral status score evaluated blindly and independently by two experienced raters.

**Results:** 54 patients fulfilled the inclusion criteria: 19 received mechanical thrombectomy, 7 intravenous tPA and 28 combined treatment. Median age was 74 years (IQR 66–78), onset-to-door was  $70.7 \pm 54$  minutes, baseline NIHSS score was 18 (IQR 14–22). Onset-to imaging was 97 (IQR 78–132) minutes with ASPECTS score of 9 (IQR 8–10). Collateral vessel status scored good in 39.0%, intermediate in 27.1% and poor in 33.9%. Collateral status was independently associated with 3-month mRS ( $p = 0.035$ ); the effect of each collateral score one-step worsening on mRS score was estimated at 0.64 ( $\pm 0.30$ ) mRS units. Collateral status was not influenced by onset-to-imaging

**Conclusions:** Our data suggest that collateral vessel status may influence the outcome of AIS patients with LVO treated within approved therapeutic window.

**Trial registration number:** N/A

### AS10-013

#### RELATIONSHIP BETWEEN MRI ASPECTS AND INFARCT SIZE IN ACUTE ISCHEMIC STROKE

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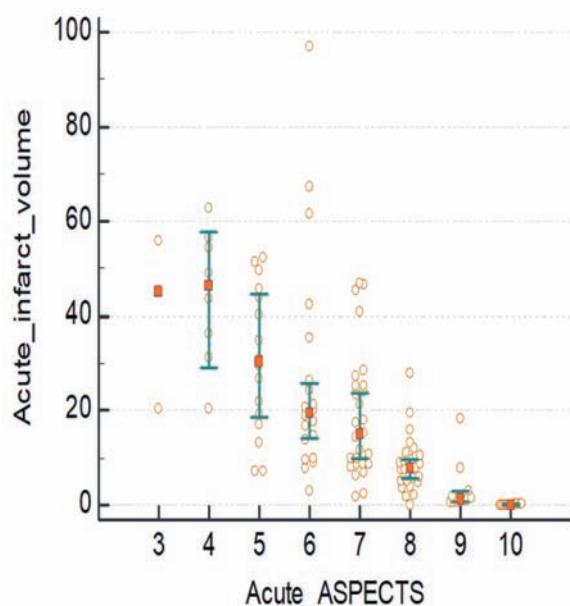
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##### Background and Aims:

**Background:** Endovascular therapy (EVT) is now the preferred treatment in acute ischemic stroke caused by a large vessel occlusion (LVO). According to guidelines, treatment should be performed if the volume of the ischemic tissue is not yet too big, i.e. if the ASPECTS score is >6. We aimed to find if MRI ASPECTS performed as reliable as infarct size when evaluating patients with acute ischemic stroke.

**Methods:** GOLIATH (General Or Local anesthesia in Intra Arterial TTherapy) was a study including patients with an LVO. MRI was done acutely and both ASPECTS and infarct size were measured by an independent imaging core lab.

**Results:** A total of 128 patients with LVO were included in the GOLIATH trial. Generally, there was a nice correlation between the infarct volume and the ASPECTS score (Figure 1), indicating that ASPECTS reflects infarct size and could be used in evaluating acute stroke. ( $P < 0.001$ , Kruskal-Wallis test.) Trying to predict outcome as defined by modified Rankin Scale (mRS) in relationship to the two acute measures of ischemic load, both performed equally well with  $p = 0.048$  for ASPECTS and  $p = 0.047$  in volume, both Kruskal-Wallis test.



**Conclusions:** MRI ASPECTS can be used in evaluation of acute ischemic stroke and performs as reliable as infarct volume.

**Trial registration number:** N/A

### AS10-012

#### E-ASPECTS AND RAPID IN THE EVALUATION OF ISCHEMIC CORE IN ACUTE STROKE PATIENTS (HELSINKI STROKE REGISTRY)

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**Background and Aims:** Ischemic core and penumbra are essential in ischemic stroke. RAPID Automated image analysis has been effective in predicting the ischemic core based on several recent studies. ASPECTS (Alberta Stroke Program Early CT Score) is a quantitative 10-point computed tomography scan score to assess early ischemic changes (EIC) of non-contrast head CT. The e-ASPECTS software (Brainomix Ltd.) is a tool for the automated use of ASPECTS and is based on automated machine learning algorithm. It has been shown to be non-inferior to neuroradiologists and stroke experts in scoring the ASPECTS score and more sensitive than junior stroke physicians. We hypothesized that e-ASPECTS, and the e-ASPECTS volume feature, might have similar ability to estimate ischemic core as RAPID

**Methods:** All 1478 consecutive acute stroke patients evaluated for revascularization procedures (stroke code) patients between 10/2016-1/2018 were screened. Only patients scanned with NCCT, CTP ((iSchemaView Rapid), and control NCCT were included. Volumes of ischemia (ml) were analyzed based on e-ASPECTS volume feature (weighted volume of ischemia) and RAPID (ischemic core, Tmax 6s).

**Results:** All in all 297 (20%) had both CTP and NCCT (0 hours and 24 hours) and verified true ischemia.[CS1] The correlation ( $r_s$ ) between the ischemic core and weighted volume of acute ischemia based on e-ASPECTS was 0.40 ( $p < 0.001$ ) and in control NCCT 0.54 ( $p < 0.001$ )

**Conclusions:** The correlation between e-ASPECTS volume feature and RAPID CTP ischemic core was mild but further assessment with neuroradiologists and more exact algorithms as well as subgroups including mRS will be studied.

**Trial registration number:** N/A

### AS10-001

#### CLINICAL UTILITY OF 320-DETECTOR ROW COMPUTED TOMOGRAPHY IN THE EVALUATION OF MOYAMOYA DISEASE

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**Background and Aims:** The present study aimed to determine the ability of 320-detector row computed tomography angiography (CTA) to evaluate moyamoya disease.

**Methods:** We retrospectively analyzed the records of 25 patients (male,  $n = 15$ ; mean age, 48 years; range, 23–71 years) with clinically diagnosed moyamoya disease (20 with infarction or transient ischemic attack, 5 with intracerebral and/or intraventricular hemorrhage) who were assessed by CTA using 320-detector row CT and magnetic resonance angiography (MRA) between April 2013 and September 2018. Based on the severity of steno-occlusive changes in the internal carotid, anterior cerebral, middle cerebral, and posterior cerebral arteries, CTA and MRA scores ranging from 0 (normal) to 10 (worst) were calculated for 50 facets in each cerebral hemisphere. Two specialists independently evaluated relationships between CTA and MRA scores and visualized basal moyamoya vessels.

**Results:** The mean CTA and MRA scores significantly correlated ( $3.82 \pm 1.53$  vs.  $4.76 \pm 1.80$  ( $P < 0.05$ )), although the mean CTA score was significantly lower. Inter-observer agreement for CTA scores was excellent ( $\kappa = 0.83 \pm 0.12$ ,  $P < 0.05$ ). The rate at which basal moyamoya vessels were visualized was significantly higher for CTA than for MRA ( $P < 0.05$ ), especially when patients had acute hemorrhagic stroke.

**Conclusions:** Steno-occlusive changes were evaluated more accurately, and basal moyamoya vessels were visualized with greater sensitivity by CTA using 320-detector row CT than by MRA.

**Trial registration number:** N/A

## AS10-073

### OUTCOMES OF THROMBECTOMY WITHIN 6 HOURS IN PATIENTS NOT MEETING CT PERfusion DEFUSE-3 CRITERIA

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**Background and Aims:** The utility of CT perfusion (CTP) to select patients with ischemic stroke  $< 6$  hours from last known normal (LKN) for thrombectomy is unclear.

**Methods:** From September 2017 to July 2018 we included patients who: presented  $< 6$  hours from LKN; underwent thrombectomy for ICA or M1 occlusions; and did not meet DEFUSE-3 CTP criteria. We collected demographics, NIH Stroke Scale (NIHSS), LKN to thrombectomy time, TICI score, CTP measures (CBF  $< 30\%$  (core), Tmax  $> 6$  seconds (penumbra), mismatch ml, mismatch ratio), and final infarct volume on MRI (MRI<sub>fv</sub>). From chart review, we estimated discharge modified Rankin Scale (mRS). Surrogate imaging outcomes were MRI<sub>fv</sub> and the MRI<sub>fv</sub>/penumbra ratio (MRI<sub>fv</sub>/P).

**Results:** 14 patients were included. Median age was 67; NIHSS, 26; core, 87.5 ml; and mismatch ratio, 1.75. At discharge 1 patient (7%) had mRS of 1 and 2 patients (14%) had mRS of 3. Mismatch ratio showed the strongest correlation with MRI<sub>fv</sub> ( $\rho = -.69$ ,  $p = .006$ ) and MRI<sub>fv</sub>/P ( $\rho = -.80$ ,  $p = .001$ ). Mismatch ml was correlated with MRI<sub>fv</sub> ( $\rho = -.48$ ,  $p = .08$ ) and MRI<sub>fv</sub>/P ( $\rho = -.67$ ,  $p = .01$ ) with core with MRI<sub>fv</sub> ( $\rho = .52$ ,  $p = .06$ ). Half of patients had MRI<sub>fv</sub>/P  $< 0.35$ .

**Conclusions:** If MRI<sub>fv</sub>/P  $< 0.35$  denotes a useful procedure, 50% of patients may have benefited with the largest core being 123 ml and lowest mismatch ratio being 1.6. The majority of these patients were disabled at discharge despite salvaged penumbra. Further refinement of CTP criteria is necessary before patients presenting  $< 6$  hours from LKN can be excluded from thrombectomy.

**Trial registration number:** N/A

## AS10-050

### AUTOMATED LARGE VESSEL OCCLUSION DETECTION FOR PATIENTS WITH ACUTE ISCHEMIC STROKE

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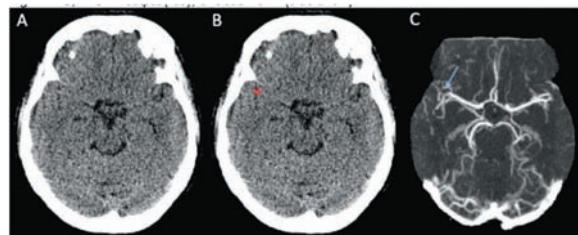
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**Background and Aims:** Hyperdense artery sign (HAS) on non-contrast CT (NCCT) is highly specific in identifying large vessel occlusion (LVO) in acute ischemic stroke. Artificial intelligence (AI) may support radiologists in swift and accurate LVO detection.

**Methods:** We used a convolutional neural network (CNN) developed by Nico.lab to automatically detect thrombi on NCCT. The CNN was trained on pairs of ipsilateral (thrombus and non-thrombus) and corresponding contralateral patches. In this retrospective study, we included 107 patients from the Amsterdam UMC with (ICA-T, M1, or M2) ( $N = 59$ ) and without occlusions (stroke mimics) ( $N = 48$ ). Ground truth of occlusion location was established by consensus of two experts, using both CTA and NCCT. Segmentations were considered accurate in case of overlap with ground truth. We evaluated the detection sensitivity and specificity of two other expert observers and compared these with the accuracy of the CNN.

**Results:** The CNN showed a thrombus detection accuracy of 81%, vs. 81% and 77% of human experts. Sensitivity of LVO detection by CNN was 0.86, vs. 0.95 and 0.79 for human observers. Specificity was 0.65 for the CNN vs. 0.58 and 0.82 for human experts respectively. Figure 1 shows an example of the result given by the CNN.

Fig 1. HAS; B. CNN output (red); C. clot on CTA (blue arrow)



**Conclusions:** The accuracy of the Nico.lab AI-based LVO detection for NCCT is comparable with expert observers.

**Trial registration number:** N/A

## AS10-035

### PERFUSION PATTERNS IN STROKE-MIMICS: THE PRISM STUDY

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**Background and Aims:** Stroke mimics (SM) have increased over the past decade, and now comprise up to 25% of stroke-codes. Recent studies show computed tomography perfusion (CTP) alterations in some SM, especially in seizures. The PRISM Study (Perfusion patteRns In Stroke Mimics) aimed to identify CTP alterations in SM attended as stroke-code.

**Methods:** We performed a retrospective study including a series of SM attended as stroke-code (up to 24 hours of neurological signs/symptoms) by neurologists at a stroke center, between January 2017 and March 2018. All of them underwent multimodal-CT study including baseline computed tomography (CT), CT-angiography and CTP as part of our stroke-code protocol. We registered clinical variables, diagnosis, CTP alteration patterns and type of map affected: time to peak (TTP), cerebral blood flow (CBF) and cerebral blood volume (CBV).

**Results:** We analyzed 117 (15,15%) SM among 772 patients attended as stroke-code. Mean age  $64 \pm 17.7$  years), women (59%), NIHSS median 2 (I-5 QR). CTP alterations were detected in 31 (26,5%) of SM. The most common CTP maps abnormalities in seizures and status epilepticus (67,74%) were altered TTP, with variable CBF and normal CBV maps; migraine (6,45%), PRES (6,45%) and HANDEL (3,22%) mainly showed altered TTP map with normal CBF and CBV maps. As a whole, the most commonly altered CTP map was TTP (96,8%) and the most frequent pattern of alteration was unilateral (90,3%), in hemispheric (38,7%) or focal non-vascular territory (41,93%).

**Conclusions:** Our results suggest that there is a CTP-pattern associated with SM. These findings may help the early and proper diagnosis of SM among patients attended as stroke-code.

**Trial registration number:** N/A

## AS10-067

### COLLATERAL CIRCULATION ASSESSMENT USING PATHS IMPROVES OUTCOME PREDICTION COMPARED WITH OTHER SCALES IN MCA THROMBECTOMY TREATED PATIENTS

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**Background and Aims:** The collateral circulation (CC) has prognostic value in stroke, but its utility in clinical practice remains unclear. We aimed to study the prognostic value of CC assessment in source images with different techniques: CT-angiography source images (CTASI), CT perfusion source images (CTPSI) and digital subtraction angiography (DSA), compared with a new scale applied in CTPSI named PATHS (Perfusion Acquisition for Thrombectomy Scale). Additionally we studied the relationship between the scores of the scales.

**Methods:** Retrospective study of patients with MCA stroke and MI/terminal carotid occlusion treated with thrombectomy in our stroke center. Data were prospectively evaluated by a stroke neurologist and radiologist, blinded to clinical data. CC was evaluated using 7 scales: CTASI (Tan and Miteff scales), CTPSI (Calleja, Cao, ASITN and PATHS scales) and DSA (Christoforidis scale). Correlations were studied using Spearman method.

**Results:** N: 108. Median age: 70 years (58-77), previous tPA 51.9%, mean NIHSS 17.4(SD:6.7). TICI > 2a: 89.9%. All scales predicted functional outcome at 3 months ( $p \leq 0.02$ ) and brain infarction at 24h ( $p \leq 0.02$ ) except Christoforidis scale. In multivariate analysis PATHS was an independent predictor of 3 months mRS  $\leq 3$ . In the convergence analysis the scales that used the same techniques (CTASI/CTPSI) showed a better correlation among them ( $p < 0.01$ ), but this strength was just moderate.

**Conclusions:** The CC assessment with different scales in source images has prognostic value and allows faster CC evaluation. PATHS showed a better prognostic value in our study so it might be considered for CC estimation in thrombectomy suitable patients. The moderate correlation between techniques suggest that their scores are not unchangeable.

**Trial registration number:** N/A

## AS10-062

### NORMAL BASELINE CT PERFUSION PREDICTS SMALLER INFARCT VOLUMES AND BETTER FUNCTIONAL OUTCOME WITH INTRAVENOUS THROMBOLYSIS IN CLINICAL LACUNAR SYNDROME

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**Background and Aims:** Lacunar infarction accounts for approximately 25% of acute ischemic strokes. Previous studies have shown patients with lacunar infarction treated with intravenous thrombolysis had a favourable clinical course. This case series tested the hypothesis that patients with clinical lacunar syndrome with normal baseline CT perfusion treated with intravenous thrombolysis had a better outcome compared to patients demonstrating hypoperfusion on CT.

**Methods:** A retrospective analysis of patients with clinical lacunar syndrome with baseline CT perfusion treated with intravenous thrombolysis in Calgary from 2015 to 2018.

**Results:** There were 15 patients [6 (40%) female; median age 64 (range: 36-83) years] included. 9 patients had normal CT perfusion. The median pre-treatment NIHSS was 6 (range 3-13). The median onset to needle time was 182 (range 60-305) minutes. The median 24-hour NIHSS was 2 (range 0-13). The median 24-hour DWI infarct volume was 0.11 (range 0-0.76) ml. The 90-day functional outcome was excellent (modified Rankin Scale, mRS: 0-2) in 9 (100%) patients. 6 patients had hypoperfusion on CT. The median pre-treatment NIHSS was 10 (range 2-17). The median onset to needle time was 227 (range 55-482) minutes. The median 24 hour NIHSS was 5 (range 0-12). The median 24-hour DWI infarct volume was 1.05 (0.15-1.19) ml. The 90-day functional outcome was excellent in 4 (67%) patients and poor (mRS:4-6) in 1 (17%) patient. No patient died or had symptomatic intracerebral hemorrhage.

**Conclusions:** Normal baseline CT perfusion predicted better 90-day functional outcome and smaller infarct volumes with intravenous thrombolysis in patients with clinical lacunar syndrome.

**Trial registration number:** N/A

## AS10-049

### TISSUE VIABILITY SCORE COMBINING ASPECTS AND COLLATERAL VESSEL STATUS PREDICTS TREATMENT OUTCOME IN ACUTE ISCHEMIC STROKE WITH LARGE VESSEL OCCLUSION

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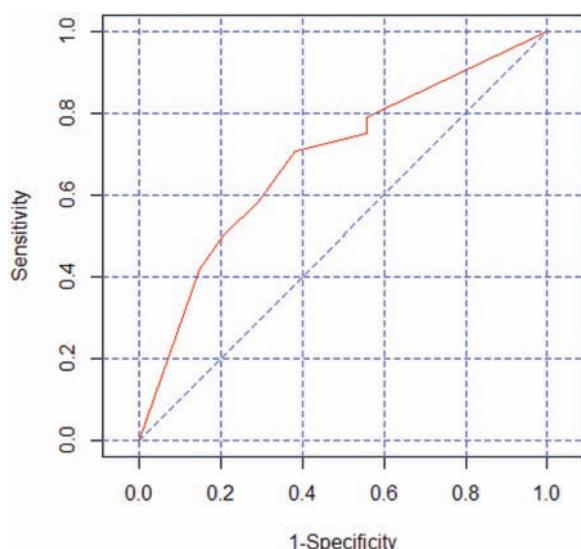
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**Background and Aims:** Prediction of functional outcome after acute ischemic stroke (AIS) with large vessel occlusion (LVO) is currently unsatisfactory despite the availability of multiple prognostic markers. We aimed to evaluate the performance of integrated ASPECTS and collateral status scores in predicting stroke outcome.

**Methods:** From our prospective database we selected consecutive AIS patients admitted within 6 hours from symptom onset, with anterior circulation LVO, treated according to clinical guidelines. Baseline ASPECTS score and collateral status score (poor = 0, intermediate = 1, good = 2) were evaluated blindly and independently by two experienced raters and integrated into a combined score. Stroke outcome was

measured at 90 days with mRS. Logistic regression was performed and a receiver-operating curve (ROC) was built.

**Results:** Fifty-nine AIS patients with median age 74 (IQR 66–78), baseline NIHSS 18 (IQR 14–22) were included. Fifty-four patients (91.5%) received acute treatment: 47 mechanical thrombectomy (19 combined with thrombolysis), 7 intravenous thrombolysis. Tissue viability (TV) score was built multiplying the three-level (0-to-2) collateral vessel score by normalized ASPECTS score (ASPECTS  $\leq 6$  being 0; ASPECTS 10 being 2). TV score significantly predicted good functional outcome (mRS  $\leq 2$ ) independently of onset-to-imaging time and treatment type ( $p=0.013$ ; odds ratio  $1.57 \pm 0.29$ ). ROC curve was built (figure 1; AUC 0.686); TV scores lower than optimal threshold of 1.5 units displayed 61.8% (CI: 43.6–77.8) sensitivity and 70.8% (CI: 48.9–87.4) specificity for poor functional outcome. We built a coloured nomogram (figure 2) to help calculating score.



### Tissue viability score calculator

COLLATERAL VESSEL STATUS			
	poor	interm	good
$\leq 6$	0,0	0,0	0,0
7	0,0	0,5	1,0
8	0,0	1,0	2,0
9	0,0	1,5	3,0
10	0,0	2,0	4,0

**Conclusions:** Tissue viability score combining ASPECTS and collateral status displayed promising value in predicting outcome in LVO stroke.

**Trial registration number:** N/A

### AS10-017

#### BASELINE BRAIN IMAGING SIGNS IN ISCHEMIC PATIENTS BY PRESENCE OF ATRIAL FIBRILLATION: THE ENCHANTED TRIAL

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**Background and Aims:** The presence of Atrial fibrillation (AF) worsens clinical outcome in patients with acute ischaemic stroke (AIS) after thrombolytic therapy. However, little is known on how baseline imaging features of the acute lesion or features indicating brain frailty contribute to this association.

**Methods:** Data are from the ENhanced Control of Hypertension AND Thrombolysis strokE stuDy (ENCHANTED), an international, randomised, open-label, blinded-endpoint trial of low- (0.6mg/kg) versus standard-dose (0.9mg/kg) intravenous alteplase in AIS patients. We used logistic regression to test associations between the presence of AF, baseline imaging features of the ischaemic lesion (presence and extent, tissue attenuation and swelling), hyperattenuated arteries, and pre-existing signs (atrophy, leukoaraiosis and old infarct) on unfavourable shift in the distribution of modified Rankin Scale scores at 90 days.

**Results:** 3285 patients (1243 female, 38%; 636 with AF, 19%), mean age 67 (SD 12.8) years, were included. After adjusting for age, stroke severity, and antiplatelet use, the common significant predictors of poor outcome were hyperattenuated arteries (odds ratio 1.75, 95% confidence interval [1.22-2.53] and 1.41, 1.13-1.75, for patients with AF and without AF respectively) and atrophy (1.57, 1.04-2.36 and 1.31, 1.06-1.71, respectively). Additionally, poor outcome was observed with ischaemic lesion hypotension (1.64, 1.13-2.38) and old infarct (1.76, 1.28-2.42) among patients with AF, and visible ischaemic lesion (1.42, 1.21-1.68), severe atrophy (1.35, 1.06-1.71), and severe leukoaraiosis (1.68, 1.29-2.19) among patients without AF.

**Conclusions:** Hyperattenuated arteries, corresponding to a large vessel occlusion likely caused by AF, was associated with poor outcome in all patients. Pre-existing imaging signs had additional prognostic value.

**Trial registration number:** N/A

### AS10-069

#### DETECTION OF EARLY CEREBRAL CORTICAL ISCHEMIA USING MONOENERGETIC IMAGES COMPARED TO CONVENTIONAL POLYENERGETIC IMAGES

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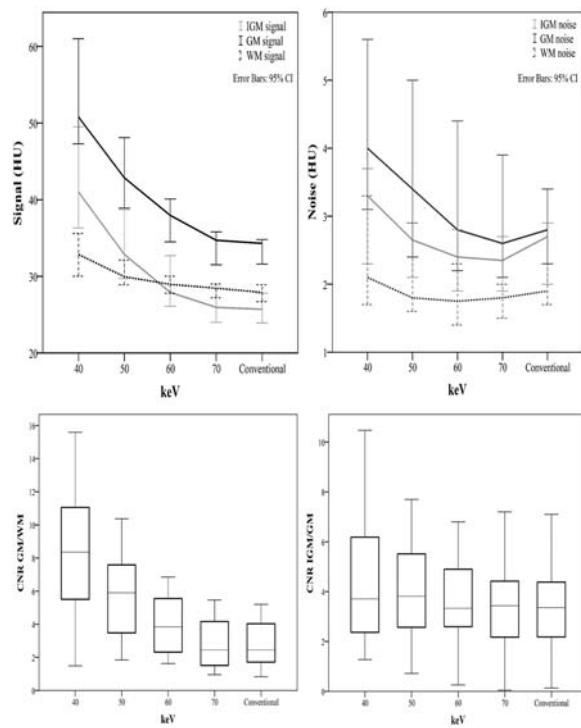
**Background and Aims:** Early ischemic changes may be difficult to detect on conventional computer tomography (CT), but virtual monoenergetic images (VMIs) may improve detection rates through increased soft tissue contrast. We compared the ability to detect early cerebral

ischemia for VMIs to conventional polyenergetic images (CIs) in patients with acute ischemic stroke.

**Methods:** We screened all patients who underwent brain CT in the Philips dual-layer IQon Spectral CT, from January to October, 2018. Inclusion criteria were: clinical suspicion of acute stroke; last seen well < 12 hours; and confirmed ischemic lesion verified by a follow-up CT or MRI.

The spectral files were used to reconstruct VMIs of 40, 50, 60 and 70 kiloelectron volt (keV) and polyenergetic 120 kV CIs. Attenuation and noise were measured in a standardized way, and discrimination between grey and white matter (signal and noise measured in median Hounsfield Unit (HU), and contrast to noise ratio (CNR)) was compared between CIs and VMIs using the Kruskal-Wallis test.

**Results:** The study included 20 patients. Both the median signal and the CNR were significantly increased in all VMIs compared to CIs with peak values at 40 keV (Figure). The noise of VMIs showed a non-significant trend of being increased compared with CI in lower keV with peak values at 40 keV (Figure).



**Conclusions:** The use of VMIs may improve early lesion detection compared to conventional CT images, and thereby enhance diagnostic accuracy.

Trial registration number: N/A

## AS10-032

### PATIENT SELECTION USING PERfusion IMAGING VS TIME FROM ONSET: A COMPARISON OF EARLY OUTCOMES

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**Background and Aims:** Onset to treatment of < 6 hours has been the limiting factor in endovascular treatment of ischemic strokes. Perfusion

imaging has the potential to identify patients who may benefit from mechanical thrombectomy outside of this time window. We analyzed data from the University Hospital North Midlands (UHNM) mechanical thrombectomy register to compare the early outcomes of patients selected by time from onset to those selected by perfusion imaging characteristics.

**Methods:** We identified all patients treated with mechanical thrombectomy at UHNM between September 2017 and October 2018. Outcome measures including imaging performed, mortality and NIHSS at onset, 24 hours and 1 week were then extracted.

**Results:** In total 90 patients were treated with mechanical thrombectomy from September 2017 to October 2018. Of these 53 were treated based on onset time alone and 27 based on perfusion imaging characteristics. Average NIHSS at onset was 20 in the perfusion group and 17 in the time from onset group. At 24 hours, median NIHSS improvement was 12 for the perfusion group and 7 for the time from onset group ( $p = 289$ ). At 1 week, median NIHSS improvement was 12 points and 11 points for perfusion and time from onset groups respectively ( $p = 258$ ). No statistically significant difference was identified between the two groups.

**Conclusions:** Patients selected by time from onset and perfusion imaging experienced similar improvement in NIHSS scores, with no statistically significant difference. Patients selected by imaging characteristics receive the same short-term benefit as those selected by time from onset.

Trial registration number: N/A

## AS10-005

### VALIDATION OF AUTOMATED ASPECTS SOFTWARE FOR DETECTION OF EARLY ISCHEMIC BRAIN CHANGES ON NON-CONTRAST CT SCANS

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**Background and Aims:** In the Alberta Stroke Program Early Computed Tomography Score (ASPECTS), 10 brain regions are dichotomously scored on presence of ischemic stroke damage. However, considerable inter- and intra-reader variability exists, even for expert readers. We evaluated computed ASPECTS (c-ASPECTS 2.0.1, Frontier, Siemens Healthineers, Forchheim, Germany) in comparison to expert readers.

**Methods:** Each included baseline non-contrast CT-scan (5.0 mm slice thickness) from the MR CLEAN trial ( $n = 446$ ) was evaluated by expert readers for manual ASPECTS. 2 observer consensus for ASPECTS-regions (normal/abnormal) was used as ground truth for training (20%) and testing (80%). A c-ASPECTS region score specificity of  $\geq 90\%$  was used to determine the software threshold (relative density difference between affected and contralateral region). Sensitivity, specificity and receiver-operating characteristic curves were calculated. Thereafter, we calculated ICC[1,1], agreement per region and trichotomized ASPECTS (0-4, 5-7, 8-10) for c-ASPECTS and expert readers, and between the expert readers in the test set.

**Results:** A subset ( $n = 442/446$ ) was included. In the training set ( $n = 88$ ), a threshold of 5.1-6.1% was found for a specificity of  $\geq 90\%$ , resulting in a sensitivity and area under the curve of 39- 48% and 0.768- 0.786. In the test set ( $n = 354$ ) the corresponding results were 91-92%, 35-50% and 0.738-0.789, respectively. Comparison of ground truth with other observers resulted in an ICC of 0.379-0.436, regional agreement of

0.78-0.82 and trichotomized ASPECTS agreement of 0.58-0.61. Comparison of ground truth with c-ASPECTS resulted in an ICC of 0.380, regional agreement of 0.81 and trichotomized ASPECTS agreement of 0.60.

**Conclusions:** The performance of c-ASPECTS is similar to expert readers.

**Trial registration number:** NTR1804

## AS10-072

### THE APPLICATION OF BRAIN IMAGING FOR THE PATIENTS WITH SUSPECTED STROKE IN THE RHÔNE AREA: CURRENT STATUS AND THE FACTORS RELATED TO THE INITIAL CHOICE

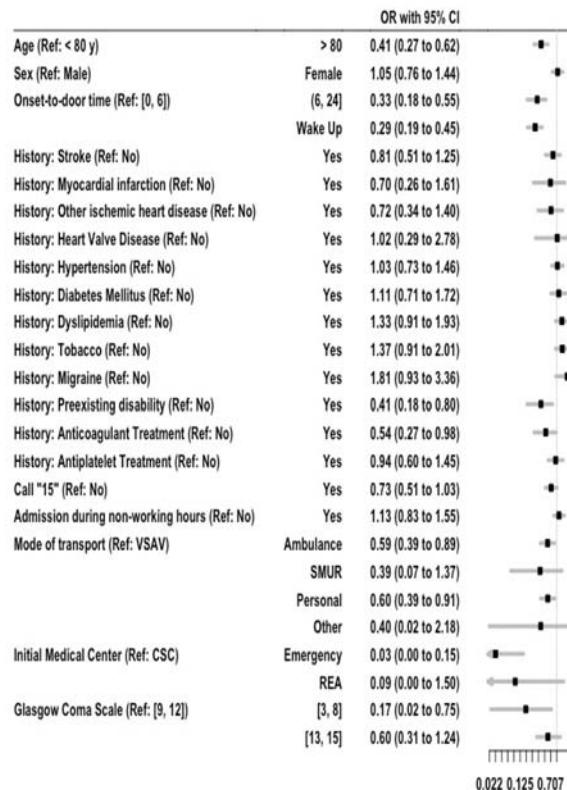
**Y. Xue<sup>1</sup>, N. Noghoghsian<sup>2</sup>, T.H. Cho<sup>2</sup>, A. Termoz<sup>3</sup>, C. Della Vecchia<sup>1</sup>, J. Haesebaert<sup>3</sup> and A.M. Schott<sup>3</sup>**

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**Background and Aims:** Brain imaging is recommended for patients with suspected stroke for appropriate management and treatment in the acute phase. Both computed tomography (CT) and Magnetic resonance imaging (MRI) could be a reasonable initial choice as brain imaging. For medical centers with both techniques available, the choice may be associated with factors related to patients, to stroke symptoms and severity or to management organization.

**Methods:** The data of 3224 patients were extracted from the database of study STROKE 69, a population-based cohort study of all adult patients with suspected stroke admitted within the 24 hours after the onset in the emergency departments or comprehensive stroke centers (CSC) in the Rhône area from November 2015 to December 2016. A multivariate logistic regression was performed.

**Results:** 94.5% patients with suspected stroke underwent brain imaging within the first 24h. 74.2% patients had CT as initial choice versus 25.8% with MRI. In multivariate analyses, older age ( $> 80$  years old,  $P < 0.01$ ), preexisting disability ( $P = 0.02$ ), longer onset-to-door time ( $> 6$  hours,  $P < 0.01$ ), wake-up stroke ( $P < 0.01$ ), not initially admitted to the CSC ( $P < 0.01$ ), transported by ambulance ( $P = 0.01$ ) or personally ( $P = 0.02$ ) and Glasgow Coma Score (GCS)  $<= 8$  ( $P = 0.04$ ) were associated with a lower probability of MRI as initial brain imaging vs CT.



**Conclusions:** Our study showed that age, preexisting disability, onset-to-door time, wake-up stroke, admission initialmedical center, mode of transport and GCS were the factors associated with the initial choice of the imaging method.

**Trial registration number:** N/A

## WITHDRAWN

and validation set ( $n=8$ ). The deep learning was implemented using PyTorch library on graphic processing units. We introduced a 2.5D fast U-Net as backbone for lesion segmentation. The algorithm output generated a pixel-wise confidence score for infarction prediction

**Results:** The performance of infarct prediction indicated a mean Dice score of  $0.552 \pm 0.150$ . The discriminating power of infarct from non-infarct area was measured at case-level, mean sensitivity of  $0.743 \pm 0.074$ , mean specificity of  $0.993 \pm 0.004$ , and mean AUC of  $0.868 \pm 0.037$ . An illustration of tissue outcome prediction was shown using multiparametric deep learning system (Figure 1).

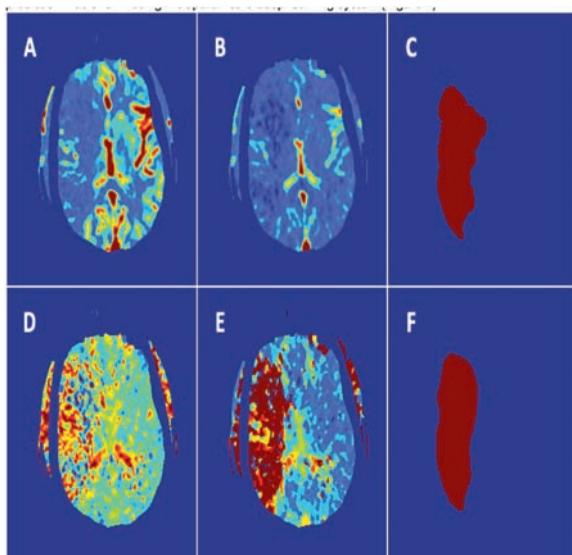


Figure 1: Prediction of stroke tissue outcome using the multiparametric deep neural network.  
Input images: A: CBF; B: CBV; D: MTT; E: Tmax. Ground truth: C. Prediction: F

**Conclusions:** Our study revealed feasibility for predicting tissue outcome in AIS with multiparametric deep learning algorithm, which may be used as decision intelligence for clinicians in pre-treatment assessments

**Trial registration number:** N/A

#### AS10-014

### THROMBOLYSIS OUTCOMES IN ACUTE ISCHEMIC STROKE BY FLAIR HYPERINTENSE ARTERIES IN THE ENCHANTED TRIAL

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Neurology and Neuroscience, Nagoya, Japan; <sup>10</sup>Royal Melbourne Hospital- University of Melbourne, Neurology Department, Melbourne, Australia; <sup>11</sup>Hotchkiss Brain Institute- Cumming School of Medicine- University of Calgary, Departments of Clinical Neurosciences and Radiology, Calgary, Canada; <sup>12</sup>Centre for Clinical Brain Sciences- University of Edinburgh, Edinburgh Imaging, Edinburgh, United Kingdom; <sup>13</sup>University of Leicester, Department of Cardiovascular Sciences and NIHR Leicester Biomedical Research Centre, Leicester, United Kingdom; <sup>14</sup>The George Institute China at Peking University Health Science Center, The George Institute China, Beijing, China

**Background and Aims:** To determine independent factors associated with fluid-attenuated inversion recovery (FLAIR) hyperintense arteries (FLAIR-HAs) on baseline magnetic resonance imaging (MRI) and their prognostic significance in thrombolysis-treated acute ischemic stroke (AIS) patients from the ENCHANTED trial alteplase-dose arm.

**Methods:** Among 3310 AIS patients, 293 with brain MRI (FLAIR and diffusion-weighted imaging [DWI] sequences) scanned  $<4.5$  hours of symptom onset were included. Presence of FLAIR-HAs was assessed by two researchers independently. Infarct volume on DWI, proximal arterial occlusion on magnetic resonance angiography, and other imaging signs (mass effect, old lesions, small vessel disease) were also assessed. 90-day outcomes were death or disability (primary, modified Rankin Scale [mRS] scores 2–6), other mRS scores, and any intracerebral hemorrhage (ICH). Logistic regression models were used for statistical analyses.

**Results:** A history of atrial fibrillation (AF), proximal arterial occlusion, large infarct volume, and anterior circulation infarct were independently associated with FLAIR-HAs. After adjustment of baseline covariates significant in univariable analyses, FLAIR-HAs predicted improved 90-day functional outcome (mRS 2–6;  $n = 139$ , adjusted odds ratio [aOR] 0.24, 95% CI 0.10–0.61) and favourable ordinal mRS shift (aOR 0.45, 95% CI 0.23–0.89). There was a nonsignificant increase in the risk of any ICH ( $n = 80$ , aOR 2.03, 95% CI 0.81–5.08) (table).

Table Thrombolysis outcomes in patients by the presence of FLAIR-HAs

	n/N	OR (95% CI)	P value	Adjusted OR (95% CI)*	P value
Any intracerebral hemorrhage	80/293	5.59 (3.00, 10.42)	<0.001	2.03 (0.81, 5.08)	0.13
modified Rankin scale (mRS) 2–6	139/283	1.61 (1.01, 2.58)	0.05	0.24 (0.10, 0.61)	0.003
mRS 3–6	97/283	2.31 (1.39, 3.86)	0.001	0.34 (0.11, 1.01)	0.05
mRS categories: 0	64/283	2.02 (1.32, 3.07)	0.001	0.45 (0.23, 0.89)	0.02
(unadjusted)					
1	80/283				
2	42/283				
3	32/283				
4	28/283				
5	21/283				
6	16/283				

CI, confidence interval; FLAIR, fluid attenuated inversion recovery; FLAIR-HAs, FLAIR hyperintense arteries; NIHSS, National Institute of Health stroke scale; OR, odds ratio.

**Conclusions:** Prior AF, proximal arterial occlusion, anterior circulation or large infarct are independent factors associated with FLAIR-HAs. FLAIR-HAs indicate a favourable prognosis in AIS patients receiving thrombolysis despite a trend for increased ICH risk.

**Trial registration number:** NCT01422616 (ClinicalTrials.gov)

#### AS11-027

### UNDERLYING MECHANISMS OF VESSEL-WALL DAMAGE AFTER MECHANICAL THROMBECTOMY: A 3-TESLA HIGH-RESOLUTION MRI STUDY

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**Background and Aims:** In preclinical models, endothelial injury is frequently found after mechanical thrombectomy (MT). In humans, endothelial damage can be imaged with high-resolution contrast-enhanced vessel-wall MRI (HRVW-MRI). Herein, we aimed to evaluate the risk factors and radiological complications associated with endothelial injury HRVW-MRI after MT.

**Methods:** A prospective cohort of patients with acute MT-treated proximal occlusions in the carotid territory was analyzed. Endothelial injury was identified as vessel-wall gadolinium-enhancement (VW-GE) in a 72h follow-up 3-Tesla HRVW-MRI. Mean vessel-wall relative signal intensity (rSI) was quantified on pre- and post-contrast black-blood T1-weighted sagittal images across twelve 2-mm thick adjacent slices covering the whole M1 segment. The association of rSI with procedural and outcome variables was analyzed through univariate analysis.

**Results:** A total of 56 patients (median-NIHSS = 16, M2-occlusions n = 10, final mTICI3 n = 48) treated with stentrieviers (n = 46) or aspiration devices (n = 10) were included. VW-GE was observed in all the treated vessels (median-rSI = 1.56, IQR = 1.43-1.80). rSI values were significantly higher in patients treated with stentrieviers (median-rSI = 1.59, IQR = 1.47-1.87) compared with aspiration devices (median-rSI = 1.34, IQR = 1.20-1.55, p = 0.015) and in those who received a higher number of passes (0-2 passes: median-rSI = 1.53, IQR = 1.40-1.68, >2 passes: median-rSI = 1.74, IQR = 1.53-2.43; p = 0.016). Patients with subarachnoid hemorrhage (SAH) after MT had higher rSI values (median-rSI = 1.87, IQR = 1.50-2.24) than those without (median-rSI = 1.55, IQR = 1.39-1.68; p = 0.019). rSI was not associated with final mTICI score or with clinical outcome measures.

**Conclusions:** VW-GE after MT is frequently found in HRVW-MRI, increases in parallel with the number of stentriever passes and is associated with MT-related SAH. The clinical relevance of VW-GE deserves further study.

Trial registration number: N/A

## ASII-058

### AUTOMATED MULTI-FEATURE QUANTIFICATION OF PLAIN CT IN ACUTE STROKE

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**Background and Aims:** Optimal decision-making in acute stroke depends upon evaluating multiple radiological features on unenhanced brain CT. While analytic software have recently been introduced to assist feature interpretation (e.g. "e-ASPECTS"), these have not been shown to distinguish multiple pathologies, that commonly co-occur. This is technologically challenging given that many relevant CT features are hypoattenuating, and overlap in appearance. Here we evaluate a novel, fully-automated method for separately quantifying infarction vs. leukoaraiosis vs. CSF on plain CT.

**Methods:** Experts annotated plain CT heads for CSF (separately for cortex/ventricles/brainstem), leukoaraiosis and established infarctions, in 50, 100 and 450 cases respectively. CTs were fine-cut (0.4 x 0.4 x 0.8mm). Annotations fed into two feature-specific, convoluted neural networks, and a random-forest model (the latter for leukoaraiosis), before being combined in a single 2.5D U-net. Validation was conducted in a separate set of 110 acute ischemic stroke cases. Tests included correlations of feature volumes, and spatial similarity (Dice score).

**Results:** Imaging processing failure occurred in 5/110 cases. Correlations between automated and expert volumes for CSF, leukoaraiosis and

infarcts were: r2: 0.92, 0.71 and 0.82 (all p < 0.001). Dice scores were respectively, 0.88, 0.65 and 0.63. However, for infarct volumes of >1cc, Dice score was 0.82. This represents a >10-30% improvement in segmentation accuracy compared to current methods for fully-automated CT infarction segmentation.

**Conclusions:** Unlike existing automated stroke-imaging software, that focus on single features, we demonstrate a method allowing for accurate distinction and quantification of multiple hypoattenuating CT features in acute stroke.

Trial registration number: N/A

## ASII-034

### PLAQUE NEOVESSELS DETECTED WITH CONTRAST-ENHANCED ULTRASOUND ARE ASSOCIATED WITH INFLAMMATION MEASURED WITH 18-FDG POSITRON-EMISSION TOMOGRAPHY IN PATIENTS WITH ISCHEMIC STROKE AND CAROTID ATHEROSCLEROSIS

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**Background and Aims:** Neovascularization is a hallmark of carotid plaque vulnerability and is closely related to inflammation. With Contrast-Enhanced Ultrasound (CEUS) it is possible to visualize plaque neovessels *in vivo*. We hypothesized that CEUS-detected neovascularization was associated with carotid plaque inflammation measured with <sup>18</sup>Fluorodeoxyglucose Positron-Emission-Tomography (<sup>18</sup>FDG PET-CT).

**Methods:** We conducted a prospective study of consecutive patients with an acute anterior circulation ischemic stroke and at least one atherosclerotic plaque in the internal carotid artery (ICA). All of our patients underwent a CEUS and neovessels were identified as hyperechoic bubbles appearing within the plaque after a bolus of Sonovue® contrast. The patients underwent also an <sup>18</sup>FDG PET-CT and we determined the maximum Standardized Uptake Value (SUV) from the symptomatic ICA. Comparison of the SUVs between neovascularized and non-neovascularized plaques was performed using the Student's t-test. A multivariate linear regression analysis was performed to study other predictors of plaque inflammation.

**Results:** We included 50 patients whose mean age was 74.3 ± 10.4y and 74.4% were men. There were 17 (34.0%) patients with a low-grade stenosis (< 50%). The remainder presented high-grade carotid plaques. The results of the CEUS were not interpretable in 8 (16%) of the patients, mainly due to calcium shadows. We detected neovascularization in 71.4% of the plaques. The presence of CEUS-detected neovessels was associated with higher plaque inflammation (SUV = 2.84 ± 0.56 vs SUV = 2.35 ± 0.36, p = 0.007). In the multivariate analysis CEUS-detected neovessels persisted independently associated with inflammation even after adjusting by the degree of stenosis.

**Conclusions:** CEUS-detected neovessels are associated with carotid plaque inflammation in patients with a recent ischemic stroke.

Trial registration number: N/A

**ASI I-048****AUTOMATED INFARCT DEFINITION USING A VOLUME-DEPENDENT MACHINE LEARNING APPROACH**

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**Background and Aims:** The purpose of this study was to evaluate the automated definition of follow-up infarct on magnetic resonance imaging (MRI) in ischemic stroke patients using a pipeline based on the Brain Intensity AbNormality Classification Algorithm (BIANCA) tool and to compare its performance with human raters.

**Methods:** Consensus masks were generated by two raters and independently adjudicated by a third from a cohort of patients with follow-up MRI scans at 24-hours or 1-week. Scans from each timepoint were divided into training and validation datasets. Volume-independent and volume-dependent BIANCA settings were derived from the training cohort using a leave-one-out approach. These settings were then evaluated in the validation cohort, and the results compared to those of a fourth human rater.

**Results:** Sixty-five patients were included, with 50 images available at 24-hours and 50 images at 1-week. 25 patients were included each in training cohort. Volume-dependent BIANCA defined infarction with high intraclass correlation coefficients at 24-hours (0.99) and 1-week (0.99). Spatial overlaps did not differ significantly from a human rater.

**Conclusions:** The volume-dependent BIANCA pipeline allowed fully automated segmentation of heterogeneous ischemic stroke lesions on follow-up imaging with only modest training data. Volume-dependent BIANCA provides an objective and automated approach to infarct definition that could be used in trials with large numbers of patients.

**Trial registration number:** N/A

**ASI I-056****INFLUENCE OF RISK OF OBSTRUCTIVE SLEEP APNEA ON CEREBRAL VASOREACTIVITY IN PATIENTS WITH STROKE.**

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<sup>1</sup>Federal University of Bahia, Neurology, Salvador, Brazil

**Background and Aims:**

**Introduction:** Obstructive sleep apnea (OSA) is present in 60–70% of stroke patients. Cerebral vasoreactivity in patients with stroke and OSA has not been well studied and could identify a new pathophysiological mechanism with potential therapeutic intervention. Therefore, we aimed to investigate cerebrovascular reactivity in stroke patients with different risk categories for OSA.

**Methods:** Cross-sectional study of a cohort of patients with stroke, using clinical questionnaires (SOS score and STOP-BANG score) to assess the risk of OSA and transcranial Doppler (TCD) to assess cerebral vasoreactivity (breath holding index-BHI- and visual evoked potential – VEP).

**Results:** 99 patients were included, 77 (77.8%) with medium or high risk for OSA (STOP-BANG score  $3.36 \pm 1.54$ , SOS score  $14.80 \pm 7.12$ ); 80 performed TCD. Mean BHI was  $0.52 \pm 0.37$ ; mean VEP  $0.11 \pm 0.05$ , with 54 (69.2%) showing low anterior circulation vasoreactivity ( $BHI < 0.69$ ) and 53 (74.6%) showing low posterior circulation vasoreactivity ( $VEP \leq 0.14$ ). There was a significant negative correlation between the risk of OSA calculated by STOP-BANG and the BHI ( $r = -0.284$ ,  $p = 0.012$ ). Dyslipidemia was the main risk factor associated with both impaired vasoreactivity and OSA risk ( $p < 0.05$ ).

**Conclusions:** There is a high risk of OSA and impaired vasoreactivity in the population that suffered a stroke. Dyslipidemia and STOP-BANG sleep apnea risk categories were independently associated with impaired anterior circulation vasoreactivity, suggesting that impaired vasoreactivity may contribute as a mechanism of stroke in patients with sleep apnea.

**Trial registration number:** N/A

**ASI I-046****RELATIONSHIPS OF SYMPTOM AGGRAVATION WITH LESION LOCATION AND VOLUME ENLARGEMENT IN SMALL ISCHEMIC STROKE DEVELOPED IN BASAL GANGLIA AND PONS**

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**Background and Aims:** The present study evaluated relationships of clinical aggravation with the location and volume enlargement of acute small ischemic stroke developed in basal ganglia and pons.

**Methods:** We analyzed clinical and radiological data of 44 patients, who were diagnosed as lacunes or BAD occurred in basal ganglia ( $n = 26$ ) or pons ( $n = 18$ ) on initial diffusion weighted image (DWI) and took follow-up DWI within 1 week. Neurological changes between the time points of initial and follow-up DWI were checked using National Institute of Health Stroke Scale (NIHSS). Symptom changes were classified into no-aggravation (0 or 1 of NIHSS change) and aggravation group ( $\geq 2$ ). Lesion volume located in basal ganglia or pons was measured on initial and follow-up DWI images using a program (ITK-SNAP). The lesion location and volume differences of acute lesion was compared between no-aggravation and aggravation groups.

**Results:** Symptom aggravation was observed in 17 (38.6 %, basal ganglia, 10 vs. pons, 7) of total patients. Lesion volume was enlarged from initial  $1759 \text{ mm}^3$  to follow-up  $3699 \text{ mm}^3$  in basal ganglia infarction ( $p < 0.001$ ), and, from  $669 \text{ mm}^3$  to  $1220 \text{ mm}^3$  in pontine infarction ( $p < 0.001$ ). The lesion volume was significantly higher in aggravation group of both basal ganglia (aggravation,  $2854 \pm 2020 \text{ mm}^3$ ; no-aggravation group,  $1369 \pm 1305 \text{ mm}^3$ , Mann-Whitney,  $p = 0.036$ ) and pontine infarction (aggravation,  $751 \pm 222 \text{ mm}^3$ ; no-aggravation group,  $424 \pm 368 \text{ mm}^3$ ,  $p = 0.044$ ).

**Conclusions:** The present study showed the severity of volume enlargement related with symptom aggravation in acute basal ganglia and pontine small infarctions.

**Trial registration number:** N/A

**WITHDRAWN**

**Background and Aims:** We sought to investigate the capacity of cerebral autoregulation in patients with cerebral venous sinus thrombosis.

**Methods:** Thirteen patients with cerebral venous sinus thrombosis and 15 healthy controls were enrolled. Cerebral autoregulation was assessed by autoregulatory parameters (rate of recovery/phase/gain) derived from transfer function from spontaneous oscillations of cerebral blood flow velocity and blood pressure.

**Results:** Rate of recovery, phase estimated from patients with cerebral venous sinus thrombosis were significantly different ( $p < 0.05$ ) from controls.

**Conclusions:** Cerebral autoregulation were impaired in patients with cerebral venous sinus thrombosis. Therefore, considering antihypertensive therapy for these patients might be cautious.

**Trial registration number:** N/A

## WITHDRAWN

## ASII-045

### HYPERPERFUSION POST-RECANALISATION IS CONFINED TO INFARCTED TISSUE: A LONGITUDINAL VOXEL-BASED ANALYSIS

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<sup>1</sup>University of Milano-Bicocca, Department of Neurology, Monza, Italy;

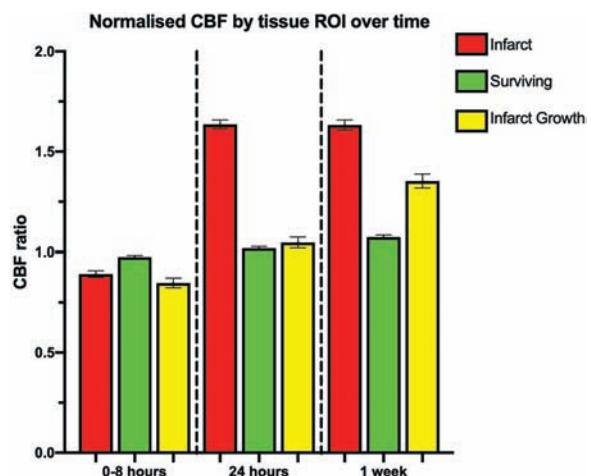
<sup>2</sup>University of Oxford, Acute Vascular Imaging Centre- Radcliffe Department of Medicine, Oxford, United Kingdom

**Background and Aims:** This study characterised changes in cerebral blood flow (CBF) over time post-canulation following mechanical thrombectomy (MT) using arterial-spin labelling (ASL) MRI.

**Methods:** 3T ASL MRI was performed three times post successful recanalization: within 8h, at 24h, and 1-week. Regions of interest (ROI) were defined within a pre-thrombectomy CT defined area of tissue at risk: infarct at presentation, infarct growth (IG) (change between 24 hours and one week), and surviving tissue, alongside their mirrored contralateral ROI. CBF of voxels within ROI was recorded at each time point and normalised against contralateral voxels (CBF ratio) to minimise the effect of individual variability.

**Results:** 597,562 voxels from 6 patients were included in the analysis. The CBF ratio in the 3 ROIs was not different within 8 hours of recanalization (ANOVA;  $p = 0.85$ ). The CBF ratio within surviving tissue remains around 1 (range 0.97-1.07) over the week following successful recanalization. CBF within tissue that was infarcted at time of first MRI demonstrated evidence of hyperperfusion at 24h that was sustained at 1-week. IG voxels were trending to hyperfusion at 1-week, but not at 24h.

**Conclusions:** Immediately following successful recanalization, there is no difference in CBF ratio by ultimate tissue outcome. Evidence of tissue hyperperfusion is limited to those voxels that have infarcted, either early or late. These observations need confirmation in a larger cohort.



**Trial registration number:** N/A

## ASII-059

### HOW MANY PATIENTS ARE ELIGIBLE FOR THROMBECTOMY IN THE FIRST 24 HOURS AFTER STROKE?

**S. Eltawil<sup>1</sup>, B. Viveka<sup>2</sup>, D. Porter<sup>2</sup>, R. Jampana<sup>2</sup> and K. Muir<sup>2</sup>**

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**Background and Aims:** Recent trials showed successful recanalization and clinical benefit from intravenous thrombolysis or endovascular treatment in patients with a major artery occlusion and a favourable perfusion imaging profile up to 24 hours from symptom onset. We sought to identify the proportion of patients presenting in the 4.5 to 24 hours window who would be eligible for treatment by trial inclusion criteria.

**Methods:** We undertook a prospective, observational, single centre study including patients with clinical diagnosis of stroke 4.5 to 24 hours after symptom onset. Patients were imaged using CTP and CTA at presentation and follow up MRI and MRA at 48 to 72 hours. CTP analysis was performed on both Mistar and RAPID software packages. Favourable imaging profile was defined based on imaging selection criteria for the DAWN and DEFUSE-3 trials

**Results:** 20 patients were included in this pilot phase, 4 were excluded due to alternate final diagnosis, leaving 16 patients (12 males, mean age 67.4+/-9.5 years), of whom 13/16 (81%) were imaged 12–24 hours after symptom onset. Hypoperfusion of any extent was seen in 6/16 by Mistar, and 7/16 by RAPID, all of which included areas identified as penumbra. Three patients (19%) had ICA or M1 occlusion. One patient (6%) met DEFUSE-3 criteria for thrombectomy, and none met DAWN criteria.

**Conclusions:** CTP detected tissue meeting penumbral perfusion criteria in 40% of patients scanned 4.5 to 24 hours after onset of symptoms but only 6% met selection criteria used in one recent mechanical thrombectomy trial.

**Trial registration number:** N/A

## AS II-035

### PREDICTION OF INTRAPLAQUE HEMORRHAGE ON FAT-SUPPRESSED T1-WEIGHTED IMAGING

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<sup>2</sup>University Hospitals of Geneva, Pathology, Geneva, Switzerland;

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**Background and Aims:** Magnetic resonance imaging (MRI) using Fat-suppressed T1 MR (fsT1-MR) imaging has emerged as a useful tool to predict vulnerable components of a carotid plaque in particular intraplaque hemorrhage. We aim to determine the correlation and predictive value of fsT1-MR in patients presenting carotid stenosis and undergoing endarterectomy.

**Methods:** Patients with a more than 50% symptomatic stenosis scheduled for endarterectomy were included in the study. Intraplaque hemorrhage was screened with fsT1-MR imaging and compared to a histological analysis of the plaque. Both analysis were realized by blinded experienced specialists. Signal hyperintensity on fsT1-MR were graded from 0 to 3. Histological sections were stained with hematoxylin-eosin using semi-quantitative scoring (grade 0 to 3) for necrotic core and recent intraplaque hemorrhage. Grade 3 was considered as plaque hemorrhage on both methods.

**Results:** 20 patients with symptomatic carotid stenosis were included, 9 (45%) were graded 3 for plaque hemorrhage on fsT1-MR. Plaque hemorrhage was confirmed on 5 (45%) of these 9 patients after histological analysis. FsT1-MR sensibility and specificity were 83% and 71% respectively. Positive and negative predictive value were 56% and 91% respectively.

**Conclusions:** In our group of patients FsT1-MR sequences overestimated the presence of intraplaque hemorrhage. These results further suggest that fsT1-MR imaging of the plaque cannot, on its own, be used as unique criteria for the decision of carotid revascularization.

**Trial registration number:** N/A

## AS II-023

### ULTRASONOGRAPHY EVALUATION AFTER ENDOVASCULAR RECANALIZATION THERAPY: USEVERT STUDY

**C.I. Gómez-Escalona Escobar<sup>1</sup>, H. García Moreno<sup>1</sup>, T. Llano Sánchez<sup>1</sup>, D. Mayo Canalejo<sup>1</sup>, M. Romeral Jiménez<sup>1</sup>, L. Silva Hernández<sup>1</sup>, D. Toledo Alfocea<sup>1</sup>, P. Simal Hernández<sup>1</sup>, M. Moreu Gamazo<sup>2</sup>, S. Rosati<sup>2</sup> and J. Egido Herrero<sup>1</sup>**

<sup>1</sup>San Carlos Clinical Hospital, Stroke Unit, Madrid, Spain; <sup>2</sup>San Carlos Clinical Hospital, Neuroradiology, Madrid, Spain

**Background and Aims:** Cerebral hyperperfusion has been associated with an unfavourable outcome after endovascular recanalization therapy, secondary to a failure in the cerebral vascular self-regulation.

To analyse the frequency and associated factors after endovascular revascularization in large vessel occlusion ischaemic stroke and its prognostic association.

**Methods:** Prospective study of patients with acute ischaemic stroke due to occlusion of the terminal internal carotid artery or middle cerebral artery (MCA), treated with mechanical thrombectomy and TICI2B-3 recanalization. There was no concomitant stenosis in the cervical carotid artery or contralateral carotid artery. A neurosonological study of both MCAs was performed at 6, 24 and 48 hours after the endovascular procedure. Mean velocities (MV) and percentage variability after recanalization and their association with infarct size, symptomatic intracranial haemorrhage (sICH) and clinical outcome were analysed.

**Results:** 91 patients with a median age of 78 years (IQR 62 – 84) and NIHSS 18 (IQR 12–22). In 77% the occlusion was at the MCA and intravenous thrombolysis was used in 40.7%. The incidence of sICH was 5.5%. At three months, the mortality rate was 19.8% and functional independence (mRS≤2) 52.7%. There was a significant association between the increase in MV in the treated MCA (in comparison to the contralateral MCA) with the infarct size, mortality and functional dependence at three months. In multivariate analysis, an increase >50% had a poor clinical outcome OR of 6.83. All patients with an increase >80% presented poor clinical outcome.

**Conclusions:** The increase of MV in the first 24 hours after endovascular recanalization has a significant prognostic relevance.

**Trial registration number:** N/A

## AS II-037

### EVOLUTION OF CHOROID PLEXUS VOLUME AFTER HUMAN ISCHEMIC STROKE

**N. Egorova<sup>1</sup>, E.W. Gottlieb<sup>2</sup>, M. Salah<sup>2</sup>, N. Spratt<sup>3</sup> and A. Brodtmann<sup>2</sup>**

<sup>1</sup>University of Melbourne, Melbourne School of Psychological Sciences, Melbourne, Australia; <sup>2</sup>University of Melbourne, Florey Institute of Neuroscience & Mental Health, Melbourne, Australia; <sup>3</sup>The University of Newcastle, School of Biomedical Sciences and Pharmacy, Newcastle, Australia

**Background and Aims:** Age related choroid plexus and ventricular decline are associated with impaired cerebrospinal fluid (CSF) dynamics. The CSF-choroid plexus system plays a critical role in neuroinflammation and the restoration of the brain in neurodegenerative animal models. However, little is known about the post-stroke evolution of the choroid plexus in humans. Our aim was to characterize longitudinal structural choroid plexus changes after human ischemic stroke.

**Methods:** We used an automatic segmentation tool to estimate the volumes of choroid plexus and lateral ventricles in stroke (n=110) and control (n=39) participants at three timepoints (baseline, 3 and 12 months) post-stroke. We assessed group differences cross-sectionally at each timepoint and longitudinally. For stroke participants, we

specifically differentiated between ipsi- and contra-lesional volumes. Statistical analyses were conducted for each region separately and included age, sex, total intracranial volume, and education as covariates.

**Results:** We observed significantly larger choroid plexus volumes in stroke participants compared to controls in both cross-sectional and longitudinal analyses (Figure 1). Repeated measure analyses revealed no changes to choroid plexus volume over the first year after stroke, with no difference between ipsi and contra-lesional volumes (Figure 2A). This was in contrast to the volume of lateral ventricles that we found to enlarge over time in all participants, with more accelerated expansion in stroke survivors ipsi-lesionally ( $F(2,192) = 3.411$ ,  $p = 0.050$ ) (Figure 2B).

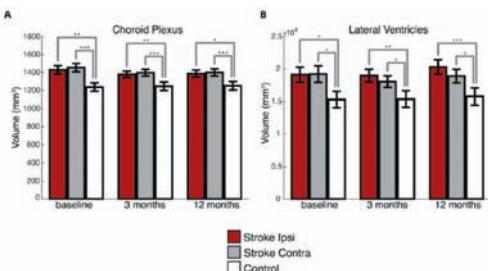


Figure 1. Cross-sectional analysis by time point. A. Choroid plexus volume. B. Lateral ventricle volume.

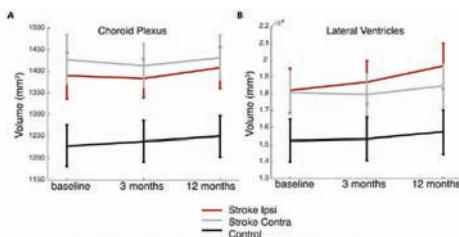


Figure 2. Longitudinal analysis. A. Choroid plexus volume over time. B. Lateral ventricle volume over time.

**Conclusions:** Our results suggest that chronic stages of stroke are characterised by larger choroid plexus volumes, but the enlargement likely takes place prior to or very early after the stroke incident.

**Trial registration number:** N/A

## ASII-061

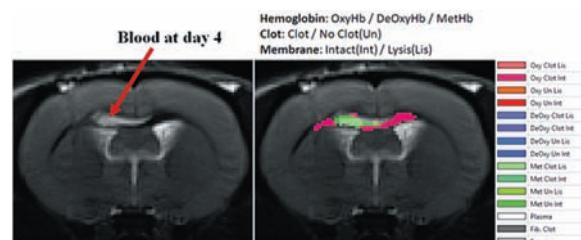
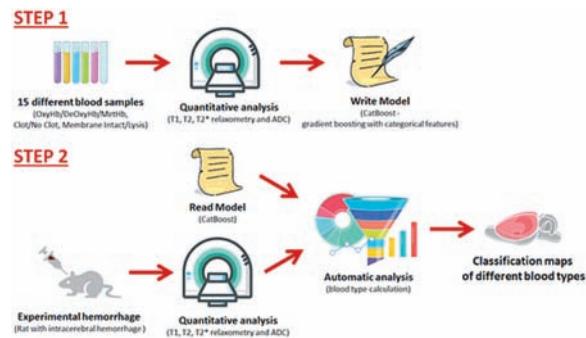
### GRADIENT BOOSTING IN AUTOMATIC DETERMINATION OF HEMOGLOBIN SPECIMEN IN INTRACEREBRAL HEMORRHAGE

I. Gubskiy<sup>1</sup>, D. Namestnikova<sup>1</sup>, D. Nebesniy<sup>2</sup>, L. Gubsky<sup>1</sup>, A. Osipov<sup>2</sup> and V. Lelyuk<sup>1</sup>

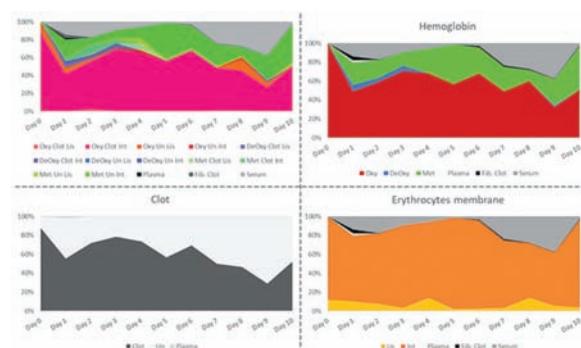
<sup>1</sup>Federal Center of Cerebrovascular Pathology and Stroke, Radiology, Moscow, Russia; <sup>2</sup>Pirogov Russian National Research Medical University, Department of Medical Biophysics, Moscow, Russia

**Background and Aims:** Automatic determination of hemoglobin species inside intracerebral hemorrhage in emergency radiology may improve efficiency and speed of radiologist diagnosis. Characterization of hemorrhage using quantification MRI and modern methods of machine learning, such as gradient boosting with categorical features (CatBoost) support can be helpful.

**Methods:** Laboratory constructed phantom was used for modeling of different hemoglobin species and statements of erythrocyte membrane. T1, T2, T2\* relaxation time and apparent diffusion coefficient were measured. Spectrophotometry was used to control of hemoglobin species and erythrocytes membrane status. Additionally, hemorrhage stroke was modeled in rat with subsequent dynamic MRI examination. At the first stage, we trained model on experimental data. After that on rat with intracerebral hemorrhage the form of hemoglobin and condition of clot were determined.



**Results:** Obtained data suggests that methemoglobin appears from the first day with a peak on the fifth, the blood clot gradually decreases within time in size in 10 days, while erythrocyte lysis is not clearly observed. The presence of oxyhemoglobin for up to 10 days can be explained by its diamagnetic nature and poor classification against the background tissue.



**Conclusions:** Using of machine learning in assessment of hemoglobin species may help in diagnostic of intracerebral hemorrhage.

**Trial registration number:** N/A

## AS1 I-050

### DYNAMICS OF ARTERIAL SPIN LABELING PERfusion MRI AND COGNITIVE PERFORMANCE AFTER REVASCULARIZATION OF CAROTID ARTERY STENOSIS

**M. Heinze<sup>1</sup>**

J. Schröder<sup>1</sup> M. Günther<sup>2</sup> B. Cheng<sup>1</sup> T. Schneider<sup>3</sup> A. Niebuhr<sup>1</sup> F. Fischer<sup>1</sup> S. Kessner<sup>1</sup> T. Magnus<sup>1</sup> J. Fiehler<sup>3</sup> A. Larena-Avellaneda<sup>4</sup> C. Gerloff<sup>1</sup> G. Thomalla<sup>1</sup>; <sup>1</sup>University Hospital Hamburg Eppendorf, Neurology, Hamburg, Germany

**Background and Aims:** Several studies have suggested a correlation between impairment of cognitive function and asymptomatic carotid artery stenosis without ischemic cerebral brain lesions. Hypoperfusion has been discussed as a possible pathophysiological cause. It remains unclear whether hypoperfusion alone without evidence of infarction is sufficient to cause cognitive decline. In this study, we evaluated cognitive performance and cerebral perfusion changes in patients with asymptomatic carotid artery stenosis by arterial spin labeling (ASL) perfusion MRI before and after revascularization therapy.

**Methods:** 17 asymptomatic patients with unilateral high-grade ( $\geq 70\%$ ) carotid artery stenosis without evidence of structural brain lesions underwent ASL perfusion MRI and cognitive testing (MMSE, DemTect, Clock-Drawing-Test, Trail-Making Test, Stroop Test) before and 6–8 weeks after revascularization therapy by endarterectomy or stenting. Multiparametric perfusion maps (cerebral blood flow (ASL-CBF), bolus arrival time (ASL-BAT)) were calculated and analyzed by vascular territory. Relative perfusion values were calculated.

**Results:** A significant impact of revascularization therapy was proven in multivariate analysis on all perfusion measures analyzed. MCA borderzones were identified as territories showing significant hypoperfusion at baseline post-hoc testing in ASL-CBF and ASL-BAT. All perfusion alterations normalized after revascularization. No significant correlation of cognitive test results with perfusion parameters was observed. Cognitive Performance showed no significant change after revascularization.

**Conclusions:** Our study was able to show perfusion alterations in asymptomatic patients with high grade carotid artery stenosis in the absence of structural brain lesions, which proved fully reversible after revascularization therapy. In this cohort of asymptomatic patients no association of hypoperfusion with cognitive performance was observed.

**Trial registration number:** N/A

## AS1 I-054

### ACCURACY OF INTRACEREBRAL HEMORRHAGE VOLUME CALCULATION: COMPARISON BETWEEN MANUAL VOLUME SEGMENTATION AND FULLY AUTOMATIC COMPUTERISED METHODS

**R.A. Radu<sup>1</sup>, L.I. Ion<sup>1</sup>, A.V. Marinescu<sup>2</sup>, E.O. Terecoasa<sup>1</sup> and C. Tiu<sup>1</sup>**

<sup>1</sup>University Emergency Hospital Bucharest, Department of Neurology, Bucharest, Romania; <sup>2</sup>University Emergency Hospital Bucharest, Department of Radiology and Medical Imaging, Bucharest, Romania

**Background and Aims:** Accurate estimation of intracerebral haemorrhage (ICH) volume is essential for adequate management decisions. We aimed to determine the accuracy of a fully automatic computerised method based on manually thresholding volumes within regions of interest (AC) relative to manual volume segmentation (MVS) method for estimating ICH volumes.

**Methods:** Neuroimaging data were prospectively collected for 73 ICH patients. Haematoma volumes were measured with both the AC and the

MVS methods. Agreement between the methods was evaluated using the Bland-Altman plots. MVS was considered the reference method.

**Results:** Mean patients' age was  $69.4 \pm 12.2$  years. Median ICH volumes and 25–75 IQR assessed with the MVS and the AC methods were 9.7 mL (3.4 – 30.6 mL) and respectively 8.6 mL (3.1– 24.6 mL). AC method systematically underestimated MVS method with a mean difference of 4.6 mL (95% CI 2.2 to 7.1 mL). Since we observed an increase in variability of the ICH volumes differences assessed with the two methods as the ICH volume increased, we created second Bland-Altman plots using the geometric means which showed an AC to MVS ratio of 0.89 (95% CI 0.85 – 0.94). In our cohort, the percentage difference between ICH volumes assessed with the AC method is not expected to exceed 14.5% (95% CI 10.4 – 16.3) of the volume assessed with the MVS method.

**Conclusions:** Despite being easier to use, automatic computerized volumetry might consistently underestimate ICH volumes. Further work is needed to establish the clinical impact of the differences between different methods of haematoma volume calculation.

**Trial registration number:** N/A

## AS1 I-005

### COLOR DOPPLER IMAGING OF ORBITAL VESSELS IN THE DIAGNOSIS OF ANTERIOR ISCHEMIC OPTIC NEUROPATHIES

**D.C. Jianu<sup>1</sup>, S.N. Jianu<sup>2</sup>, L. Petrica<sup>3</sup>, T.F. Dan<sup>1</sup>, C. Barsan<sup>1</sup> and G. Munteanu<sup>1</sup>**

<sup>1</sup>"Victor Babeș" University of Medicine and Pharmacy, Neurology, Timisoara, Romania; <sup>2</sup>"Dr. Victor Popescu" Emergency Military Hospital, Ophthalmology, Timisoara, Romania; <sup>3</sup>"Victor Babeș" University of Medicine and Pharmacy, Internal Medicine–Nephrology, Timisoara, Romania

**Background and Aims:** Anterior ischemic optic neuropathies, represented by a segmental infarction of the optic nerve head supplied by the posterior ciliary arteries (PCAs), can be: non-arteritic (NA-AIONs), which are a multifactorial disease, and arteritic (A-AIONs), due to giant cell arteritis (GCA).

The aim of our study was to investigate the clinical and ultrasound characteristics of the orbital vessels, and of the branches of ECAs, in patients with unilateral acute AION, which help differentiate newly diagnosed NA-AIONs from A-AIONs, which require immediate steroid treatment, in order to protect the fellow eye from going blind.

**Methods:** In this prospective comparative, observational study, 80 consecutive patients with clinical suspicion of unilateral acute AION were examined at admission, and in the first two months, following a protocol including color Doppler imaging (CDI) of the orbital vessels.

**Results:** We found 16 patients with A-AIONs, and 64 with NA-AIONs. The firsts presented a combination of a history of amaurosis fugax (4 cases), before abrupt, painless, and severe vision loss and diffuse pale optic disc edema in 13 patients. A typical sonographic feature in temporal arteritis as part of GCA was "dark halo" sign in 12 A-AIONs cases. CDI of the orbital vessels revealed in all A-AION cases high resistance index (RI) in all orbital vessels, with severe diminished velocities in the PCAs, especially in the affected side. In all NA-AIONs patients, none of these clinical symptoms were found and velocities and RI in PCAs were preserved.

**Conclusions:** CDI of the orbital vessels enables prompt differentiation between NA-AIONs and A-AIONs.

**Trial registration number:** N/A

**ASII-044**
**DEVELOPMENT OF A STROKE POPULATION  
SPECIFIC ANATOMICAL CT BRAIN ATLAS – A  
TOOL TO STANDARDISE CLINICAL RESEARCH  
AND IMPROVE STROKE  
OUTCOME PREDICTION**

**T. Kaffenberger<sup>1</sup>, V. Venkatraman<sup>2</sup>, C. Steward<sup>2</sup>, V. Thijs<sup>1,3</sup>,  
J. Bernhardt<sup>1,4</sup>, P. Desmond<sup>2</sup>, B. Campbell<sup>5</sup> and N. Yassi<sup>5,6</sup>**

<sup>1</sup>The Florey Institute of Neuroscience and Mental Health- University of Melbourne, Stroke Theme, Heidelberg, Australia; <sup>2</sup>University of Melbourne, Department of Medicine and Radiology, Parkville, Australia;

<sup>3</sup>Austin Health, Department of Neurology, Heidelberg, Australia; <sup>4</sup>The Florey- University of Melbourne, Stroke Theme, Parkville, Australia;

<sup>5</sup>Melbourne Brain Centre- Royal Melbourne Hospital, Department of Medicine and Neurology, Parkville, Australia; <sup>6</sup>The Florey Institute of Neuroscience and Mental Health- University of Melbourne,

Neuropathology and Neurodegeneration Laboratory, Parkville, Australia

**Background and Aims:** Computed tomography (CT) is the most commonly used imaging modality in acute stroke, yet no stroke population-specific anatomical atlas exists for use in stroke outcome prediction studies. In the few studies which employ standardised brain atlases to investigate infarct location as a predictive marker, no formal validation of the alignment of individual images to template space is usually described. We aimed to develop the first stroke population-specific standard-resolution CT template and corresponding anatomical brain atlas together with a reliable registration algorithm.

**Methods:** We used 50 normal-for-age non-contrast CT scans to create the template. We manually defined anatomical brain regions to generate a segmented whole brain atlas. We then validated the registration algorithm using CT scans of 100 individuals to assess the alignment of insular ribbon, lateral ventricle, caudate and cerebellum using the DICE coefficient.

**Results:** We derived a CT atlas with axial 5mm slice thickness from adults with a typical age and sex distribution (median age 71.9 y (62.1 – 80.2), 60 % male) for stroke patients. This approach accounts for structural changes related to aging which can interfere with registration to atlases derived in young healthy individuals. The alignment between manually segmented and automatically co-registered segmentations of 100 individuals with small (< 10 ml), medium (10-70ml), and large (>70ml) infarct lesions indicated reliable registration (all DICE coefficients > 0.6).

**Conclusions:** The newly created CT brain atlas has the potential to standardise stroke lesion segmentation. Together with the automated registration algorithm it allows analysis of large datasets to improve prediction tools for stroke patients.

**Trial registration number:** N/A

**ASII-055**
**VULNERABLE CAROTID PLAQUES IN  
SYMPTOMATIC CAROTID STENOSIS INDUCE  
INTRACRANIAL VASOMOTOR REACTIVITY**

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<sup>1</sup>Postgraduate Institute of Medical Education and Research, Neurology, Chandigarh, India; <sup>2</sup>Postgraduate Institute of Medical Education and Research, Radiodiagnosis, Chandigarh, India

**Background and Aims:** Vulnerable plaques can show plaque micro-vascularization. We hypothesize that vulnerable plaques induce intracranial collaterals thereby limiting ischemic effects of stroke.

**Methods:** Patients of TIA/Ischemic stroke within 6 months with symptomatic severe carotid stenosis and good temporal window for transcranial doppler (TCD) were included in the study. Ultrasound carotid

duplex of extracranial carotids with contrast (sonovue) and TCD of middle cerebral artery (MCA) for high intensity transients (HITS) and vasomotor reactivity by breath holding index (BHI) was done. Intracranial collaterals were assessed by CT Angiography (CTA) and classified as per modified Tan System.

**Results:** 48 patients were recruited. 14 (29.1%) had TIA (transient ischaemic attack), 34(70.9%) had stroke. 15 (31.2%) patients had right internal carotid artery (RICA) stenosis, 28 (58.3%) had left carotid artery (LICA) stenosis, 5 (10.4%) had bilateral stenosis. Mean ICA stenosis was  $84 \pm 11.37\%$ . 15 (31.2%) had vulnerable plaques.(hypoechoic, ulceration, contrast enhancement): 11 (73.3%) patients had hypoechoic plaque (type I and 2), 3 (20%) had plaque ulceration, 3 (20%) had plaque contrast enhancement. 33 (68.7%) had no plaque vulnerability. Mean MCA-BHI on symptomatic side was  $0.72 \pm 0.56$  and  $1.08 \pm 0.31$  on asymptomatic side. Thirty three (68.7%) had good collaterals (more than 50% MCA), 15 (31.2%) had poor collaterals (less than 50% MCA). Higher VMR (BHI: $0.91 \pm 0.49$ ) was associated with plaque vulnerability vs no plaque vulnerability ( $0.65 \pm 0.52$ ). 44% patients with normal BHI vs 17.4% with impaired VMR group had features of plaque vulnerability ( $p < 0.05$ ).

**Conclusions:** In patients with severe symptomatic carotid stenosis, plaque vulnerability may be protective by inducing angiogenesis and therefore better VMR in the MCA.

**Trial registration number:** N/A

**WITHDRAWN**

**AS11-041****GREY AND WHITE MATTER-SPECIFIC THRESHOLDS FOR OPTIMISING THE DEFINITION OF INFARCT CORE IN CT-PERFUSION**

**C. Laredo MSc<sup>1</sup>, A. Renú<sup>1</sup>, A. Rodriguez<sup>1</sup>, S. Rudilosso<sup>1</sup>, L. Llull<sup>1</sup>, S. Amaro<sup>1</sup>, V. Obach<sup>1</sup>, X. Urra<sup>1</sup> and A. Chamorro<sup>1</sup>**

<sup>1</sup>Hospital Clinic, Institut Clinic de Neurociències, Barcelona, Spain

**Background and Aims:** CT-perfusion (CTP) is a widely available technique that allows measuring infarct core in patients with ischemic stroke. However, it often overestimates the true infarct and has a limited accuracy compared to MRI, probably because applying homogeneous thresholds of cerebral blood flow (CBF) results in under/overestimation of the lesion in brain areas with different susceptibility to ischemia.

**Methods:** In consecutive patients ( $n = 101$ ) with witnessed strokes due to proximal occlusions in the carotid territory with baseline CTP, full (TICI 3) endovascular reperfusion, and follow-up MRI, we segmented grey and white matter (GM/WM) and co-registered CTP with DWI-MRI. We assessed the yield of different relative CBF thresholds to predict: 1/ Infarcted voxels in DWI through ROC analysis, and 2/ Final DWI lesion volume (net difference of the estimation and intraclass correlation coefficient, ICC).

**Results:** A double GM/WM-specific threshold of rCBF 45%/30% was superior to a fixed threshold (rCBF 35%) in predicting infarcted voxels (Youden index 0.32 vs. 0.30). The fixed threshold underestimated lesions in GM and overestimated them in WM. In the analysis of the final volume, the best thresholds were also different for GM (rCBF 30% or 35%) and WM (rCBF 20%). The different thresholds in both analyses could be partially explained by the individual infarct growth from CTP to MRI, that cannot be controlled in the voxel-based study.

**Conclusions:** GM and WM-specific thresholds result in different thresholds for defining infarcted tissue in CTP and increase the accuracy of the predictions regarding the tissue fate of each voxel and total infarct volume.

**Trial registration number:** N/A

**AS11-040**

**ASII-033****CEREBRAL VASOMOTOR REACTIVITY IN CHRONIC INSOMNIA**

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**Background and Aims:** Breath holding index (BHI) is a transcranial Doppler ultrasonography (TCD) technique useful to estimate cerebral vasomotor reactivity. We evaluated BHI changes in patients with chronic insomnia (CI), according to ICSD-3 definition, also investigating the role of vascular risk factors (VRF).

**Methods:** We recruited 61 subjects with CI (42 females, mean age 61.7 ± 7.1) and 34 controls (16 females, mean age 60.2 ± 7.6) demanding the presence of VRF. Everyone was submitted to TCD, obtaining the mean blood flow velocity (MFV) of both middle cerebral arteries (MCAs). BHI was calculated as follows: [(MFVBH-MFVR/MFVR) × 100/s], with MFV<sub>BH</sub> at the end of apnoea, MFV<sub>R</sub> at rest, and s indicated apnoea seconds, usually 30s. The mean BHI of the two sides was compared in two groups, analysing also the effect of VRF.

**Results:** An inverse correlation was found between MFVR and age ( $r = -0.28$ ,  $p = 0.007$ ) in the whole study group, without significant difference of BHI values between CI subjects and controls. By linear regression and ANOVA, we found that the presence of both CI and VRF had an interactive effect on the BHI values. Consequently, we performed a four group comparison according to the presence/absence of both CI and VRF showing significant BHI increasing in CI patients without VRF compared to CI patients with VRF ( $p = 0.024$ ).

**Conclusions:** Several studies demonstrate increased levels of arousal in insomnia over the day. This cortical hyperactivation could make cerebral vasoreactivity more efficient. In presence of VRF this adaptation seems to be compromised. This study showed that cerebral vasoreactivity assessed by BHI is greater in patients with CI without VRF.

**Trial registration number:** N/A

**ASII-028****DIAGNOSIS OF CHRONIC CEREBRAL VENOUS SINUS THROMBOSIS WITH MAGNETIC RESONANCE BLACK BLOOD THROMBOSIS IMAGING TECHNIQUE: COMPARISON WITH CE-TI-MPRAGE AND CE-MRV**

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**Background and Aims:** The valid cerebral imaging to diagnose chronic cerebral venous sinus thrombosis (CVST) is lacking. Magnetic resonance black Blood thrombus imaging technique (MRBTI) has advantages in visualizing cerebral vasculature. Here we compared the ability of MRBTI, contrast enhanced TI-MPRAGE (CE-TI-MPRAGE) and contrast enhanced magnetic resonance venography (CE-MRV) to detect chronic CVST.

**Methods:** We included CVST patients admitted between March, 2016 and September, 2019. The followed-up imaging was obtained 30 days after symptom onset. We defined the degree of stenosis as mild (less than 50%), moderate (51%~69%), severe (70%~99%) and occlusion (100%). Superior sagittal sinuses (SSS), left transverse sinuses (LTS), left

sigmoid sinuses (LSS), right transverse sinuses (RTS) and right sigmoid sinuses (RSS) were analyzed. The accuracy, positive predictive value (PPV) and negative predictive value (NPV) were analyzed when predicting severe stenosis or occlusion for each sinus.

**Results:** Thirteen patients were included in this study. Compared with MRBTI, the accuracies of CE-MRV were from 53.9% to 76.9% and the NPVs were from 45.5% to 70.0% in SSS, LTS, LSS, RTS and RSS. The PPVs were 100%. On the other hand, compared with MRBTI, the accuracies of CE-TI-MPRAGE were from 46.2% to 61.5% and the NPVs were from 41.7% to 58.3% in SSS, LTS, LSS, RTS and RSS. The PPVs were 100% except for LTS and LSS, because CE-TI-MPRAGE failed to detect severe stenosis or occlusion at these sites.

**Conclusions:** CE-MRV and CE-TI-MPRAGE may overestimate the recanalization rate. MRBTI may be an effective non-invasive imaging method to assess cerebral venous sinus recanalization in chronic CVST patients.

**Trial registration number:** N/A

**ASII-008****USEFULNESS OF THE OPTIC NERVE SHEATH DIAMETER IN PATIENTS WITH MALIGNANT MEDIA INFARCTION**

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**Background and Aims:** A malignant middle cerebral artery (mMCA) infarction, which accounts for up to 10% of patients with supratentorial ischemia has a mortality rate of nearly 80%, if these patients did not undergo hemicraniectomy. The ultrasound-based evaluation of the optic nerve sheath diameter (ONSD) has been demonstrated to be a useful and noninvasive assessment for detecting raised intracranial pressure (ICP).

Our aim was to investigate whether increased ONSD at patient admission and its serial evaluation was associated with raised ICP during the first hours and days after MCA infarction.

**Methods:** In a single-center prospective study we enrolled 29 patients with MCA infarction, including 10 with malignant MCA stroke, and 14 control patients matched for age. ONSD was measured with a 10-MHz linear ultrasound probe. Volumetric analysis of infarction was performed by a neuroradiologist.

**Results:** ONSD on admission was larger in patients who developed mMCA (mean 5.99 mm, standard deviation (SD) 0.318) compared to patients with MCA infarction (4.98 mm, SD 0.532;  $p = 0.003$ ), and to control patients (4.57 mm, SD 0.285;  $p < 0.001$ ). The difference persisted over 3 days. Correlation was observed between the largest ONSD and volumetric evaluation of cerebral infarction in the CT scan on day two ( $r = 0.757$ ;  $p < 0.001$ ). An ONSD of 5.595 mm accurately predicted an mMCA with a sensitivity of 100% and specificity of 90%.

**Conclusions:** In the early hours after severe ischemic stroke, ONSD may be useful for noninvasively detecting high ICP and to indicate the necessity of hemicraniectomy.

**Trial registration number:** N/A

**ASII-043****EFFECT OF ANTITHROMBOTIC THERAPY ON CEREBRAL MICROBLEEDS AT 1-YEAR FOLLOW-UP IN PATIENTS AFTER ISCHEMIC STROKE: A PRELIMINARY DATA**

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**Background and Aims:** Patients with ischemic stroke are known to have a higher prevalence of cerebral microbleeds. Microbleeds are associated with increased risk of intracerebral hemorrhage, especially if combined with antithrombotic therapy. Fewer data are available about the incidence of new microbleeds in patients after the acute stage of stroke. **Methods:** 1-year prospective data were collected from 100 patients with ischemic stroke. 1,5T MRI including T2 star-weighted images was performed 7 – 12 days after stroke onset and at 1 year. Patients were clinically controlled at 3 months and 1 year and medication history were recorded.

**Results:** 35 patients had microbleeds at baseline MRI. At 1-year follow-up, 8 patients newly developed microbleeds, 7 patients showed microbleeds progression, and 7 patients had new hemosiderin deposits in the ischemic lesion. No space occupying hemorrhage was found. The incidence of new microbleeds did not differ in patients with antiplatelet monotherapy, dual antiplatelet therapy (DAPT) and anticoagulation. However, a trend of longer duration of anticoagulation in patients with microbleeds was observed (6.05 compared to 4.96 months). 30 patients had DAPT longer than 3 months, no trend towards higher microbleeds incidence was observed.

**Conclusions:** Our data suggest that 15% of ischemic stroke patients develop new microbleeds and 7% patients infarct hemorrhagic transformation in the first year following stroke (after the acute stage of stroke). The risk of microbleeds seems to be increasing with duration of anti-coagulation therapy. In contrast, we did not find any relationship between DAPT duration and microbleeds incidence. Confirmation on a larger sample is needed.

**Trial registration number:** N/A

**ASII-012****NEURORADIOLOGICAL CHARACTERISTICS OF PATENT FORAMEN OVALE RELATED STROKE**

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**Background and Aims:** Right-to-left shunt (RLS) via patent foramen ovale (PFO) is an important stroke mechanism in cryptogenic stroke patients. In this study, we evaluated neuroradiological features of PFO-related stroke according to the RLS burdens resulting from PFO.

**Methods:** We evaluated consecutive cryptogenic stroke patients who underwent contrast transcranial doppler examinations between September 2010 and May 2018. Patients were classified into four groups according to RLS burdens, based on the International Consensus Criteria. The groups were compared with their radiological findings.

**Results:** Among 100 cryptogenic stroke patients, 59 (59%) showed RLS. When we compared between four groups, patients with higher RLS burden showed more frequent diffusion-weighted imaging (DWI) lesions,

cortical lesion involvement, and multiple territory infarction, and less frequent large ( $>1$  cm) DWI lesions in a dose-response manner. In multivariate analyses, curtain type micro-embolic signal was independently associated with multiple territory infarction [adjusted odds ratio (aOR) = 5.24, 95% confidence interval (CI) = 1.57-17.53,  $P=0.007$ ], cortical lesion involvement (aOR = 15.75, 95% CI = 1.94-127.71,  $P=0.010$ ), number of DWI lesions ( $B=0.713$ , 95% CI = 0.245 to 1.181), and number of large DWI lesion ( $B=-0.328$ , 95% CI = -0.629 to -0.026).

**Conclusions:** Patients with large shunt amount show more smaller and higher number of lesions with cortical and multiple vascular territory involvement. DWI lesion patterns may provide clues for PFO-related stroke in patients with cryptogenic stroke.

**Trial registration number:** N/A

**ASII-026****DIAGNOSTIC VALUE OF INTRACRANIAL TIME-OF-FLIGHT-MRA TO PREDICT EXTRACRANIAL CAROTID STENOSIS IN ACUTE ISCHEMIC STROKE OR TRANSIENT ISCHEMIC ATTACK**

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**Background and Aims:** Diagnostic standard in detecting extracranial carotid artery stenosis (ECAS) is contrast-enhanced CT- or MR-Angiography and Doppler ultrasound. This study aims to introduce intracranial time-of-flight MRA (TOF-MRA) as an additional method to predict extracranial carotid stenosis without using contrast agent.

**Methods:** We retrospectively analyzed patients with acute ischemic stroke or TIA and high-grade unilateral ECAS according to NASCET criteria assessed by doppler ultrasound between January 2016 and August 2018. Patients without ECAS on Doppler ultrasound formed the control group. We measured the intraluminal signal intensities (ISI) on axial TOF-MRA images of the intracranial carotid artery (C4-segment) and calculated ratios between the non-affected and the affected side according to the following formula: ISI\_ratio = ISI\_contralateral / ISI\_ipsilateral. Ratios between groups were compared using Mann-Whitney-U-test.

**Results:** In total, 79 patients were included into the final analysis. ISI\_ratios in intracranial C4-segment were significantly higher in patients with unilateral ECAS ( $n=26$ , median 73yrs, 60% male) compared to the control group ( $n=53$ , median 66yrs, 48% male). Mean ISI\_ratio was 1.605 vs. 1.004 ( $p<0.001$ ) for right-sided stenosis and 1.410 vs. 1.012 ( $p<0.001$ ) for left-sided stenosis. Receiver operating characteristic curve demonstrated a cut-off value of 1.137 for right-sided [sensitivity/specificity 93%/88%; area under the curve (AUC) 0.93] and 1.168 for left-sided stenosis (sensitivity/specificity 89%/90%; AUC 0.94) in C4 as a very good predictor for high-grade ECAS.

**Conclusions:** ISI on axial TOF-MRA can be used as a contrast-agent free method to discriminate therapeutically relevant unilateral ECAS in patients with acute ischemic stroke or transient ischemic attack.

**Trial registration number:** N/A

**ASII-004****ULTRASONOGRAPHIC FEATURES USED AS HEMODYNAMIC PREDICTORS FOR RUPTURE RISK OF CEREBRAL ARTERIOVENOUS MALFORMATIONS.****F. Padilla<sup>1</sup>**

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**Background and Aims:** Nowadays, the relationship of hemodynamic variables of transcranial Doppler Ultrasound (TCD) with risk of hemorrhage in patients with cerebral AVMs has not been studied. The aim of our study was to evaluate the association and risk of bleeding among the hemodynamic variables by TCD in patients with cerebral AVMs with or without hemorrhage.

**Methods:** We included 188 patients with angiographic diagnosis of cerebral AVM classified according to Spetzler Martin (SM) and 15 healthy control subjects to observe differences between these groups from May 1, 2014 to July 31, 2015. TCD studies were performed with analysis of Resistance (R), Mean velocity (mV) and Pulsatility index (PI). We compared the variables between the 3 groups (AVM with rupture, AVM without rupture and normal patients) and the relative risks of presenting as hemorrhage or not.

**Results:** We included 188 patients, 53% men and 47% women, (16% AVM-I, 29% AVM-II, 35% AVM-III, 16% AVM-IV and 4% AVM-V). The PI and R were directly proportional to each other but inversely proportional to the size of the AVM. mV was directly proportional to the size of the AVM. It was observed that mV < 90 cm/s increases 6.5 (95% CI, 1.6-26.6) times the risk of bleeding. Similarly, the size of the malformation nidus < 3 cm presents 4.1 times higher risk of bleeding (95% CI, 1.2-13.3).

**Conclusions:** These parameters are easy to obtain, they help us to make a better presurgical assessment and they are associated with the risk of hemorrhage that each patient can have.

**Trial registration number:** N/A

**ASII-060****ADAPTATIVE FOCUSING FOR ADULT CLINICAL TRANSCRANIAL ULTRAFAST ULTRASOUND MICROVASCULAR IMAGING IN CEREBROVASCULAR DISEASES: A DISRUPTIVE TECHNOLOGY****F. Perren<sup>1</sup>, J. Robin<sup>2</sup>, C. Demene<sup>3</sup> and M. Tanter<sup>4</sup>**

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**Background and Aims:** Human brain vascular imaging is one of the most challenging modalities generally requiring ionizing (CT) or expensive (MRI) devices. Ultrasound is poorly used for neuroimaging due to very limited sensitivity and resolution at frequencies going through the skull bone. Here we implement an aberration law derived by studying distortions in the incoming wavefronts and introduced Ultrasound Localization Microscopy (ULM) using microbubbles contrast agent that proved to beat by almost two orders of magnitude the resolution limit of conventional ultrasound.

**Methods:** Healthy volunteers and stroke patients were scanned transcranially with a phased-ultrasonic-array of 2MHz (Supersonic Imagine). Post processing of the filtered RF data was combined with a delay law focusing on the point of interest.

Small boluses of contrast agent were administrated IV while imaging using Ultrafast sequences consisted in 4 different virtual sources, repeated at a

framerate of 800Hz during 2 minutes. Singular Value Decomposition clutter-filtering was performed to remove tissue signal, aberration corrections were calculated on bubbles and integrated in the delay-and-sum beamforming.

**Results:** On average after 5 iterations focus-quality criterion was improved by 20 % using the corrected focal law, and the contrast on Ultrafast images was improved by 6 dB. Qualitatively, the aberration correction method allowed the better delimitation of small vessels at all depths in the image. Quantitatively, the contrast was improved by 3 dB on average.

**Conclusions:** We show for the first time cerebral superficial and microvasculature and pave the way for future transcranial ultrasound imaging with high-sensitivity by maximizing antenna gain through the bone windows.

**Trial registration number:** N/A.

**ASII-015****MIGRAINE, STROKE PATENT FORAMEN OVALE****M. Pradeep<sup>1</sup>, A. Saleem<sup>1</sup> and E. Deepak<sup>1</sup>**

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**Background and Aims:** Over 40 % of ischemic strokes that occur in young people are cryptogenic. The prevalence of Patent Foramen Ovale (PFO) is higher in patients with cryptogenic stroke than in those with known stroke etiology (61% vs 19%). The prevalence of PFO may be 47 – 67 % in migraine with aura & 23–47 % in those with out aura. Aim was to establish the relationship of large right to left cardiac shunts to migraine & increased risk of stroke.

**Methods:** 600 migraine patients were studied between Feb 2013 & Jan 2018. 62 % were females & 48 % were males. Patients who had migraine with aura, without aura & those who patients who developed stroke were subjected to bilateral TCD monitoring of MCA (middle cerebral artery) with bubble study to identify HITS (high intensity transient signals) suggestive of right to left cardiac shunts (RLS). The patient performs valsalva maneuver during the procedure. The RLS was quantified using the Spencers Logarithmic scale.

**Results:** TCD showed the presence of large RLS due to PFO in patients with migraine with aura & who had stroke. The chances of developing stroke was high with Spencer grades 4 & 5 of RLS due to PFO

**Conclusions:** TCD is a sensitive, non invasive method in identifying the subset of migraine patients who are at a high risk of developing stroke. TCD bubble test is a safe, cost effective test which is highly reliable in detecting & quantifying RLS due to PFO.

**Trial registration number:** N/A

**ASII-029****PROGNOSTIC VALUE OF ULTRASONOGRAPHIC STUDY AND MONITORIZATION OF INTRACRANIAL HEMORRHAGE IN ACUTE STROKE UNIT.****M. Rico<sup>1</sup>, L. Martínez-Rodríguez<sup>2</sup>, D. Larrosa<sup>1</sup>, L. Benavente<sup>1</sup>, E. López-Cancio<sup>1</sup>, J. Calvo<sup>3</sup> and S. Calleja<sup>1</sup>**

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**Background and Aims:** There are few studies regarding utility of transcranial duplex sonography (TDS) in intracranial hemorrhage (IH). TDS is a non-invasive tool that can be easily used in patients' bed-side.

**Methods:** Consecutive patients with spontaneous IH admitted to a stroke unit were recruited. TDS was performed within 12 hours of

baseline CT and up to 3 control studies were scheduled every 24 hours. Included neurosonological markers were: hematoma volume (HV), midline shift (MLS), third ventricle diameter, pulsatility index and mean velocity (MV) in both MCAs and mean thickness of both optic nerve sheaths (MTONS). Correlation of HV and MLS between CT and TDS was analyzed if the time between both was less than 2 hours. As prognostic variables we evaluated early neurologic deterioration (END) and death during hospitalization (DDH).

**Results:** 33 patients were included (median age 74, 78% men). Median HV was 19 ml (11-52). A good correlation with CT was found ( $n=12$ ) regarding both HV (ICC = 0.93) and MLS (ICC = 0.82). Crude logistic regression analysis showed an association of HV, MLS, mean velocity in ipsilateral MCA and MTONS with both END and DDH ( $p < 0.05$ ). After adjustment for age and baseline NIHSS, MTONS > 0.535 cm was independently associated with DDH (OR 8.5;  $P < 0.001$ ). No prognostic value of the variation of any of these variables was found.

**Conclusions:** Transcranial duplex sonography has an excellent correlation with CT. We found some prognostic neurosonological markers in patients with IH. MTONS larger than 0.535 cm was an independent predictor of DDH. TDS may be used as a complementary tool in IH.

**Trial registration number:** N/A

### AS11-051

#### ENLARGEMENT OF OPTIC NERVE ASSESSED BY RETROBULBAR COLOUR DOPPLER SONOGRAPHY CORRELATES TO INTRACEREBRAL HAEMORRHAGE VOLUME

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**Background and Aims:** Optic nerve enlargement and increased velocity in superior ophthalmic vein (SOV) were described as signs of intracranial hypertension. However, there were less studied in patients with intracerebral haemorrhage (ICH). Our aim was to evaluate optic nerve sheath diameter (ONSD) and SOV flow by ocular duplex ultrasound (ODU) in patients with ICH and its correlation with haemorrhage volume.

**Methods:** Prospective study of patients with supratentorial ICH evaluated within 24 hours of onset. All patients underwent CT scan and ODU on admission. Hematoma volume was determined using the formula (longitudinal X sagittal X coronal)/2. ONSD was measured at 5 mm of the papilla in both eyes and diameter up to 5.0 mm was considered normal. SOV was assessed over optic nerve and velocity up to 4.0 cm/sec was considered normal. Association of ONSD and SOV with ICH volume was evaluated.

**Results:** Thirty-two patients were included. Mean age was 63.7 (SD 15.6) year-old and 14 (43.8%) were male. Admission mean ICH volume was 25.9 cc (SD 28.3). All ONSD were bigger than normal. Mean Ipsilateral ONSD was 6.8 (SD 0.9) mm and contralateral 6.6 (SD 0.7) mm ( $p = 0.506$ ). Mean ipsilateral SOV flow was 5.6 (SD 2.7) cm/sec and contralateral was 6.4 (SD 2.5) cm/sec ( $p = 0.155$ ). ICH volume was linearly correlated in ipsilateral ( $r = 0.349$ ;  $p = 0.025$ ) and contralateral ONSD ( $r = 0.344$ ;  $p = 0.027$ ). VSP flow did not correlate with ICH volume.

**Conclusions:** ONSD measured by ODU is higher than normal in any ICH volume showing correlation with ICH volume on admission.

**Trial registration number:** N/A

### AS11-010

#### VASODILATATION AND BLOOD-BRAIN BARRIER LEAKAGE OF THE LENTICULOSTRIATE ARTERIES IN STROKE PATIENTS TREATED WITH MECHANICAL THROMBECTOMY

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**Background and Aims:** Patients treated with mechanical thrombectomy (MT) for proximal vascular occlusions, frequently present infarct and even hemorrhages in deep grey matter despite angiographically successful recanalization. We described the lenticulostriate artery (LEA) features and associations with lesions in lenticular nucleus (LN) and clinical course in stroke patients treated with MT.

**Methods:** We studied a prospective cohort of 47 patients with stroke in the anterior circulation treated with stent retrievers that achieved successful recanalization (mTICI = 2b/3). In a 3T-MRI study at 48–72h, we assessed the presence of infarct (L-INF) and any hemorrhagic transformation (L-HT) in the LN. We evaluated LEA-vasodilation (LEA-VD) in TOF-sequences and blood-brain-barrier leakage in LN (LEA-BBL) was defined as gadolinium enhancement in TI-sequences. The neurological course was assessed as a percentage decrease in the NIHSS from admission to day 7.

**Results:** L-INF and L-HT were present in 30 (63.8%) and 13 (27.7%) patients, respectively. LEA-VD and LEA-BBL were observed in 28 (59.6%) patients each. Patients with LEA-VD and LEA-BBL presented more L-INF (89.3% and 85.7%, respectively) than patients without L-INF (26.3% and 31.6%, respectively;  $p < 0.001$  for both signs). Patients with LEA-BBL presented more L-HT (39.3% vs. 5.3%;  $p = 0.015$ ), and less NIHSS improvement (median, IQR, 93%, 74–100 vs. 100%, 95–100,  $p = 0.023$ ) than patients without LEA-BBL, but these associations were not significant in patients with LEA-VD ( $p = 0.087$  and  $p = 0.295$ , respectively).

**Conclusions:** Vasodilation and disruption of perforant vessels were associated with established lesions despite large vessel recanalization. The association of vessel disruption with neurological course suggests that these imaging features may have significant clinical implications.

**Trial registration number:** N/A

### AS11-013

#### ASSOCIATIONS OF BASELINE DWI LESIONS WITH LESION WORSENING ON FOLLOW-UP DWI IN ACUTE ISCHEMIC STROKE

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**Background and Aims:** Clinical implications of baseline and follow-up diffusion-weighted imaging (DWI) remains investigational in patients with acute ischemic stroke (AIS). We sought to investigate which factors were associated with lesion worsening on follow-up DWI and whether these were associated with functional outcomes in patients with AIS.

**Methods:** This was an analysis of a prospective registry for AIS (within 72h of onset) from a comprehensive stroke center between April 2012 and December 2013. Follow-up DWI was performed at 5d after admission. Patterns of lesion worsening were considered as infarct growth, new lesions within relevant arterial territory (NLWT), and new lesions beyond relevant arterial territory (NLBT). Multivariate logistic regression

models were generated to identify independent predictors of lesion worsening. Good outcome was defined as functional independency at 3m (modified Rankin Scale 0–2).

**Results:** A total of 1218 patients (age:  $68 \pm 12$  yr, male: 58.5%) were analyzed. The worsened lesions on follow-up DWI were observed in 39.1% patients. The proportions of patterns of lesion worsening were as follows: no or swelling 60.9%, infarct growth 23.6%, NLWT 20.6%, and NLBT 5.7%. Independent factors associated with lesion worsening were reperfusion therapy, relevant arterial occlusion, and cortical, borderzone or cerebellar lesions on initial DWI. In addition, patients with lesion worsening was less likely to achieve a good outcome at 3m than those without (adjusted OR, 0.61 [0.46–0.82],  $p = 0.001$ ).

**Conclusions:** The study found lesion worsening at 5d were associated with initial DWI findings and reduced the likelihood of a good outcome at 3m, suggesting the potential benefits of repeat DWI in AIS.

**Trial registration number:** N/A

## ASII-036

### PERFORMANCE OF DIFFERENT CAROTID STENOSIS ULTRASOUND CRITERIA IN PATIENTS WITH CONTRALATERAL CAROTID OCCLUSION. A CASE SERIES

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**Background and Aims:** Several flow velocity thresholds have been proposed as diagnostic criteria for carotid stenosis >50% using color-coded duplex (CCD) in patients with contralateral occlusion, assuming that compensatory flow acceleration may overestimate the grade of stenosis. Our aim was to evaluate the performance of different criteria in our neurosonology lab.

**Methods:** Retrospective observational study of patients attended at our neurosonology lab for CCD with confirmed contralateral carotid occlusion by angio-CT in the preceding 6 months. We compared classic criteria for carotid stenosis >50%: Peak Systolic Velocity (PSV) >125cm/s, End Diastolic Velocity (EDV) >40cm/s and Systolic Index (SI) >2 with those proposed by Preiss et al.: PSV >250 cm/s, EDV >90 cm/s and SI >2.3. We built ROC curves to determine the best cut-off points (defined by highest Sensitivity + Specificity) in our sample. Measurements in angio-CT using NASCET criteria were used as the gold standard.

**Results:** Of 86 patients with carotid occlusion, 25 (29%) had a contralateral carotid stenosis >50%. Classic criteria showed better performance (88.84–76% Sensitivity, 85–82–87% Specificity, according to PSV–EDV–SI) than those proposed by Preiss et al (60–32–64% Sensitivity, 100–100–92% Specificity). ROC curves set the best cut-off points at PSV >114cm/s, EDV >38cm/s and SI >1.46, with 96–88–88% Sensitivity and 82–82–84% Specificity.

**Conclusions:** Classic criteria for defining carotid stenosis by CCD showed a good performance in patients with contralateral occlusion. Use of more specific criteria may result in under detection of significant stenosis. Even lower cut-offs seem to achieve the best performance in our cohort.

**Trial registration number:** N/A

## ASII-011

### ALTERATIONS OF COGNITIVE PERFORMANCE AND BRAIN PERFUSION AS ASSESSED BY CONTRAST ENHANCED MRI IN REVASCULARIZATION OF CAROTID ARTERY STENOSIS.

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**Background and Aims:** There is evidence suggesting a detrimental effect of asymptomatic carotid artery stenosis on cognitive function even in the absence of ischemic cerebral lesions. Hypoperfusion has been suggested as pathophysiological mechanism causing cognitive impairment. We aimed to assess cognitive performance and cerebral perfusion changes in patients with carotid artery stenosis without ischemic lesions by contrast enhanced (CE) perfusion MRI before and after revascularization therapy.

**Methods:** 17 asymptomatic patients with unilateral high-grade ( $\geq 70\%$ ) carotid artery stenosis without evidence of structural brain lesions underwent CE perfusion MRI and cognitive testing (MMSE, DemTect, Clock-Drawing Test, Trail-Making Test, Stroop Test) before and 6–8 weeks after revascularization therapy by endarterectomy or stenting. Multiparametric perfusion maps (cerebral blood flow (CE-CBF), mean transit time (CE-MTT), cerebral blood volume (CE-CBV)) were calculated and analyzed by vascular territory. Relative perfusion values were calculated.

**Results:** Multivariate analysis revealed a significant impact of revascularization therapy on all perfusion measures analyzed. At baseline post-hoc testing showed significant hypoperfusion in MCA borderzones as assessed by CE-MTT and CE-CBV, but not in CE-CBF. All perfusion alterations normalized after revascularization. We did not observe any significant correlation of cognitive test results with perfusion parameters. There was no significant change in cognitive performance after revascularization.

**Conclusions:** We found evidence of traceable perfusion alterations in patients with high grade carotid artery stenosis in the absence of structural brain lesions, which proved fully reversible after revascularization therapy. In this cohort of asymptomatic patients we did not observe an association of hypoperfusion with cognitive performance.

**Trial registration number:** N/A

## ASII-022

### DO WE NEED TO DO FOLLOW-UP IMAGING AFTER ACUTE ISCHEMIC STROKE TREATMENT TO MAKE THERAPEUTIC DECISIONS?

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**Background and Aims:** According to current guidelines, stroke patients treated with rt-PA should undergo brain imaging to exclude

intracerebral bleeding 24 hours after thrombolysis, before the start of medical secondary prevention. However, the usefulness of routine follow-up imaging with regard to changes in therapeutic management in patients without neurological deterioration is unclear.

We hypothesized that follow up brain imaging solely to exclude bleeding in patients who clinically improved after rt-PA application may not be necessary.

**Methods:** Retrospective single-center analysis including stroke patients treated with rt-PA. Records were reviewed for hemorrhagic transformation one day after systemic thrombolysis and brain imaging-based changes in therapeutic management. Twenty-four hours after thrombolysis patients were divided into four groups: 1) increased NIHSS score; 2) unchanged NIHSS score; 3) improved NIHSS score and; 4) NIHSS score = 0.

**Results:** Out of 188 patients (mean age 73 years, 100 female) receiving rt-PA, 32 (17%) had imaging-proven hemorrhagic transformation including 11 (6%) patients with parenchymal hemorrhage. Patients in group 1) and 2) more often had hypertension ( $p = 0.015$ ) and more often had parenchymal hemorrhage (9% vs. 3.6%;  $p < 0.206$ ) compared to group 3) and 4) and imaging-based changes in therapeutic management were more frequent (19.2% vs. 6.7%;  $p = 0.007$ ). Patients of group 3) and 4) had no changes in therapeutic management in 93.6% of the cases.

**Conclusions:** Routine follow-up brain imaging solely to exclude intracerebral bleeding before the start of medical secondary prevention seems to be unnecessary in stroke patients with complete recovery or with clinical improvement in the NIHSS.

**Trial registration number:** N/A

## AS1 I-030

### RECRUITMENT OF PIAL COLLATERALS IN CEREBRAL LARGE-ARTERY STENO-OCCLUSIVE DISEASE IS ASSOCIATED WITH HEMODYNAMIC FAILURE AND MICROSTRUCTURAL CORTICAL TISSUE DAMAGE

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**Background and Aims:** Collateral blood flow is believed to be pivotal in large-artery steno-occlusive disease to prevent ischemic tissue damage, which may involve the cerebral cortex. At an early stage, pathological structural alterations may be subtle or subclinical and not detected on conventional magnetic resonance imaging (MRI). The aim of this study was to investigate microstructural cortical tissue damage in chronic cerebral hypoperfusion, which may reasonably be assumed to depend on leptomeningeal collateral supply.

**Methods:** 30 patients with high-grade unilateral internal carotid artery (ICA) or middle cerebral artery (MCA) stenosis/occlusion were included. Microstructural changes of normal-appearing hypoperfused cerebral cortex were assessed with quantitative (q)T2 mapping. The volumetric abundance of leptomeningeal collaterals was directly quantified based on perfusion-weighted imaging (PWI), which was also used to determine intravascular hemodynamic properties of collateral vessels. In patients with ICA pathology, flow velocity in the poststenotic MCA was determined with duplex ultrasonography.

**Results:** qT2 values within hypoperfused normal-appearing cortical tissue were significantly increased compared to the contralateral side ( $p < 0.01$ ), at an increased volumetric abundance of adjacent leptomeningeal blood vessels ( $p = 0.001$ ). The collateral vessel abundance was

negatively correlated with the intravascular ratio relative cerebral blood flow/relative cerebral blood volume ( $r = -0.530$ ,  $p = 0.003$ ) as an indicator of local perfusion pressure within collateral vessels. Furthermore, the pial collateral vessel abundance was negatively correlated with relative MCA flow velocity in patients with ICA stenosis/occlusion ( $r = -0.648$ ,  $p = 0.002$ ).

**Conclusions:** Recruitment of leptomeningeal secondary collaterals in ICA and MCA occlusive disease is associated with severe hemodynamic impairment, but is not sufficient to prevent microstructural cortical damage.

**Trial registration number:** N/A

## AS1 I-018

### RELATION BETWEEN REDUCTION OF HYPOXIC TISSUE AND COGNITIVE IMPROVEMENT AFTER REVASCULARIZATION SURGERY IN PATIENTS WITH CHRONIC CEREBRAL ISCHEMIA

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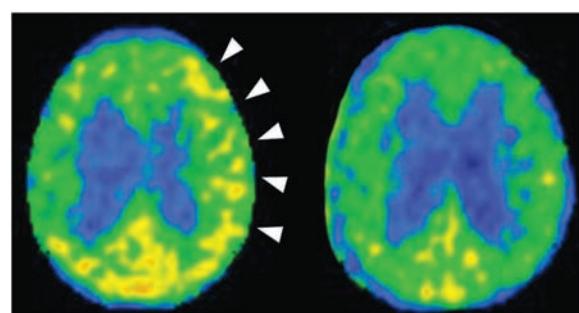
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**Background and Aims:** Hypoxic but viable neural tissue finding is observed on 1-(2-[<sup>18</sup>F-fluoro-1-[hydroxymethyl]ethoxy) methyl-2-nitroimidazole positron emission tomography (<sup>18</sup>F-FRP170 PET) in patients with chronic cerebral ischemia with a combination of misery perfusion and moderately reduced oxygen metabolism. Our purpose is to determine whether hypoxic tissue-induced findings on <sup>18</sup>F-FRP170 PET was reduced and whether the reduction was associated with cognitive improvement after the revascularization surgery in chronic ischemic patients.

**Methods:** In the present study, 14 (for carotid endarterectomy) and 16 adult patients (for anastomosis of the superficial temporal artery to the middle cerebral artery) underwent revascularization surgery. For all patients, <sup>18</sup>F-FRP170 PET, single-photon emission tomography (SPECT) and neuropsychological tests were performed preoperatively and 6 months postoperatively. Regions of interest were automatically placed in the bilateral middle cerebral artery territories on standardized SPECT and <sup>18</sup>F-FRP170 PET images by statistical parametric mapping 2. The ratio of values in the affected versus contralateral hemispheres on each image was defined as CBF ratio or <sup>18</sup>F-FRP170 ratio.

**Results:** As the results, the CBF ratio and <sup>18</sup>F-FRP170 ratio were significantly increased and reduced, respectively, after surgery compared to before. The difference in the <sup>18</sup>F-FRP170 ratio was negatively correlated with the difference in the CBF ratio. The difference in the <sup>18</sup>F-FRP170 ratio was significantly lower in patients with postoperative improved cognition compared to those without.



**Conclusions:** Finally, hypoxic tissue-induced findings on 18F-FRP170 PET in chronic ischemic patients were reduced after the revascularization surgery, which indicates the hypoxic tissue reduction, and the reduction was significantly associated with the cognitive improvement.

**Trial registration number:** N/A

## WITHDRAWN

## ASII-019

### SPATIO-TEMPORAL TOPOLOGY OF THE POST-CONTRAST SIGNAL ENHANCEMENT IN NORMAL-APPEARING WHITE MATTER 1–3 MONTHS POST-STROKE

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**Background and Aims:** Dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI) has limitations in the assessment of subtle blood-brain barrier (BBB) permeability changes. We evaluate the use of Graph-variate signal analysis (GVSA) to ameliorate this problem.

**Methods:** We used data from 40 small vessel disease (SVD) patients who had a recent small subcortical infarct (RSSI), obtained at 1–3 months post-stroke. Images of normal-appearing white matter were sparsified into a coherent spatial graph representation by down-sampling via 3D skeletonisation. We then mapped skeletal voxel clusters and pathways into nodes and connecting edges, respectively. The post-contrast time-series at each node was the average of brain fluid flow over its 2-voxel-radius neighbourhood. We averaged the instantaneous correlations between signals connected through the graph to get one value for each node and time-point. Signal activations comprised the 5% highest values over the time-node array. We used the Kruskal-Wallis test to determine whether the distances (Euclidean) between spatio-temporal activations and RSSI discriminated patients with different baseline vascular risk factors or SVD burden, and/or patterns of RSSI evolution.

**Results:** The median distances between the temporal activations in the graph and the centroid of the RSSI discriminated patients stratified according to 1) brain microbleeds, white matter hyperintensities and perivascular spaces, 2) presence/absence and spatial proximity of these imaging features and old stroke lesions with the RSSI (all  $p < 0.001$ ).

**Conclusions:** Using GVSA, the DCE-MRI signal was clearer closer to the RSSI and with patterns related to SVD markers. Thus, GVSA is promising for analysing and understanding BBB permeability in stroke using DCE-MRI.

**Trial registration number:** N/A

## ASII-020

### BLOOD-FLOW PULSATILITY VARIATION ALONG THE CAROTID ARTERY INCLUDING CROSSING THE EXTRACRANIAL-INTRACRANIAL BORDER

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**Background and Aims:** Previous studies have reported attenuation of arterial flow pulsation over the carotid siphon. We aimed to confirm these results and to further extend the observations by assessing the extracranial part of the internal carotid artery (ICA) and by assessing the carotid distensibility by measuring the lumen area pulsatility.

**Methods:** Blood-flow pulsation was assessed using flow-sensitized 2-dimensional phase-contrast magnetic resonance imaging (2D PC-MRI) at 3T (Philips) in 39 healthy volunteers. Pulsatility Index (PI) and Area Index (AI) were calculated from time-resolved blood-flow velocities measured at the extracranial C1, carotid canal C4, and intracranial C7 segments of the ICA. (Index = (Maximum-Minimum)/Mean)

**Results:** The blood-flow pulsation patterns confirmed the previous studies: The PI reduced by 8.9% ( $P < 1.5 \times 10^{-5}$ ) from the distal C4- to the proximal C7 segments of the carotid siphon. However, the reduction of PI measured between the extracranial C1- and intracranial C7 segment was small and not significant (3.3%,  $P = 0.07$ ). The AI decreased significantly from C1 to C4 (0.19 vs 0.11,  $P < 1.0 \times 10^{-12}$ ) and was largest at C7 (0.29). The reported trend in PI and AI over the C1, C4, and C7 segments was consistently seen in individual patients and vessels (left or right ICA).

**Conclusions:** Although we found similar attenuation over the siphon as previous studies, the addition of extracranial measurements and distensibility measurement suggest a more complicated behaviour than just damping caused by the carotid siphon. Rather, the bony carotid canal seems to locally limit the distensibility of the ICA, thus increasing the flow pulsatility at C4.

**Trial registration number:** N/A

## ASI I-057

### CAROTID ATHEROSCLEROSIS PREDICTS MIDDLE CEREBRAL ARTERY PULSATILITY INDEX: DATA FROM THE AKERSHUS CARDIAC EXAMINATION (ACE) 1950 STUDY

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**Background and Aims:** Pulsatility index (PI) in the middle cerebral artery (MCA), as measured by transcranial ultrasound, has traditionally been considered a measure of peripheral vascular resistance, and associated with cerebral small vessel disease. In this study we sought to elucidate whether there is an association between indices of carotid atherosclerosis and MCA PI. Further we assessed cerebral hemodynamics and cardiovascular risk factors according to percentiles of MCA PI.

**Methods:** All residents in Akershus County, born in 1950, were invited to a cardiovascular examination in The Akershus Cardiac Examination (ACE) 1950 study (2012-2015). The participants underwent ultrasound examination of the carotid arteries, with assessment of atherosclerosis, and a transcranial ultrasound of the MCA, with assessment of intracerebral hemodynamics. Of the 3706 individuals included, 3154 (85.1%) had adequate transcranial data. Determinants of MCA PI were assessed by regression analyses adjusted for cardiovascular risk factors.

**Results:** Mean age was 64 (standard deviation [SD] 0.6) years, 1797 (57%) were men. Mean PI was 0.97 (SD 0.17). In multivariable-adjusted regression analyses carotid plaque burden and carotid intima-media thickness (cIMT) were associated with MCA PI. Adjusted odds ratio for carotid plaque burden was 1.11 (95% CI 1.05 to 1.18) and for cIMT 4.87 (95% CI 1.72 to 13.75). There was no significant association between MCA PI and echolucent plaques. Participants with PI levels in the upper 10% had higher pulse pressure, more hypertension, diabetes mellitus, and history of stroke.

**Conclusions:** Plaque burden and cIMT independently predicts MCA PI, supporting a link between different measures of vascular pathology.

**Trial registration number:** NCT01555411

## ASI I-032

### AUTOMATIC MAPPING OF VASCULAR ISCHEMIA WITH DEEP LEARNING TECHNIQUES IN ACUTE ISCHEMIC STROKE

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**Background and Aims:** We applied artificial intelligence techniques of deep learning to automatically map ischemic lesions from diffusion weighted MRI (DWI) images to a vascular territory atlas and to identify the vascular origin of an ischemic stroke. Aggregated brain imaging data are useful for outcomes research if they are quantifiable and reproducible. Automatic vascular mapping of ischemic stroke based on DWI is possible but technical challenges remain. DWI is highly heterogeneous and spatially distorted due to magnetic field effects from air-tissue interface, resulting in a high rate of false positives.

**Methods:** We identified a large cohort of consecutive ischemic patients with T1 FLAIR, T2 FLAIR and DWI images ( $n = 2,132$ ). DWI are normalized to MNI coordinates through the mapping of T1 MRI to MNI atlas. Acute ischemic regions were identified using ADC threshold of  $620 \times 10 - 6 \text{ mm}^2/\text{s}$ . Semi-automatic labeling was used in place of manual labeling for model training and testing in deep learning. Deep learning was used to recognize the true ischemic location based on DWI images in MNI coordinates. The ischemic regions are then mapped back to the vascular territory for scoring.

**Results:** Deep learning algorithms segmented ischemic stroke region from DWI with minimal false positives and identified the vascular origin on the MNI atlas, despite DWI image distortion. See Figure 1.

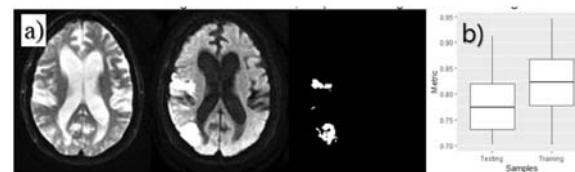


Figure 1: a) Diffusion MRI [b0, b1000, segmented ischemic regions] and b) model performance in training/testing using Dice similarity coefficient.

**Conclusions:** Novel deep learning algorithms overcame technical barriers preventing accurate mapping of DWI lesions and provide an objective map for a database to process infarct volume, asymmetry and scatter. Such an imaging database can answer outcomes questions and detect ischemic trends.

**Trial registration number:** N/A

## ASI I-003

### CEREBRAL HAEMODYNAMIC PREDICTORS OF CHANGES IN CEREBROVASCULAR REACTIVITY FOLLOWING CAROTID ANGIOPLASTY AND STENTING

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**Background and Aims:** To evaluate the hemodynamic changes in cerebrovascular reactivity (CVR) proven by the breath holding index (BHI) before and after carotid angioplasty and stenting (CAS) in Egyptian patients presented with symptomatic carotid stenosis.

**Methods:** Thirty-five patients presented with acute stroke/ TIA, with carotid stenosis over 50% have been evaluated for CAS. Transcranial Doppler (TCD) was performed few days prior to, and few days after the intervention. Mean flow velocities (MFV) at middle cerebral artery (MCA) ipsi/contralateral stenosis was recorded. CVR through the apnoea test (BHT) was measured, recording an increase in the mean flow velocity and calculating MCA-BHI (breath-holding index) of ipsi/contralateral stenosis.

**Results:** MFV in the MCA has significantly increased both ipsilateral to stenosis from  $51.29 + / - 20.89$  cm/s prior to intervention, to  $66.74 + / - 28.26$  cm / s ( $p < 0.01$ ) post-CAS, as well as contralateral to stenosis, from  $60.63 + / - 21.76$  before intervention to  $72.86 + / - 31.89$  post-intervention ( $p < 0.01$ ). BHI significantly increased ipsilateral from  $0.52 + / - 0.37$  to  $1.00 + / - 0.32$  ( $p < 0.01$ ) post-intervention, and contralateral from  $0.56 + / - 0.41$  before intervention to  $0.91 + / - 0.34$  post-intervention ( $p < 0.01$ ). The improvement persisted three months after intervention, both ipsi and contralateral to stenosis.

**Conclusions:** CAS produces an early significant increase of MFV and BHI in the ipsilateral and contralateral anterior circulation. This effect is maintained three months later. As a result, CAS produces an improvement of CVR both ipsilateral and contralateral.

Please indicate the Trial registration number: in the following box.

N/A

## Intracerebral Haemorrhage

### AS24-011

#### QUALITY OF LIFE IN PEOPLE WITH INTRAVENTRICULAR HAEMORRHAGE: ANALYSIS OF THE CLEAR III TRIAL

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**Background and Aims:** Ventricular clearance using alteplase in people with intraventricular haemorrhage reduced mortality but more survivors had severe disability. We explored health-related quality of life (HRQoL) using data from the CLEAR III trial (ClinicalTrials.gov NCT00784134).

**Methods:** We included data from participants with at least one measure of HRQoL using the EQ-5D scale. Our primary outcome measure was EQ-5D health utility state (HUS) at day 180, censored by death. Secondary outcomes were the EQ-5D visual analogue scale self-rating of health, the Preference-Based Stroke Index, and the Stroke Impact Scale. We assessed change in HRQoL outcomes from day 30 to day 180 and 365 and compared these changes between treatment groups. We assessed risk factors for HUS at day 180.

**Results:** We included 436 participants. Median (inter-quartile range) HUS at days 30, 180 and 365 was 0.16 (0.12 to 0.59), 0.69 (0.33 to 0.83) and 0.77 (0.44 to 0.84) respectively. The median changes in HUS from day 30 to 180 and from day 180 to 365 were 0.23 (IQR 0.00 to 0.48,  $p < 0.001$ ) and 0 (0.05 to 0.14,  $p < 0.001$ ) respectively. At day 365 only 9 surviving participants (2.6%) had a HUS rated as worse than death. There were no differences between treatment groups in HRQoL outcomes and treatment group was not associated with poorer HRQoL.

**Conclusions:** The greatest improvement in HRQoL took place between day 30 and day 180. Despite more survivors with mRS of 5 at day 180, HRQoL was not worse following alteplase treatment, and few participants had HRQoLs rated as worse than death.

**Trial registration number:** N/A

### AS24-020

#### OVERLAP BETWEEN COMPUTED TOMOGRAPHIC FEATURES OF HEMORRHAGIC CEREBRAL VENOUS THROMBOSIS AND AMYLOID ANGIOPATHY

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**Background and Aims:** Both amyloid angiopathy and cerebral venous thrombosis are associated with lobar hemorrhage and subarachnoid hemorrhage. The recently published Edinburgh criteria were developed to allow a diagnosis of cerebral amyloid angiopathy on non-contrast CT, based on the presence of lobar hemorrhage with fingerlike projections and subarachnoid hemorrhage. The specificity of these criteria in patients with cerebral venous thrombosis has however not been established. We studied the prevalence of features of cerebral amyloid angiopathy in a multicenter cohort of patients with hemorrhagic cerebral venous thrombosis.

**Methods:** We previously enrolled 285 patients with confirmed cerebral venous thrombosis in a retrospective, multicenter cohort study to assess the diagnostic accuracy of non-contrast CT. For the current study, two raters applied the Edinburgh CT criteria and the modified Boston criteria for cerebral amyloid angiopathy to patients with cerebral venous thrombosis who had an intracerebral hemorrhage at baseline.

**Results:** Of 102 patients with hemorrhagic cerebral venous thrombosis, 12 (11%) patients had a high probability and 7 patients (6%) had an intermediate probability of cerebral amyloid angiopathy according to Edinburgh CT criteria. Of 82 patients with lobar hemorrhage, 7 (9%) were classified as probable cerebral amyloid angiopathy and 13 (16%) as possible cerebral amyloid angiopathy according to modified Boston criteria.

**Conclusions:** Hemorrhages from cerebral venous thrombosis may mimic cerebral amyloid angiopathy related hemorrhages. Therefore, the presence of cerebral venous thrombosis needs to be considered in

patients who present with hemorrhage suggestive of cerebral amyloid angiopathy.

**Trial registration number:** N/A

## AS24-006

### INFLUENCE OF TELECONSULTATION ON OUTCOME OF PATIENTS WITH SPONTANEOUS INTRACEREBRAL HEMORRHAGE

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**Background and Aims:** Telemedicine allows highly qualified personnel to be available for decision-making stages in the management of intracerebral hemorrhage patients. Our goal was to evaluate the influence of teleconsultation on the outcomes of intracerebral hemorrhage patients after 30 days.

**Methods:** A prospective open-label nonrandomized clinical trial used two parallel groups. The first group included adult patients up to 80 years of age with spontaneous unilateral supratentorial intracerebral hemorrhages with a 4 to 36 NIHSS score who received bedside consultation from a neurosurgeon and neurocritical-care physician from the Comprehensive Stroke Center. The second group comprised analogous patients who received teleconsultation of the aforementioned specialists. The primary end point was mortality 30 days after the onset of intracerebral hemorrhage. The non-inferiority hypothesis was tested, and the 95% confidence interval (CI) for the difference in mortality between groups should not exceed 15%.

**Results:** A total of 140 patients (70 in each group) with intracerebral hemorrhage were enrolled. Mortality in the bedside group was 14.3% (CI 7.1%-24.7%); in the remote group, 25.7% (16.0%- 37.6%);  $p = 0.091$ . However, non-inferiority was not proven because the difference in mortality between groups was 11.4 with CI from -0.07% to 24.5%, which was beyond the predetermined limit.

**Conclusions:** Telemedicine at the current development level of medicine and information technology cannot fully replace traditional (bedside) consultation by highly qualified neurosurgeons and neurocritical-care physicians treating patients with spontaneous intracerebral hemorrhage.

**Trial registration number:** N/A

## AS24-083

### HYPERGLYCEMIA AND INTRAVENTRICULAR DISSECTION IN PATIENTS WITH SPONTANEOUS INTRACEREBRAL HEMORRHAGE: SHOULD WE CONSIDER A BIDIRECTIONAL ASSOCIATION?

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**Background and Aims:** Hyperglycemia induced hematoma enlargement (HE) potentially explains the association between admission glycemia (AG) and mortality from spontaneous intracranial hemorrhage (sICH). Intraventricular dissection (IVD) is associated with HE and predicts poor prognosis. We aim to assess if AG predicts the occurrence of IVD.

**Methods:** Observational study of consecutive sICH patients admitted to a tertiary care hospital (2009-2015). ROC-curve analysis and Youden

index were used to identify the best discriminative value of AG for the occurrence IVD. Logistic regression was used to test the association between reference AG and IVD.

**Results:** Of the original cohort, 493 patients (89.8%) were included (mean age of 71.6 years, 63.3% male), of which 230 (46.7%) had IVD. The mean admission glycemia was 147.85mg/dL, being significantly higher in IVD patients (163.5 vs 134.1mg/dL  $p < 0.001$ ). The optimal value of glycemia associated with IVD was 126mg/dL (70% sensitivity; 62% specificity) and it was independently associated with IVD (OR 3.1, IC95%; 2-4.7,  $p < 0.001$ ), after adjusting for co-variables – gender (OR 2.1,  $p < 0.002$ ), anticoagulation medication (OR 2.1,  $p < 0.022$ ), and hematoma size (OR 6.7,  $p < 0.000$ ).

**Conclusions:** Our study shows that higher AG values are independently associated with IVD in sICH patients. Although both AG and IVD are considered independent predictors of sICH severity, it is reasonable to admit that hyperglycemia induced HE may increase independently the risk of IVD.

**Trial registration number:** N/A

## AS24-060

### HEMOSTASIS BIOMARKERS IN THE PROGNOSIS OF NON-TRAUMATIC INTRACEREBRAL HEMORRHAGE

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**Background and Aims:** Non-traumatic intracerebral hemorrhage (ICH) accounts for 10–15% of all strokes and results in higher rate of mortality as compared to ischemic strokes. In the IRONHEART study we aimed to find potential hemostasis biomarkers with prognostic value in patients with ICH.

**Methods:** In this prospective, observational study, 183 acute stroke patients and 140 healthy controls were included. Patients were grouped: 51 primary ICH patients (PICH), 118 acute ischemic stroke patients who underwent thrombolysis without hemorrhagic events (AIS), 13 patients with AIS who suffered hemorrhagic complications after intravenous thrombolysis (AIS-ICH). On admission, CT angiography, detailed clinical and laboratory investigations were performed. The following hemostasis measurements were carried out from blood samples: hemostasis screening tests, von Willebrand factor (VWF) antigen, factor XIII (FXIII), plasminogen and a2 antiplasmin activity, D-dimer. Patients were followed for 90 days, long term outcomes were defined using the modified Rankin Scale.

**Results:** VWF level was significantly higher in all patient groups as compared to controls. VWF levels were significantly higher in patients with worse long-term outcomes ( $mRS > 3$ ) in all patient cohorts. FXIII activity was significantly elevated in the PICH group as compared to controls and to both AIS groups. FXIII activity in the lowest quartile was associated with a significant risk of mortality in the PICH group (OR: 9.9; 95%CI: 1.6-61.6,  $p = 0.015$ ). Among fibrinolytic markers, only D-dimer showed association with worse long-term outcomes ( $mRS > 3$ ).

**Conclusions:** VWF antigen, FXIII activity and D-dimer could serve as biomarkers of long-term outcomes in PICH patients. Funding: GINOP-2.3.2-15-2016-00043, NKFI-K120042

**Trial registration number:** N/A

**AS24-007****THE DYNAMICS OF HEMATOMA SURFACE REGULARITY AND HEMATOMA EXPANSION IN ACUTE INTRACEREBRAL HEMORRHAGE****D.D. Oge<sup>1</sup>, M.A. Topcuoglu<sup>1</sup>, R. Gocmen<sup>2</sup> and E.M. Arsava<sup>1</sup>**<sup>1</sup>Hacettepe University Faculty of Medicine, Department of Neurology, Ankara, Turkey; <sup>2</sup>Hacettepe University Faculty of Medicine, Department of Radiology, Ankara, Turkey

**Background and Aims:** The clarification of factors that contribute to hematoma expansion in ICH patients and the relevant physical dynamics are implemental for development of management strategies. Herein, we assessed the interplay between surface regularity of intracerebral bleeds and their expansion during ensuing days.

**Methods:** Hematoma contours were outlined on admission and follow-up CT's using semi-automated thresholding algorithms in 133 ICH patients. Hematoma volume, surface area and surface regularity [ $SR = 6 \times \pi \times (\text{volume}/(\text{surface area}^3))$ ; ranging from 0 (very irregular surface) to 1 (perfectly regular surface suggestive of 3D spherical structure)] were determined by 3D Slicer software ([www.slicer.org](http://www.slicer.org)). Hematoma growth was defined as  $\geq 33\%$  relative, or  $\geq 6$  mL absolute growth.

**Results:** The median (IQR) hematoma volume was 14.2 (6.0-34.9) mL on admission CT obtained 2.4 (1.5-4.4) hours after symptom onset; SR was calculated as 0.63 (0.52-0.72). Patients who underwent imaging at earlier time points had higher SR values ( $r = 0.18$ ;  $p = 0.035$ ). The median hematoma volume at follow-up, obtained 35 (21-47) hours after the initial scan, was 19.7 (6.9-44.4) mL. The regularity index decreased significantly at this time point to 0.59 (0.49-0.66) ( $p < 0.001$ ) and corresponding increase of surface irregularity was independent of change in hematoma volume. Baseline hematoma volume, INR, and time to initial imaging were the only significant predictors of hematoma expansion.

**Conclusions:** Our findings suggest that hematomas evolve into more irregular 3D structures during follow-up. These observations are consistent with the 'domino' hypothesis put forward for ICH expansion, where shearing of blood vessels around the initial site of hemorrhage contribute to additional bleedings and culminate in asymmetric hematoma growth.

**Trial registration number:** N/A

**AS24-038****IN-HOSPITAL AND LONG-TERM PROGNOSIS AFTER SPONTANEOUS INTRACEREBRAL HEMORRHAGE AMONG YOUNG ADULTS AGED 18 TO 65 YEARS****F. Bernardo<sup>1</sup>, L. Rebordão<sup>1</sup>, S. Machado<sup>1</sup>, V. Salgado<sup>1</sup> and A. Nogueira Pinto<sup>1</sup>**<sup>1</sup>Hospital Professor Doutor Fernando Fonseca, Neurology, Amadora, Portugal

**Background and Aims:** Spontaneous intracerebral hemorrhage (ICH) accounts for 10–15% of all strokes, having an estimated annual incidence of 5/100,000 in young adults. Limited data on short-term and, particularly, on long-term prognosis after ICH in young adults are available. We aimed to identify prognostic predictors after ICH among adults aged 18–65 years.

**Methods:** We retrospectively selected all patients with ICH from a prospective single-center registry of adults with first stroke before 65 years between 1997 and 2002. We recorded in-hospital mortality as well as mortality and recurrent stroke after discharge until December 2018. For in-hospital analysis, we compared patients that died in-hospital versus patients discharged alive. For long-term analysis, we compared patients that died in follow-up versus patients still alive. Independent prognostic predictors were identified using multivariate analyses.

**Results:** Among 161 patients included, 24 (14.9%) died in-hospital. Among in-hospital survivors, 5-year survival was 92%, 10-year survival

78.1%, and 15-year survival 62.0%. After median follow-up of 17 years, 47.4% of patients died, 18 patients had ischemic stroke and six recurrent ICH. Regarding in-hospital prognosis, coma at admission [OR 0.02 (0.00-0.11)] was independent predictor for mortality whereas alcoholic habits [OR 12.32 (1.82-83.30)] was independent predictor for survival. An increasing age [OR 1.08 (1.03-1.12)], higher blood glucose levels [OR 1.01 (1.00-1.01)], and hypertension [OR 2.21 (1.22-4.00)] were independent predictors of long-term mortality after ICH.

**Conclusions:** Alcoholic habits may influence in-hospital mortality after ICH in young adults. Long-term mortality in young adults seems to be lower than in elderly and was predicted by higher blood glucose levels and hypertension.

**Trial registration number:** N/A

**AS24-086****MANAGEMENT OF ANTICOAGULANTS AND FOLLOW-UP OF INTRACEREBRAL HEMORRHAGE IN PATIENTS WITH MECHANICAL HEART VALVE: A FRENCH COHORT.****L. Bonnet<sup>1</sup>, G. Charbonnier<sup>1</sup>, B. Bouamra<sup>1</sup>, F. Vuillier<sup>1</sup> and T. Moulin<sup>1</sup>**<sup>1</sup>Besançon University Hospital, Neurology, Besançon, France

**Background and Aims:** Anticoagulant reversal and cessation is highly recommended in the management of acute intracerebral hemorrhage (ICH). However, mechanical heart valve needs a constant effective anti-coagulation. Management of anticoagulant in the acute phase of an ICH is of clinical importance. The aim of this study was to analyse demographic data, acute treatments, and outcome of patients with mechanical heart valve presenting with an acute ICH.

**Methods:** We conducted an observational retrospective analysis of prospectively collected consecutive acute ICH patients with mechanical heart valve from the Besançon Stroke Registry from January 2015 to December 2018.

**Results:** We identified 13 patients (8 men; mean age 62 years). Median NIHSS at onset was 6 (range 0-22). Three patients had neurosurgical evacuation. Anticoagulant was stopped for every patient in the hyperacute phase. The median anticoagulant withholding period was 1 day (range 0-14). Anticoagulant was restarted by heparin in every case. Three patients died in the acute phase at 2, 5 and 14 days. Median modified Rankin Score (mRS) was 2 (range 1-6). Median mRS for survivor was 2 (range 1-3) at median follow-up of 81 days.

**Conclusions:** Management of anticoagulants is not well established in the acute phase of ICH for patients with mechanical heart valves. Systematic and specific heart and brain imaging could help the clinician to face this complicated dilemma.

**Trial registration number:** N/A

**AS24-001****GENETIC POLYMORPHISM OF APOLIPOPROTEIN E IN HEMORRHAGIC STROKE: STUDY CASE-CONTROL****S. Boumendjel<sup>1</sup>, Djamel KHODJA Abdelmajid HAMRI Chérifa BENLATRECHE Noureddine ABADI**<sup>1</sup>Laboratory of Biology and Molecular Genetics- Faculty of Medicine-Mentouri University- Constantine- Algeria., Constantine, Constantine, Algeria

**Background and Aims:** Our study is the type case-control realized at the Hospital of Constantine. Objective: It discusses the relationship between polymorphism of apolipoprotein E and hemorrhagic stroke.

**Methods:** The determination of the polymorphism of apolipoprotein E was carried out by PCR- digestion (polymerase chain reaction) using the enzyme of restriction Hhal. The study population consisted of 81 Algerian patients with hemorrhagic stroke, and 509 control subjects.

**Results:** Three isoforms of apolipoprotein E have been identified. The allelic distribution of apo E in the general population showed a predominance of the allele ε3 (84.3%) followed distantly by allele ε4 (10.7%) and ε2 (5%) respectively. In hemorrhagic stroke patients, allele frequencies of ε4 and ε2 are respectively 10.5 % and 3.3%. These frequencies are not statistically different as reported in the control group. The assessment of the odds ratio of patient subjects with an allele ε4, ε2, ε3/ε4, and ε2/ε3 compared to control subjects with genotype ε3/ε3 don't show any statistical association between the polymorphism of the apo E and the hemorrhagic stroke.

**Conclusions:** The distribution of apolipoprotein E allele frequencies in the population of Constantine is similar to that of Southern Europe. The ε2, ε4 alleles do not appear to be implied in the occurrence of this affection; Nevertheless, large additional studies are necessary to confirm these results.

**Trial registration number:** None

#### AS24-053

### REPORTING A REGIONAL SCALE-OUT OF THE ACUTE BUNDLE OF CARE FOR INTRACEREBRAL HAEMORRHAGE (ABC-ICH): A MIXED METHODS EVALUATION

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**Background and Aims:** The 'ABC' care bundle for intracerebral haemorrhage (ICH) was developed and implemented at Salford Royal Hospital and reduced 30-day case fatality in 2015–2016 by 35%. Implementation of the bundle was scaled out across the two other hyperacute stroke units (HASUs) in Greater Manchester from April 2017. A mixed-methods evaluation was conducted alongside.

**Methods:** A harmonised quality improvement register at each HASU captured consecutive ICH patients from 01/10/2016-30/03/2017 (pre-launch) and 01/04/2017-30/03/2018 (post-launch). Quantitative data are presented as median and interquartile range. Qualitative evaluation captured how the bundle was implemented across sites; it involved: 33 interviews with implementation teams/clinicians; 79 hours of non-participant observation; analysis of project documents.

**Results:** HASU1 significantly reduced anticoagulant reversal door-to-needle time (134 min [120– 392; n = 14] pre-launch vs 72 min [63– 108; n = 21] post-launch; p < 0.001) and intensive BP lowering door-to-target time 336.5 min [199-856, n = 22] pre-launch vs 83.5 min [59.5- 114.5, n = 30] post-launch; p < 0.001). 30-day case fatality at HASU1 fell from 34.3% (n = 70) to 26.8% (n = 97, 21.9% relative reduction), but was not statistically significant. No statistically significant changes in care process/ case fatality occurred at HASU2. Qualitative evaluation identified importance of facilitation: all-site quarterly meetings encouraged a learning culture between HASUs; robust planning before bundle launch contributed to early adoption at one site; close monitoring of data helped identify missed targets and provide early feedback to staff. Contextual

changes over-time impacted upon implementation across sites, identifying a need for continued implementation support.

**Conclusions:** Findings will be used to support an implementation strategy to test bundle in hospitals outside of Greater Manchester.

**Trial registration number:** N/A

#### AS24-002

### GENOME-WIDE TRANSCRIPTOME ANALYSIS USING RNA-SEQ REVEALS A LARGE NUMBER OF DIFFERENTIALLY EXPRESSED GENES IN THE LATER PHASE AFTER INTRACEREBRAL HEMORRHAGE.

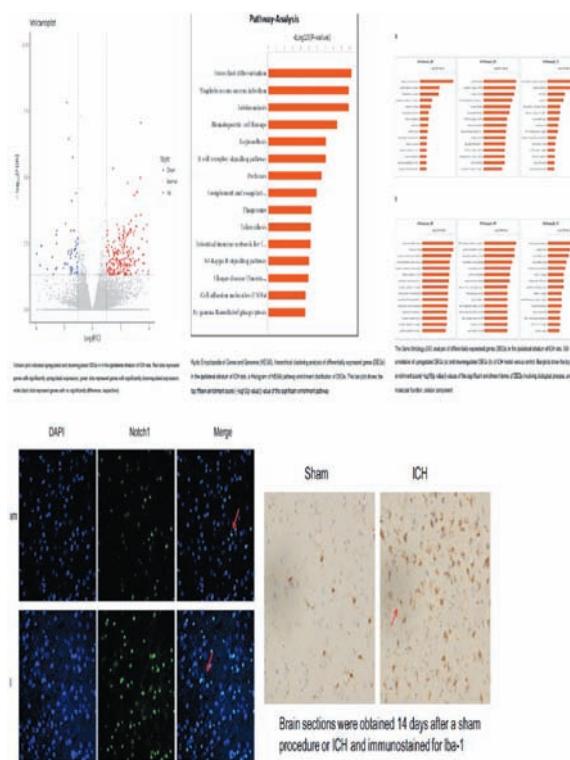
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**Background and Aims:** Intracerebral hemorrhage (ICH) is a devastating form of stroke and a leading cause of disability and mortality worldwide. However, the molecular mechanisms of functional recovery after stroke in later phase are not fully understood.

**Methods:** Intracerebral hemorrhage (ICH) was induced by injection of collagenase in Sprague-Dawley rats. A Sham group was treated with saline solution instead of collagenase. We examined differentially expressed genes (DEGs) in the rat striatum by RNA sequencing (RNA-seq) between ICH and control groups. Then, enrichment analyses were performed for these DEGs using Gene Ontology (GO) function, Kyoto Encyclopedia of Genes and Genomes (KEGG) pathway, Hierarchical Cluster, and Pathway-Act-Network analysis. Expression of the following proteins was measured by Western blot, immunohistochemistry, or immunofluorescence: HMGB1, Notch1, Hes1 and Jagged1.

**Results:** A total of 336 DEGs were found significantly changed with 276 upregulated (e.g., Cx3cr1, Epst1l, notch1) and 60 downregulated (e.g., Dusp1, jagged1) at 14 days after ICH. Quantitative reverse-transcribed PCR (qRT-PCR) verified changes in 10 randomly selected DEGs. GO and KEGG biological pathway analyses showed that the upregulated DEGs were mostly enriched in immune response-related biological processes, as well as immune- and inflammation-related pathways. Most of these genes which have previously been linked to immune and inflammation.



**Conclusions:** Our results revealed that immune and inflammatory pathways may contribute to the function recovery in later phases of ICH. These mRNAs can be used to identify potential therapeutic targets in the development of new strategies for the prevention and treatment of ICH.

**Trial registration number:** N/A

#### AS24-004

### INTRACRANIAL HEMORRHAGE AS INITIAL PRESENTATION OF CEREBRAL VENOUS SINUS THROMBOSIS: A CASE SERIES OF FOUR PATIENTS

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**Background and Aims:** Intracranial hemorrhage due to cerebral venous sinus thrombosis is an unusual initial clinical presentation and a series of 4 cases from Canada will be presented.

**Methods:** A retrospective study of stroke patients seen at the William Osler Health System in Toronto, CANADA between 2014 -2018.

**Results:** 1: 43 y.o. female presented with headaches and right hemiparesis. CT and MRI/MRV showed L. parietal intra-cerebral hemorrhage and sagittal and transverse sinus thrombosis. She was treated with IV heparin and subsequent oral Warfarin but developed symptomatic left subdural hematoma which was successfully evacuated. Hypercoagulable workup was negative. Subsequent MRI/MRV showed resolution of her sinus thrombosis and received aspirin only since. 2: 45 y.o. male presented with generalized seizure 10 days following a motor vehicle accident. Initial CT showed focal right frontal subarachnoid hemorrhage and subsequent

MRI/MRV confirmed extensive sagittal sinus thrombosis. He was treated successfully with IV heparin and subsequent Warfarin. 3: 32 y.o. male presented with generalized seizure. CT and MRI/MRV confirmed a large right temporal lobe intra-cerebral hemorrhage and extensive right transverse sinus and straight sinus thrombosis. He was successfully treated with IV heparin followed by Rivoroxaban. 4: 41 y.o. female with acute left temporal hemorrhage and MRI/MRV showed left transverse sinus thrombosis. She was treated with IV heparin followed by Apixaban 5mg BID with a good recovery. Follow-up MRI/MRV 1 year later showed partial resolution of the transverse sinus thrombosis.

**Conclusions:** Intracranial hemorrhage in patients with cerebral venous sinus thrombosis could be managed successfully with anticoagulation therapy and with careful clinical and neuro-imaging monitoring.

**Trial registration number:** N/A

#### AS24-074

### TRANSCRANIAL DOPPLER AND HEMATOMA EXPANSION IN ACUTE SPONTANEOUS PRIMARY INTRACEREBRAL HEMORRHAGE: A SINGLE CENTER STUDY

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**Background and Aims:** Spontaneous intracerebral hemorrhage (ICH) is the second most common cause of stroke. Hematoma expansion, defined as a 33% or a 6-mL increase in blood volume is a predictor of poor outcome in ICH. Transcranial Doppler (TCD) is a noninvasive ultrasound (US) study which allows dynamic monitoring of cerebral blood flow (CBF). The aim of this study is to evaluate the TCD variables during the acute stage of spontaneous primary ICH and their correlation with hematoma expansion.

**Methods:** Primary ICH patients within 24 h of symptom onset from February 2018-November 2018 were recruited. Baseline computerized tomography of brain was performed to assess the hematoma volume. Baseline TCD parameters (Peak Systolic velocity, Mean Flow velocity, Resistance Index, and Pulsatility Index) were obtained from both the middle cerebral arteries (MCAs) of the affected and unaffected hemisphere. Follow up (24 hours) assessment of hematoma volume and TCD were done. The TCD variables were compared in hematoma expansion and non-expansion group.

**Results:** Thirty-two patients were recruited in the study (Table I)

TABLE I. Baseline and 24-h follow up clinical and investigational data

Parameters	Baseline [Mean ± SD; range]	24-h follow up [Mean ± SD; Range]
Number of study subjects	32	32
Age	52.35 ± 9.2 years (35-66 years)	52.35 ± 9.2 years (35-66 years)
GCS	13 ± 2.45 (9-15)	13.68 ± 2.83 (8-15)
NIHSS	14.68 ± 5.34 (5-21)	12.43 ± 5.67 (5-19)
Systolic Blood Pressure (in mmHg)	183.13 ± 15.1 (120-240)	162.50 ± 10.5 (120-180)
Diastolic Blood Pressure (in mmHg)	104.38 ± 10.78 (80-130)	94.38 ± 13.23 (70-110)
Heart Rate (beats per minute)	82.38 ± 13.11 (72-110)	78.94 ± 9.32 (68-105)
CT scan, from symptom onset (minutes)	380.94 ± 202.74 (71-795)	1641.56 ± 316.82 (1460-1840)
Hematoma volume	16.81 ± 16.2 mL (1.5-54.5)	25.37 ± 10.58 mL (2-61.3)
TCD from symptom onset (minutes)	458.13 ± 375.5 (165-823)	1730.53 ± 279.1 (1490-1976)

TABLE 2. Correlation of TCD MCA variables with hematoma expansion

Parameter	Baseline MCA (affected)		P value	24-H MCA (affected)		p-value
	(+) HE	(-) HE		(+) HE	(-) HE	
PSV (cm/s)	86.53 ± 20.6	80.48 ± 30.1	0.26	86.7 ± 28.1	82.02	0.32
MFV (cm/s)	45.02 ± 19.2	43.98 ± 25.3	0.40	46.9 ± 18.9	46.52	0.76
PI	1.47 ± 0.32	1.11 ± 0.28	0.12	1.50 ± 0.26	1.2	0.15
RI	0.73 ± 0.12	0.67 ± 0.09	0.34	0.76 ± 0.05	0.7	0.28
<hr/>						
	Baseline MCA (unaffected)		p-value	24-H MCA (unaffected)		p-value
	(+) HE	(-) HE		(+) HE	(-) HE	
PSV (cm/s)	70.53 ± 18.5	69.24 ± 23.1	0.23	75.36 ± 25.1	68.18 ± 17.0	0.46
MFV (cm/s)	39.13 ± 20.4	41.56 ± 15.8	0.33	40.04 ± 30.2	42 ± 17.2	0.13
PI	1.06 ± 0.35	0.89 ± 0.43	0.07	1.37 ± 0.29	1.02 ± 0.37	0.11
RI	0.6 ± 0.12	0.65 ± 0.10	0.56	0.83 ± 0.05	0.63 ± 0.12	0.47

TCD = transcranial Doppler, MCA= middle cerebral artery, PSV = peak systolic velocity, MFV = Mean Flow Velocity, PI = Pulsatility Index, RI = Resistance Index, (+) HE = those with Hematoma Expansion, (-) HE = those without hematoma expansion, Significant p-value: <0.05

Twelve patients (37%) had hematoma expansion (Table 2)

ROC Curve showed that a PI of 1.1 was discriminative in predicting hematoma expansion with a sensitivity of 83% and specificity of 85%

**Conclusions:** TCD assessment could aid in prediction of hematoma expansion in ICH patients by measuring pulsatility index. This can help in risk stratification and prognostication of primary ICH patients.

**Trial registration number:** N/A

## AS24-036

### PATIENTS TREATED WITH PERCUTANEOUS LEFT ATRIAL APPENDAGE CLOSURE AFTER INTRACEREBRAL HAEMORRHAGE. SAFETY DATA AND STROKE RECURRENCE AT 2 YEARS FOLLOW-UP

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**Background and Aims:** Percutaneous left atrial appendage closure (PLAAC) is a therapeutic alternative to be considered in patients who have suffered an intracranial hemorrhage and need oral anticoagulation due to atrial fibrillation in recent guidelines (IIb;B). We present a series of patients treated by this technique, with special attention to long-term safety and efficacy.

**Methods:** Neurological patients with atrial fibrillation and PLAAC, performed by interventional cardiologist, were recruited from 2013 to 2018 and followed until December 2018. We assessed baseline characteristics, incidence of new ischemic strokes and complications during follow-up.

**Results:** 52 patients were treated, 40 with previous intracerebral haemorrhages and 12 with ischemic stroke with no possibility of anticoagulation due to major non-cerebral hemorrhages, incidental unruptured intracranial aneurysms/malformations or severe chronic kidney failure. Of these 40 patients, 67.5% were men with mean age of 74 years, follow-up time of 22 months. Median CHA<sub>2</sub>DS<sub>2</sub>VASc and HAS-BLED scores were 4 and mRS: 2. 95% had arterial hypertension, 57.5% diabetes and 20% previous ischemic stroke. Hemorrhage was located: in basal ganglia (45%), lobar (37.5%), subarachnoid (10%) and subdural (7.5%). 70% were previously taking warfarin, 22.5% direct anticoagulants and 7.5% antiplatelets. 47.5% were given Amplatzer Amulet and 52.5% Watchman device. During follow-up only 3 patients had a complication

(7.5%), all related with vascular access; 6 (15%) patients died, none related with the procedure; and there were no new ischemic stroke.

**Conclusions:** Based on our experience, PLAAC is a safe and effective procedure for secondary stroke prevention in patients with atrial fibrillation and previous intracranial hemorrhage.

**Trial registration number:** N/A

## AS24-091

### DEEP LEARNING FOR AUTOMATED SEGMENTATION OF HEMATOMA AND PERIHEMATOMAL EDEMA VOLUMES IN SUPRATENTORIAL INTRACEREBRAL HEMORRHAGE

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**Background and Aims:** Hematoma volume (HV) and perihematomal edema (PHE) are well-established neuroimaging biomarkers of primary and secondary injury, respectively, in intracerebral hemorrhage (ICH). Fast and accurate quantification of these biomarkers will enable the identification of the biological mechanisms that mediate their evolution and effect on outcome.

**Methods:** Regions of HV and PHE were manually delineated on serial head CT scans of patients enrolled in the Yale Longitudinal Study of ICH. These ground-truth masks were then used to train a U-Net convolutional neural network (CNN) to segment CT image pixels into HV/IVHV, PHE, or unaffected brain. Results from this training were assessed using 3-fold cross-validation, with accuracy quantified by Dice similarity coefficient (DSC) and Pearson correlation between manual ground-truth and automated volumetric results.

**Results:** 191 scans from 108 patients were used for training. ICH location was deep (56%) vs. lobar (54%), with median HV of 19ml (IQR 8–39) and PHE volume of 12ml (IQR 5–27). Follow-up scans were available for 51 subjects (47%). Automated segmentation using CNN yielded median DSC of 0.88 for HV (IQR 0.80–0.92) and 0.46 for PHE (IQR 0.29–0.57). Correlations of automated-to-manual volumes were excellent for HV ( $r = 0.97$ ) and strong for PHE ( $r = 0.72$ , both  $p < 0.001$ ). There was also strong agreement between both absolute and relative measurement of change in HV between baseline and follow-up scans ( $r = 0.89$  and 0.94 respectively). Automated measurements of HV and PHE were associated with 3-month dichotomized mRS (both  $p < 0.001$ ).

**Conclusions:** Deep learning with CNN accurately measures neuroimaging biomarkers of primary and secondary injury in ICH.

**Trial registration number:** N/A

## AS24-070

### PROPHYLACTIC ANTIEPILEPTIC TREATMENT MIGHT MODIFY OUTCOME IN PATIENTS WITH SPONTANEOUS LOBAR INTRACEREBRAL HEMORRHAGE

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**Background and Aims:** Patients with spontaneous lobar intracerebral hemorrhage (SLIH) are occasionally treated with prophylactic antiepileptic drugs (p-AEDs) due to its superficial location, despite limited scientific evidence. We study outcome differences in patients with SLIH according to the use of p-AEDs.

**Methods:** Patients with SLIH attended in our center between January-2011 and January-2016 were studied. We compare clinical and radiological features in two groups, according to the use of p-AEDs or not. Patients with death  $\leq$ 24hours or limitation of therapeutic effort  $\leq$ 48hours from admission were excluded.

**Results:** The mean age of the 130 patients was 71 years old. 48% of them were women. 27% of the subjects were on p-AEDs treatment. Levetiracetam was the most used p-AED(86%). There were no differences in terms of previous cognitive impairment (22%), GCS[15|13-15] or NIHSS at admission (7[3'7-12'2]) between p-AEDs/no-p-AEDs group. The mean size of SLIH was 33'58ml and patients uptaking p-AEDs had larger hemorrhage size ( $p < 0'02$ ). The use of p-AEDs was associated with less evolution to persistent coma ( $p = 0'037$ ), less clinical epileptic seizures ( $p = 0'003$ ) and fewer mortality ( $p = 0'05$ ) during admission. Patients on p-AEDs treatment had more frequently undergone a surgical hematoma evacuation ( $p < 0'05$ ). In the surgically operated patients, the use of p-AEDs was associated with less seizures ( $p < 0'02$ ), with no relationship with the other features.

**Conclusions:** In our study, patients treated with p-AEDs showed a better outcome, with lower rates of epileptic seizures, persistent coma and mortality. It was remarkable that these results were found despite a larger hemorrhage size in this group, although it might be influenced by the higher rate of surgical treatment.

**Trial registration number:** N/A

## AS24-067

### HEADS UP OR HEADS DOWN? INTERNATIONAL PERSPECTIVES ON HEAD OF BED POSITION FOR INTRACEREBRAL HEMORRHAGE IN THE POST-HEADPOST ERA

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**Background and Aims:** An international survey of 128 clinicians prior to HeadPoST showed equipoise for best head of bed (HOB) position in acute stroke. We aimed to determine whether HOB equipoise remains for intracerebral hemorrhage (ICH) following HeadPoST.

**Methods:** A 5-question international survey was constructed to examine interdisciplinary clinicians' beliefs/practices associated with ICH HOB position (Likert scale: 1 = strongly agree, 2 = agree, 3 = unsure, 4 = disagree, 5 = strongly disagree). Surveys were distributed on stroke-specific listservs targeting physicians, advanced practice providers (APP), and nurses, and e-mailed to practitioners worldwide.

**Results:** A total of 181 responses were received representing 13 countries/4 continents (79% North America; 11% Europe; 7% Australia; 3% Asia). Respondents were 37% nurses, 33% APP, and 30% physicians with overall 8.6 + 8 (median 7) years stroke experience and median 100 (IQR

37.5-200) ICH admissions/year. Respondents disagreed (4; IQR:3-4) that HeadPoST provided definitive evidence for ICH HOB practices and agreed (2; IQR:2-3) with the statement, "medical orders at my hospital call for ICH HOB 30-degrees" with no differences by nurse/physician profession. Policy/procedures for ICH HOB 30-degrees existed at 54% of hospitals. Respondents were unsure (3; IQR:2-3) whether 30-degree HOB alone could influence ICH 6-month outcome, and 82% believed proximal clinical stability was the most appropriate future trial endpoint; 14% believed longitudinal measures were suitable and 4% felt both proximal/longitudinal measures were important endpoints.

**Conclusions:** Interdisciplinary clinicians remain unconvinced that HOB positioning may not matter in ICH patients. Future trials examining the proximal effects of HOB positioning on clinical stability are warranted to definitively determine how best to position acute ICH patients.

**Trial registration number:** N/A

## AS24-046

### WHITE MATTER HYPERINTENSITIES IN PATIENTS WITH CEREBRAL AMYLOID ANGIOPATHY AND CEREBELLAR INVOLVEMENT.

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**Background and Aims:** Cerebral amyloid angiopathy (CAA) typically involves the cerebral cortex but whether it affects the cerebellum remains uncertain, and its relationship to deep white matter changes is not studied.

**Methods:** Patients with intracerebral hemorrhage (ICH) who underwent magnetic resonance imaging were prospectively enrolled. Patients were diagnosed with CAA according to the Boston criteria and their hemorrhage types were categorized as macro-hematoma (MH) or micro-bleeds (MB). We compared white matter hyperintensities using the Fazekas scale comparing those with cerebellar involvement and without cerebellar hemorrhages.

**Results:** Out of 614 patients with ICH, 96 (16%) had a post-ICH MRI. Of those, 41 (43%) were diagnosed with possible ( $n = 19$ ), probable ( $n = 21$ ) or definite ( $n = 1$ ) CAA. Cerebellar involvement was seen in 14/41 (34%) patients with CAA. A more severe white matter hyperintensities grade (Fazekas 2-3) was more frequent in patients with cerebellar involvement (12/14; 86% vs. 8/27; 30%  $p = 0.002$ ).

**Conclusions:** Cerebellar involvement in not rare in CAA. These patients tend to have more white matter hyperintensities, even when clinical variables were adjusted for risk factor profile. Most patients have multiple superficial cerebellar MB. Clinical characteristics do not differ between CAA patients with or without cerebellar involvement. Patients presenting with cerebellar ICH and sever with matter disease (Fazekas 2-3) should be screened for CAA with MRI.

**Trial registration number:** N/A

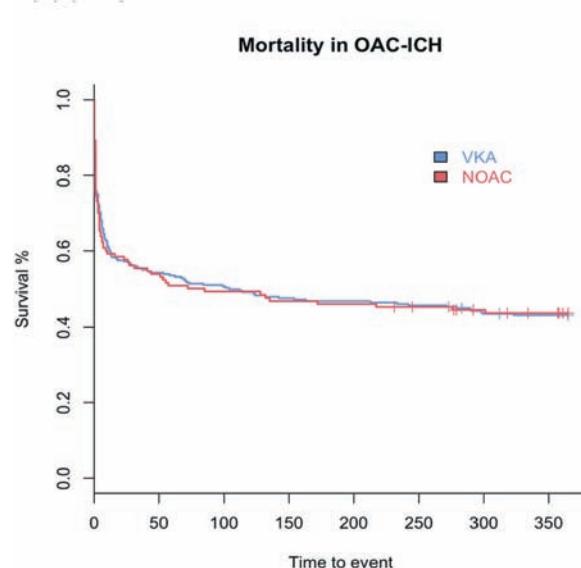
**WITHDRAWN**

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**Background and Aims:** In oral anticoagulant (OAC) related intracerebral hemorrhage (ICH) (non-vitamin-K oral anticoagulant (NOAC) and vitamin-K antagonist (VKA)), reports on mortality including differences between VKA and NOAC are conflicting. The aim was to describe and analyze mortality in patients with OAC-related ICH.

**Methods:** The COOL-ICH cohort is a consecutive clearly defined geographical population, including all patients in the Capital Region of Denmark with OAC-related ICH from January 2010 until June 2018. Patients were identified through discharge records from all hospitals, and through patient lists from the Danish Stroke Registry. Data was validated through individual patient charts. The study was approved by Danish Data Protection Agency (2012-58-0004) and by Danish Patient Safety Authority (3-3013-2102/I).

**Results:** A total of 403 patients were included. Mortality was 22.3% within 24 hours, 35.5% within 7 days, 49.6% within 3 months, and 58.5% within one year. In Cox-regression adjusting for age, sex, and pre-stroke modified Rankin Scale, hazard ratio was 0.9 (95% CI: 0.7 to 1.2) for death within the first year in NOAC vs VKA ICH.

**AS24-047**

### COMPARABLE MORTALITY AFTER VITAMIN-K ANTAGONIST- VERSUS NON-VITAMIN-K ORAL ANTICOAGULANT RELATED INTRACEREBRAL HEMORRHAGE – A POPULATION-BASED STUDY

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**Conclusions:** The mortality rate within the first year after ICH onset was comparable among VKA versus NOAC related ICH.

**Trial registration number:** N/A

**AS24-026**

### HYPERACUTE SPONTANEOUS INTRACEREBRAL HEMORRHAGE DURING CT SCANNING

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**Background and Aims:** Mechanisms underlying hematoma expansion in spontaneous intracerebral hemorrhage are still poorly understood.

Our case report on the earliest possible phase of hematoma growth aims to shed light on this.

**Methods:** A 76 year-old hypertensive man underwent elective carotid CT angiography to evaluate a previously known asymptomatic right carotid stenosis. Before the examination the patient had no neurological symptoms. During scanning he developed head and gaze deviation to the right. After scanning the patient was examined: left hemiplegia, hemisensory loss, hemianopia, neglect and severe gaze and head deviation to the right was noted. He was immediately re-scanned and later had follow up scans.

**Results:** This case demonstrates -for the first time to our knowledge- the hyperacute presentation and evolution of a spontaneous hypertensive intracerebral hemorrhage (ICH) serendipitously caught by CT and CTA. This setting is unique as it catches both space and -because of the contrast administration- time dynamics of the hemorrhage in its earliest phase.

**Conclusions:** Our findings detailed in the presentation/poster support the hypothesis of multiple sources of bleed due to a cascade of secondary vessel ruptures with excentric expansion rather than a single source and continuous bleeding with concentric expansion.

**Trial registration number:** N/A

## AS24-066

### DIFFERENTIATING NEUROIMAGING AND CLINICAL OUTCOMES ACROSS ANTITHROMBOTIC-ASSOCIATED INTRACEREBRAL HEMORRHAGE

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**Background and Aims:** Antithrombotic-related intracerebral hemorrhage (ICH) outcomes may vary. We aimed to compare ICH-related outcomes while on direct oral anticoagulants (DOAC), warfarin, and acetylsalicylic acid (ASA).

**Methods:** Consecutive antithrombotic-related ICH patients admitted to a tertiary stroke center between January 2010 and May 2016 were retrospectively reviewed. Neuroimaging parameters including ICH volume, fluid level and hematoma expansion (>6mL or >33% growth within 72h), and in-hospital mortality were compared between DOAC, warfarin and ASA-related ICH.

**Results:** In 138 cases (mean age 73y), there were 14, 56 and 68 DOAC, warfarin and ASA-related ICH, respectively. Patients with DOAC-ICH had smaller median hematoma volumes relative to warfarin-ICH (10.9mL [IQR 6.0–20.1] vs. 23.3mL [IQR 9.5–58.5],  $p = 0.03$ ), but not ASA-ICH (19.5mL [IQR 5.3–41.1],  $p = 0.17$ ). Fluid levels (0% DOAC-ICH, 23% warfarin-ICH and 10% ASA-ICH,  $p = 0.04$ ) and intraventricular hemorrhage (43% DOAC-ICH, 71% warfarin-ICH and 47% ASA-ICH,  $p = 0.04$ ) were underrepresented in DOAC-ICH. Hematoma expansion occurred in 30%, 43% and 28% of DOAC-ICH, warfarin-ICH and ASA-ICH ( $p = 0.46$ ), respectively with a trend towards lower median absolute hematoma growth in DOAC and ASA-ICH relative to warfarin-ICH (1.8mL [-0.5–5.5] DOAC-ICH, 5.1mL [-0.7–11.9] warfarin-ICH, and 0mL [-2.6–6.5] ASA-ICH;  $p = 0.06$ ). In-hospital mortality was 41% ( $n = 51$ ); 31% DOAC-ICH, 51% warfarin-ICH, and 36% ASA-ICH. Warfarin-ICH carried a two-fold increased risk of mortality relative to DOAC-ICH and ASA-ICH (OR 2.0, 95% CI 0.94–4.1,  $p = 0.07$ ).

**Conclusions:** DOAC-ICH neuroimaging characteristics and outcomes appear similar to ASA-ICH and more favorable than warfarin-ICH. Larger studies are required to better characterize these associations.

**Trial registration number:** N/A

## AS24-049

### INCIDENCE OF INTRACEREBRAL HAEMORRHAGE IN DENMARK BASED ON DATA FROM A NATIONWIDE STROKE REGISTRY

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**Background and Aims:** Studies of trends in the incidence of intracerebral haemorrhage (ICH) in this century have produced conflicting results, pointing towards either stable or declining rates. We investigated the recent incidence of ICH in Denmark.

**Methods:** The Danish Stroke Registry, established in 2003, is a nationwide clinical registry. Reporting data on hospitalised acute stroke patients to Danish Stroke Registry is mandatory. We retrieved information on patients aged 20+ years with an ICD-10 diagnosis code of ICH (I61) in Danish Stroke Registry in 2008–2017. Incident cases had to be free of a diagnosis of ICH in the 5 years prior to 2008. We calculated crude annual incidence rates and 95% Poisson confidence intervals (CIs).

**Results:** We identified 12,188 incident cases (mean age 72.1 years, 53% men) of ICH in 2008 to 2017. Annual incidence rates of ICH per 100,000 person-years were similar throughout the study period. In 2008, the incidence rate was 28.1 (CI 26.5–29.8) and in 2017 28.9 (CI 27.4–30.5). Sex-specific incidence rates per 100,000 person-years were also similar in 2008 and 2017, albeit higher in men than women in both years (men: 30.7, CI 28.4–33.3 vs. 30.5, CI 28.3–32.9; women: 26.62, CI 23.5–27.9 vs. 27.3, CI 25.2–29.6). Incidence rates in 2008 vs 2017 for the age-groups 20–59, 60–74, and 80+ years were, respectively, 7.0 (CI 6.1–8.1) vs 6.9 (CI 6.0–7.9); 43.9 (CI 39.6–48.6) vs 40.0 (CI 36.2–44.2); and 153.4 (CI 141.3–166.4) vs 151.1 (CI 140.0–162.9).

**Conclusions:** Our results suggest stable incidence rates of ICH in Denmark in the past 10 years.

**Trial registration number:** N/A

## AS24-080

### GOLDEN HOUR IMAGING IN INTRACEREBRAL HEMORRHAGE – RETROSPECTIVE DATA FROM TWO REGISTRIES

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**Background and Aims:** Intracerebral hemorrhage (ICH) is the second most common cause of stroke. Early ICH imaging and diagnostics (e.g., blood pressure, coagulation status) is prognostically crucial. However, only limited data is available on ultra-early hemorrhage growth within the first 60 minutes after symptom onset (“golden hour”).

**Methods:** We retrospectively and systematically collected data on ICH imaging using two registries, the Berlin Mobile Stroke Unit (MSU) registry and B-SPATIAL (clinicaltrials.gov, NCT03027453). We identified 61 patients receiving golden hour imaging: 37 patients with prehospital CT scan aboard the MSU, and 24 patients with CT or MR imaging at hospital arrival. Hemorrhages were measured using ABC/2 formula.

**Results:** The median time to first imaging was 42 min [IQR 35–48] in the MSU group compared to 48 min [IQR 41–54]. Median hemorrhage volumes were 15.2 mL [IQR 7.4–17.6] and 13.2 mL [IQR 5.7–18.9], and median hemorrhage growth rates were 20.8 mL/h [IQR 11–33.4] and 15.8 mL/h [IQR 8.1–22.1]. MSU patients received earlier follow-up imaging (70 min [IQR 55–779] versus 828 min [IQR 299–1438]), and median ICH volumes in follow-up imaging within 24 hours were less increased after MSU intervention (11.7 mL [IQR 6.8–19] versus 15.6 mL [IQR 7–25.8], n = 17/15). In-hospital mortality was 21.6 % and 17.4 %, respectively.

**Conclusions:** Here, we could show that MSU intervention leads to earlier follow-up imaging and may thus provide more information about hemorrhage growth and outcome prognosis.

**Trial registration number:** N/A

## AS24-065

### CORRECTION FACTOR FOR EACH MRI SEQUENCE IN VOLUMETRIC ANALYSIS OF ICH WHEN EVALUATING HEMATOMA EXPANSION FOR PATIENTS WHO UNDERGO BASELINE CT AND FOLLOWUP MRI

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**Background and Aims:** Measuring ICH volume for hematoma expansion is required for evaluating potential hemostatic and coagulation reversal treatments. CT is the primary acute imaging modality but MRI is preferred for finer details and ICH etiology at follow-up (next day or later). Given MRI blooming artifacts and various sequences, a correction factor may be needed when comparing baseline CT and followup MRI ICH volumes. The aim of our study was to establish correction factors for each MRI sequence that is equivalent to CT volumes.

**Methods:** A single-centre, retrospective, cohort study was used to identify patients with ICH who had a followup CT and MRI within the 12–72 hour period after baseline imaging. Quantomo software (Cybertrials, Inc) was used to measure hemorrhage volume for both followup imaging modalities. Linear regression was used to generate a correction factor for each MRI sequence compared to CT.

**Results:** 22 patients were included with a median 2.7 hours, IQR (-5.9, 20.1) between followup CT and MRI. Hematomas were confirmed stable by followup imaging in all included subjects.

MR Sequence	n	Correction factor to estimate CT volume equivalent	95% CI
FLAIR	19	1.06	0.94 - 1.17
T2	14	0.99	0.85 - 1.12
GRE	7	0.81	0.73 - 0.9
DWI	19	0.79	0.66 - 0.92
SWI	10	0.76	0.72 - 0.8

**Conclusions:** Preferred MRI sequences for a post-ICH followup MRI protocol are T2 or FLAIR since they closely match CT ICH volumes. Other sequences can be utilized to measure ICH volume with correction factor. Followup CT is not necessary in RCTs requiring volumetric ICH analysis if MRI is performed.

**Trial registration number:** N/A

## AS24-048

### INTRACEREBRAL HEMORRHAGE RELATED TO ORAL INFECTION OF CNM-POSITIVE STREPTOCOCCUS MUTANS

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**Background and Aims:** Oral microbiomes are epidemiologically associated with stroke. We assess clinico-radiological features of intracerebral hemorrhage (ICH) with collagen-binding (*cnm*-positive) *Streptococcus mutans* (*cnm*+ *S. mutans*).

**Methods:** In this single hospital-based, prospective observational study, 91 acute primary ICH patients were enrolled. The *cnm* gene in *S. mutans* isolated from saliva was screened using PCR. Clinical severity was examined by NIHSS and worsening of mRS at day 90 from discharge was defined as poor prognosis. The hematoma volume and the blend or black hole signs were evaluated as factors of severity.

**Results:** We compared 21 patients with *cnm*+ *S. mutans* (*cnm*+ group) and 70 patients without *cnm*+ *S. mutans* (*cnm*- group). The median NIHSS on admission was lower in the *cnm*+ group (4 [IQR 1–6.5] vs. 7 [IQR 3–13]; p < 0.05). The median hematoma volume (mL) was significantly smaller in the *cnm*+ group (5 [IQR 2.5–8.3] vs. 7.2 [IQR 3.2–16.2] (p < 0.05). The blend or black hole signs were negative in all patients of the *cnm*+ group, but positive in 12 (17%) of the *cnm*- group (p < 0.05). These findings unexpectedly suggest that ICH patients with *cnm*+ *S. mutans* show milder clinical and radiological features. Nevertheless, the proportion of poor prognosis was significantly higher in the *cnm*+ group (24% vs. 6%; p < 0.05).

**Conclusions:** *Cnm*-associated ICH is accompanied by milder symptoms and radiological presentation in the acute phase but by poorer prognosis in the chronic phase. A subset of ICH associated with *cnm*+ *S. mutans* may be different from conventional hypertensive ICH.

**Trial registration number:** N/A

## AS24-076

### MRI VOLUMETRIC PARAMETERS OF ISCHAEMIC LESION AND RISK OF HEMORRHAGIC TRANSFORMATION IN ISCHAEMIC STROKE PATIENTS

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**Background and Aims:** In patients with ischaemic stroke, infarcted tissue is frequently spontaneously affected by hemorrhagic transformation (HT). The aim of the study is to assess the relation of HT occurrence to the volumes of regions of the ischaemic lesion, ischaemic core, and area of an impaired blood-brain barrier (BBB) on MRI.

**Methods:** Prospective monocentric study on patients with supratentorial acute ischaemic lesion with a negative history of previous stroke and no HT on early imaging (24–72 hours). MRI imaging with gadolinium contrast agent was performed 7–12 days after stroke. Volumes of the ischaemic core (hyperintensity on DWI), the area of lesion affected by stroke (hyperintensity on FLAIR) and the area of BBB impairment (gadolinium

detection) were measured by an automatic algorithm and compared between HT and non-HT groups.

**Results:** The data of 72 patients were analyzed (64% men, average age 67 years, median NIHSS 5, 36% received intravenous thrombolysis, in 13% mechanical thrombectomy was done). HT occurred in 25 patients. Between HT and non-HT groups the volumes differed: DWI lesion 15.48ml vs. 8.18ml ( $p < 0.05$ ), FLAIR lesion 33.36ml vs. 17.13ml ( $p < 0.001$ ), BBB impairment 38.30ml vs. 18.49ml ( $p < 0.05$ ), the lesion area that is FLAIR positive and DWI negative at the same time 21.68ml vs. 11.10ml ( $p < 0.001$ ), this parameter was the best predictor of HT in ROC analysis (0.779).

**Conclusions:** Patients with ischaemic stroke affected by HT have significantly larger ischaemic lesions on all compared MRI sequences, the volume of lesion that is FLAIR positive and DWI negative at the same time being the best predictor.

**Trial registration number:** N/A

## AS24-015

### THE DIAGNOSTIC UTILITY OF ICH-SCORE IN PATIENTS WITH ANTICOAGULANT RELATED INTRACEREBRAL HEMORRHAGE

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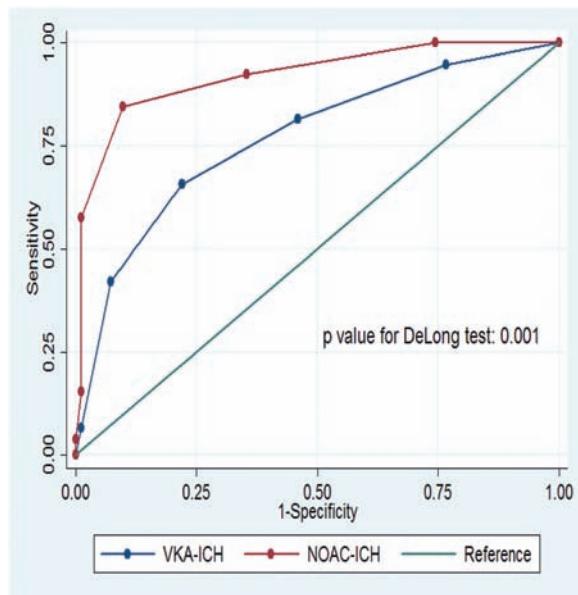
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**Background and Aims:** Intracerebral hemorrhage (ICH) score presents a prognostic model of mortality among patients with spontaneous ICH of any cause, which has not been validated in patients with oral anticoagulant related ICH (OAC-ICH). We performed a post-hoc analysis of two prospective cohorts to estimate the diagnostic performance of ICH score in OAC-ICH related to the use of vitamin K antagonists (VKA-ICH) or non-vitamin K oral anticoagulants (NOAC-ICH).

**Methods:** We identified the diagnostic accuracy and optimal cut-off in ICH score for the prognostication of 30-day mortality between NOAC-ICH and VKA-ICH patients with receiver operating characteristic (ROC) curve analysis.

**Results:** We included 108 NOAC-ICH and 241 VKA-ICH patients [mean age: 74 ± 10 years, 58% men, median NIHSS score: 11 (4-21), median ICH-score: 2 (1-3)]. A cut-off of 4 points in the ICH score was

highlighted as the optimal threshold for the prognostication of 30-day mortality [sensitivity: 57.7%, specificity: 98.8% for NOAC-ICH; sensitivity: 42.1%, specificity: 92.6% for VKA-ICH]. Overall, the predictive value of ICH-score was higher ( $p = 0.001$ ) in NOAC-ICH (AUC: 0.92, 95%CI: 0.86-0.98) compared to VKA-ICH (AUC: 0.77, 95%CI: 0.70-0.83; Figure).



**Conclusions:** ICH score has satisfactory predictive value in the prognostication of 30-day mortality for OAC-ICH. The diagnostic yield of the score appears to be higher in NOAC-ICH than in VKA-ICH.

**Trial registration number:** N/A

## AS24-082

### GENETIC LOAD OF HYPERCHOLESTEROLEMIA RISK ALLELES IS ASSOCIATED WITH A REDUCTION IN RISK OF INTRACEREBRAL HEMORRHAGE

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**Background and Aims:** Cholesterol levels are inversely correlated with risk of spontaneous intracerebral hemorrhage (ICH). We investigated whether the load of cholesterol-related genetic risk variants is inversely associated with ICH risk.

**Methods:** We analyzed publicly available individual-level data from three ICH genetic case-control studies in Caucasians and one in South Asians. We built polygenic risk scores (PRSs) using independent single nucleotide polymorphisms (SNPs) known to associate with total serum cholesterol, LDL, HDL and triglycerides at  $p < 1 \times 10^{-5}$ . For each subject, we calculated a PRS as the sum of the risk alleles at each SNP multiplied by its effect on lipids. Each PRS became the independent variable in a multivariate logistic regression model for ICH risk. We pooled study-specific results using fixed effects inverse variance weighted meta-analysis.

**Results:** We analyzed 2,503 ICH cases (mean age 61 [SD 16], 1171 females [47%]) and 2,512 controls (mean age 60 [SD 14], 1165 females [46%]). We used 588 SNPs for total cholesterol, 478 for LDL, 554 for HDL, and 463 for triglycerides to construct PRSs. For each additional standard deviation increase of the LDL-based PRS, ICH risk decreased by 8% (OR = 0.92; 95%CI 0.86-0.97;  $p = 0.003$ ). For each additional standard deviation increase of the total cholesterol-based PRS, ICH risk decreased by 6% (OR 0.94, 95%CI 0.89-1.00;  $p = 0.03$ ). No significant associations were found for HDL or triglycerides-based PRSs.

**Conclusions:** Increasing numbers of genetic risk variants for high total cholesterol and LDL levels associate with decreased ICH risk. These findings have translational implications for risk prediction and our understanding of ICH mechanisms.

**Trial registration number:** N/A

## AS24-075

### NEUROLOGISTS DO IT BETTER: REDUCED MORTALITY AND BETTER OUTCOME IN PATIENTS WITH LOBAR HEMORRHAGE.

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**Background and Aims:** The aim of our study was to evaluate the prognosis of patients with acute lobar intracerebral hemorrhage (ICH) in two different clinical settings.

**Methods:** This prospective observational study included all patients admitted to our University Hospital from January 1<sup>st</sup> 2016 to December 31<sup>st</sup> 2017 with spontaneous ICH. The patients were divided into two groups based on the location of ICH at CT: typical (deep/cerebellar/brainstem) or atypical (lobar). All patients underwent urgent neurosurgical evaluation.

**Results:** Out of 265 patients with ICH, 47% presented with atypical location; these patients were significantly older (75 vs 69 years,  $p < 0.001$ ). Lobar hemorrhage was associated with a higher mortality rate at 3 months (44% vs 35%,  $p < 0.05$ ) compared to typical ICH. Forty-five percent of patients with lobar hemorrhages were admitted to neurology/neurosurgery/neuroICU, while 55% were admitted to a general ward. The former group underwent a more intensive diagnostic protocol (86% underwent additional CTA and/or MRI vs 35%,  $p < 0.001$ ), more often aggressive therapy (40% vs 6% received surgical treatment) and targeted rehabilitation. This difference in ICH management resulted in a much lower mortality rate (14% vs 63%,  $p < 0.001$ ) and a better outcome (mRS 0-2 at 3 months: 40% vs 18%,  $p < 0.05$ ) in the neurological setting.

**Conclusions:** Lobar hemorrhages represent a relevant subset of hemorrhagic patients that benefit significantly from targeted neurologic care, in spite of a higher pre-morbid frailty.

**Trial registration number:** N/A

## AS24-081

### ELECTRONIC HEALTH RECORD SCREENING IN INTRACEREBRAL HEMORRHAGE TRIALS MAY IMPROVE OVERALL RECRUITMENT YIELD

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**Background and Aims:** Screening data is informative for providing numbers of patients available. A newer method for identifying the available population is using the electronic health record (EHR) to improve recruitment. We conducted an independent validation of MISTIE III trial screening activity to test whether available populations are missed by in-person screening compared to EHR screening.

**Methods:** The MISTIE III trial screened patients from Dec. 30, 2013 to Aug. 15, 2017. We surveyed active sites for EHR-reported ICH patients, based on specific ICD 9/10 codes, in years 2015 and 2016. Fifty-four sites responded to both surveys, 12 European and 42 North American. We compared actual screen numbers captured in the MISTIE III electronic data capture system (EDC) to EHR results.

**Results:** There is a significant increase in the number of ICH patients reported using EHR (mean = 327, 95% CI 257–398) compared with the EDC screening sources (mean = 155, 95% CI 129–181),  $p < 0.001$ . The change in percent increase in EHR-reported ICH vs. EDC, for both years, was 52.6%. In Europe, the average number of patients reported in the EHR was 224 (95% CI 141–307) and EDC was 101 (95% CI 56–147),  $p = 0.002$ . Similarly, the North American average EHR reported was 357 (95% CI 270–443) and EDC was 170 (95% CI 140–200),  $p < 0.001$ .

**Conclusions:** Using an EHR screening strategy can increase the available population yield and possibly the rate of enrollment, thereby improving trial performance overall.

**Trial registration number:** NCT01827046

## AS24-024

### VALIDATION AND COMPARISON OF NONCONTRAST CT SCORES TO PREDICT INTRACEREBRAL HEMORRHAGE EXPANSION

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**Background and Aims:** The BAT, BRAIN and HEP scores have been proposed to predict hematoma expansion (HE) with noncontrast CT (NCCT). We sought to validate these tools and compare their diagnostic performance.

**Methods:** We retrospectively analyzed two cohorts of patients with primary intracerebral hemorrhage. HE was defined as volume growth  $>33\%$  or  $>6$  mL. Two raters analyzed NCCT scans and calculated the scores, blinded to clinical and imaging data. The inter-rater reliability was assessed with the interclass correlation statistic. Discrimination and

calibration were calculated with area under the curve (AUC) and Hosmer-Lemeshow  $\chi^2$  statistic respectively. AUC comparison between different scores was explored with DeLong test. We also calculated the sensitivity, specificity, positive and negative predictive values of the dichotomized scores with cutoffs identified with the Youden's index.

**Results:** A total of 230 subjects were included, of whom 86 (37.4%) experienced HE. The observed AUC for HE were 0.696 for BAT, 0.700 for BRAIN and 0.648 for HEP. None of the scores had a significantly superior AUC compared with the others (all  $p > 0.4$ ). All the scores had good calibration (all  $p > 0.3$ ) and good to excellent inter-rater reliability (interclass correlation  $> 0.8$ ). BAT  $> 3$  showed the highest specificity (0.81) whereas BRAIN  $> 6$  had the highest sensitivity (0.76).

**Conclusions:** The BAT, BRAIN and HEP scores can predict HE with acceptable discrimination and require just a baseline NCCT scan. These tools may be used to stratify the risk of HE in clinical practice or randomized controlled trials.

**Trial registration number:** N/A

## WITHDRAWN

### AS24-010

#### CEREBRAL MICROBLEED PREVALENCE AND BURDEN IN NOAC VS VKA- ASSOCIATED INTRACEREBRAL HEMORRHAGE

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**Background and Aims:** Vitamin-K antagonists (VKA) have been associated with elevated prevalence and incidence of cerebral microbleeds (CMBs). The association between non-vitamin K oral anticoagulants (NOACs) and CMBs is less well described. We undertook this observational study to describe differences in CMB burden in a cohort of anti-coagulation-related intracerebral hemorrhage (ICH).

**Methods:** From a multicenter cohort of 357 ICH patients, 89 (25 NOAC, 64 VKA) received MRI allowing identification of CMBs. We identified CMB burden both as a continuous number and dichotomized (cutoff of  $>5$  vs.  $<5$ ).

**Results:** Both groups had comparable cardiovascular comorbidities and concomitant medications. NOAC-ICH patients were older [median age 78 (70-81) vs. 70 (60-77) years,  $p = 0.005$ ] with less frequent lobar ICH (28% vs 57.8%  $p = 0.001$ ). CMB prevalence was comparable (VKA-ICH:51.6%, NOAC-ICH:48%). However, amongst patients with present CMB(s), NOAC-ICH had lower median CMB count 2(1-3) vs 7(4-11);  $p < 0.001$  and a significantly lower proportion of  $\geq 5$  CMBs (4.0% vs 31.2%,  $p = 0.006$ ). On multivariable logistic regression models, NOAC-ICH was independently associated with lower odds ( $OR = 0.10$ , 95%CI: 0.01,0.83) and 3T MRI field strength with higher odds ( $OR = 6.42$ , 95%CI: 1.96,21.03) of higher CMB burden ; the proportion of 3T MRI was evenly distributed between groups (39.1% vs 36%).

**Conclusions:** CMB prevalence is similar in NOAC vs VKA-ICH. However, NOAC exposure was independently associated with lower CMB count and lower odds of a higher CMB burden. Given the association between CMB burden and future ICH risk, longitudinal follow up studies are necessary to delineate whether this association translates into reduced ICH recurrence risk.

**Trial registration number:** N/A

**AS24-063****LOW LEVELS OF VITAMIN D ARE ASSOCIATED WITH POOR PROGNOSIS OF HYPERTENSIVE INTRACEREBRAL HEMORRHAGES**

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**Background and Aims:** The role of chronic hypovitaminosis D in some neuropsychiatric and neurocardiovascular diseases is well demonstrated (although the benefit of dietary vitamin D supplements is not conclusive); however, its association with spontaneous intracerebral hemorrhage (ICH) is not known.

**Methods:** We studied 219 patients with non-traumatic ICH with a determination of vitamin D in a blood sample obtained on admission or in the first 24 hours. The registry includes demographic, clinical, biochemical, ultrasonographic, neuroimaging and evolutive variables up to 3 months. Of the included sample, 98 were hypertensive IHC, 17 amyloid, 38 for anticoagulation and 66 for indeterminate cause. One hundred and seventeen patients presented good prognosis at 3 months (modified Rankin scale < 3).

**Results:** Vitamin D levels were inversely related to the basal volume of the hematoma (Pearson coefficient = -0.192, p = 0.008) and to the NIHSS at admission (Spearman coefficient = -0.312, p < 0.0001), and were lower in patients with a poor prognosis (8.1 ± 7.1 vs. 14.5 ± 7.4 ng / mL, p < 0.0001); this association was confirmed in a multivariate study (OR 0.91, 95% CI 0.83-0.98, p = 0.017), and was more potent in hypertensive hemorrhages. The same is demonstrated when markers of inflammation are analyzed.

**Conclusions:** Low levels of vitamin D are associated with poor prognosis of ICH, especially in hypertensive ICH, so it is possible that high blood pressure is the link between hypovitaminosis D and ICH.

**Trial registration number:** N/A

**AS24-093****INCREASED PAI-1 LEVELS IN AGED FEMALES WITH CAA PATHOLOGY**

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**Background and Aims:** Cerebral amyloid angiopathy (CAA) is caused by deposition of amyloid beta plaques in the cerebral vasculature and remains the most common cause of lobar intracerebral hemorrhage in the elderly. Studies have shown that women have more extensive amyloid plaque depositions in the brain compared to men. Plasminogen activator inhibitor-1 (PAI-1) is an inhibitor of tissue plasminogen activator (tPA) that converts plasminogen into active protease plasmin. Plasmin plays a major role in amyloid beta clearance. We hypothesized that sexual dimorphism in CAA may be secondary to decreased amyloid beta clearance in women.

**Methods:** We used C57BL/6-transgenic (Tg, Thy1-APPswDutlowa) mouse model of CAA for our studies. We sacrificed young (3 month) and aged (13 month) male and female Tg mice and collected plasma. Aged (22 month) male and female C57BL/6J were used as controls. Plasma was tested for PAI-1 levels using ELISA

**Results:** No difference in plasma PAI-1 levels was seen in young male (659.7 ± 11.13 pg/mL) and female (602.3 ± 12.95 pg/mL) Tg CAA mice,

p = 0.8. Aged Tg CAA females had a significantly higher level of PAI-1 (1176 ± 85.98 pg/mL) as compared with aged CAA males (667.5 ± 63.5pg/mL), p < 0.0001. No sex difference in PAI-1 levels was seen in control aged male (622.3 ± 21.29 pg/mL) or female mice (728.1 ± 103 pg/mL), p = 0.5

**Conclusions:** Our study shows that aged females with CAA pathology have higher PAI-1 levels as compared to aged males. We speculate that impaired plasmin/PAI-1 clearance may be the underlying mechanism for increased amyloid beta deposition in elderly women. PAI-1 may be an important sex specific target for amyloid clearance.

**Trial registration number:** N/A

**AS24-069****ANALYSIS OF CM352 VERSUS PROTHROMBIN CONCENTRATE COMPLEX IN AN EXPERIMENTAL MODEL OF INTRACRANIAL HAEMORRHAGE ASSOCIATED WITH RIVAROXABAN**

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**Background and Aims:** Direct oral anticoagulants (DOACs), has decreased the risk of Intracranial haemorrhage (ICH) [HR = 0.48 (0.39-0.59)]. Matrix metalloproteinases (MMPs) are involved in the coagulation-fibrinolysis system. We developed a MMPs inhibitor (CM-352), that controls bleeding in experimental models. In this study we evaluated the effect of CM-352 against rivaroxaban and the role of MMP10 in an experimental ICH model.

**Methods:** Two experimental models were performed (tail bleeding and collagenase induced-ICH) in C57Bl6J mice anticoagulated with warfarin and rivaroxaban. CM-352 or saline was given intravenously before the tail excision and bleeding time was measured. In the ICH model, CM-352 and Prothrombin Concentrate Complex (CCP) were administered after collagenase injection. Haemorrhage volume (diaminobenzidine staining), and motor activity were measured at 24h. Finally, the ICH model was also performed in Mmp10-/- mice.

**Results:** CM-352 treatment diminished bleeding time in mice anticoagulated with rivaroxaban (75%, p < 0.001) and warfarin (60%, p < 0.01). In the ICH model, CM-352 effectively reduced the volume of haemorrhage (70%, p = 0.001) in rivaroxaban anticoagulated mice. CCP decreased the volume of haemorrhage in warfarin and rivaroxaban anticoagulated mice (50%, p < 0.01 and p < 0.05). Both, CM-352 and CPP prevented motor impairment at 24h (p < 0.05). Finally, Mmp10-/- mice showed lower haemorrhage volume (p = 0.041) than wild type, not further modified by CM-352

**Conclusions:** MMPs inhibition by CM-352 is effective in the control of bleeding associated with warfarin and rivaroxaban but highly effective in rivaroxaban associated-ICH. This beneficial effect is dependent of MMP10 inhibition, suggesting that MMP10 is a key factor in the control of ICH associated with rivaroxaban.

**Trial registration number:** N/A

**AS24-009****WHERE ARE PATIENTS WITH ACUTE INTRACEREBRAL HEMORRHAGE BEING CARED? A POPULATION-BASED STUDY****J. Martí-Fàbregas<sup>1</sup>**<sup>1</sup>Hospital de la Santa Creu i Sant Pau- IIB Sant Pau Biomedical Research, Neurology, Barcelona, Spain

**Background and Aims:** There is limited information about the hospital types where intracerebral hemorrhage (ICH) patients are being admitted to. This may be important as some effective therapeutic measures can only be administered in tertiary stroke centres (TSC).

**Methods:** Using the database for Acute Hospitals Discharge which provides population-based information, we identified ICH patients admitted (Jan2015 to Dec2016) in Catalonia in 11 TSC and 49 non-TSC. TSCs were defined as centres with Emergency Department, ready to assess and handle code stroke patients, presence of neurologist/neurosurgeon 24/7, access to neuroradiology 24/7, admission to Stroke Unit or Intensive Care Unit. The database provided demographics, admission hospital, and interhospital transfers. Long-term mortality was retrieved from the Central Registry of the Catalan Public Health Insurance.

**Results:** A total of 3339 patients were diagnosed (mean age  $72.2 \pm 14.6$ , 56.8% were men). Of these, 63.2% were admitted to a TSC and 36.8% to a non-TSC. Only 1.7% patients were transferred from a non-TSC to a TSC. Acute phase mortality was equivalent between TSC and non-TSC (29.6% vs. 27.3%,  $p = 0.17$ ). However, long-term mortality (censored June 2017) was lower in the TSC group (44.3% vs 49.8%,  $p = 0.003$ ).

**Conclusions:** A considerable proportion of ICH patients remain in non-TSC during all their hospitalization. While short-term mortality is comparable between the two hospital types, long-term mortality is higher in patients admitted to non-TSC. More studies are needed to find out whether patients admitted to both types of centres are comparable and whether routing protocols of acute ICH patients should be modified.

**Trial registration number:** N/A

**AS24-032****LEFT ATRIAL APPENDAGE CLOSURE EFFECTIVENESS IN PATIENTS WITH PRIOR INTRACRANIAL HEMORRHAGE AFTER LONG-TERM FOLLOW-UP**

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**Background and Aims:** To decrease the risk of ischemic/hemorrhagic strokes in patients with prior intracranial hemorrhage (ICH) and atrial fibrillation, left atrial appendage closure (LAAC) has been proposed as an alternative to start or resume long-term oral anticoagulation (OAC). We aimed to assess the long-term effectiveness of LAAC.

**Methods:** We performed a retrospective two-center study of a prospectively-collected database (from 2013 to 2017) of all patients who underwent LAAC after ICH. We collected demographic variables and risk scores for ischemic (CHA<sub>2</sub>DS<sub>2</sub>-VASc) and hemorrhagic (HAS-BLED) strokes. We also collected time to LAAC, use of antithrombotic drugs following LAAC and procedure complications. During follow-up, we registered ICH recurrence, ischemic stroke (IS) and mortality and calculated Kaplan-Meier survival curves.

**Results:** A total of 36 patients underwent LAAC (age  $77 \pm 7.1$ , 66% were men). Prior ICH events were intracerebral (67%), subdural (28%) and subarachnoid (5%). Median CHA<sub>2</sub>DS<sub>2</sub>-VASc and HAS-BLED scores were 4 (IQR = 3) and 4 (IQR = 1), respectively. Amplatzer Cardiac Plug/Amulet was implanted in 35 patients and Watchman in 1. We recorded one major peri-procedural complication (AV block). All patients received indefinite antiplatelet treatment following LAAC (36% ASA, 36% Clopidogrel, 27% both 3 months followed by ASA). After a mean follow-up of  $24.4 \pm 12$  months, 4 patients suffered ICH, 1 IS and 7 were dead. The risk at 1, 2 and 3 years was 0%, 5% and 5% for IS, 9%, 12% and 12% for ICH and 9%, 15% and 24% for mortality, respectively. **Conclusions:** In this observational study, LAAC appeared to be safe and a reasonable alternative to long-term OAC.

**Trial registration number:** N/A

**AS24-014****INFECTION AND VENOUS THROMBOEMBOLISM AFTER PRIMARY INTRACEREBRAL HEMORRHAGE****K. Melmed<sup>1</sup>, S. Murthy<sup>2</sup> and D. Roh<sup>1</sup>**<sup>1</sup>Columbia University Medical Center, Neurology, New York, USA;<sup>2</sup>NewYork-Presbyterian / Weill Cornell Medical Center, Neurology, New York, USA

**Background and Aims:** Venous thrombotic events (VTE) after intracerebral hemorrhage (ICH) can be devastating. Infection is a known risk factor for VTE. This relationship has yet to be carefully studied in patients with ICH.

**Methods:** We retrospectively looked at prospectively collected data for ICH patients admitted to Columbia University Medical Center. We included consecutive patients admitted between 2009–2018 with primary ICH who survived 24 hours, excluding patients with recent anticoagulation use, systemic coagulopathy or prior documented VTE. Our primary predictor variable was infection. Our primary outcome was a composite of deep venous thrombosis (DVT), and pulmonary embolism (PE). Binary logistic regression modeling was used to study the relationship between infection type and thrombotic events. We then looked at association of VTE and poor outcome.

**Results:** 414 patients met inclusion criteria. Of these, 32 (8%) were diagnosed with VTE after infection, 10 (3%) with PE. 175 (42%) of patients carried a diagnosis of infection. After controlling for illness severity and ICH score, respiratory (OR, 4.2; 95% CI, 1.9-9.6;  $p = 0.001$ ) and blood stream infections (OR, 4.9; 95% CI, 1.7-13.7;  $p < 0.01$ ) were associated with future thrombotic events. Patients with VTE during hospitalization had a worse mRS at discharge ( $p < 0.001$ ) and at 3 months ( $p < 0.01$ ).

**Conclusions:** We have expanded upon prior observations that infection and VTE are related, and to our knowledge, this is the first temporal association between infection and thrombotic events in patients with ICH. Further understanding of this association could lead to improvement of VTE prevention in this unique population.

**Trial registration number:** NA

**AS24-073****MICROGLIAL ACTIVATION AND BLOOD-BRAIN BARRIER BREAKDOWN IN ACUTE INTRACEREBRAL HAEMORRHAGE: A MULTIPARAMETRIC PET-MR STUDY**

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**Background and Aims:** Clinical studies of acute intracerebral haemorrhage (ICH) demonstrate that systemic inflammation is associated with worse short and long-term outcomes and inflammation modulates outcomes in animal models. However, little is known on inflammation within the human brain *in vivo* after acute ICH. Using non-invasive multiparametric brain imaging, we sought to investigate microglial activation and blood-brain barrier permeability in the perihematomal brain in acute ICH.

**Methods:** Patients with spontaneous, supratentorial ICH underwent multiparametric MRI (including dynamic contrast-enhanced MRI to allow measurement of blood-brain barrier transfer constant [ $K^{trans}$ ]) 1–3 days post-onset. Where possible, PET scanning with [ $^{11}\text{C}$ ]-( $\text{R}$ )-PK11195 was performed within 2–7 days post-onset. Mean values for  $K^{trans}$  and [ $^{11}\text{C}$ ]-( $\text{R}$ )-PK11195 binding potential were derived from regions of interest (ROIs) defined by haematoma and perihematomal oedema and compared to corresponding contralateral regions. C-reactive protein (CRP) and interleukin-6 (IL-6) were measured in the plasma at each imaging time point.

**Results:** 36 patients had complete MR data of whom 16 completed PET scanning. Mean  $K^{trans}$  for haematoma and perihematomal oedema was significantly increased vs. matched contralateral ROIs ( $1.245 \times 10^{-3} \text{ min}^{-1}$  vs.  $0.648 \times 10^{-3} \text{ min}^{-1}$ ,  $p < 0.0001$  and  $0.971 \times 10^{-3} \text{ min}^{-1}$  vs.  $0.674 \times 10^{-3} \text{ min}^{-1}$ ,  $p = 0.0002$  respectively). We found significantly raised binding of [ $^{11}\text{C}$ ]-( $\text{R}$ )-PK11195 in the perihematomal volume compared to matched contralateral region ( $0.104$  vs.  $0.021$ ,  $p = 0.024$ ). IL-6 and CRP were not associated with imaging measures.

**Conclusions:** There is increased BBB breakdown in and around the haematoma in acute ICH with evidence of increased microglial activation in the perihematomal region.

**Trial registration number:** N/A

## AS24-005

### PREDICTING INTRACEREBRAL HEMORRHAGE EXPANSION WITH CT PERfusion

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**Background and Aims:** We investigated whether CT perfusion (CTP) can identify intracerebral hemorrhage (ICH) patients at high risk of hematoma expansion.

**Methods:** We studied subjects with primary spontaneous ICH undergoing CTP within 24 hours from symptom onset/time last seen well. Cerebral blood flow (CBF), cerebral blood volume (CBV) and mean transit time (MTT) levels were measured in four regions of interest: (1) hemorrhagic core; (2) perihematomal rim; (3) 1 cm rim of normal-appearing brain tissue surrounding the perilesional area; and (4) a mirrored area, including the clot and the perihematomal region, located in the contralateral hemisphere. Predictors of log-transformed absolute hematoma growth were explored with univariable and multivariable linear regression. In a secondary analysis we studied predictors of ICH expansion defined as ICH growth >33% or >6 mL, using logistic regression.

**Results:** A total of 155 patients were included (median age 68, 47.1% males). After adjustment in multivariable analysis, perihematomal CBV was inversely associated with ICH growth ( $B = -0.20$ ,  $p < 0.001$ ), independently from systolic blood pressure, baseline ICH volume and other potential confounders. This association was not dose-dependent and only very low CBV ( $< 1.4 \text{ mL}/100\text{g}$ ) was significantly associated with increased ICH growth ( $B = 0.24$ ,  $p < 0.001$ ). Logistic regression confirmed the inverse relationship between perihematomal CBV and risk of ICH expansion (odds ratio: 0.69,  $p = 0.032$ ).

**Conclusions:** The risk of hematoma expansion is increased in patients with low perihematomal CBV. This finding provides further insights into the pathophysiology of ICH expansion and suggests a potential role of the brain region surrounding the hemorrhage.

**Trial registration number:** N/A

## AS24-092

### SECONDARY PREVENTION WITH BLOOD PRESSURE LOWERING AFTER INTRACEREBRAL HAEMORRHAGE: A COHORT STUDY

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**Background and Aims:** Blood pressure (BP) lowering reduces the risk of recurrent stroke after intracerebral haemorrhage (ICH). UK stroke guidelines recommend long-term BP lowering to a systolic target < 130 mmHg, unless contraindicated. However, implementation of BP lowering in clinical practice in the UK is unknown.

**Methods:** We identified adults with incident ICH to quantify the proportion who survived >14 days after hospital discharge and received antihypertensive drug(s) in (1) June 2010–May 2012 inclusive in a prospective, population-based, inception cohort study in the Lothian region of Scotland, and in (2) January 2017–November 2017 in the Scottish Stroke Care Audit (when we also extracted information about reasons for not using antihypertensive drugs after hospital discharge from paper and electronic patient records).

**Results:** In 2010–2012, 83 (58%) of 142 ICH survivors received antihypertensive drug(s) at hospital discharge, and 45 (41%) of 109 survivors with BP data available at one year had systolic BP < 130 mmHg. In 2017, 36 (55%) of 65 survivors received antihypertensive drug(s) at hospital discharge; of the 29 who did not receive antihypertensive drug(s), 11 (38%) already had systolic BP < 130 mmHg and 9 (31%) were too frail or had contraindications, but reasons in the remaining 9 (31%) were unclear.

**Conclusions:** Just over half of ICH survivors receive antihypertensive drug(s) at hospital discharge. Almost a third of the adults who did not receive antihypertensive drug(s) did not appear to have a reason for avoiding them. Interventions are needed to improve the use of antihypertensive drugs and achieve systolic target BP after ICH.

**Trial registration number:** N/A

**AS24-085**

**GENETIC LOAD OF HIGH BLOOD PRESSURE RISK ALLELES INFLUENCES RISK OF SPONTANEOUS INTRACEREBRAL HEMORRHAGE IN SOUTH ASIANS**

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**Background and Aims:** High blood pressure (BP) influences risk of intracerebral hemorrhage (ICH) in Caucasians. We investigated whether the load of high BP risk alleles is positively correlated with ICH risk in South Asians.

**Methods:** We analyzed publicly available individual-level genome-wide data from patients enrolled in the Risk Assessment of Cerebrovascular Events (RACE) Study, an ongoing, case-control genetic study of ischemic and hemorrhagic stroke in Pakistan. For each person we calculated the BP polygenic risk score (PRS) as the weighted sum of the alleles at single-nucleotide polymorphisms (SNPs) shown in prior studies to associate with BP at  $p < 5 \times 10^{-5}$ ; weights were the published effect size for a BP trait. PRSs were used as independent variables in multivariate logistic regression models of ICH.

**Results:** A total of 1,217 ICH cases (mean age 50 [SD 10], 578 females [48%]) and 1,251 stroke-free controls (mean age 52 [SD 8], 552 females [45%]) were included in this analysis. Separate PRSs were built using 234 SNPs for systolic blood pressure (SBP), 214 SNPs for diastolic blood pressure (DBP), and 101 SNPs for pulse pressure (PP). Each additional standard deviation of the PRS was associated with a 17% increase in ICH risk when considering SBP (OR 1.17, 95%CI 1.08-1.27;  $p = 0.0002$ ), 10% for DBP (OR 1.10, 95%CI 1.02-1.20;  $p = 0.02$ ), and 14% for PP (OR 1.14, 95%CI 1.05-1.24;  $p = 0.001$ ).

**Conclusions:** The genetic load of risk alleles for high BP is positively correlated with ICH risk in South Asians. This genetic information could be used to risk stratify individuals prior to manifestation of clinical hypertension.

**Trial registration number:** N/A

**WITHDRAWN**

**AS24-013**

**CEREBRAL AMYLOID ANGIOPATHY RELATED CONCURRENT HEMORRHAGE & INFARCT- AN EMERGENT TREATMENT DILEMMA**

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**Background and Aims:** Cerebral Amyloid angiopathy (CAA) is recognised as a major cause of hemorrhagic stroke. CAA is most often causes multiple, strictly lobar intracerebral hemorrhages, micro bleeds or superficial sulcal bleeding which are sensitively detected by T2\*-weighted gradient Echo MRI techniques. CAA also causes brain lesions such as white matter T2 hyper intensities & Micro infarcts. There is growing evidence that CAA is associated with increased cerebral ischemic burden.

**Methods:** we evaluated 25 cases of CAA who presented to our hospital between Jan 2018 & Dec 2019. The patients presented with spontaneous symptomatic intracranial hemorrhage. The patients age group ranged between 56 to 78 yrs. There were 16 females & 9 males. Hypertension was seen in 6 cases out of which 4 were males & 2 were females. 10 patients were diabetic. one patient had atrial fibrillation. A 128 slice CT scan & 1.5 Tesla MRI was done in all the patients. Ct scan revealed intracranial hemorrhage in all the patients. Old micro hemorrhages & superficial siderosis were seen in MRI in most of the patients characteristic of CAA. MRI showed diffusion restriction in 6 out of 25 cases.

**Results:** Clinical presentation was head ache, altered sensorium, hemiparesis, monoparesis, dysphasia, unsteadiness of gait.

CAA can present with intracranial hemorrhage & cerebral ischemia simultaneously. Almost 25 % of cases showed diffusion restriction apart from intracerebral hemorrhage. we are highlighting the frequent presence of ischemic pathology in this condition.

**Conclusions:** cerebral amyloid angiopathy presenting concurrently with hemorrhagic & ischemic pathology poses a significant challenge in the management of these cases.

**Trial registration number:** N/A

**AS24-018****FREQUENCY, RISK FACTORS AND OUTCOME OF NORMOTENSIVE PATIENTS WITH A DEEP SUPRATENTORIAL INTRACEREBRAL HEMORRHAGE**

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**Background and Aims:** Hypertension is usually considered the cause of deep intracerebral hemorrhage (dICH) in hypertensive patients. We compared the frequency, risk factors and outcome of normotensive and hypertensive patients with dICH.

**Methods:** We studied prospectively patients with spontaneous ICH attended to a tertiary stroke center (Jul2013-Jun2018). We excluded patients with lobar or infratentorial ICH and those in whom arterial hypertension was not ruled out. We defined normotensive patients with dICH if the ICH was deep (thalamus, putamen, pallidus, caudate, internal capsule, deep white matter, isolated intraventricular hemorrhage), did not need lowering blood pressure agents after discharge, and in whom arterial hypertension was ruled out (transthoracic echocardiography without left ventricle hypertrophy and/or blood pressure map with mean blood pressure < 140/90mmHg). We collected demographics, etiology (H-ATOMIC), clinical and radiological data and the 3-month functional outcome (good when Rankin Scale 0–2). We performed bivariate analyses.

**Results:** From 451 ICH patients, 124 met the inclusion criteria (mean age  $69.3 \pm 15.8$ , 47.6% were women), and 73.4% had known hypertension. After a diagnostic work-up for hypertension, 13 patients (10.4%) were classified as normotensive dICH while 111 (89.6%) were hypertensives. Vascular malformations/cavernomas (H-ATOMIC: 8/13) were the most common cause of dICH in normotensives. Good outcome at 3 months was more common in normotensive dICH compared to hypertensive dICH patients (8/13 vs 29/111,  $p < 0.001$ ).

**Conclusions:** The frequency of dICH without hypertension is 10.4% and the 3-months outcome is better than in patients with dICH associated to hypertension. Further studies are needed to confirm the etiologic and prognostic implications of this group of patients.

**Trial registration number:** N/A

**AS24-056****LONG TERM OUTCOME OF PATIENTS WITH SPONTANEOUS INTRACEREBRAL HEMORRHAGE AND HYPERINTENSE DWI LESIONS**

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**Background and Aims:** Patients with acute intracerebral hemorrhage (ICH) and silent cerebral infarctions (sCI) have a poor outcome at 3-months. However, whether the poor outcome is sustained in the long term remains unknown. We evaluated the 12-months outcome, and ischemic stroke (IS) or ICH recurrences.

**Methods:** We studied consecutive ICH patients attended in a tertiary stroke center and included in a prospective database (Jul2013-Jun2018). We excluded patients with clinical IS, neurosurgical procedures, or MRI performed after discharge. We defined sCI as hyperintense DWI lesions with low intensity on ADC maps. We prospectively registered functional

outcome (poor outcome defined as modified Rankin Scale score 4–6), mortality, IS and ICH recurrence at 3 and 12-months. We performed bivariate and Cox-regression analyses.

**Results:** We studied 134 patients ( $69.6 \pm 15.2$  y, 50% men) and 26 of them had sCI. MRI were performed a median of 7 (interquartile range [IQR]:5-11) days after ICH onset. Compared to patients without sCI, patients with sCI showed a worse outcome at 3-months (53.8% vs 31.4%,  $p = 0.041$ ) and 12-months (56.5% vs 31.6%,  $p = 0.032$ ). Mortality was higher in sCI patients at 3-months (26.9% vs 9.2%,  $p = 0.023$ ) but not at 12 months (34.7% vs 21.4%,  $p = 0.185$ ). During a follow-up of 22.4 (IQR:8.9-38.3) months, 5 patients had a IS and 13 ICH. No patients with sCI experienced IS recurrence. Cox-regression modelling showed that sCI were not associated with ICH recurrence (adjusted HR:1.8 (0.4-7.5),  $p = 0.378$ ).

**Conclusions:** At 12-months follow-up, sCI patients showed a worse functional outcome but mortality or cerebrovascular recurrences weren't different. Thus, interventions to reduce sCI in ICH patients may improve long-term functional outcome.

**Trial registration number:** N/A

**AS24-071****PROGNOSTIC VALUE OF PLAIN CT IMAGIOLOGICAL SIGNS ON PATIENTS WITH HEMORRHAGIC STROKE**

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**Background and Aims:** There is currently no disease modifying therapeutic approach in "primary" hemorrhagic stroke. Identification of prognosis predictors, especially hemorrhagic growth (HG), may be important in the design of therapeutic trials.

We assess the prognostic value of plain CT imagiological signs on patients with hemorrhagic stroke.

**Methods:** Retrospective study of hemorrhagic stroke patients who attended our hospital between 2014–2017. Imagiological signs and hematoma volumes were assessed by two independent observers. Predicting value of HG, mortality at 30 days, and functional dependency at 3 months were calculated for each sign, using diagnostic tests statistics and univariate/multivariate logistic regression.

**Results:** We identified 368 patients with hemorrhagic stroke and available admission CT. Inter-observer concordance was higher to satellite ( $\kappa = 0.758$ ), and lower to black hole ( $\kappa = 0.581$ ) signs. Sensibility for HG was higher for "any hypodensity" and swirl sign (88.9%), despite low specificities (45.3% and 48.3%). "Any hypodensity" (OR = 3.06,  $p = 0.031$ ) and swirl sign (OR = 3.54,  $p = 0.013$ ) were identified as independent predictors of HG. Satellite sign (OR = 2.50,  $p = 0.035$ ) and irregular margins were independent predictors of mortality at 30 days. Island sign (OR = 4.37,  $p = 0.042$ ) and irregular margins (OR = 254,  $p = 0.034$ ) were the best independent predictors of functional dependency at 3 months.

**Conclusions:** Selection of hemorrhagic stroke patients for hemostatic treatment trials should be based on frequent HG signs, with good sensitivity/specificity. Although several assessed imagiological signs were independent predictors of HG, mortality at 30 days, and functional dependency at 3 months, the moderate inter-observer concordance and the imbalanced relationship between sensitivity and specificity might be obstacles to their use in clinical trials.

**Trial registration number:** N/A

**AS24-062****EFFECTS OF PRIOR ANTICOAGULATION OR ANTIPLATELET THERAPY ON HEMORRHAGE VOLUME AND MORTALITY IN PATIENTS WITH INTRACEREBRAL HEMORRHAGE****L. Rebordão<sup>1</sup>, S. Machado<sup>1</sup>, A. Nogueira Pinto<sup>1</sup>****and F. Bernardo<sup>1</sup>**<sup>1</sup>Hospital Professor Doutor Fernando Fonseca, Neurology, Amadora, Portugal

**Background and Aims:** Intracerebral hemorrhage (ICH) is a devastating disease with about 50% case-fatality rate. Antiplatelet therapy (APT) and anticoagulation are commonly used in these patients. Although prior APT-related ICH risk is controversial, anticoagulation has a recognized increased risk of ICH, hemorrhage volume expansion and death. We aimed to compare hemorrhage volume and mortality in patients taking anticoagulation or APT prior to ICH.

**Methods:** Retrospective analysis of all patients with ICH and prior anti-coagulation or APT admitted at a regional hospital from May 2013 to December 2017. We compared patients with prior anticoagulation to patients with previous APT, using a univariate analysis.

**Results:** We included 142 patients, median age of 76 and 49.3% males. Fifty-four patients (38.0%) were taking anticoagulation and 88 patients (62.0%) APT. APT patients were more frequently younger than 65 years-old than anticoagulation patients (27.3% versus 7.4%, p=0.04). Anticoagulation patients had more atrial fibrillation (p<0.01) as well as higher INR (p<0.01) and aPTT (p<0.01) than APT patients. APT patients had more alcohol abuse (p=0.026) and more basal ganglia ICH (p=0.014) than anticoagulation patients. No significant differences were noted in hemorrhage volume neither in 30-day mortality between groups. However, anticoagulation patients had higher three-month (p=0.070), one-year (p=0.02) and cumulative mortality (p=0.028) than APT patients.

**Conclusions:** In this single-center cohort of ICH patients with prior antithrombotic therapy, we did not find significant differences in hemorrhage volume neither in 30-day mortality. However, anticoagulation patients had a significant higher one-year and cumulative mortality than APT patients, probably due to the increased age of anticoagulation patients.

**Trial registration number:** N/A**AS24-068****EXCELLENT CORRELATION OF TRANSCRANIAL DUPLEX SONOGRAPHY WITH BRAIN CT IN MONITORING INTRACEREBRAL HEMORRHAGE VOLUME****G. Ruiz-Ares<sup>1</sup>, F. Dahl<sup>1</sup>, M. Ramirez-Torres<sup>1</sup>, J. Rodriguez-Pardo<sup>1</sup>, M. Alonso de Leciñana<sup>1</sup>, R. Gutierrez-Zúñiga<sup>1</sup>, B. Fuentes<sup>1</sup> and E. Díez-Tejedor<sup>1</sup>**<sup>1</sup>Hospital Universitario La Paz, Neurology, Madrid, Spain

**Background and Aims:** Transcranial duplex sonography (TDS) showed good correlation with CT scan measuring bleeding extent in acute phase in patients with intracerebral haemorrhage (ICH). Our aim was to correlate ICH volumes measured by TDS and CT scan in patients with ICH on admission and after 48 hours and its relation with prognosis.

**Methods:** Prospective study of patients with supratentorial ICH evaluated within 24 hours of onset. All patient underwent CT scan and TDS exam on admission and at 48 hours. Hematoma volume was determined using the formula (longitudinal×sagittal×coronal)/2 in both techniques. Association of ICH volume measured by TDS with outcome at 3 month by modified Rankin Scale was evaluated.

**Results:** Thirty-eight patients were included. ICH was measured by TDS in 27 cases due to the lack of transtemporal window. Mean age was 64 year-old and 12 (46.2%) were male. Admission mean ICH volume by CT scan was 27.4 cc (SD 30.1) and 36.4 cc (SD 37.5) by TDS with excellent correlation r=0.823 (p<0.001). Mean ICH volume measured by TDS was 25.7 (SD 24.7) in independent patients at 3 month and 66.9 (SD 46.5) in dependent group (p=0.008). Mean ICH volume at 48 hours by CT scan was 24.8 cc (SD 24.2) and by TDS 29.0 cc (SD 30.6) with very good correlation r=0.767 (p<0.001).

**Conclusions:** TDS showed an excellent correlation with CT scan measuring ICH volume on admission and very good correlation within the first 48 hours. This non-invasive technique may be helpful to monitoring ICH at bedside and predicting outcome.

**Trial registration number:** N/A**WITHDRAWN****AS24-064****GENETIC, CONVENTIONAL AND DIETARY RISK FACTORS OF PRIMARY INTRACEREBRAL HEMORRHAGE FROM EASTERN INDIA****I. Sebastian<sup>1</sup>, L. John<sup>2</sup>, R. Mashon<sup>3</sup>, C. Mochahari<sup>4</sup>, S. Basumatary<sup>5</sup>, S. Sangthang<sup>6</sup>, S. Lamichhane<sup>5</sup>, T.R. Sangma<sup>7</sup>, S. Longkumer<sup>8</sup>, P. Kumar<sup>9</sup>, H. Khatter<sup>1</sup>, A. Kaliyaperumal<sup>1</sup> and J. Pandian<sup>1</sup>**<sup>1</sup>Christian Medical College and Hospital, Neurology, Ludhiana, India;<sup>2</sup>Baptist Christian Hospital, Medicine, Tezpur- Assam, India; <sup>3</sup>Christian Medical College and Hospital, Hematology, Ludhiana, India; <sup>4</sup>Baptist Christian Hospital, Research Coordinator, Tezpur- Assam, India; <sup>5</sup>Baptist

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**Background and Aims:** Plausible interplay between genetic and environmental factors is possible for high incidence of primary intracerebral haemorrhage (ICH) in eastern India. This study evaluated the dietary, conventional and genetic (Apolipoprotein E alleles) risk factors for ICH. **Methods:** First ever ICH patients over 18 years of age were included from March 2017 at Baptist Christian Hospital, Tezpur, Assam. Control subjects without ICH were recruited from the community. Dietary details were assessed by 24-hour recall method and urine spot sodium was measured. ApoE polymorphism was evaluated using RFLP polymerase chain reaction.

**Results:** 95 patients with ICH and 95 age matched healthy controls were enrolled. ICH cohort were more likely to have had increased consumption of alcohol [33 (34.7%) vs 9 (9.7%), p = < 0.001], smoking [26 (27.4%) vs 7 (7.4%), p = < 0.001], and hypertension [86 (90.5%) vs 8 (8.6%), p = < 0.001] as compared to controls. Mean urinary sodium levels (mmol) were comparable ICH 104.2 ± 57.7 vs controls 107.1 ± 47.01, p = 0.712. ICH subjects had lower calorie [777.9 ± 289.9 vs 918.9 ± 287.9, p = 0.001] and higher salted tea intake [28 (30.1%) vs 12 (12.6%), p = 0.004] in diet. ApoE polymorphisms between ICH and controls e2/e2: 2.2% vs 1.1%, e4/e4: 8.8% vs 2.3%, p = 0.139) were not different. In the multivariate regression current alcohol use and smoking, low calories and consuming salted tea were the predictors for ICH. (Table 1)

**Table 1: Multivariate Logistic regression analysis of risk factors for Intracerebral Haemorrhage as compared with Control subjects**

Variable	Odd's ratio	95% CI	p value
<b>Current use of Alcohol</b>			
No (ref)	<b>1.000</b>		
Yes	<b>2.981</b>	<b>1.248 – 7.123</b>	<b>0.014</b>
<b>Current smoker</b>			
No (ref)	<b>1.000</b>		
Yes	<b>4.255</b>	<b>1.570 – 11.535</b>	<b>0.004</b>
<b>Calories</b>			
No (ref)	<b>0.998</b>	<b>0.997 – 0.999</b>	<b>0.005</b>
<b>Salted Tea</b>			
No (ref)	<b>1.000</b>		
Yes	<b>2.260</b>	<b>0.997 – 5.125</b>	<b>0.051</b>

**Conclusions:** In this ongoing case control study conventional risk factors are common in ICH patients. Diet also would play a role in ICH in this region.

Funded by Indian Council of Medical Research

Trial registration number: N/A

## AS24-016

### SAFETY OF HEPARIN FOR PROPHYLAXIS OF VENOUS THROMBOEMBOLISM IN ORAL ANTICOAGULATION-ASSOCIATED INTRACEREBRAL HEMORRHAGE

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**Background and Aims:** Patients with intracerebral hemorrhage (ICH) have high risk of venous thromboembolism (VTE). Next to intermittent pneumatic compressions low-dose subcutaneous heparins represent the most intuitive treatment for VTE-prophylaxis. This study pooled individual data of patients with spontaneous primary ICH and OAC-ICH to explore incidences of intracranial hemorrhagic complications (IHC) among subgroups of ICH-patients treated with heparins for VTE-prophylaxis.

**Methods:** We integrated both parts of the RETRACE-program (part-I: 2006–2010; part-2:2011–2015) and the single-center UKER-ICH registry (2006–2015). Including patients receiving low-dose subcutaneous heparin for VTE-prevention we pooled individual patient data of 1702 vitamin-K-antagonist-(VKA) or non-VKA oral anticoagulants (NOAC)-related ICH-patients treated at 22 tertiary-care centers across Germany and of 1022 primary ICH-patients from UKER. We defined IHC during hospital stay as primary safety outcome. Secondary outcomes included mortality and functional outcome at 3 months of patients with and without IHC.

**Results:** IHC occurred in 1.7%(42/2416) of ICH-patients. There were no differences in crude incidence rates among patients with VKA-ICH, NOAC-ICH and non-OAC-ICH (Log-rank p = 0.645; Breslow p = 0.753; VKA-ICH: 27/1406[1.9%], NOAC-ICH 1/130[0.8%], non-OAC-ICH 14/88[1.6%];p = 0.577). Analysis according to days spent on heparin revealed no differences in IHC-rates per 1000 patient days (VKA-ICH: 1.49[1.00-2.14], NOAC-ICH 0.63[0.03-3.13], non-OAC-ICH 1.45 [0.82-2.37];p = 0.687). To rule out influences of imbalances in baseline characteristics we documented also no differences after propensity-score-matching. Secondary outcomes showed differences in functional outcome (mRS = 4-6: IHC:29/37[78.4%] vs no-IHC:1213/2048[59.2%]; p = 0.019) and mortality (IHC:14/37[37.8%] vs no-IHC:485/2048 [23.7%];p = 0.045) in disfavor of IHC-patients. Small ICH volume (OR: volume < 4.4ml: 0.18[0.04-0.78], p = 0.022) and low NIHSS score (OR: NIHSS < 4: 0.29[0.11-0.78], p = 0.014) were associated with fewer IHC.

**Conclusions:** Heparin administration for VTE-prophylaxis in ICH patients showed no differently increased risks of IHC among non-OAC-ICH, VKA-ICH and NOAC-ICH.

Trial registration number: N/A

## WITHDRAWN

post-ICH times for ensuring the specific FMISO uptake by hypoxic cells. Hematoma volumes were measured on T2-weighted MRI.

**Results:** All [<sup>18</sup>F]-FMISO PET images in ICH rats exhibited hypoxic-ischemic tissue around the hematoma area. A quantitative analysis showed increased FMISO uptake values in ICH rats compared to the control group at 18h ( $>10\%$ ;  $p < 0.01$ ) and 24h post-ICH (5-10%;  $p < 0.01$ ), but not at 42h and 48h post-ICH. The presence of hypoxic tissue corresponded to the higher volumes of hematoma as measured by T2-MRI. [<sup>18</sup>F]-NaF PET studies allowed to ensure that the increase of FMISO uptake around the hematoma is due exclusively to the presence of hypoxic cells (at post-ICH times  $>12$ h).

**Conclusions:** [<sup>18</sup>F]-FMISO PET/MRI imaging exhibits hypoxic-ischemic tissue around the hematoma in a collagenase-induced ICH model.

**Trial registration number:** N/A

## AS24-029

### INTERACT3 UPDATE: FEASIBILITY OF AN IMPLEMENTATION CLUSTER CLINICAL TRIAL

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**Background and Aims:** The ongoing trial INTERACT3 (NCT03209258) aims to determine the effectiveness of a goal-directed care bundle of early intensive blood pressure (BP) lowering, glycemic control, treatment of pyrexia, and reversal of anticoagulation in patients with acute intracerebral hemorrhage (ICH). **Methods:** An international, multicenter, stepped-wedge (4 phases/3 steps, av 29 patients per phase), cluster randomized trial to assess the effectiveness of a multifaceted care package in 8621 patients across 75+ sites. After a variable background ‘usual care’ control period, hospitals are randomized for immediate implementation of the intervention (BP control, SBP target  $<140$ mmHg; glucose control by diabetes status, target 6.1-7.8/7.8-10.0 mmol/L; body temperature  $\leq37.5$  °C; reversal of anticoagulation, INR  $<1.5$ ). Primary outcome is ordinal analysis of mRS scores at 6 months.

**Results:** To date, 1774 ICH patients (mean age 62 yr; 37% female) were enrolled at 45 Chinese hospitals during December 2017 to December 2018. Mean baseline clinical characteristics include SBP 174 mmHg, blood glucose 8.1 mmol/L, NIHSS 14, and hematoma volume 21.5 mL. Medical history of hypertension (71.2%) diabetes 9.4%, smoker 22.8% and current drinker 21.9%. 21 sites has crossed over to intervention for 550 patients. **Conclusions:** INTERACT3 is the first large-scale pragmatic complex system of care interventional clinical trial to determine the effectiveness of a widely applicable goal-directed care bundle in acute ICH. Rapid activation of sites, recruitment and baseline data support the feasibility of the study.

**Trial registration number:** NCT03209258

## AS24-089

### RELATIVE IMPACT OF MODIFIABLE RISK FACTORS IN WARFARIN-ASSOCIATED INTRACEREBRAL HAEMORRHAGE AMONG CHINESE ATRIAL FIBRILLATION PATIENTS WITH CEREBRAL MICROBLEEDS

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**Background and Aims:** Atrial fibrillation (AF) patients with cerebral microbleeds (CMBs) have increased risk of warfarin-associated intracerebral haemorrhage (ICH), which may be potentially reduced by stringent control of modifiable risk factors. This study aims to explore the relative impact of over-warfarinization and hypertensive arteriopathy to ICH in AF patients with CMBs.

**Methods:** We recruited Chinese AF patients on warfarin for 3T MRI brain. We examined the correlation of percentage of time with INR  $\geq 3$ , deep and subcortical CMBs counts with clinical ICH during the 2-year follow-up.

**Results:** Total 237 patients were included. CMBs were present in 84 (35.4%) patients. During the mean follow-up period of  $22.4 \pm 10.3$  months, 4 patients developed ICH (2 in basal ganglia, 1 in lobar region and 1 in cerebellum). In univariate logistic regression, presence of subcortical CMBs (OR 17.56, 95% CI 1.77-173.78), deep CMBs (OR 9.13, 95% CI 1.23-67.92) were more predictive of ICH than percentage of time with INR  $\geq 3$  (OR 1.05, 95% CI 1.01-1.10). In ROC analysis, subcortical CMB counts was most sensitive in predicting ICH (c-index 0.813), compared to cortical CMBs count (c-index 0.705), deep CMB count (c-index 0.722), infratentorial CMBs count (c-index 0.715) and percentage of time with INR  $\geq 3$  (c-index 0.538).

**Conclusions:** In Chinese AF patients with CMBs, hypertensive arteriopathy has greater impact than over-warfarinization in modulating risk of ICH. Compared to frequent INR monitoring which has only marginal benefit in reducing risk of ICH, stringent control of blood pressure may be more effective in preventing this devastating adverse outcome.

**Trial registration number:** NA

## AS24-021

### AGE-DEPENDENT CLINICAL OUTCOMES IN PRIMARY VERSUS ORAL ANTICOAGULATION-RELATED INTRACEREBRAL HEMORRHAGE

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**Background and Aims:** This study determined the influence of age on bleeding characteristics and clinical outcomes in primary spontaneous

(non-OAC), vitamin K antagonist-related (VKA-) and non-vitamin K antagonist oral anticoagulant-related (NOAC-) intracerebral hemorrhage (ICH).

**Methods:** Pooled individual patient data of multicenter cohort studies were analyzed by logistic regression modelling and propensity-score (PS)-matching to explore the influence of advanced age on clinical outcomes among non-OAC-, VKA- and NOAC-ICH. Primary outcome measure was functional outcome at 3 months assessed by the modified Rankin Scale, dichotomized into favorable ( $mRS = 0-3$ ) and unfavorable ( $mRS = 4-6$ ) functional outcome. Secondary outcome measures included mortality, hematoma characteristics, and frequency of invasive interventions.

**Results:** In non-OAC-ICH 25.7% (276/1,076), in VKA-ICH 32.8% (760/2,314) and in NOAC-ICH 45.3% (86/190) of the patients were of older age ( $p < 0.001$ ). After adjustment for treatment interventions, elderly ICH patients comprised worse functional outcome at three months (OR in non-OAC-ICH: 3.86[2.75-5.40];  $p < 0.001$ ; VKA-ICH: 1.56[1.28-1.90];  $p < 0.001$ ; NOAC-ICH: 2.72 [1.37-5.42];  $p = 0.004$ ). Anticoagulation was significantly associated with worse functional outcome below the age of 70 years, (OR: 2.00[1.35-2.96];  $p = 0.001$ ), but not in patients of  $\geq 70$  years (OR: 1.20[0.90-1.59];  $p = 0.218$ ). The difference in volume of ICH enlargement between OAC-ICH and non-OAC-ICH gradually decreased with increasing patient age.

**Conclusions:** As compared to elderly ICH-patients, in patients  $< 70$  years OAC-ICH showed worse clinical outcomes compared to non-OAC-ICH because of larger baseline ICH-volumes and extent of hematoma enlargement. Treatment strategies aiming at neutralizing altered coagulation should be aware of these findings.

**Trial registration number:** N/A

## AS24-022

### PERIHEMORRHAGIC EDEMA: REVISITING HEMATOMA VOLUME, LOCATION AND SURFACE

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**Background and Aims:** To determine the influence of intracerebral hemorrhage (ICH) location, volume and hematoma surface on perihemorrhagic edema evolution.

**Methods:** ICH patients of the prospective UKER-ICH cohort study (NCT03183167) between 2010 and 2013 were analyzed. Hematoma and edema volume during hospital stay were volumetrically assessed, and time course of edema evolution and peak edema correlated to hematoma volume, location and surface to verify strength of parameters on edema evolution.

**Results:** Overall 300 patients with supratentorial ICH were analyzed. Peak edema showed high correlation with hematoma surface ( $R^2 = 0.864$ ,  $p < 0.001$ ) rather than with hematoma volumes, irrespective of hematoma location. Smaller hematomas with higher ratio of hematoma-surface-to-volume showed exponentially higher relative edema ( $R^2 = 0.755$ ,  $p < 0.001$ ). Multivariable logistic regression analysis revealed a cut-off ICH-volume 30ml beyond which an increase of total mass lesion volume (combined volume of hematoma and edema) was not associated with worse functional outcome; specifically, peak edema was associated with worse functional outcome in ICH  $< 30$  ml (OR 2.59[1.55-4.31];  $p < 0.001$ ), contrary to ICH  $\geq 30$  ml (OR 1.20[0.82-1.75];  $p = 0.339$ ). There were no significant differences between patients with lobar versus deep ICH after adjustment for hematoma volumes.

**Conclusions:** Peak perihemorrhagic edema, though influencing mortality, is not associated with worse functional outcomes in ICH volumes

above 30ml. Although hematoma volume correlates with peak edema extent, hematoma surface is the major parameter for edema evolution. The effect of edema on functional outcome is therefore more pronounced in smaller and irregularly shaped hematomas and these patients may benefit more significantly from edema-modifying therapies.

**Trial registration number:** N/A

## AS24-045

### A SURVEY ON USUAL CARE OF PHYSIOLOGICAL VARIABLES IN ICH PATIENTS – INTERACT3 TRIAL

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**Background and Aims:** The ongoing trial – INTERACT3 aims to determine the effectiveness of a goal-directed care bundle of intensive blood pressure (BP) lowering, glycemia control, treatment of pyrexia and reversal of anticoagulation in patients with acute intracerebral haemorrhage (ICH).

**Methods:** A multicentre, hospital-based survey was conducted among INTERACT3 investigators from November 2017 to October 2018. Data on usual management of BP, glucose, pyrexia and elevated INR were collected using a pre-tested, structured questionnaire.

**Results:** A total of 106 hospitals across 24 provinces in China were included, with 80 (75.5%) from low-income regions based on World Bank Classification. Intensive BP control with a target of systolic BP (SBP)  $< 140$  mmHg was administrated in 28 (26.4 %) hospitals, but only 21.4% hospital would lower SBP to this target within one hour. A moderate target of SBP reduction (140-160 mmHg) was given in 75 (70.8%) hospitals. Comparing to low-economic regions, hospitals at high-income regions had a higher application of intensive BP control (38.5% vs. 23.4%). In addition, 40.6% hospitals and 14.7% will control glycemia with a target of 7.8-10 mmol/L for diabetic patients and  $\leq 7.8$  mmol/L for non-diabetic patients, respectively. Only 12 hospitals will treat pyrexia, and 7.1% hospitals will reverse anticoagulation-related ICH with an INR target  $< 1.5$ . Prothrombin complex concentrates (PCCs) was available in 37 hospitals.

**Conclusions:** Acute ICH management varies across regions in China. Implementation of evidence-based care bundle through high quality RCTs may translate evidence-based recommendations to clinical practice, and provide broader evidence to policy makers.

**Trial registration number:** NCT03209258

**AS24-058**

## **THE ASSOCIATION OF PLASMINOGEN ACTIVATOR INHIBITOR-I (PAI-I) 4G/5G POLYMORPHISM WITH THE RISK AND PROGNOSIS OF INTRACEREBRAL HEMORRHAGE**

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**Background and Aims:** Non-traumatic intracerebral hemorrhage accounts for 10–15% of all strokes, but has much higher mortality than acute ischemic stroke (AIS). Plasminogen activator inhibitor-I (PAI-I) is a natural inhibitor of fibrinolysis that protects against bleeding. PAI-I 5G/5G genotype is associated with lower PAI-I levels, thus we hypothesized that it could be associated with the risk and outcome of intracerebral hemorrhage.

**Methods:** Three populations were included in the study: 51 patients with primary intracerebral haemorrhage (PICH), 13 patients with AIS who suffered hemorrhagic transformation after intravenous thrombolysis (AIS-ICH), and 118 AIS patients without hemorrhagic events (AIS). PAI-I 4G/5G polymorphism was determined in all patients. Clinical data was registered on admission and day 7 post-event. Short-term outcome was defined according to NIHSS change at 7 days. Long-term outcome was measured by the modified Rankin Scale at 3 months.

**Results:** The presence of PAI-I 5G allele was significantly more frequent in the AIS-ICH group as compared to the AIS and PICH cohorts and a population control cohort. PAI-I 4G/5G polymorphism had no effect on stroke severity or short-term outcome in either groups. In a binary backward logistic regression model including age, gender, BMI, NIHSS on admission, hypertension, hyperlipidaemia it was revealed that PAI-I 5G/5G genotype confers an independent, significant risk for post-lysis intracranial hemorrhage (OR:4.75, 95%CI:1.18-19.06, p = 0.028). PAI-I 4G/5G polymorphism had no influence on mortality and long-term outcome in the studied patient cohorts.

**Conclusions:** PAI-I 5G/5G genotype confers an independent, significant risk for post-lysis intracerebral haemorrhage. Funding: GINOP-2.3.2-15-2016-00043, NKFI-K120042

Trial registration number: N/A

**AS24-025**

## **EFFECT OF RAPID INR REVERSAL IN ORAL ANTICOAGULANT-ASSOCIATED INTRACEREBRAL HEMORRHAGE**

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**Background and Aims:** The use of oral anticoagulants (OAC) is associated with poor outcome in intracerebral hemorrhage (ICH). Here we investigated the effect of early correction of the international normalized ratio (INR) to < 1.4 in patients with vitamin K antagonist (VKA)-associated ICH.

**Methods:** The Ethnic/Racial Variations of Intracerebral Hemorrhage (ERICH) study is a prospective multicenter study of ICH enrolling 3000 ICH patients equally of Hispanic, African American and Caucasian ethnicity. Subjects with missing baseline imaging, INR, or being on heparin or new OACs were excluded. INR reversal was defined as INR < 1.4 at 6h after admission. Rate of favorable outcome, defined by modified Rankin Scale (mRS) 0–3, and case-fatality were modeled using multivariate logistic regression against anticoagulant use and INR categories, adjusting for age, presence of intraventricular hemorrhage, baseline Glasgow Coma scale, and ICH location and volume

**Results:** VKA users (n = 240) were older and more likely to have hypertension, diabetes mellitus, hypercholesterolemia than non-VKA users (n = 2238). Baseline demographic and radiologic characteristics were comparable among VKA users with INR < 1.4 and ≥ 1.4. The rates of ICH expansion in non-VKA users, VKA INR < 1.4, and VKA INR ≥ 1.4 were 13.7%, 18.2%, and 29.7%, respectively (p = 0.0007). In multivariate analysis, outcomes were comparable for non-VKA and VKA uses with INR < 1.4 (OR = 0.8, 95% CI 0.4-1.5). Among VKA users, INR ≥ 1.4 at 6h was associated with lower rate of favorable outcome (38% vs. 59%) and increased mortality (33% vs. 18%) (p = 0.026).

**Conclusions:** Rapid reversal of INR to < 1.4 at 6h is associated with reduced case-fatality and improved clinical outcome in VKA-associated ICH.

Trial registration number: ERICH ClinicalTrials.gov Identifier NCT01202864

## **Neurointervention – Excluding Clinical Trial Results**

**AS07-089**

## **SAFETY AND EFFICACY OF ENDOVASCULAR TREATMENT IN IN-HOSPITAL STROKE (IHS) VERSUS COMMUNITY-ONSET STROKE (COS)**

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**Background and Aims:** Between 2–17% of all acute ischaemic strokes occur in hospitalized patients. However, mechanical thrombectomy has not been well studied in this population. The purpose of this research is to compare safety and efficacy of endovascular treatment among patients with IHS and COS.

**Methods:** Prospective study including patients treated with mechanical thrombectomy in a comprehensive stroke center in Andalucía in 2017–2018. Baseline characteristics, safety (complications) and efficacy data (NIHSS, 90-day mRS, TICI) between IHS and COS were compared.

**Results:** Of 653 treated patients (mean age:  $69.7 \pm 13.4$ , women: 56.9%) 88 were IHS (13.5%). In 87.5% anterior circulation was involved. IHS patients were younger ( $p = 0.05$ ), had more coronary artery disease ( $p = 0.03$ ), diabetes ( $p = 0.01$ ), peripheral artery disease ( $p = 0.008$ ) previous TIA/Stroke ( $p < 0.0001$ ) and clopidogrel treatment ( $p = 0.006$ ). IHS patients had higher median NIHSS pre-procedure ( $p = 0.05$ ) and higher baseline mRS ( $p = 0.004$ ). Median door to imaging time (25 vs 40 minutes,  $p < 0.0001$ ) was higher in IHS. Intravenous thrombolysis rate (48.6% vs 17%;  $p < 0.0001$ ) was lower in IHS group. Median NIHSS immediately after reperfusion treatment (11 vs 15;  $p = 0.02$ ) and 24 hours after (7 vs 9;  $p = 0.009$ ) were higher in IHS patients. There was no association with large vessel occlusion localization, recanalization rates (TICI2b-3), discharge and 90 days mRS, death or symptomatic intracranial haemorrhage between both groups.

**Conclusions:** IHS patients had more vascular risks factors and worse baseline functional status. Furthermore, intravenous thrombolysis is often contraindicated in IHS. Despite all this, mechanical thrombectomy achieves similar recanalization rates, functional outcomes and safety in both groups.

**Trial registration number:** N/A

#### AS07-044

### OUTCOMES AFTER THROMBECTOMY FOR BASILAR ARTERY THROMBOSIS IN BELFAST: A SINGLE CENTRE EXPERIENCE

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**Background and Aims:** Without treatment, basilar artery thrombosis (BAT) has a dismal prognosis with mortality rates up to 90%. While the optimal treatment approach remains uncertain, data from observational studies suggest that thrombectomy leads to higher rates of functional recovery than would be expected without intervention. The aim of this study was to review outcomes after thrombectomy for BAT in a single centre.

**Methods:** Data was collected for thrombectomy procedures for BAT from 2014 to 2017. The primary outcome was functional independence (mRS < 3) at 3 months. Outcomes in various subgroups were compared using chi-square test.

**Results:** 24 patients (median age 70y) underwent thrombectomy for BAT. Reperfusion (TICI 2b/3) was achieved in 22/24. Overall, 71% survived and 42% were functionally independent (mRS < 3) at 3 months. Patients under 70y were more likely to survive than those over 70y (survival: 92% v 45%,  $p = 0.01$ ; mRS < 3: 69% v 9%,  $p < 0.01$ ). Similar outcomes (mRS < 3) were achieved in patients presenting directly to endovascular centre versus local hospital (43% v 41%,  $p = 0.9$ ). There was no difference in outcomes in those who received IV thrombolysis versus those who did not (mRS < 3 in 38% v 44%,  $p = 0.8$ ) and in those with known onset time  $\leq 6$ h versus those who presented later or with unknown onset time (mRS < 3 in 42% v 42%,  $p = 1$ ).

**Conclusions:** Functional independence was achieved in 42% patients after thrombectomy for basilar artery thrombosis which is similar to that reported by other centres. Younger patients (aged < 70y) were much more likely to survive and achieve a good outcome than older patients.

**Trial registration number:** N/A

#### AS07-124

### MECHANICAL THROMBECTOMY FOR ACUTE ISCHEMIC STROKE OF THE ANTERIOR CIRCULATION IN THE ELDERLY: A COMPARATIVE SAFETY AND EFFICACY ANALYSIS

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**Background and Aims:** The aging of the population is leading to increased numbers of elderly patients [ $\geq 80$  years old (yo)] suffering from acute ischemic stroke subsidiary of endovascular treatment. We dichotomized patients based on the age in two groups ( $< 80$  and  $\geq 80$  yo). Our purpose is to analyze examine the efficacy and safety of mechanical thrombectomy (MT) in older patients.

**Methods:** Prospective registry (2017-2018) of patients with anterior circulation acute ischemic stroke and treated with thrombectomy. Baseline characteristics, safety and efficacy data were compared.

**Results:** 527 patients (55% men, mean age of 70 yo) were included. 140 patients (26.6%) were  $\geq 80$  yo. Patients with  $\geq 80$  yo were more frequently women (68.3 vs 31.4;  $p < 0.001$ ), older (median 68 vs 84;  $p < 0.001$ ), had more arterial hypertension ( $p < 0.001$ ), peripheral artery disease ( $p = 0.008$ ), atrial fibrillation ( $p = 0.001$ ), aspirin ( $p = 0.006$ ) and clopidogrel treatment ( $p = 0.003$ ), with higher baseline mRS ( $p < 0.001$ ) and higher median pre-procedure NIHSS (18 vs 16;  $p = 0.001$ ). Intravenous thrombolysis rate (45% vs 36.7%;  $p = 0.05$ ) was lower in older group. Median required passes were higher in older group (2 vs 1;  $p = 0.002$ ). There was no association with recanalization rates (TICI2b-3) and puncture times to recanalization. At 90-days there was a trend to less independent patients in the older group (45.5% vs 62.2;  $p = 0.04$ ). There was no association with death or symptomatic intracranial haemorrhage between both groups.

**Conclusions:** Older patients had more vascular risks factors and worse baseline functional status. Although poorer outcomes are to be expected in older patients, MT in the elderly is safe and effective.

**Trial registration number:** N/A

#### AS07-060

### THE ROLE OF MODIFIED TAN SCORE IN PREDICTING PROGNOSIS OF ACUTE ISCHEMIC STROKE PATIENTS UNDERWENT ENDOVASCULAR TREATMENT

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**Background and Aims:** To evaluate the prognostic role of modified TAN collateral score (mTCS) in predicting functional independence in patients with ischemic stroke undergoing endovascular treatment (EVT).

**Methods:** Patients who were assessed with computed tomography (CT) angiography and received EVT for large vessel occlusion between April 2015 and September 2018 were retrospectively analyzed. A total of 101 patients included in the study. Modified Tan collateral score was performed for the assessment of collaterals on CT angiography. Poor and good collateral scores were compared statistically according to NIHSS scores, mortality, hemorrhage, reperfusion, and 3rd month good outcome (mRS 0–2).

**Results:** Forty-one patients (48%) had poor mTCS. Mortality rates were significantly higher in the poor collateral group (32% vs 5.9%). Reanalization rates (TICI 2b / 3) were similar but futile recanalization rates were higher in patients with poor collateral (60.5% -8.7%). Univariate analysis revealed that glucose, admission NIHSS, mTAN, symptom-angiography time and good ASPECT score are predictors for good outcome. Multiple logistic regression analysis showed that baseline glucose, admission NIHSS and mTAN were found to be a strong and independent predictor for good outcome.

**Conclusions:** The successfull recanalization may not always translate into good clinical outcome in patients with poor collaterals. The data obtained from our study; are consistent with the current literature and shows the importance of the role of collateral circulation in determining functional independence. Modified TAN collateral scoring system is a simple and accurate tool fort he assessment of collateral status in patients underwent EVT.

**Trial registration number:** N/A

## AS07-111

### INITIAL EXPERIENCE WITH NOVEL SUPER DISTAL ACCESS CATHETER AS A PRIMARY LOCAL ASPIRATION CATHETER FOR ACUTE STROKE THROMBECTOMY

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**Background and Aims:** We describe the initial results of the Syphontrack SDA (super distal access) catheter (InNeuroco Inc., Sunrise, Fl, USA) used for endovascular treatment of patients with acute ischemic stroke of the anterior circulation.

**Methods:** A retrospective review of prospectively collected data in Maastricht University Medical Center is performed. Patients were enrolled between June 2017 and May 2018 and treated with direct aspiration or a combination of distal aspiration with stent retriever. Primary endpoints are reperfusion grade (eTICI) and accessibility of the occlusion. Secondary endpoints are NIHSS score 24- 48 hours post-intervention, symptomatic intracranial hemorrhage (sICH) within 24 hours, and mRS score at 3 months.

**Results:** The first 50 patients in whom the Syphontrack catheter was used, were included in this study. Direct aspiration was used in 33/50 patients (66%). In 29/33 (88%) the occlusion was reached and successful reperfusion (eTICI 2B or higher) was achieved in 16 of these 29 (55%) after the first pass. In total successful reperfusion was finally reached in 48/50 (96%) patients. Early neurologic recovery (an improvement of 4 or more points on the NIHSS) was seen in 21 cases (42%), and functional independence (mRS score of 0–2) at 3 months was achieved in 17/50 patients (34%). sICH occurred in 3/50 patients (6%) within 24 hours post-procedural.

**Conclusions:** In our clinical practice, patients treated with the Syphontrack SDA catheter used for endovascular treatment of ischemic stroke had excellent technical outcome. Clinical outcome and safety were similar to earlier reported results of overall Dutch clinical practice.

**Trial registration number:** N/A

## AS07-008

### AGE-ADJUSTED INFARCT VOLUME CUT-OFF FOR FAVORABLE OUTCOME AFTER STROKE ENDOVASCULAR THERAPY

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**Background and Aims:** Optimal selection paradigms for large vessel occlusion acute stroke (LVOS) endovascular therapy (ET) are yet to be established. Previous studies have shown the benefit of adjusting infarct size to age. We sought to study the impact of age-adjusted final infarct volumes (FIV), a surrogate for pre-reperfusion infarct core, on functional outcomes and determine the ideal thresholds for good outcome discrimination (90-day mRS 0–2).

**Methods:** We reviewed our prospectively collected endovascular database at a tertiary care center between 9/2010- 2/2018. All patients that underwent ET for anterior circulation LVOS and achieved full reperfusion (mTICI-3) were included and categorized into 4 age groups: (G1) < 60 years, (G2) 60–69, (G3) 70–79 (G4) ≥80. Baseline characteristics and outcome parameters were compared. FIV was measured on follow-up MRI or CT within 5 days of treatment. For each group, a FIV-good outcome ROC curve was constructed and Youman Index was used to identify the optimal cut-off.

**Results:** 516 patients were studied (G1:171, G2:130, G3:103, G4:112). The mean FIV was  $46 \pm 64$  ml and 58% achieved good outcome. Patients with poor outcome had larger FIV in each group ( $p < 0.01$  for all). The target FIV cut-off (mL) decreased with increased age: G1:45.7(SE 56%, SP 80%); G2:30.4(SE 63%, SP 75%); G3:20.2(SE 76%, SP 65%); G4:16.9(SE 68%, SP 70%). In multivariate analysis, after adjusting for age, baseline NIHSS, glucose level and FIV, achieving a FIV less than the age-adjusted threshold was an independent predictor of good outcome (aOR:2.75 95% CI [1.43-5.29],  $p = 0.002$ ).

**Conclusions:** Age-adjusted infarct volume represents a strong outcome discriminator substitute and might help refine patient selection for stroke endovascular therapy.

**Trial registration number:** N/A

## AS07-009

### SELECTION PARADIGMS FOR ENDOVASCULAR THERAPY IN LATE PRESENTING AND WAKE-UP LARGE VESSEL OCCLUSION STROKE

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**Background and Aims:** Optimal selection modalities for large vessel occlusion stroke (LVOS) thrombectomy beyond 6 hours remain under debate.

**Methods:** Review of a prospectively collected database of endovascular patients with anterior circulation LVOS, adequate CTP maps, NIHSS  $\geq 10$  and presenting beyond the 6-hour window from 01/2014 to 06/ 2018 in a clinical setting where no specific ASPECTS or CTP criteria defined treatment selection. Three mismatch criteria were assessed: DAWN Clinical-Core Mismatch (DAWN-CCM), DEFUSE 3 Perfusion Imaging Mismatch (DEFUSE-3-PIM) and modified Clinical-ASPECTS Mismatch (mCAM) defined as ASPECTS 6–10 and one of the following criteria: NIHSS  $\geq 10$  and 0–1 Cortical-ASPECTS(M1-6 areas) Involvement (any age); NIHSS  $\geq 10$  and 0–2 Cortical-ASPECTS(M1-6 areas) Involvement (and age  $< 80$  years old); NIHSS  $\geq 20$  and 0–3 Cortical-ASPECTS(M1-6 areas) Involvement (and age  $< 80$  years old).

**Results:** 251 Patients met inclusion criteria. DEFUSE-3-PIM had the highest inclusion rate followed by mCAM and DAWN-CCM (95.2%, 88.8% and 85.3% respectively). Both mCAM(+) and DAWN-CCM(+) patients had higher rates of 90-day mRS 0–2 compared to non-selected counterparts (47.3% vs 14.3%, p = 0.004 and 47.6% vs 19.2%, p = 0.007 respectively). There was no difference between DEFUSE-3-PIM(+) and (-) patients (42.9% vs 62.5%, p = 0.27). mCAM(+) had lower rates of 90-day mortality than mCAM(-) patients (22% vs 42.9%, p = 0.04). There was a trend towards lower mortality rates in DAWN-CCM (+) patients (22% vs 40%, p = 0.05) and no difference between DEFUSE-3-PIM(+) and (-) patients (25.4% vs 0%, p = 0.1). On multivariate analysis, mCAM(+) (aOR 2.71, 95%CI [1.12–6.53], p = 0.027), DAWN-CAM(+) (aOR 2.38, 95%CI [1.08–5.24], p = 0.03) were independent predictors of a favorable 90-day mRS shift. DEFUSE-3-PIM(+) did not achieve significance (aOR 0.71, 95%CI [0.2–2.6], p = 0.6).

**Conclusions:** mCAM has a similar inclusion rate and outcome discrimination ability as DAWN-CCM while performing better than DEFUSE-3-PIM. This could represent a valuable substitute in centers where access to advanced imaging is limited.

**Trial registration number:** N/A

## AS07-032

### NOT ALL ASPECTS ARE CREATED EQUAL: HIGH HETEROGENEITY IN FUNCTIONAL OUTCOMES ACROSS SIMILAR ASPECTS CATEGORIES IN STROKE THROMBECTOMY

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**Background and Aims:** Large vessel occlusion stroke (LVOS) patients with a low ASPECTS are often not offered endovascular therapy (ET) as they are thought to carry a poor prognosis. We hypothesize that patients with low ASPECTS and small baseline infarct volumes might still benefit from ET.

**Methods:** Review of a prospectively collected endovascular database at a tertiary care center between 9/2010–11/2018. All patients with anterior circulation LVOS and interpretable baseline CT-Perfusion (CTP) were included. Subjects were divided into low ASPECTS(0-5) and high ASPECTS(6-10) groups and subsequently into small and large CTP-core volumes. We used 2 definitions for large core (LC)(D1:CBF30%>50cc and D2:CBF30%>70cc)

**Results:** 941 patients fit inclusion criteria. 104 patients had low ASPECTS of which 26(25%) and 13(12.5%) had a core larger than 50cc and 70cc respectively. In the low ASPECTS category, Patients with LC had worse good outcome (90-day mRS 0–2) (D1:21.7% vs 47.7%, p = 0.03 and D2:15.4% vs 45.3%, p = 0.04). This persisted on multivariate analysis after adjusting for potential confounders (D1:Beta-1.21, 95%CI [-3.02\_0.2], p = 0.056, D2: Beta-2.17, 95%CI[-22.59\_-0.61], p = 0.006). 837 patients had high ASPECTS with 49(5.9%) and 19(2.3%) having a core larger than 50cc and 70cc respectively. For D1, there were no differences in good outcome between large and small core (50% vs 56%, p = 0.46) while for D2 there was a trend towards worse outcomes in the LC population (35.7% vs 56.2%, p = 0.13). On multivariate analysis, when using D2, LC was associated with worse outcomes (Beta-1.17, 95%CI [-2.41\_-0.14], p = 0.01)

**Conclusions:** Outcomes could vary significantly in the same ASPECTS category depending on infarct volume. Patients with low ASPECTS but small baseline infarct volumes may achieve independence in almost half of the cases and thus should not be excluded from treatment.

**Trial registration number:** N/A

## AS07-041

### INCIDENCE AND TIMING OF ENDOVASCULAR THERAPY IN ACUTE STROKE PATIENTS: A POPULATION-BASED ANALYSIS USING THE BREMEN STROKE REGISTER

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**Background and Aims:** In patients with large vessel occlusions endovascular treatment (ET) has become the standard of care, so that the potential number of these patients needs to be considered for the effective implementation of comprehensive stroke services. However, population-based data on the incidence of ET is scarce.

**Methods:** Using our prospective stroke register, in which all endovascular procedures on the 557464 inhabitants of the city of Bremen are included, we performed a population-based analysis on the frequency and timing of ET in acute stroke patients with large vessel occlusions in the year 2017.

**Results:** Out of a total of 1448 acute ischemic stroke patients 173 patients (12%) had received ET (161 patients in the anterior circulation, 12 patients in the posterior circulation). Among these, 95 patients were inhabitants of Bremen. The population-based incidence thus was 17 (95% confidence interval: 14–21) ET cases per 100.000 person-years. The number of stroke procedures per month varied from 9–19 (median: 14.5; (interquartile range (IQR): 12–17). The number of stroke procedures per month and 100.000 inhabitants varied from 0.7–2.1 (median: 1.4; IQR: 0.9–1.7). Many procedures (42%) were performed during non-work hours (between 17:00 hours and 06:59 hours).

**Conclusions:** Approximately 12% of all ischemic stroke patients received ET and the incidence of ET was 17 (95% confidence interval: 14–21) ET cases per 100.000 person-years. However, despite being a high volume center, the absolute number of stroke procedures per month and 100.000 inhabitants was low and many patients were treated during non-work hours.

**Trial registration number:** N/A

## AS07-109

### OCCURRENCE OF SECONDARY INSULTS DURING ENDOVASCULAR TREATMENT FOR ACUTE ISCHEMIC STROKE

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**Background and Aims:** It is still debated if endovascular treatment (EVT) for acute ischemic stroke (AIS) should be performed under local anaesthesia (LA), conscious sedation (CS) or general anaesthesia (GA). The hypothesis is that anaesthesiological techniques may expose patients to different secondary insults, which may mediate the potential impact of anaesthesia on the outcome. The purpose of the study is to evaluate the number and duration of secondary insults during EVT, in relation to the type of anaesthesia.

**Methods:** AIS patients undergoing EVT at the University Hospital of Turin were consecutively enrolled over 1-year period. During EVT,

arterial blood pressure and peripheral oxygen saturation ( $\text{SpO}_2$ ) values were recorded every 5 minutes.

**Results:** 70 patients were enrolled ( $70 \pm 13$  years, 50% women), 17.1% received LA, 67.1% CS and 15.7% GA. The proportion of CS patients who experienced at least one 5-minutes episode of desaturation ( $\text{SpO}_2 < 94\%$ ) was significantly higher, compared to LA and GA ( $p = 0.0156$ ), and the duration of desaturation periods was significantly longer ( $p = 0.0410$ ). Moreover, the proportion of GA patients who experienced one or more episodes of hypotension (systolic arterial pressure  $< 140\text{mmHg}$ ) was higher if compared to LA and CS ( $p = 0.0062$ ). On average, LA patients spent significantly less time under the hypotension threshold ( $p = 0.0481$ ).

**Conclusions:** This is the first study proposing the concept of secondary insults for AIS patients during EVT. With the limits of a small sample size, our results demonstrated larger alterations in  $\text{SpO}_2$  for CS and greater hypotensive insults for GA.

**Trial registration number:** N/A

## AS07-003

### THROMBECTOMY IN ACUTE STROKE WITH SYNCHRONOUS LARGE VESSEL OCCLUSION IN ANTERIOR AND POSTERIOR CIRCULATION: A CASE SERIES

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**Background and Aims:** Thrombectomy has largely proven its efficacy in MCA acute stroke secondary to MI occlusion. However, stroke with simultaneous occlusion of MCA and PCA (SOMP) is a severe entity of uncertain incidence and complex management. Occlusion of PCA may affect collateral circulation in MCA territory, worsening ischaemic tolerance. We aimed to review the patients who suffered stroke with SOMP and were treated with thrombectomy at our hospital.

**Methods:** We present a series of patients with acute stroke and SOMP treated with thrombectomy in our stroke centre between 2011 and 2018. Clinical features, radiological data and stroke outcome were retrospectively recorded.

**Results:** Out of 249 patients that were treated for MI/carotid-T occlusion in the study period, only 4 patients suffered SOMP (1.6%). Women 100%, mean age 71.2 years (SD 8). Previously known atrial fibrillation in 2 (50%), both anticoagulated with acenocoumarol (mean INR 1.23). Median NIHSS 16 (8-22), median ASPECTS 9. Primary thrombectomy was performed in 2 patients. Final MCA recanalization (TICI > 2a) was achieved in all patients, but PCA reperfusion was successful in only 50% of them. None of the patients suffered hemorrhagic complications. A cardioembolic source was found in all cases. Three months after the stroke, 3 patients reach functional independence and one patient died (unsuccessful recanalization of PCA).

**Conclusions:** Synchronous occlusion of MCA and PCA is a rare entity. In our series the etiology was cardioembolic, and mechanical thrombectomy was safe and effective. Successful recanalization in both territories could lead to a better functional outcome in these patients.

**Trial registration number:** N/A

## AS07-130

### REAL-WORLD THROMBECTOMY BEYOND 6 HOURS FROM ONSET OF ACUTE ISCHEMIC STROKE DUE TO LARGE VESSEL OCCLUSION

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**Background and Aims:** Recent trials have demonstrated the benefit of endovascular thrombectomy (ET) beyond 6 hours from stroke symptom onset, in patients with proximal vessel occlusion in the anterior circulation (ALVO), selected on the basis of appropriate imaging. The aim of this study was to evaluate, in real-world settings, the outcome of patients treated beyond 6 hours using data of the Italian Registry of Endovascular Thrombectomy

**Methods:** We included patients > 18 years of age, with acute stroke due to ALVO, with an ASPECTS score > 6, who underwent ET 6–24 hours after a stroke with known onset time. The decision to treat beyond the standard therapeutic windows was individualized case-by-case on the basis of clinical and neuroimaging findings. Primary outcome was the mRS score at 90 days. Safety outcomes included symptomatic hemorrhagic transformation and 90-day mortality.

**Results:** We included 183 patients (110 men), mean age 65.4 ± 15.4 years, and median baseline NIHSS 16 (IQR 12-21). The rates of very favorable (mRS 0–1), good (mRS 0–2), and acceptable clinical outcome (mRS 0–3) were 27.8%, 40% and 55% respectively. Complete recanalization was achieved in 49% of patients and a TICI 2b/3 score in 68.4%. The 3-month mortality was 20%, and symptomatic intracerebral hemorrhage occurred in 6.7 % of patients.

**Conclusions:** Patients receiving ET beyond 6 hours achieved outcomes comparable to DAWN and DEFUSE-3 eligible patients. These data indicate that a larger population of patients could benefit from ET in an expanded time window, in real-world settings.

**Trial registration number:** N/A

**AS07-103**
**ENDOVASCULAR TREATMENT APPROACHES FOR ACUTE ISCHEMIC STROKE DUE TO CERVICAL CAROTID DISSECTION AND TANDEM OCCLUSION: A MULTICENTRIC STUDY**

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**Background and Aims:** Mechanical thrombectomy is a technically challenging procedure in patients with stroke and tandem occlusion. Specifically, the current evidence of the safety and efficacy of this treatment in patients with cervical carotid dissection (CCD) is sparse.

**Methods:** We describe a retrospective multicentric series of patients with tandem occlusion (severe carotid stenosis/complete occlusion with MCA occlusion associated) secondary to CCD and treated with mechanical thrombectomy at 3 stroke centers from January/2012 to February/2018. Baseline characteristics, clinical, radiological and treatment features and outcome were prospectively collected.

**Results:** N = 22. Mean age 51 [43-59]. Women 50%. Hypertension: 59.1%. Smoker: 22.7%. pre-angiography median-NIHSS: 20[15-23]. Baseline median-ASPECTS 8[7-9]. 68.2% had complete cervical carotid occlusion and 63.6% M1-occlusion. Mechanical thrombectomy was performed in 63.6% using stent-retriever in 50% of the patients. Acute carotid stenting was performed in 50% and angioplasty without stent placement in 9%. Distal-to-proximal approach was done in 66% of our patients. The acute carotid stenting group showed a better recanalization rate (90.1% vs 63.6%) although without achieving statistically significant differences ( $P = 0.3$ ). One patient suffered from subarachnoid haemorrhage secondary to vessel microperforation but none of the patients had symptomatic haemorrhage. 50.1% were functionally independent at 3 months.

**Conclusions:** Endovascular treatment in tandem occlusion due to CCD seems to be a safe and effective treatment in acute stroke. The technical approach was heterogeneous in our series with a tendency to a better outcome in patients with acute carotid stenting and without showing major haemorrhagic complications.

**Trial registration number:** N/A

**AS07-085**
**IMPACT OF EMERGENT CAROTID REVASCULARIZATION ON REPERFUSION AND CLINICAL OUTCOMES IN PATIENTS WITH ACUTE STROKE WITH TANDEM LESION TREATED WITH THROMBECTOMY**

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**Background and Aims:** The aim of this study was to identify the optimal endovascular approach in patients with acute stroke with tandem lesions.

**Methods:** This was a retrospective analysis of consecutive patients presenting to comprehensive stroke center with AIS due to tandem lesion of the anterior circulation who underwent mechanical thrombectomy. Patients were treated by intracranial thrombectomy as well as 1 of the following 2 strategies: acute carotid artery stenting (CAS) or angioplasty of the extracranial ICA. The outcome endpoints of the study were the patency of the ICA at day 1, and the 90-day clinical outcome.

**Results:** A total of 66 patients were treated, 54 patients in stenting group resp. 12 in angioplasty group. At 90-days, 72.2%, resp. 66.7% achieved a good outcome (mRS 0-2),  $p = 0.70$ . There was no statistical difference in successful reperfusion (mTICI score 2b-3) 85.2%, resp. 75.0% ( $p = 0.392$ ), NIHSS score 15.2, resp. 13.9 ( $p = 0.505$ ), patency of the ICA at day 1 75.0%, resp. 75.0% ( $p = 1.0$ ) and time from onset to recanalization 277, resp. 240 min. ( $p = 0.180$ ) between stenting and angioplasty of the ICA. Among patients treated with CAS, those with occlusion of the stented artery at day 1, had significantly lower initial recanalization, 61.6 % resp. 94.5 % ( $p = 0.002$ ) and the good 90-day clinical outcome 46.2 % resp. 82.1 % ( $p = 0.012$ ).

**Conclusions:** Emergent carotid revascularization of the extracranial carotid lesion is associated with a successful 90-day clinical outcome. There was no statistical difference between CAS and angioplasty alone. Almost every fourth treated ICA is occluded at day 1 in both groups.

**Trial registration number:** N/A

**AS07-094**
**DOES INITIAL ADC VALUE IS ASSOCIATED WITH SYMPTOMATIC INTRACEREBRAL HEMORRHAGE AFTER MECHANICAL THROMBECTOMY?**

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**Background and Aims:** Mechanical thrombectomy (MT) is indicated for acute ischemic stroke (AIS) caused by large vessel occlusion. Symptomatic intracerebral hemorrhage (sICH) is a major complication. We hypothesized that a lower Apparent Diffusion Coefficient could be associated with sICH after MT for AIS.

**Methods:** All consecutive patients who presented with an AIS and benefited from a MT at CHRU Besançon between January 1st 2015 and December 31st 2016 were included. They were monitored by the Besançon Stroke Registry who collected modified Rankin Scale scores (mRS) at three months and sICH which was defined by a deterioration of the neurological exam (4 points on the NIHSS or more) and parenchymal hematoma during the 24 hours following the procedure. Mean ADC value was calculated by a manual region of interest drawn on the ischemic lesion. ADC reduction was calculated by the difference between the ROI ADC and the a controlateral ROI ADC on the healthy hemisphere.

**Results:** Sixty-four patients had an MRI with available data for ADC. Mean age was 69, 52% were women, median NIHSS at arrival was 18. Five patients presented an sICH after MT. Patients with sICH had a mean ADC reduction of 43% versus 42% ( $p = 0.9$ ) for non-sICH patients. However, patients with good outcome (mRS 0-2) were associated with a lower reduction of ADC (38% vs 43%,  $p = 0.045$ ).

**Conclusions:** ADC reduction was not associated with sICH in our cohort, but it could be a good predictor for bad outcome.

**Trial registration number:** N/A

**WITHDRAWN**

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**Background and Aims:** Whether intra-arterial thrombectomy (IAT) should be performed under general anesthesia (GA), conscious sedation (CS) or with local anesthetics at the puncture site is a matter of debate, since previous studies have shown conflicting results with regard to clinical outcomes. We aimed to determine whether GA-induced blood pressure variation during IAT is associated with postprocedural functional outcome.

**Methods:** In this double-center retrospective observational study, peri-procedural systolic and diastolic blood pressures from patients with a proximal occlusion of the anterior circulation, who underwent IAT, were collected. To quantify the extent and duration of hypotension, the area under the threshold (AUT) was calculated. Hypotension was predefined as a mean arterial pressure (MAP) < 70 mm Hg. Ordinal logistic regression analyses with adjustment for relevant confounders were performed to investigate the effect of AUT, the occurrence of periprocedural hypotension, hypotension frequency, and hypotension duration on associations between functional outcome (modified Rankin Scale (mRS) at 90 days).

**Results:** Data from 367 patients who underwent IAT between December 2008 and December 2017 were analyzed. For each mm Hg\*min AUT the chance of poor clinical outcome increased (adjusted odds ratio (aOR): 0.999; 95% confidence interval (CI): 0.998-1.001). Periprocedural hypotension as well as hypotension frequency were associated with poor outcome (aOR: 0.60; 95% CI: 0.40-0.92 and aOR: 0.85; 95% CI: 0.73-0.99, respectively).

**Conclusions:** Periprocedural hypotension and higher frequency of hypotensive episodes during IAT under GA were associated with poor clinical outcome. If IAT is performed under GA, hypotension should be avoided as much as possible.

**Trial registration number:** N/A

**AS07-107****THROMBECTOMY ABOVE 80 YEARS OLD – REAL-WORLD OUTCOME**

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**Background and Aims:** Stroke is the leading cause of death in people older than 80 years of age. Evidence from trials shows that endovascular thrombectomy (EVT) is safe and effective treating major intracranial arterial occlusions. However its benefit in real day-to-day practice, particularly in the elderly is still under debate.

We aimed to study the efficacy of EVT in patients ≥80 years old with anterior acute ischemic stroke (A-AIS) and evaluate if clinical, demographic, imaging and procedural factors can influence the outcome.

**Methods:** 32-months retrospective study. Data from patients older than 80, with A-AIS that underwent EVT was collected and clinical, demographic, imaging and procedural variables and outcome analyzed. Correlation between those factors and stroke severity 24 hours after procedure and at 3 months was determined.

**Results:** Final sample of 56 patients. NIHSS on admission was  $17.39 \pm 4.5$  and ASPECTS 8. Mean number of passages with device was  $2.43 \pm 1.7$ . Time from symptoms to recanalization was  $365.76(\pm 130.6)$  minutes. (TICI ≥2b) was achieved in 83.9%. NIHSS 24hr after EVT was  $12.52 \pm 8.3$ ; with a significant percentage of patients decreasing ≥4 points.

At discharge, 17.9% were mRS = 0-2 and at 3months, 21.4%. 3 months mRS = 0-3 (favourable outcome) in 44.6% of the patients. A correlation

**AS07-073****DETRIMENTAL EFFECTS OF BLOOD PRESSURE VARIATION DURING INTRA-ARTERIAL THROMBECTOMY FOR ACUTE ISCHEMIC STROKE**

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was found between clinical outcome and reduction in NIHSS post EVT, mRS on discharge and number of passages.

**Conclusions:** Almost half of our patients reached a favourable outcome at 3 months. EVT was safe and effective in our advanced age population and these patients should not be excluded from the treatment based on the age alone.

**Trial registration number:** N/A

## AS07-010

### MECHANICAL THROMBECTOMY AT UNIVERSITY HOSPITALS OF NORTH MIDLANDS NHS TRUST.

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**Background and Aims:** Mechanical thrombectomy for acute ischaemic stroke has been commissioned by NHS England since 2017. Royal Stoke University Hospital has now provided mechanical thrombectomy as an endovascular treatment in acute stroke for over 400 patients since the first procedure at the trust in 2009.

**Methods:** Data has been extracted from a prospective registry of patients who presented with acute ischaemic stroke and managed with mechanical thrombectomy at Royal Stoke University Hospital. Registry data includes patient demographics, medical history, baseline National Institutes for Health Stroke Scale (NIHSS) and NIHSS at one week, discharge destination and 90 day outcomes by means of modified Rankin Scale have been recorded.

**Results:** Since December 2009 over 400 patients presenting with acute stroke have been treated at Royal Stoke University Hospital with mechanical thrombectomy (median age 68 years with 56% being male). The median baseline NIHSS of 18 and median NIHSS at one week of 6. There was a mean arrival to groin time of 92 minutes for these patients. Nearly 50% of patients had a good outcome at 90 days (mRS  $\leq 2$ ) with 66% returning to their own home following discharge.

**Conclusions:** Mechanical thrombectomy remains critical for endovascular treatment for select patients with acute ischaemic stroke and continues to provide good outcomes for 1 in 2 (mRS  $\leq 2$ ) of those who undergo the procedure with the vast majority returning to their own home upon discharge.

**Trial registration number:** N/A

## AS07-135

### RESCUE-REOPRO: RETROSPECTIVE OBSERVATIONAL STUDY OF INSTANT IN SITU REOCLUSIONS FOLLOWING ENDOVASCULAR THERAPY WITH IV ABCIXIMAB USED AS A RESCUE THERAPY

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**Background and Aims:** Durable and complete recanalization is the most important modifiable prognostic factor for good clinical outcome after endovascular therapy (EVT). Instant reocclusions following EVT are

rare but devastating conditions whose pathophysiology and treatment are poorly understood.

We report a series of 9 consecutive patients presenting EVT failure with stentriever due to recurring instantaneous reocclusions in anterior circulation large vessel acute ischemic stroke (AIS).

**Methods:** We retrospectively observed the efficacy and the safety of intravenous (IV) infusion of Reopro (Abciximab), a murine-human monoclonal antibody chimeric Fab fragment of 7E3 IgG3 mainly acting as a selective platelet glycoprotein IIb/IIIa receptor antagonist.

**Results:** All patients were given a standard dose of Reopro (0.25mg/kg IV bolus followed by 12-h IV infusion of 0.125µg/kg/min).

Median baseline NIHSS was 15. The median number of devices passes during EVT was 5. The median delay between groin puncture and recanalization was 124 minutes. There was no thrombocytopenia induced by the perfusion of Reopro. A final successful recanalization in our series (defined as a TICI >2B) was observed in 8 of 9 cases. A hemorrhagic transformation (HT) was found in 4 cases including two symptomatic parenchymal hematomas. Favorable clinical outcome at 3 month was reported in 2/9 cases and mortality in 2 cases.

**Conclusions:** The recanalization efficacy of IV Reopro highlights the key role of platelet aggregation on EVT-induced endothelial cells activation in instant reocclusion. But, the amount of HT is particularly high and further research is needed to identify new anti-platelet agents associated with a lower HT risk.

**Trial registration number:** N/A

## AS07-071

### ENDOVASCULAR THROMBECTOMY, PLATELET COUNT AND INTRACRANIAL HEMORRHAGE

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**Background and Aims:** Intracranial hemorrhage (ICH) can be a devastating complication of endovascular thrombectomy (ET) following ischemic stroke increasing disability and mortality. Patients with low platelet count were excluded from major ET trials. This study explores the association between platelet count and ICH after ET.

**Methods:** Retrospective review of patients undergoing ET at a comprehensive stroke center (January 2015–February 2018). Demographic and clinical information including NIHSS, IV-tPA, ASPECTS, platelet count, time from symptom onset and mTICI score were analyzed. Radiological imaging and clinical course in the hospital was evaluated to identify parenchymal hemorrhage (PH) and symptomatic intracranial hemorrhage (sICH). Univariable and multivariable analysis was conducted.

**Results:** 555 patients underwent ET and 43% were male. Mean age and NIHSS were  $71 \pm 14$  years and  $17 \pm 6$ . PH-2 and sICH was noted in 9.7% and 5.8% patients respectively. Rate of sICH in patients with platelet count  $< 100,000$  ( $n = 15$ ),  $100,000 - < 150,000$  ( $n = 59$ ) and  $\geq 150,000$  ( $n = 481$ ) were 6.7% ( $n = 1$ ), 10.1% ( $n = 6$ ) and 5.2% ( $n = 25$ ), respectively ( $p = 0.25$ ). Low ASPECTS was a significant predictor of sICH ( $p$  value = 0.046). Platelet count was not a predictor ( $p = 0.386$ ).

**Conclusions:** Risk of sICH after ET is low and comparable in patients with normal platelet counts. Low platelets should not exclude patients from undergoing intra-arterial therapy.

**Trial registration number:** N/A

**AS07-129****THROMBOLYSIS IN CEREBRAL INFARCTION SCALE SCORE PREDICTS INTRACRANIAL HEMORRHAGE AFTER ENDOVASCULAR THROMBECTOMY****S. Desai<sup>1</sup>, B. Gross<sup>2</sup>, B. Jankowitz<sup>2</sup>, T. Jovin<sup>1</sup> and A. Jadhav<sup>1</sup>**<sup>1</sup>University of Pittsburgh, Neurology, Pittsburgh, USA; <sup>2</sup>University of Pittsburgh, Neurosurgery, Pittsburgh, USA

**Background and Aims:** Intracranial hemorrhage (ICH) is a devastating complication after endovascular thrombectomy (ET) for acute ischemic stroke (AIS) caused by large vessel occlusion (LVO), reducing the likelihood of a good outcome. We aim to study the impact of the degree of reperfusion on parenchymal hemorrhage (PH) and symptomatic ICH after ET.

**Methods:** Single-center retrospective review of all anterior circulation LVO patients who underwent ET between January 2015–February 2018. Clinical and radiographic analyses were performed by a vascular neurologist. Impact of the degree of reperfusion (TICI- Thrombolysis in Cerebral Infarction) on PH 1/2 and sICH (NINDS definition) was evaluated using multivariable logistic regression analyses.

**Results:** 497 of 555 patients undergoing ET achieved a TICI score  $\geq 2B$  and 43% were males. Mean age and NIHSS were  $71.5 \pm 14$  years and  $17 \pm 6$ . 83% (413) achieved TICI 2B and 17% (84) achieved TICI 2C/3. Using age, sex, NIHSS, vascular risk factors, use of tPA, time from stroke onset, ASPECTS and TICI 2B vs 2C/3 as variables, we identified that hypertension ( $p=0.03$ ), low ASPECTS ( $p=0.005$ ) and TICI 2B (vs 2C/3) ( $p=0.05$ ) as predictors of increased PH1/2 and only TICI 2B (vs 2C/3) ( $p=0.04$ ) as a predictor of sICH.

**Conclusions:** Higher degree of reperfusion following endovascular thrombectomy is associated with reduced likelihood of parenchymal hemorrhage and symptomatic intracranial hemorrhage. Further studies are warranted to confirm these findings.

Trial registration number: N/A

**AS07-017****COMPARISON BETWEEN VOLATILE AND INTRAVENOUS GENERAL ANESTHESIA DURING ENDOVASCULAR THROMBECTOMY FOR STROKE****W. Diprose<sup>1,2</sup>, M.T.M. Wang<sup>1</sup>, D. Campbell<sup>3</sup>, J. Sutcliffe<sup>4</sup>, A. McFetridge<sup>5</sup> and P.A. Barber<sup>1,2</sup>**

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**Background and Aims:** The choice of anesthetic technique for ischemic stroke patients undergoing endovascular thrombectomy is controversial. Volatile and intravenous agents have differing effects on cerebral hemodynamics that may affect ischemic brain tissue and clinical outcome. We compared outcomes in patients undergoing endovascular thrombectomy with general anesthesia who were treated with intravenous or volatile agents.

**Methods:** Consecutive endovascular thrombectomy patients treated with general anesthesia were identified from our prospective database. Baseline patient characteristics, use of volatile or intravenous anesthesia, and clinical outcomes were evaluated. Functional independence at 3 months was defined as a modified Rankin Scale of 0 to 2.

**Results:** There were 283 endovascular thrombectomy patients who received general anesthesia [ $165$  (58.3%) men; mean  $\pm$  SD age,  $64.7 \pm 15.8$  years;  $231$  (82%) anterior circulation], of whom  $234$  (83%) received volatile (desflurane or sevoflurane) and  $49$  (17%) intravenous (propofol) anesthesia. Patients receiving intravenous anesthesia had more ischemic heart disease, higher baseline National Institutes of Health Stroke Scale scores and were less likely to be treated with intravenous thrombolysis. However in a multivariate regression analysis, intravenous anesthesia patients had lower 3-month mortality [odds ratio =  $0.28$ ; 95% confidence interval (CI),  $0.09$ - $0.89$ ;  $P = 0.03$ ], and a non-significant trend towards increased functional independence at 3 months (odds ratio =  $1.94$ ; 95% CI,  $0.90$ - $4.21$ ;  $P = 0.09$ ).

**Conclusions:** There may be a differential effect on outcome between intravenous and volatile general anesthetic agents in endovascular thrombectomy, with a signal that intravenous agents may be preferred. This observation may explain the conflicting results in previous studies, but should be considered hypothesis generating and tested in future randomized-controlled trials.

Trial registration number: N/A

**AS07-074****ENDOVASCULAR THROMBECTOMY IN PATIENTS WITH AND WITHOUT PRIOR ANTIPLATELET THERAPY****W. Diprose<sup>1,2</sup>, J. Donnelly<sup>3</sup>, J. Sutcliffe<sup>4</sup>, A. McFetridge<sup>5</sup> and P.A. Barber<sup>1,2</sup>**

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**Background and Aims:** In endovascular thrombectomy, antiplatelet therapy has been hypothesized to restore microvascular perfusion and potentially improve functional outcomes, and has been reported to be associated with higher rates of successful recanalization in small observational studies. We compared outcomes in patients with and without prior antiplatelet therapy.

**Methods:** Consecutive thrombectomy patients were identified from a prospective database. Baseline patient characteristics, antiplatelet therapy status and outcomes were evaluated. Successful recanalization was defined as a Thrombolysis in Cerebral Infarction scale score of 2b-3. Functional independence at 3 months was defined as a modified Rankin Scale score of 0–2.

**Results:** There were 302 patients [ $178$  (58.9%) men, mean  $\pm$  SD age  $64.3 \pm 16$  years,  $248$  (82%) anterior circulation] included in the analysis.  $134$  (44%) had prior antiplatelet therapy, and  $168$  (56%) had no prior antiplatelet therapy. In patients with prior antiplatelet therapy,  $93$  (69%) were already taking antiplatelet agents at the time of their stroke, and  $41$  (31%) were treated acutely with antiplatelet agents. Patients with prior antiplatelet therapy were more likely to be older, male, have a greater number of comorbid conditions, and have basilar or internal carotid artery occlusions. There were no differences in symptomatic intracerebral hemorrhage ( $p=0.68$ ) or mortality ( $p=0.13$ ). In a multivariate analysis, there was no difference in the rates of successful recanalization [odds ratio (OR)  $1.97$ , 95% confidence interval (CI),  $0.84$ - $5.05$ ;  $p=0.13$ ] or functional independence (OR  $0.65$ , 95% CI,  $0.37$ - $1.14$ ;  $p=0.13$ ) in patients with or without prior antiplatelet therapy.

**Conclusions:** In endovascular thrombectomy patients, antiplatelet therapy was not associated with better procedural or functional outcomes.

Trial registration number: N/A

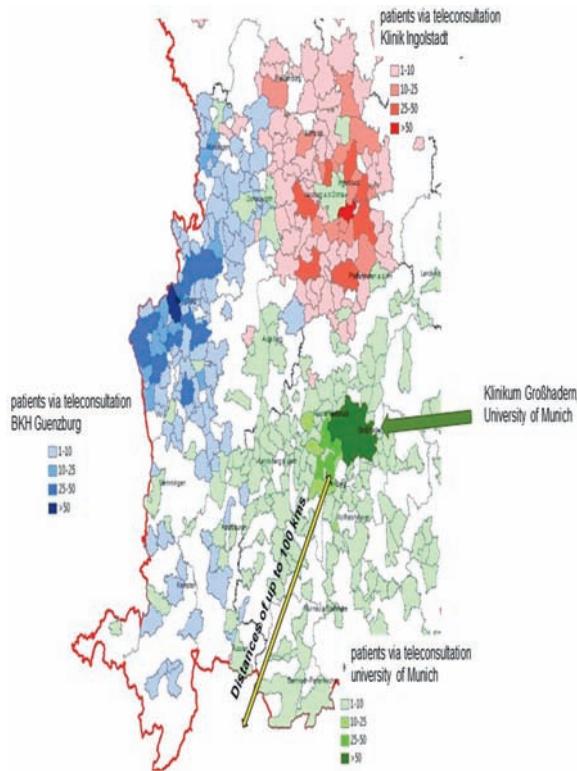
**AS07-007**

**DRIP-AND-SHIP VERSUS DIRECT-TO-CENTER STROKE PATIENTS FOR MECHANICAL THROMBECTOMY – COMPARISON WITHIN A SUPRAREGIONAL STROKE NETWORK IN RURAL AREAS (NEUROVASKULAERES NETZWERK SUEDWESTBAYERN, NEVAS)**

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**Background and Aims:** Since mechanical thrombectomy (MT) became standard of care in acute stroke due to large vessel occlusion (LVO), there is increasing need to achieve reorganization of acute stroke patient pathways. We examined the outcome of patients in the context direct-to-center (DTC) versus drip-and-ship (DS) in our tertiary endovascular stroke center as part of a dedicated supraregional stroke network (NEVAS).



**Methods:** All patients who underwent MT (01/2015 to 05/2018) were analyzed. Good functional outcome was defined as modified Rankin Scale (mRS) 0–2 at 90 days follow-up. Symptomatic intracerebral hemorrhage (sICH) was defined according to SITS-MOST criteria.

**Results:** MT was performed in 410 patients ( $71.5 \pm 14.0$ , 46.6% female, 221 DTC-/189 DS-patients). Median NIHSS-score on admission was 16, median premorbid mRS was 0. 84% of patients suffered from LVO in anterior circulation. Thrombolysis was applied in 62%. Both groups did not differ significantly regarding all baseline parameters besides mRS at admission with DS-patients being more affected ( $p = 0.005$ ). Successful recanalization was comparable in both groups (79.3% vs. 77.8%). Both groups benefit from the treatment with the same median NIHSS-score reduction from admission to discharge (16 to 7 vs. 17 to 6). Time delay (onset-to-revascularization) in DS-patients was 96 min (212 vs. 308 min,  $p = 0.001$ ). At 90days follow-up, DTC-patients had a non-significant better functional outcome (33.5% vs. 24.3%,  $p = 0.05$ ), though sICH (3.7% vs. 4.1%,  $p = 0.854$ ) and mortality (31.1% vs. 34.4%,  $p = 0.387$ ) did not differ.

**Conclusions:** Although longer process times, DS-patients significantly benefit from MT without any safety concerns. These results suggest that DS might be suitable to provide MT in rural areas when DTC is not feasible.

**Trial registration number:** N/A

**AS07-102**

**RECANALIZATION SUCCESS WITH THROMBOASPIRATION IN ACUTE STROKE: A MULTIVARIATE CLINICAL AND RADIOLOGICAL ANALYSIS**

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**Background and Aims:** To correlate the hyperdense vessel sign with pathology of retrieved clot and to correlate clinical and radiological variables with a direct aspiration first-pass technique (ADAPT) efficacy in acute ischemic stroke.

**Methods:** A total of 71 acute ischemic stroke were retrospectively included and evaluated with CT. Presence or absence of hyperdense vessel sign was recorded and Hounsfield Unit (HU) was measured on cerebral thrombus before and after contrast injection. Angiography was used to confirm large vessel occlusion and to perform recanalization (thromboaspiration and/or stent retriever). Thrombus material was histological analysed to differentiate red-blood-cell-dominant or fibrin-dominant composition. Multivariate analysis based on clinical (onset, NIHSS, time-to-puncture, vascular tortuosity, concomitant intravenous thrombolysis) and radiological (hyperdensity vessel sign, HU measurement, TICI, embolization to a new territory -ENT-) data was made for evaluation of ADAPT efficacy.

**Results:** Hyperdense vessel sign was present in 62% of cases (44/71). ADAPT was used in 100% (71/71) of patients with ACE 68, SOFIA PLUS or 4 MAX devices and was completed with SOLITAIRE, EMBOTRAP or SOLUMBRA stent retriever in 21% (15/71). Hyperdense vessel sign with  $HU > 66$  was related to red-blood-cell-dominant composition. Cardioembolic thrombi demonstrated higher fibrin-dominant portion. Successful recanalization (TICI  $> 2a$ ) was obtained in 87% of ADAPT with a median of 1.4 aspiration attempts. Time-to-puncture, hyperdense vessel sign and concomitant intravenous thrombolysis were significative related to ADAPT efficacy (TICI  $> 2a$ ).

**Conclusions:** Hyperdense vessel sign is related to thrombus composition. Time-to-puncture, hyperdense vessel sign and intravenous thrombolysis could predict ADAPT efficacy in acute stroke.

**Trial registration number:** n/a

**AS07-125****ACUTE ISCHAEMIC STROKE IN PATIENTS WITH LEFT VENTRICULAR ASSIST DEVICE: FOCUS ON ENDOVASCULAR INTERVENTION**

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**Background and Aims:** Mechanical Assistance for the treatment of end staged heart failure (HF) gradually replaces heart transplantation as a permanent treatment concept. Due to impaired hemocompatibility and HF-related adverse events, patients with left ventricular assist device (LVAD) are at high risk of neurovascular complications despite intensified anticoagulation management and surveillance. For LVAD-supported patients with acute ischaemic stroke (AIS) due to large vessel occlusion (LVO), neuroendovascular therapy is the only treatment option. However, little is known about outcome, complications and antithrombotic treatment recommendations are so far missing in this high risk population.

**Methods:** We retrospectively analysed forty LVAD-supported patients at Hannover Medical School who suffered severe ischaemic stroke within the last 5 years. In case of treatment with mechanical recanalisation, periprocedural course, complications and clinical outcome as well as post-interventional management were analyzed and compared to former case series consulted from literature search.

**Results:** AIS mostly occurred in the context of insufficient anticoagulation or hospitalisation due to other reasons than stroke. In one patient intravenous thrombolytic therapy was administered. Neurointerventional treatment was performed in 5 patients with LVO. All but one of these patients showed poor outcome (mRS3-6) despite of pre-interventional high ASPECTS (8-10) and favorable TICI-score (2a-3) after recanalisation due to intracranial hemorrhage.

**Conclusions:** In LVAD-supported patients, AIS is associated with poor outcome. Technically, recanalisation in LVO can successfully be achieved by neurovascular intervention. However ideal peri- and posttherapeutic anticoagulation management still remains unclear. We propose an interdisciplinary approach and a prospective multicentre registry for addressing these critical issues.

**Trial registration number:** N/A

**AS07-016****RECANALIZATION OF THE POSTERIOR CIRCULATION STROKE BY MECHANICAL THROMBECTOMY WITH STENT-RETRIEVER AND THROUGH THE DEVICES AVAILABLE BEFORE ITS IRRUPTION: AN OBSERVATIONAL, MONOCENTRIC AND RETROSPECTIVE STUDY.**

**P.B. García Jurado<sup>1</sup>, I.M. Bravo Rey<sup>1</sup>, E. Jiménez Gómez<sup>1</sup>, R. Valverde Moyano<sup>2</sup>, R. Oteros Fernández<sup>1</sup> and F. Delgado Acosta<sup>1</sup>**

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**Background and Aims:** To evaluate the recanalization rate and functional outcome at three months of patients with posterior circulation stroke (PCS) treated by mechanical thrombectomy with stent-retriever and through the techniques available before the stent-retriever eruption,

as well as analyze independent prognostic factors of good functional outcome after revascularization with stent-retriever.

**Methods:** Retrospective analysis of patients with PCS treated between September 2000 and May 2018. A descriptive statistical analysis and a binary logistic regression model were performed.

**Results:** 75 patients were analyzed (48 treated with stent-retrievers and 27 without stent-retrievers), with a mean age of 61.8 years, being 84% men. The mean of the National Institutes of Health Stroke Scale was 18.5 (8.1 +/- 1), and the average of the Glasgow Coma Scale (GCS) was 8.1 (4.1 +/- 0.5). Better recanalization rates were obtained in patients treated with stent-retrievers (95.8% successful recanalizations (46/48) vs 55.6% (15/27), p < 0.0001), there being no statistically significant differences in the functional outcome at three months (60.4% dependent patients (29/48) vs 77.8% (21/27), p > 0.05). The GCS has been independently related to the functional outcome at 90-days (odds ratio, 0.67, confidence interval, 0.5-0.91, p = 0.01) in patients treated with stent-retrievers.

**Conclusions:** Stent-retriever thrombectomy can achieve high rates of recanalization in the PCS with a result of functional independence at three months and an acceptable complication rate. The initial GCS is an independent prognostic factor of the 90-day functional outcome.

**Trial registration number:** N/A

**AS07-086****IMPACT AND EFFECT OF ASPIRATION CATHETERS IN MECHANICAL THROMBECTOMY – AN IN VITRO STUDY.**

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**Background and Aims:** Mechanical thrombectomy as the gold standard therapy for treating acute ischemic stroke either consists of aspiration and stent retrieval of clots used side by side or by using each technique alone. We aimed for understanding how aspiration effects the thrombus configuration in order to understand benefits and disadvantages of this procedure.

**Methods:** We built models of the proximal middle cerebral artery using shrinkage plastic tubing to simulate tapering vessels. Clots built from human whole blood by dynamic and static coagulation methods were injected into these models to obliterate the lumen. Under continuous high-speed camera monitoring clot aspiration was performed with increasing vacuum levels. We analysed how aspiration was effected by catheter size, suction power, time, thrombus size and composition.

**Results:** Small red clots were aspirated completely by low vacuum levels, while more complex red clots with a higher amount of fibrin were sucked out of erythrocytes. The resulting white clots were difficult to retrieve, as same as the white or mixed clots in general, which were complicated to retrieve by aspiration at all vacuum levels. Furthermore, we observe a typical breaking point, most likely due to internal clot architecture that leads to new clot fragments.

**Conclusions:** Interaction between clots and aspiration tubing is highly dependent on clot composition. Whereas small red clots can be aspirated effectively and safely at low vacuum levels, more complex clots should be secured by an additional stent retriever placement. Ideally, clot composition should be known in advance according to choose the ideal technique for the case.

**Trial registration number:** N/A

**AS07-115**
**NEVA DROP ZONE EFFECT ON FIRST PASS SUCCESS OF MECHANICAL THROMBECTOMY: INITIAL CLINICAL RESULTS ON MCA OCCLUSIONS**

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**Background and Aims:** NeVa is a novel thrombectomy device, which has a unique design. The empty spaces on the device is called as “drop zone” where the trombus is intended to be dropped inside the stent and be trapped. Animal lab and in vitro testing had promising results. Herein, preliminary experience with the use of NeVa thrombectomy device for treatment of large vessel occlusion is presented.

**Methods:** Brain Angiography and Stroke Centers (BASC) network that is constituted by three strategically located comprehensive stroke centers that uses IschemiaView RAPID software in Istanbul.

**Results:** Twenty-five acute ischemic stroke patients were included in this observational case series. NeVa thrombectomy device was used in 22 patients as first line therapy whereas for rescue in 3 patients. The mean age (48% male) was 71 years. Occlusion site was as follows: MCA M1 segment in 20 patients, M2 segment in 4 patients and M3 segment in one patient. The mean admission NIHSS score was 15 (3-22). The mean mismatch ratio was 2.6 and mismatch volume was 45 ml. The first pass re-canulation rates and final re-canulation rates were independently evaluated for device performance. First pass re-canulation scores were as follows: TICI2b/3 (81.9%), TICI2c/3 (59%), TICI2c (27.2%) and TICI 3 (31.8%). The mean pass number was 1.5 for final recanalization. Final re-canulation scores were: TICI 2b/3 (96%), TICI2c/3 (92%) and TICI 3 (60%). The mean discharge NIHSS score was 5.

**Conclusions:** NeVa thrombectomy device has promising results with relatively high first pass and final re-canulation rates.

**Trial registration number:** N/A

**AS07-038**
**CAROTID STENTING OR ANGIOPLASTY IN ACUTE ISCHEMIC STROKE DUE TO TANDEM OCCLUSION: TATTOO STUDY**

**C.I. Gómez-Escalonilla Escobar<sup>1</sup>, S. Rosati<sup>2</sup>, P. Calleja Castaño<sup>3</sup>, S. Trillo Senín<sup>4</sup>, F. Ostoz Moliz<sup>3</sup>, C. Aguirre Hernández<sup>4</sup>, B. Fuentes Gimeno<sup>5</sup>, A. Cruz Culebras<sup>6</sup>, A. García Pastor<sup>7</sup>, J. Carneado Ruiz<sup>8</sup>, P. Simal Hernández<sup>1</sup>, J. Campollo Velarde<sup>9</sup>, J.L. Caniego Monreal<sup>10</sup>, J. Rodríguez Pardo<sup>5</sup>, J. Masjuan Vallejo<sup>6</sup>, M. Moreu Gamazo<sup>2</sup> and J. Egido Herrero<sup>1</sup>**

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**Background and Aims:** The endovascular treatment technique in patients with tandem occlusion ischaemic stroke is not established.

The aim of our study is to analyse the procedural aspects that influence the prognosis

**Methods:** Multi-centre retrospective analysis of patients with tandem occlusion acute ischaemic stroke with endovascular management during the period between January 2014 and December 2017. We analysed the type of approach, use of stent/angioplasty, antithrombotic treatment, application of general anaesthesia and its association with recanalization, symptomatic intracranial haemorrhage (sICH) and clinical results

**Results:** 172 patients with a median age of 65 years (IQR 55 – 74) and NIHSS 17 (IQR 12 – 22). TICI2B-3 recanalization was achieved in 77.3% with a sICH rate of 7%. At three months, mortality rate was 8.1% and 49.7% presented functional independence (mRS ≤2). Carotid occlusion was treated with stent in 41.7%, angioplasty in 29.2%, aspiration in 7.7% and not treated in 21.4%. In the multivariate analysis, general anaesthesia was associated with a lower degree of functional independence at three months with an OR of 3.03 (1.1 – 8.34). The retrograde approach was associated with a greater degree of functional independence at three months adjusted for age, NIHSS and blood glucose on admission, intracranial occlusion, degree of recanalization and the use of general anaesthesia with an OR of 2.94 (1.08 – 7.97). Intravenous thrombolysis and antithrombotics were not associated with a higher rate of sICH

**Conclusions:** General anaesthesia was associated with a lower probability of functional independence at three months. The retrograde approach was associated with better functional outcomes

**Trial registration number:** N/A

**AS07-039**
**ENDOVASCULAR TREATMENT IN UNKNOWN-ONSET STROKE: USE OF ASPECTS IN CRANIAL CT AS PATIENT SELECTION CRITERIA**

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**Background and Aims:** Two clinical trials using advanced neuroimaging techniques as selection criteria for endovascular treatment in unknown-onset ischaemic strokes have been published.

Our aim is to assess the efficacy and safety of the use of ASPECTS in cranial CT as selection criteria for endovascular treatment of acute ischaemic stroke, secondary to large vessel occlusion, in patients with wake-up or unknown-onset stroke.

**Methods:** Prospective study of patients with wake-up or unknown-onset acute ischemic stroke secondary to large vessel occlusion, last-seen-well between 6 and 24 hours, who were treated with mechanical thrombectomy during the period between September 2013 and November 2018. The neuroimaging selection method was an ASPECTS ≥ 6 in the cranial CT.

**Results:** 80 patients with a median age of 74 years (IQR 64 – 81) and NIHSS of 18 (IQR 13 – 22). The median time from the last-seen-well to the first observation of symptoms was 510 minutes (IQR 443 – 611) and to endovascular treatment was 750 minutes (IQR 645 – 900). In 26.3% of patients, intravenous thrombolysis (IVT) was administrated prior to endovascular treatment. TICI2B-3 was achieved in 85% with 7.5% of symptomatic intracranial haemorrhage and without differences whether they had previously received IVT. At three months, 53.8% of patients presented functional independence (mRS ≤2), with a mortality rate of 13.8%.

**Conclusions:** In our series, the use of non-contrast cranial CT as selection criteria for endovascular treatment in these patients shows similar results to those obtained with advanced neuroimaging.

**Trial registration number:** N/A

**AS07-065**

## OUTCOMES AFTER ENDOVASCULAR TREATMENT IN PATIENTS WITH ACUTE ISCHEMIC STROKE AND ACTIVE CANCER: THE MR CLEAN REGISTRY

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**Background and Aims:** Cancer is an established risk factor for acute ischemic stroke (AIS). We explored outcomes of patients with AIS with active cancer who underwent endovascular treatment (EVT).

**Methods:** We used data of the MRCLEAN Registry (March 2014–June 2016), an ongoing registry of all AIS patients treated with EVT in the Netherlands. We compared patients with active cancer (diagnosis < 12 months prior to stroke, or receiving cancer treatment) with patients without cancer. Outcomes included 90-day modified Rankin Scale (mRS) score and mortality, successful reperfusion ( $\geq$ TICI $\geq$ 2B), and symptomatic intracranial hemorrhage (sICH). We adjusted for baseline imbalances.

**Results:** Of 1219 included patients, 47 (4%) had active cancer, most frequently colorectal ( $n = 12$ ), breast ( $n = 10$ ) or lung cancer ( $n = 7$ ). Most baseline characteristics were comparable, but patients with active cancer had worse pre-stroke mRS scores (mRS 0–1: 64% vs. 82%,  $p = 0.003$ ), had longer times from stroke onset to first hospital (median 102 vs. 54 minutes,  $p = 0.003$ ) and were less often administered intravenous alteplase (49% vs. 79%,  $p < 0.001$ ) than patients without cancer. Patients with active cancer tended to have worse functional outcomes (mRS 0–2: 21% vs. 43%, aOR 1.9, 95% CI 0.8–4.1 and a higher risk of death (45% vs. 26%, aOR 1.6, 95% CI 0.8–3.3), despite a higher frequency of successful reperfusion (66% vs. 55%,  $p = 0.178$ ). The rate of sICH was non-significantly increased in patients with cancer (13% vs. 6%,  $p = 0.057$ ).

**Conclusions:** Based on limited data available, patients with AIS and active cancer treated with EVT appear to have worse 3-month outcomes and a higher risk of sICH

**Trial registration number:** N/A

**AS07-108**

## ANGIOPLASTY USING DRUG-COATED BALLOONS IN OSTIAL VERTEBRAL ARTERY STENOSIS – FIRST EXPERIENCES IN A SMALL CASE SERIES

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**Background and Aims:** Approximately 20–25% of all ischemic strokes occur in the posterior circulation; and 10–20% of the patients with ostial vertebral artery stenosis (OVAS) will suffer from a stroke. Furthermore, patients with a vertebrobasilar transient ischemic attack (TIA) due to OVAS ( $\geq$ 50%) have a 5-years risk of stroke recurrence of 30%. Thus, OVAS is a relevant cause of acute ischemic posterior circulation stroke. Percutaneous trans-luminal angioplasty (PTA) might offer a promising treatment modality, but re-stenosis rate is high. So far, little is known

about recanalization using drug-coated balloons (DCB) in OVAS. Here, we aimed to test the safety and feasibility of DCB-PTA in OVAS.

**Methods:** Retrospective, mono-center case series of six patients with ostial vertebral artery stenosis ( $\geq$  50%) treated with PTA using a drug-coated balloon.

**Results:** Median age was 72 years (IQR 66–76) with a 1:1 female: male proportion. Patients were treated with Neuro Elutax SV and SeQuent Please NEO. Median pre-interventional stenosis degree was 73% (IQR 60–80) with a median lesion length of 6mm (IQR 4–13). Median post-interventional stenosis degree was 45% (IQR 25–50). All treated vessels remained patent. No major complications such as dissection, vessel perforation, hemorrhage or ischemic events occurred. Moreover, we did not detect any restenosis during a median follow-up period of 5.3 months.

**Conclusions:** PTA using drug-coated balloons are safe and feasible in patients with ostial vertebral artery stenosis. Drug-coated balloons might be considered as a novel treatment option in patients with ostial vertebral artery stenosis

**Trial registration number:** N/A

**AS07-047**

## BY-PASS SIGN AS A PREDICTOR OF ARTERIAL RECANALIZATION IN MECHANICAL THROMBECTOMY

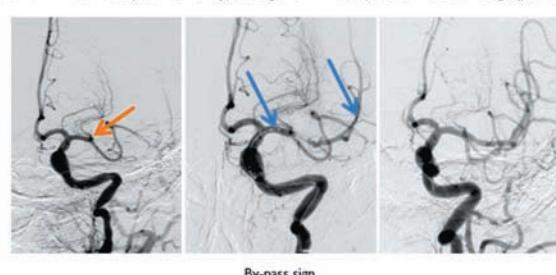
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**Background and Aims:** Mechanical thrombectomy is the most effective treatment for arterial recanalization in patients with ischaemic stroke. Nevertheless, there is 20–30% of patients in whom recanalization is not achieved. One of the possible explanations is that there is an inadequate trapping of the thrombus by the devices used in the procedure. Our aim is to analyze whether after opening the stent-retriever and performing a contrast run from the carotid catheter, the passage of contrast through the opened device and the visualization of the entire arterial tree distal to the occlusion (by-pass sign) correlates with better thrombus entrapment and therefore with a greater probability of extracting it.

**Methods:** Retrospective analysis of a cohort of patients undergoing endovascular treatment for large-vessel intracranial occlusion carried out in our center from 2010 to 2017, in which an arteriography was performed with the stent-retriever device opened at the point of occlusion. We analyzed the presence of the by-pass sign and the degree of recanalization ( $\geq$ TICI $\geq$ 2B).

**Results:** We reviewed 219 patients with a total of 421 mechanical thrombectomy passes. The degree of recanalization  $\geq$ TICI $\geq$ 2B was 73.97% and the bypass-sign was demonstrated in 65.01% of the cases. The presence of the bypass-sign was significantly associated with arterial recanalization as there was a  $\geq$ TICI $\geq$ 2B in 59.1% of patients with bypass-sign vs. 27.7% of patients without this sign ( $p = 0.001$ ).



**Conclusions:** The presence of the by-pass sign was significantly associated with a higher probability of recanalization  $\geq$ TICI2B. In cases where this sign is absent, relocation of the stent-retriever could be considered in order to avoid ineffective passes.

**Trial registration number:** N/A

## AS07-067

### THERAPY AND OUTCOME IN PATIENTS WITH M2 SEGMENT OCCLUSION OF THE MIDDLE CEREBRAL ARTERY AND MINOR NEUROLOGICAL DEFICITS

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**Background and Aims:** Therapy modality in patients with M2 segment occlusion of the middle cerebral artery and mild neurological deficits is a matter of debate.

**Methods:** Patients admitted to our Bernese stroke center between 05/2004-06/2018 with M2 segment occlusion and NIHSS score  $\leq 5$  on admission and therapy decision  $< 4.5$  hours after symptom onset were continuously included in this study. Neurological deterioration/improvement (defined as at least +1/-1 point change of NIHSS score compared to baseline) and outcome was compared between IV-thrombolysis only vs. endovascular therapy (+/- IV-thrombolysis).

**Results:** Among 114 patients (39.1% women; median age 67.2y), 58.3% received IV-thrombolysis only and 41.7% endovascular therapy (+/-IV-thrombolysis). Baseline characteristics were similar between both groups, except collateral status being worse in IV-thrombolysed patients ( $p$ -trend  $< 0.0001$ ). 3-months neurological deterioration occurred in 12 (11.2%), improvement in 84 (78.5%) of patients. Reperfusion status ( $p$ -trend = 0.489) and symptomatic intracranial haemorrhages ( $n = 1$  of 4 in IV-thrombolysed patients;  $p = 0.206$ ) did not significantly differ between both groups. IV-thrombolysis over endovascular therapy (+/-IV-thrombolysis) showed a trend towards better 3-months mRS shift:  $p = 0.085$ , better favourable 3-months outcome (90.9% vs. 73.9%); OR 3.53 (95% CI:1.22-10.25);  $p = 0.020$ , similar excellent 3-months outcome (65.2% vs. 50%);  $p = 0.110$ , similar 3-months survival (95.5% vs. 89.1%);  $p = 0.214$ , a trend towards less 3-months neurological deterioration (6.3% vs. 18.6%);  $p = 0.057$  and similar improvement (81.3% vs. 74.4%);  $p = 0.401$  and less 3-months facial palsy: OR 0.39 (95%CI:0.16-0.47);  $p = 0.033$  and dysarthria: OR 0.15 (95%CI 0.04-0.58);  $p = 0.006$ .

**Conclusions:** Our study found better effectiveness of IV-thrombolysis over endovascular therapy (+/-IV-thrombolysis) in the analysed patient group despite worse collateral status in IV-thrombolysed patients. There is an unmet need for randomized controlled trials in this stroke field.

**Trial registration number:** N/A

## AS07-122

### STENTREIVERS AND ASPIRATION CATHETERS – NOT JUST FOR STROKE. THE USE OF STENTREIVERS AND ASPIRATION CATHETERS IN NON-STROKE CASES: A CASE SERIES

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**Background and Aims:** Stent retrievers and aspiration catheters can be used in non-stroke cases to retrieve migrated coils, manage thromboembolic events and retrieve migrated detached catheter tips. We present our experience with the use of these devices. We describe the devices and techniques used, case details and clinical outcomes.

**Methods:** We performed a single-center retrospective cohort study of 26 patients undergoing endovascular treatment for non-ischaemic stroke cases.

**Results:** 26 patients were treated – 16 patients had thromboembolic events, 8 had coil migration events and 2 had microcatheter tip detachment complications. Thromboembolic events were treated with a combination of stent retrieval and aspiration. 15 of thromboembolic cases achieved TICI 3 revascularisation at the end of procedure. Of the migratory coil complications 8 coils were successfully retrieved and 3 were retained. One microcatheter tip was retrieved, the other was repositioned into a non-flow limiting position and a stent was used to jail the microcatheter against the arterial wall.

The majority of patients had no neurological sequelae. Two patients experienced serious adverse events. One case was due to stent retriever device failure ultimately leading to patient death and one adverse event was due to a retained coil resulting in cerebral infarction, cerebral oedema and decompressive craniectomy. Neither of the patients with microcatheter tip detachment complications had adverse neurological outcomes.

**Conclusions:** Stent retrievers and aspiration catheters can be used safely and effectively as adjunctive or rescue devices during embolisation procedures.

**Trial registration number:** N/A

## AS07-037

### REVERSIBLE MITOCHONDRIAL STABILISATION WITH MITOCHONDRIAL-TARGETED S-NITROSOTHIOL (MITOSNO) ACUTELY AT REPERFUSION AS A POSSIBLE NEUROPROTECTIVE THERAPY IN TRANSIENT ISCHAEMIC STROKE.

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**Background and Aims:** In this study, mitochondrial biogenesis, glycolysis and mitophagy were evaluated post-stroke. Additionally, the therapeutic potential of a mitochondrial-targeted S-nitrosothiol (MitoSNO), that drives mitochondrial accumulation of a nitric oxide donor, was investigated in spontaneously hypertensive stroke prone (SHRSP) rats post-transient middle cerebral artery occlusion (tMCAO).

**Methods:** SHRSP rats (18-22 weeks, 270–329g) underwent tMCAO (30min). *PINK1*, *PARKIN*, *Nrf2*, *PPARGC1a*, *Tfam* and *HK2* gene expression was determined (tMCAO: n = 6 and Sham: n = 3) (RQ+RQmax shown). MitoSNO: 200(n = 5), 500(n = 4) and 750(n = 6) ng/kg and saline (n = 4) tMCAO groups were studied (interim analysis). Animals were tested for neurological function (30-point neurological score, tapered beam, sticky label test) longitudinally to day 10. Groups compared using unpaired t-test.

**Results:** Compared to sham, markers for biogenesis; *PPARGC1* (infarct: 0.43 + 0.05,  $p = 0.0006$ ) and *Tfam* (peri-infarct: 0.68 + 0.08,  $p = 0.03$ ) as well as mitophagy; *PINK1* (peri-infarct: 0.52 + 0.09,  $p = 0.001$ ) and *PARKIN* (peri-infarct: 0.52 + 0.07,  $p = 0.008$ ) were significantly reduced

across the ipsilateral but not contralateral hemisphere, at 24h post-stroke. In the intervention study, a trend towards improved removal of right (affected side) sticky label at day 10 in 500ng/kg MitoSNO compared to control was observed (mean±sem; MitoSNO:15.3s±6.8 and saline:38.5s±17.7) with similar trends at day 3 on the tapered beam, measured as %footfaults (mean±sem; MitoSNO:25.9%±9.1 and saline:28.2%±10.7). All treatment groups scored higher median neuroscore at day 10 (MitoSNO; 750ng/kg:26, 500ng/kg:26.5, 200ng/kg:27.0 vs. control:25.0).

**Conclusions:** Altered mitochondrial markers elucidate mechanisms of impairment caused by ischaemia-reperfusion injury. Interim analysis reveals a trend towards improved functional recovery with MitoSNO compared to control. MitoSNO studies are on-going to increase group size and to characterise lesion volume/cellular damage.

**Trial registration number:** N/A

## AS07-023

### IMPACT OF VASCULAR ANATOMY ON CLINICAL AND RADIOLOGICAL OUTCOME OF ENDOVASCULAR TREATMENT OF ACUTE ISCHAEMIC STROKE PATIENTS

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**Background and Aims:** To investigate to what extent aortic arch and carotid artery anatomy relate to clinical and radiological outcome after EVT of acute ischaemic stroke (AIS) patients.

**Methods:** CTA images of 891 patients from the MR CLEAN Registry, a prospective Dutch registry of AIS patients treated with EVT, were evaluated on aortic arch configuration, carotid artery tortuosity and atherosclerosis. Logistic prediction models were developed including baseline patient and radiological characteristics. Added value of vascular parameters for prediction of patient outcome was assessed using likelihood-ratio-test for increase in area under the curve (AUC). Effect estimates were used to create risk prediction charts.

**Results:** The AUC of the baseline model slightly increased with addition of vascular parameters for clinical outcome (AUC from 0.79 (95% CI, 0.76-0.82) to 0.80 (95% CI, 0.77-0.83); $p < 0.05$ ) and reperfusion (AUC from 0.54 (95% CI, 0.50-0.58) to 0.60 (95% CI, 0.57-0.64); $p < 0.05$ ). For EVT discontinuation (target occlusion not reached) AUC of 0.72 (95% CI, 0.65-0.79) was improved to 0.82 (95% CI, 0.77-0.88); $p < 0.001$ ). Risk chart for EVT discontinuation showed that increase in predicted probability was most pronounced in the elderly patient ( $>80$  years), where probability increased from 0.02 in absence to 0.86 in presence of complex aortic arch configuration, carotid artery tortuosity and  $\geq 70\%$  carotid artery stenosis.

**Conclusions:** Clinical outcome of AIS patients after EVT is largely predicted by patients' baseline characteristics. Prediction of reperfusion remains poor. Impact of vascular anatomy and atherosclerosis is most pronounced for prediction of EVT discontinuation. These results could have implications for treatment decision in patients with complex vascular anatomy.

**Trial registration number:** N/A

## AS07-040

### RETROSPECTIVE ANALYSIS OF PATIENTS TREATED WITH RECURRENT MULTIPLE THROMBECTOMY

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**Background and Aims:** Recurrent thrombectomy for acute stroke treatment in individual patients has been proved feasible. However, less is known which patients are at higher risk for another vessel occlusion and eventually require a second thrombectomy.

**Methods:** Retrospectively, we identified all patients at our center who received a recurrent mechanical thrombectomy (2007 to 2018). Clinical data were retrieved from medical records. Presumed etiology of stroke was redefined retrospectively. Angiographic studies were revisited with focus on local pathologies at the recanalized vessel.

**Results:** 22 patients (i.e. 1.5% among 1449 patients) received a recurrent thrombectomy. Mean age was 64.9 years (SD  $\pm$  18). Mean NIHSS score at first admission was 11 (IQR 5–15.25). Mostly (20 patients; 91%) a vessel of the anterior circulation was occluded, with successful (TICI Score  $\geq 2b$ ) thrombectomy in 21 patients (95%). Stroke recurrence was observed mostly (18 patients; 82%) in the same vessel territory. In one patient the reason for stroke recurrence (dissection after angiography) differed from the index event (cardioembolic origin). In all other cases stroke etiology was considered identical for both events (13x (59.1%) cardioembolic, 3x (13.6%) arterio-embolic, 2x (9.1%) other defined disease, 4x (18.2%) unknown etiology). According to angiographic studies 5 patients (23%) showed an intima lesion after first thrombectomy.

**Conclusions:** In this analysis the need for recurrent thrombectomy was low. However, the high number of patients with presumed known origin of stroke etiology raise the question how monitoring of such patients may be optimized. A detailed analysis of angiographic studies regarding local vessel pathologies will be of high interest.

**Trial registration number:** N/A

## AS07-116

### THROMBECTOMY IN STROKE PATIENTS WITHOUT PRIOR SEDATION: FREQUENCY OF INTRAPROCEDURAL USE OF ANALGOSEDATION

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**Background and Aims:** In stroke patients with acute large vessel occlusion (LVO), endovascular therapy (EVT) may be performed with or without prior sedation. While several studies have evaluated patients treated under conscious sedation, only limited data are available on EVT performed without prior sedation. Our aim was to determine the proportion of non premedicated patients who will eventually require analgosedation during the procedure.

**Methods:** We analyzed data from the prospective Montreal Neurovascular and Stroke Data Repository (MONSTER) on patients

undergoing EVT for acute LVO without prior sedation for acute stroke treatment.

**Results:** Between January and December 2018, 219 consecutive patients (mean age: 70 years SD ± 15, 52 % women) underwent EVT for acute LVO without prior sedation. Overall, median procedural time was 36 minutes (IQR 27–59) and recanalization (TICI 2b/3) was achieved in 184 (84%). One hundred and sixty-three procedures (74%) were completed without the use of any systemic analgesedation. Fifty-six patients (26%) required some sedation during the procedures including 6 (3%) who required intubation.

**Conclusions:** Our findings suggest thrombectomy without prior sedation is feasible. Only one fourth of non-premedicated patients eventually require intraprocedural analgesedation. Further studies are needed to evaluate the impact of sedation on procedural parameters, patient comfort and stroke outcome.

**Trial registration number:** N/A

## AS07-119

### VALIDATION OF A NEW SCALE ALLOWING SYSTEMATIC EVALUATION OF INTRAPROCEDURAL PATIENT COMFORT DURING THROMBECTOMY

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**J. Jolteus**<sup>1</sup>, **M. Labrie**<sup>1,2,3</sup>, **M. Lapierre**<sup>2</sup>, **C. Odier**<sup>1,2,3</sup>,

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**Background and Aims:** In stroke patients with acute large vessel occlusion, endovascular therapy (EVT) may be performed with or without sedation. Our aim was to develop a pragmatic scale allowing systematic evaluation of intraprocedural patient comfort, and to evaluate its feasibility and interobserver agreement.

**Methods:** We performed a prospective observational single-center study of patients undergoing EVT at a tertiary stroke center. A 5-domain scale (vocalization, nausea/vomiting, body movements, vital signs, coping), each item scoring 0–2 points for a maximum total of 10 points (a higher score indicating greater discomfort), was used to assess patient comfort as perceived by the medical team. Patients were independently scored by the treating stroke nurse and vascular neurologist present during the procedure. Proportional scoring agreement and interobserver agreement (weighted kappa) were calculated for both overall scores and by domain using standard statistical procedures.

**Results:** Between October and December 2018, 58 patients underwent EVT. Overall, 50 patients were fully evaluated, while 8 were excluded due to at least one missing evaluation (86% completeness). The proportion of overall scoring agreement between evaluators was 82% (95%CI:69-91; κ = 0.55, 95%CI:0.29-0.82) including the domains vocalization (proportion of agreement 86%, 95%CI:73-94; κ = 0.71, 95%CI:0.51-0.92), nausea/vomiting (96%, 95%CI:85-99; κ = 0.48, 95%CI:0-1), body movements (71%, 95%CI:56-82; κ = 0.59, 95%CI:0.41-0.77), vital signs (71%, 95%CI:56-82; κ = 0.55, 95%CI:0.34-0.76), and coping (78%, 95%CI:64-88; κ = 0.50, 95%CI:0.28-0.72).

**Conclusions:** In patients undergoing EVT, a pragmatic scale evaluating patient comfort appears feasible and shows high proportional and moderate to substantial interobserver agreement between two independent evaluators.

**Trial registration number:** N/A

## AS07-121

### SELF-REPORTED INTRAPROCEDURAL PATIENT COMFORT DURING THROMBECTOMY WITHOUT PRIOR SEDATION

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**L. Gioia**<sup>1,2,3</sup>, **D. Iancu**<sup>4</sup>, **M. Labrie**<sup>1,2,3</sup>, **C. Odier**<sup>1,2,3</sup>, **J. Raymond**<sup>4</sup>,  
**A. Weill**<sup>4</sup>, **D. Roy**<sup>4</sup>, **D. Volders**<sup>4</sup>, **N. Daneault**<sup>1,2,3</sup>, **M. Lapierre**<sup>2</sup>,  
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**Background and Aims:** In stroke patients with acute large vessel occlusion (LVO), endovascular therapy (EVT) may be performed with or without sedation. Our aim is to describe self-reported intraprocedural comfort in patients undergoing EVT without prior sedation.

**Methods:** We are currently performing a prospective observational single-center study of patients undergoing EVT without prior sedation. Patients are systematically interviewed on the day following intervention using a structured questionnaire addressing 5 domains (nausea/vomiting, pain of any kind, physical discomfort, emotional discomfort, team interaction); each domain is scored 0–2 points for a maximum total of 10 points (a higher score indicating greater discomfort). In addition, satisfaction with procedural comfort is rated on a 0–100 point visual analog scale (VAS), and patients report whether they would have preferred more, less, or the same amount of sedation.

**Results:** The analysis includes 30 complete questionnaires from 56 patients who underwent EVT without prior sedation between October and December 2018. We excluded questionnaires that were either incomplete (14 patients with aphasia), or missing (12). The median score on the structured 5-domain questionnaire was 1 (IQR 0–2). On the VAS, average satisfaction with procedural comfort rating was 88 (SD ± 18.2). Patients were satisfied with the amount of sedation in 23 cases (77%), while 6 (20%) would have preferred more sedation and 1 (3%), less sedation.

**Conclusions:** Our findings suggest EVT without prior sedation seems to be well tolerated. Systematic self-evaluation of patient comfort appears feasible and may be integrated into clinical routine.

**Trial registration number:** N/A

## WITHDRAWN

**AS07-030**

**STROKE ETIOLOGY, INTRACRANIAL COLLATERAL STATUS AND OUTCOME IN ACUTE STROKE DUE TO LARGE VESSEL OCCLUSION IN THE ANTERIOR CIRCULATION**

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**Background and Aims:** Collateral status (CS) is a major determinant of clinical outcome after mechanical thrombectomy (MT) for large vessel occlusion (LVO) stroke. Little data exists on the influence of stroke etiology on CS. We hypothesized that patients with preexisting extracranial carotid stenosis (CAS) would have better CS compared to non-CAS patients, and furthermore investigated potential differences in MT-related adverse events and Outcome.

**Methods:** Over a 7-year period, we identified all anterior circulation MT patients (excluding extracranial carotid occlusion and dissection). Patients were grouped into those with CAS  $\geq 50\%$  and those without significant carotid stenosis (non-CAS). CS was rated on pre-treatment CT- or MR-angiography and categorized into absent/poor versus moderate/good according to the Tan Score. Post-interventional infarct size, adverse events (symptomatic intracranial hemorrhage, vessel re-occlusion) and 90-day functional outcome were assessed.

**Results:** Of 281 LVO stroke patients, this was related to CAS in 46 (16%). Compared to non-CAS strokes ( $n=235$ ), they occurred more often in men (52% versus 33%), tended to lower admission NIHSS (median: 14 versus 15), and more often had good CS (76% versus 46%). Intravenous thrombolysis rates, successful reperfusion, post-interventional infarct size and functional 90-day outcome were comparable between both subgroups. CAS LVO stroke patients more often had adverse events after MT (20% versus 6%).

**Conclusions:** Prior to intervention, CAS LVO strokes had increased collateral recruitment compared to non-CAS strokes. However, this was not associated with better functional 90-day outcome, which might be explained by a higher complexity of MT procedures and higher rate of post-interventional adverse Events.

**Trial registration number:** N/A

**AS07-126**

**ENDOVASCULAR TREATMENT IN M2-M3 OCCLUSIONS**

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**Background and Aims:** Endovascular therapy (EVT) is the standard of care for the treatment of large vessel occlusion strokes. Distal vessel occlusions can cause significant morbidity in terms of functional independence. Safety and efficacy of thrombectomy in M2-M3 occlusions are not well established yet.

**AS07-081**

**ASSOCIATION BETWEEN FUNCTIONAL OUTCOME AND TIME TO ENDOVASCULAR REPERFUSION IN PATIENTS WITH CLINICAL-DWI MISMATCH BY LARGE ARTERY OCCLUSION**

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**Background and Aims:** Our purpose was to evaluate the influence of onset-to-reperfusion (OTR) time by endovascular treatment (EVT) on clinical outcomes in stroke patients with clinical-diffusion mismatch.

**Methods:** Using a prospective stroke registry database, we identified consecutive ischemic stroke patients with anterior circulation large artery occlusion and clinical-diffusion mismatch, who were reperfused successfully by EVT (Thrombolysis in Cerebral Infarction grade 2b-3). The clinical-diffusion mismatch was defined as National Institutes of Health Stroke Scale (NIHSS) score  $\geq 8$  and diffusion-weighted imaging (DWI) lesion volume  $< 25$  mL. The frequency of good outcome (modified Rankin scale, 0-2) was compared between patients reperfused within an early time window and those with reperfusion within a late time window. Multivariable analysis was performed to determine independent predictors of good outcome.

**Results:** Among 86 patients with clinical-diffusion mismatch, 62 patients (mean age 67.2 years, 52.6% women) were treated with EVT with TICI 2b to 3 reperfusion. The rate of good outcome was higher in early reperfusion group (OTR time; 130–260 minutes) compared to in late reperfusion group (OTR time; 260–480 minutes) (71.4% vs. 41.7%,  $P=0.03$ ). DWI lesion volume and NIHSS score were not statistically different in two groups. In multiple regression analysis, OTR time (Odds ratio (OR), 0.73 per 15 minutes; 95% confidence interval (CI), 0.63-0.91) was independently associated with good outcome along with TICI 3 recanalization (OR, 7.61; 95% CI 3.05-30.7).

**Conclusions:** In patients with clinical-diffusion mismatch by large artery occlusion, earlier reperfusion by EVT from symptom onset is more beneficial.

**Trial registration number:** N/A

**Methods:** Brain Angiography and Stroke Centres (BASC) network is constituted by three strategically located comprehensive stroke centers that uses RAPID technology and provide services for Istanbul. Data of 837 acute ischemic stroke patients, admitted between October 2017 and September 2018, were prospectively recorded. The results of 37 patients with MCA M2-M3 segment occlusion who underwent endovascular treatment (EVT) were analyzed and compared to MCA M1 patients. Occlusions were demonstrated by BTA/MRA or DSA.

**Results:** Out of 249 patients that received EVT, 153 patients (116 in M1, 37 in M2-M3 group) were admitted and treated for MCA occlusion. There was no statistically significant difference in terms of demographics. Mean admission NIHSS score (M1:14+/-6, M2-M3:12+/-6; p:0.03) was higher in M1 patients. More intention to treat cases were noted in M2-M3 patients (M1:5.2%, M2-M3:22.5%; p:0.000) reflecting higher recanalization rate before EVT. Recanalization rate and procedure time were similar. Although not statistically significant the rates of good prognosis (3. months mRS 0-2)(M1 37% M2-M3 50% p:0.176) and hemorrhage (SITS-MOST) (M1 2.6% M2-M3 8.1% p:0.155) were higher while mortality rate (M1:24%, M2-M3:14%; p:0.247) was lower.

**Conclusions:** In our M2-M3 cohorts, outcome, complication and mortality trends of EVT are in line with the recently published meta-analysis.

**Trial registration number:** N/A

## AS07-034

### LOW RATE OF STROKE PROGRESSION IN PATIENTS WITH MINOR STROKE AND LARGE VESSEL OCCLUSION

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**Background and Aims:** Large vessel occlusion (LVO) in anterior circulation is present in up to 18% of patients with minor stroke. It is unclear which of these patients experience clinical worsening if mechanical thrombectomy (MT) is withheld. Purpose of our analysis was to investigate rate and risk factors for stroke progression in patients with LVO when MT was not performed.

**Methods:** The telemedical stroke network TEMPiS registry was searched for patients with LVO and mild clinical deficit (National Institute of Health Stroke Scale /NIHSS 0-5) in which MT was not performed between 01/2013 and 10/2018. We analyzed frequency of non-hemorrhagic clinical deterioration compatible with stroke progression in the area of the occluded artery (= increase in NIHSS >4) during hospital stay as well as patients' characteristics.

**Results:** Of 19 patients that were included, 2 (11%) showed clinical deterioration. Of these, 1 had left internal carotid artery (ICA)-occlusion, 1 left tandem-occlusion (ICA/M1 segment of middle cerebral artery). Clinical deterioration did not occur in patients with occlusions of M2-segments of the middle cerebral artery, nor of anterior or posterior cerebral artery. Patients with deterioration compared to those without were older (79y versus 72y), had more often onset beyond 4.5h (50% versus 29%) and had more often cardio embolic cause for stroke (50% versus 24%).

**Conclusions:** Rate of stroke progression in patients with minor stroke caused by large vessel occlusion was low. Age, time from onset, site of occlusion and stroke aetiology may be identifiable risk factors.

**Trial registration number:** N/A

## AS07-053

### DO PATIENTS WITH LARGE VESSEL OCCLUSION ISCHEMIC STROKE HARBORING PRESTROKE DISABILITY BENEFIT FROM THROMBECTOMY?

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**Background and Aims:** Patients with acute large vessel occlusion (LVO) ischemic stroke harboring substantial prestroke disability were excluded from randomized trials and evidence lacks whether endovascular treatment (EVT) is beneficial in this patient group.

**Methods:** Consecutive patients undergoing EVT for acute LVO ischemic stroke at the Sahlgrenska University Hospital from January 1, 2015 to March 31, 2018 were registered in the Sahlgrenska Stroke Recanalization Registry. Pre- and post-stroke functional levels were assessed by the modified Rankin Scale (mRS). Outcomes were recanalization rate (mTICI = 2b/3), complications (symptomatic intracranial hemorrhage [SICH] and other severe complications), return to prestroke functional level, and mortality at three months.

**Results:** Among 596 patients, 89 had prestroke disability (mRS >2). The latter group were older, more often female, had more comorbidities and higher NIHSS-score before intervention compared to patients without prestroke disability. Recanalization rates (80.1% vs 86.2%, p = 0.17), SICH (5.6% vs 8.7 % p = 0.33) and the proportion of patients returning to prestroke functional level (19.1% vs 22.9 % p = 0.430) did not differ between the groups. However, patients with prestroke disability had higher rates of other complications (53.5% vs 40.2% p < 0.05) and mortality at three months (48.2% vs 13.7% p < 0.001). Among patients with prestroke disability, mortality at three months did not differ between those with and without successful recanalization (46.2% vs 56.3%, p = 0.16). None of the no-recanalization patients returned to prestroke functional level.

**Conclusions:** Patients with prestroke disability and LVO treated with thrombectomy returned to prestroke functional level to the same extent as patients without prestroke disability. However, mortality was higher.

**Trial registration number:** N/A

## AS07-075

### THROMBUS CHARACTERISTICS AND RECANALIZATION RATES IN PATIENTS WITH MILD ISCHEMIC STROKE AND LARGE VESSEL OCCLUSIONS; INTERSECT MULTI-NATIONAL MULTI-CENTER PROSPECTIVE COHORT STUDY

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**Background and Aims:** Early neurological deterioration occurs in one third of mild ischemic strokes primarily due to the presence of a large vessel occlusion (LVO). We studied vascular occlusive patterns, thrombus characteristics and recanalization rates in mild strokes with LVO.

**Methods:** Amongst patients enrolled in the INTERSeCT multi-center prospective study of acute ischemic strokes with proven LVO, we compared clinical, thrombus characteristics and recanalization rates without endovascular treatment (EVT) in mild (NIHSS≤5) vs. moderate/severe strokes.

**Results:** Among 575 patients, 12.9% had a NIHSS ≤5 (median age 70.5 (63-79), 58% male, median NIHSS 4 (2-4)). As compared to those with NIHSS>5, mild patients had longer symptom-onset-to-CT (240 vs. 167 min) and CTA (246 vs. 172 min), different occlusion pattern (table), lower clot burden score [9 (6-9) vs. 6 (4-9)] and similar residual flow grade (grades I-II, 21% vs. 19%). Mild patients were less likely to receive IV alteplase (62% vs. 84%), but more likely to recanalize (rAOL2b and 3): 38% (46% with alteplase) vs. 26%. In multivariable modeling among mild patients, neither occlusion site nor alteplase treatment were associated with recanalization.

Intracranial Occlusion	NIHSS≤5 (%)	NIHSS>5 (%)
Intracranial ICA and proximal M1	13	47
Distal M1	16	18
M2	49	30
M3, ACA and PCA	22	6

**Conclusions:** Mild ischemic strokes have a higher prevalence of distal intracranial occlusions, less thrombus burden but similar thrombus characteristics to more severe strokes. Only 2.3 out of 5 mild patients recanalized with intravenous alteplase suggesting that better thrombolytics and/or EVT may be viable treatment options in this population.

**Trial registration number:** N/A

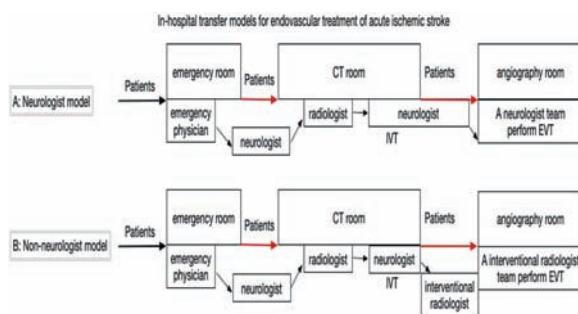
## AS07-097

### CHOICE OF IN-HOSPITAL TRANSFER MODELS FOR ENDOVASCULAR TREATMENT OF ACUTE ISCHEMIC STROKE: A PROPENSITY SCORE MATCHING ANALYSIS

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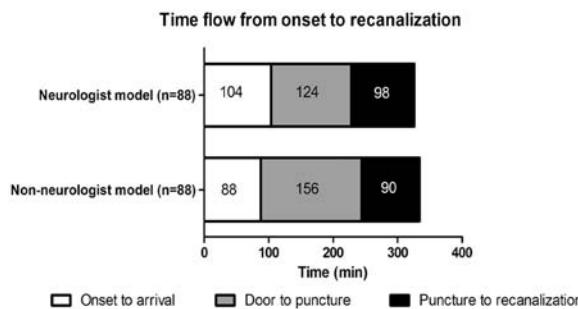
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**Background and Aims:** In-hospital transfer for acute stroke patients undergoing thrombectomy is important. In China there are two in-hospital transfer models. When a patient arrives, a neurologist performs an assessment and escorts the patient to have an CT and CTA examination. If eligible, the neurologist escorts the patient to the angiograph room to have an endovascular treatment (EVT) performed by the neurologist team. This model is called the Neurologist model. For the Non-neurologist mode, after image the neurologist consults an interventional radiologist who decides whether to perform EVT, and at last an interventional radiologist team treats the patient. This study aims to investigate the effects of these two different in-hospital transfer models on outcomes.



**Methods:** Patients were enrolled from the endovAsCular Treatment for acUte Anterior circuLation ischemic stroke (ACTUAL) registry, a retrospective and multicenter registry in China. Of 632 patients, 543 were treated with the Neurologist model and 89 were with the Non-neurologist model. We matched patients using propensity score matching (PSM) analysis.

**Results:** After matching, successful recanalization, symptomatic intracerebral hemorrhage, mRS at 90days and mortality did not differ between the two groups. However, a shorter door to puncture time (124[86–172] vs 156[120–215], P = 0.005), fewer passes (2[1–3] vs 2[1–4], P = 0.04), and a lower rate of passes >3 (11.4% vs 28.4%, P = 0.004) were observed in Neurologist model, as well as a lower asymptomatic intracerebral hemorrhage rate (aICH) (27.3% vs 43.2%, P = 0.045).



**Conclusions:** Both two models were effective for stroke patients. The Neurologist model decreased in-hospital delays and aICH risk. The Neurologist model may be a better option.

**Trial registration number:** N/A

## AS07-013

### EVALUATION OF THE EFFECTIVENESS OF CAROTID ARTERY STENTING IN PATIENTS WITH ACUTE ISCHEMIC STROKE

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**Background and Aims:** We evaluated the effectiveness of carotid artery stenting in patients with atherosclerotic ischemic stroke admitted for treatment outside the therapeutic window.

**Methods:** 120 patients with atherosclerotic ischemic stroke treated for the period from January 2017 to December 2018 were

retrospectively analyzed. First group: 56 patients with stenting of ICA (internal carotid artery) in the first 24 hours after stroke. Second (control): 64 patients who received only medication.

**Results:** Patients with stenting by 10 days had a significant improvement on NIHSS scale. By 21 days this result improves and average score drops. There was a significant increase in number of patients without or with minor disorders on RS (Rankin scale) by 10 days of treatment. In control group was a decrease in NIHSS score and an increase of patients without or with minor disorders. Hemorrhagic symptomatic transformation was in 10 patients who received stenting, and in 3 cases in control group. Mortality rate: 12.5% and 16% respectively. 3 patients in first group died from brain edema, combined with hemorrhagic transformation of parenchymal hematoma-I.

Demographic and baseline characteristics		With stenting, n=56	Without stenting, n=64
Age		58.8 ± 9.4	62.7 ± 6.0
Male gender		76%	72%
Atherosclerosis in symptomatic ICA > 70%		34 (61%)	24 (37%)
Atherosclerosis in symptomatic ICA 50-70%		20 (36%)	28 (44%)
Atherosclerosis in symptomatic ICA < 50%		2 (3%)	12 (19%)
Time from first symptom onset to admission to hospital in minutes		348 ± 24	384 ± 49
Treatment details			
NIHSS	1 day	11.4 ± 3.1 */**	14.0 ± 1.1
	10 day	5.8 ± 2.0 * p < 0.05	10.4 ± 2.4
	21 day	3.6 ± 2.1 ** p < 0.05	8.0 ± 1.1
RS 0-1 n (%)	1 day	4 (7%) *	8 (12%)
	10 day	18 (32%) * p < 0.05	13 (20%)
	21 day	20 (36%)	14 (22%)
RS 3-4 n (%)	1 day	10 (18%)	10 (15%)
	10 day	4 (7%)	7 (11%)
	21 day	4 (7%)	6 (9%)

**Conclusions:** Among patients who received carotid artery stenting by the 10th day there was positive dynamic and 32% did not have any disabilities. Patients without surgical treatment didn't have such dynamics. Despite the hemorrhagic transformation after endovascular treatment, mortality rate is lower than in patients who received only conservative traditional therapy. To assess the effectiveness of carotid artery stenting, further study of endovascular treatment experience of stroke at different time intervals from the onset of disease is required.

**Trial registration number:** N/A

## AS07-006

### EFFECT AND INTERVENTION OF PERIPHERAL BLOOD IMMUNE CHANGES ON BRAIN INJURY IN ACUTE STAGE OF ISCHEMIC STROKE

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**Background and Aims:** Ischemic postconditioning is a clinical strategy aimed at protecting the brain from subsequent, more serious ischemia-reperfusion insults. Ischemic postconditioning inhibit the invasion of inflammatory agents and further block secretion of pro-inflammatory cytokines and chemokines. We hypothesized that the clinical efficacy of

remote ischemic postconditioning (RIPC) for acute ischemic stroke involve effects on the peripheral immune system.

**Methods:** Circulating levels of IL-2, IL-4, IL-6, IL-10, IL-17aA, IFN-γ, and TNF-α; Th1/Th2 cellular ratios were assessed in 31 patients with acute ischemic stroke who were treated with RIPC for 7 days, and in 44 patients with acute ischemic stroke who were going through with basic treatment. Cytokines and cells were correlated to measures of inflammation and its effect on outcome assessed.

**Results:** The levels of peripheral blood inflammatory factor IL-6 and anti-inflammatory factor IL-10 have been at a high level 8D after ischemia. The levels of TNF-α and IFN-γ in patients also increased in 8D. The levels of 2D and 8D peripheral blood Th2 cells increased, while the level of Th2 after ischemia 3D do not change, and there was an upward trend on the 8th day. The level of peripheral blood Th17 increased significantly after ischemia, while the level of Treg cells in 8 D after ischemia remained below normal.

**Conclusions:** RIPC administered to the bilateral upper arms improved neurological function in patients with acute ischemic stroke. The mechanism of action may involve the regulation of peripheral pro-/anti-inflammatory cytokines and T-lymphocytes.

**Trial registration number:** N

## AS07-015

### ENDOVASCULAR TREATMENT IN PATIENTS WITH ACUTE STROKE WITH LVO IN THE VERTEBROBASILAR REGION – OUR EXPERIENCE FROM 2015–2018

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**Background and Aims:** Ischemic stroke in vertebrobasilar circulation includes 15–20% of all ischemic strokes. The most severe, basilar artery occlusion, leads to 85–95% mortality.

**Methods:** Using endovascular thrombectomy (EVT) for restoration of cerebral blood flow is the most effective reperfusion therapy. EVT has been extensively studied for anterior circulation strokes, leading to clear guidelines.

However patients with posterior circulation strokes had been excluded from pilot studies, there are few trials evaluating the benefit of clot retrieval in vertebrobasilar circulation strokes, but the results are uncertain.

Authors present an overview and analysis of 46 patients with acute stroke with LVO in the vertebrobasilar region treated with EVT from 368 stroke patients treated in our “high volume” comprehensive stroke center between the period of years 2015–2018.

**Results:** Authors evaluate rates of recanalization, efficacy and safety of endovascular treatment in posterior stroke circulation. Compare results of patients treated with EVT or intravenous thrombolysis in anterior and posterior circulation.

**Conclusions:** Mechanical thrombectomy for LVO in vertebrobasilar stroke is same effective as in anterior circulation in cohort of patients who do not meet the top criteria for MT.

**Trial registration number:** N/A

**AS07-076**
**ENDOVASCULAR COILING TRENDS AND HOSPITAL CHARACTERISTICS FOR TREATMENT OF UNRUPTURED ANEURYSM: US EXPERIENCE**

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**Background and Aims:** The majority of unruptured aneurysms are now being treated with endovascular coiling. Our objective was to determine if distribution and outcome of endovascular coiling is changing at the national level in terms of hospital characteristics.

**Methods:** Nationwide Inpatient Sample (years 2005–2014), was analyzed to identify patients using ICD 9 codes, with primary diagnosis of unruptured aneurysm and patients treated with endovascular coiling.

**Results:** A total of 55,338 unruptured aneurysms were treated by endovascular coiling, 90 % (n = 49,710) of which were performed at the teaching hospitals and this overwhelming split of treatment favoring teaching hospitals was demonstrated every year during study period. There was no difference in neurological complications (ischemic stroke, intracranial hemorrhage and subarachnoid hemorrhage) as well as systemic complications rate in teaching compared to non-teaching hospitals. Outcomes including mortality (0.54% versus 0/43%), Length of stay (2.7 days versus 2.8 days) and institutional care (4.54% versus 4.98%) were not different between groups however hospital charges were significantly higher at non-teaching hospital (\$ 96,295) compared to teaching hospital (90,814\$, p = 0.01). In both settings majority of the procedures (n = 41,212, 82.9%; n = 4920, 87.4%, p = 0.0004) were performed at large volume centers.

**Conclusions:** Even though overwhelmingly high number of procedures are done at teaching hospital in the United States, outcomes are comparable to non-teaching hospitals. Outcomes are probably determined by high volume of aneurysms treated at a hospital irrespective of its teaching status.

**Trial registration number:** N/A

**AS07-055**
**INTRACRANIAL HAEMORRHAGE AFTER EMERGENCY CAROTID ARTERY STENTING FOR ANTERIOR CIRCULATION STROKE THROMBECTOMY IS ASSOCIATED WITH WORSE FUNCTIONAL OUTCOME – COHORT STUDY**

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**Background and Aims:** Mechanical thrombectomy in anterior circulation stroke sometimes requires stenting of the internal carotid artery in tandem occlusions. In these conditions anticoagulant and antiplatelet therapy is indicated to ensure stent patency. This puts patients at additional risk for intracranial haemorrhage (ICH). We aim to compare functional outcome between patients with and without ICH after emergency carotid artery stenting for mechanical thrombectomy.

**Methods:** In this single-centre, retrospective cohort study, consecutive case records of patients with carotid stenting for mechanical thrombectomy were reviewed. Baseline characteristics and outcome measures were compared using univariate statistics.

**Results:** A total of 79 patients were included. ICH was detected in 38% (n = 30) of patients. Patients with ICH achieved favourable outcome significantly less often: Modified Rankin Scale at discharge was 0–2 in 3/30 (10%) patients with ICH vs 16/49 (33%) in patients without ICH (p = 0.02). Patients with ICH underwent significantly more neurosurgical interventions: 9/30 (30%) patients with ICH vs 2/49 (4%) patients without ICH (p = 0.01). Patients with and without ICH did not differ significantly in age, sex, NIHSS at admission, rates of thrombolysis or death.

**Conclusions:** Patients with carotid artery stenting for anterior circulation thrombectomy achieved low rates of favourable outcome even without ICH. When ICH occurred, favourable outcome was significantly less frequent. Patients with and without ICH did not differ in baseline characteristics. Further studies into the causes of ICH in this situation are warranted to better understand its causes and improve outcome.

**Trial registration number:** N/A

**AS07-096**
**ENDOVASCULAR TREATMENT IN PATIENTS WITH ASPECTS  $\leq 5$  IN BASAL CRANIAL CT**

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**Background and Aims:** Endovascular treatment for patients with ischemic stroke due to large vessel occlusion with ASPECTS  $\leq 5$  is not clearly established. The objective of our study is to analyze the results of safety and efficacy in this type of patients.

**Methods:** Retrospective analysis of a prospective cohort of patients undergoing endovascular treatment in our institution from July 2009 to March 2018, who presented with an ASPECTS  $\leq 5$ . The rates of TICI2B-3 recanalization, symptomatic intracranial haemorrhage (sICH), functional outcome and mortality are analyzed.

**Results:** 404 patients with ischemic stroke due to large vessel occlusion in carotid territory underwent endovascular treatment during the study period. Of these, only 39 had an ASPECTS  $\leq 5$ . The median age was 66 years (ICR 60–76), 53% were women and the median NIHSS was 20 (ICR 18–23). Forty-eight percent of patients received IV fibrinolysis prior to endovascular treatment. The median time onset to recanalization was 305 minutes (ICR 230–340). Successful recanalization rate (TICI2B-3) was achieved in 61.5%, with a sICH of 5.1%. TICI2B-3 was associated with better functional outcome at 3 months, achieving an mRS  $\leq 3$  of 41.7% vs 20%. With, functional independence (mRS  $\leq 2$ ) of 20.8% vs 6.7% and a reduction in mortality, 25% vs 40%. There were no significant differences in the sICH.

**Conclusions:** Endovascular treatment in patients with basal ASPECTS  $\leq 5$  is a safe procedure, with good functional results and a tendency to decrease mortality in patients with successful recanalization.

**Trial registration number:** N/A

**AS07-001**
**CT FINDINGS FOR THROMBECTOMY OF THE VERTEBRO-BASILAR ARTERY OCCLUSION IN ACUTE ISCHEMIC STROKE**

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**Background and Aims:**

**Introduction:** In cases of embolic occlusion, thrombectomy may be effective in the vertebro-basilar artery (VBA) as well as in the carotid or middle cerebral artery. There are probable computed tomography

(CT) findings to differentiate embolic-occlusion from atherosclerotic occlusion in the VBA.

**Methods:** We included in our retrospective study patients 1) who were admitted to our institution between January 1st, 2013 and July 15th, 2018, 2) who underwent emergency thrombectomy or percutaneous angioplasty of the VBA occlusion, and 3) who underwent pre-contrast CT(pcCT) and CT angiography (CTA). We defined Hyper-dense distal basilar artery sign (HD-dBA-sign) as high-density in the distal basilar artery (BA) in the pcCT and defined distal basilar-artery open sign (dBA-open-sign) as proximal occlusion but distal patency of the BA in the CT angiograms (CTAs). We evaluated patients' HD-dBA-sign, dBA-open-sign and the subtypes of embolic or atherosclerotic stroke. We determined the stroke subtypes according to angiographic findings during or after endovascular procedures.

**Results:** Twenty-five patients met our inclusion criteria and were analyzed. Eighteen patients had embolic occlusion, seven patients had atherosclerotic occlusion. The HD-dBA-sign in the pcCT scans was noted in 18 patients. Fifteen of the 18 patients with the HD-dBA-sign had embolic occlusion and three of the 7 patients without the HD-dBA-sign had embolic occlusion ( $p < 0.05$ ). The dBA-open-sign in the CTAs was noted in 9 patients. Seven of the 9 patients had atherosclerotic occlusion and no patients without the dBA-open-sign had atherosclerotic occlusion ( $p < 0.0001$ ).

**Conclusions:** HD-dBA-sign in the pre-contrast CT scans and dBA-open-sign in the CTAs can differentiate embolic-occlusion from atherosclerotic-occlusion in the vertebro-basilar artery.

Trial registration number: N/A

## AS07-042

### PERFUSION BASED SELECTION FOR MECHANICAL THROMBECTOMY WITHIN 6 HOURS FROM LAST KNOWN WELL; A RETROSPECTIVE SINGLE CENTER OUTCOME STUDY IN THE USA

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**Background and Aims:** There is clinical equipoise regarding the use of advanced imaging to select the appropriate acute ischemic stroke (AIS) patient with a Large Vessel Occlusion (LVO) for mechanical thrombectomy (MT) during the first 6 hours from symptom onset.

**Methods:** We retrospectively analyzed data from our comprehensive stroke center from 09/2016 to 09/2018. We identified 565 patients with AIS presenting < 6hrs from Last Known Well (LKW); patients without LVO and/or with incomplete data were excluded, leaving 188 for final analysis. Eighty-one patients underwent MT and 107 did not. We dichotomized our population into recanalized ( $\geq$ TICI 2b) and non-recanalized ( $\leq$ TICI2a, including those whom did not undergo MT).

**Results:** Functional independence, defined as MRS 0–2 at 90 days, was seen in 44% of the recanalized group, and 22% of the non-recanalized group (OR 2.72, 95% CI 1.40-5.25,  $p$ -value 0.002). Mortality rates of 25% vs. 49% were seen in the recanalized group as compared the non-recanalized group (OR 2.89, 95% CI 1.46-5.70,  $p$ -value 0.002). Discussion: The 2018 American Stroke Association guidelines state that perfusion imaging is not required < 6 hours from LKW. However, our center has utilized non-quantitative perfusion imaging to select patients for MT, regardless of time from LKW. Rates of functional independence (MRS 0–2) in our population are similar to published clinical trials which did not utilize perfusion imaging and less than the rates of functional independence in studies using quantitative perfusion.

**Conclusions:** Utilization of non-quantitative perfusion imaging for patient selection < 6hrs from LKW does not improve the proportion of patients achieving functional independence.

Trial registration number: N/A

## AS07-091

### FORGET SPAN-100 TO EXPAND STROKE THROMBECTOMY BENEFITS

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**Background and Aims:** Score for Stroke Prognostication Using Age and NIHSS Stroke Scale (SPAN) for patients treated with IV-tPA, indicated that SPAN-100-positive patients do not benefit from IV-tPA. We analyzed if this finding holds true for endovascular therapy.

**Methods:** Prospective registry (2017-2018) of patients with acute ischemic stroke and treated with thrombectomy. We dichotomized patients based on the sum of age and NIHSS, less or equal/greater than 100 (SPAN-100 positive), and analyzed the association among SPAN and clinical outcome.

**Results:** 521 consecutive patients with large vessel occlusion (70 yo, 55% male, 15.7 baseline NIHSS) underwent mechanical thrombectomy of which 107(20.5%) were SPAN-100 positive. Patients with SPAN positive were more frequently women (67.3 vs 32.7;  $p < 0.001$ ), older (median:84 vs 69;  $p < 0.001$ ), left hemispheric stroke (67.9% vs 50.1%;  $p=0.002$ ), had more arterial hypertension ( $p = 0.05$ ), atrial fibrillation ( $p = 0.05$ ), with higher baseline mRS(median:0(IQR: 0–1) vs 0(IQR:0-0)  $p < 0.001$ ) and higher pre-procedure NIHSS (22 vs 15;  $p < 0.001$ ). Intravenous thrombolysis rate was similar in both SPAN groups (38.7% vs 44%;  $p = 0.174$ ). There was no association with large vessel occlusion localization, number of passes, puncture times to recanalization, symptomatic intracranial hemorrhage, and successful recanalization rates (TICI 2b-3)(86% in SPAN-100 positive vs 91.3% ; $p=0.213$ ). At 90-days there was a trend to less independent patients in the SPAN positive group (mRS 0–2; 62.3% vs 41.3%,  $p = 0.05$ ). Mortality in SPAN positive was 25.5% vs 13.2% ( $p=0.006$ ).

**Conclusions:** Although poorer outcomes are to be expected in SPAN-100 positive group, the effect of mechanical thrombectomy may still afford a similar magnitude of benefit regardless of age and NIHSS.

Trial registration number: N/A

## AS07-019

### FLOW DIVERTER DEVICES IN RUPTURED INTRACRANIAL ANEURYSMS

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**Background and Aims:** Flow diverter devices (FDDs) are new generation stents placed in parent artery at the level of the aneurysm neck to disrupt the intra-aneurysmal flow thus favouring intracranial-aneurysmal thrombosis. The use of these stents is advisable mainly for unruptured

aneurysms, particularly those located at the internal carotid artery or vertebral and basilar arteries, for fusiform and dissecting aneurysms with large necks and low dome to neck ratio. The role of FDDs in treating ruptured aneurysms is less clear. In this multi centre series, we retrospectively evaluated the effectiveness, safety and midterm follow up results of ruptured aneurysms treated by implantation of a flow diverter device.

**Methods:** Out of total 94 patients who underwent FDD treatment for aneurysms in last six years, the records of 44 patients (19 male and 25 female) who presented with SAH due to the rupture of an intracranial aneurysm treated with an FDD were retrospectively reviewed. The average age at presentation was 48 years. Average WFNS score was 1.8. The mean delay between SAH and treatment was 4 days. Intraprocedural and periprocedural morbidity and mortality were recorded. Clinical and angiographic follow up evaluations were conducted between 6 and 12 months after the procedure.

**Results:** Two ruptured aneurysms rebled post treatment with FDD. Overall mortality rate was 9%. Overall morbidity rate was 12%. Follow up studies were available in 30 patients. Total occlusion of aneurysm was seen in 76.6% of patients.

**Conclusions:** FDDs can be used in patients with ruptured aneurysms where conventional neurosurgical or endovascular treatments can be challenging.

**Trial registration number:** N/A

## AS07-088

### THROMBECTOMY IN THE REAL WORLD: COMPARING OUTCOMES FOR PROCEDURES COMMENCED WITHIN AND AFTER FIVE HOURS SINCE SYMPTOM ONSET FOR ANTERIOR CIRCULATION OCCLUSIONS IN BELFAST

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**Background and Aims:** The HERMES meta-analysis of five thrombectomy trials suggested benefit up to 7.3 hours after symptom onset. Current UK national guidelines recommend intervention within 5 hours, although this may be considered up to 12 hours with advanced imaging selection. More recent trials suggest benefit up to 24 hours with careful patient selection.

This review compares outcomes of those who had thrombectomy commenced within five hours (early treatment, ET) versus those treated after five hours using imaging selection (late treatment, LT).

**Methods:** Data was collected for thrombectomy procedures for anterior circulation stroke from 2014 to 2017 inclusive. The primary outcome was modified Rankin Score (mRS) < 3 at 3 months.

**Results:** 185 patients underwent thrombectomy (118 ET, 67 LT). Baseline characteristics were similar in both groups. Mean age 70.6 (both groups), median NIHSS 16 (ET) v 15 (LT), male sex 46% (ET) v 36% (LT). More patients in the ET group received thrombolysis (67.8% v 17.9%, p < 0.001). Functional independence (mRS < 3) was 63.6% (ET) v 49.3% (LT), p = 0.058. Groin puncture to recanalisation time was shorter in ET group (40 v 52 min, p < 0.05). Mortality was lower in ET group (13.3% v 34.3%, p < 0.01). Symptomatic haemorrhage was similar (ET 3.4% v LT 1.5%, p = 0.44).

**Conclusions:** Approximately a third of patients were treated after 5 hours. Functional independence was similar in those treated before or after 5 hours. Mortality, but not symptomatic haemorrhage, was higher in

those treated late. A significant number of acute stroke patients may achieve good outcomes after late thrombectomy.

**Trial registration number:** n/a

## AS07-062

### BLOOD SAMPLING DISTAL TO THE OCCLUSIVE SEGMENT DURING THROMBECTOMY: AN EXPLORATIVE FEASIBILITY STUDY

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**Background and Aims:** Stent-retriever based thrombectomy and microcatheter guidance used during the procedure provides an opportunity for blood sampling distal to the site of occlusion. We explored metabolic changes within the ischemic tissue, by performing arterial blood gas (ABG) analyses from samples obtained beyond the occluded segment in patients with acute proximal vessel occlusion.

**Methods:** In patients undergoing mechanical thrombectomy, blood sampling was performed once the microcatheter completely traversed the thrombus. Simultaneously, another sample was obtained from radial artery to assess oxygenation and acid-base status of the body. ABG analyses were performed from local and systemic samples, and were evaluated in regards to stroke related metrics like admission NIHSS score, reperfusion status and clinical outcome.

**Results:** Our study population was comprised of 18 patients; the median (IQR) pH in local samples were significantly lower [7.40 (7.38-7.46) vs. 7.42 (7.39-7.46); p = 0.028] in comparison to systemic samples along with lower cHCO<sub>3</sub> levels [22 (21-23) vs. 23 (22-24); p = 0.074] and negative base excess [-3.0 (-3.9-1.1) vs. -1.7 (-3.3-0.1); p = 0.066]. There was no difference between the samples with respect to PaO<sub>2</sub>, PaCO<sub>2</sub>, electrolyte, glucose and lactate levels. Both local and systemic pH levels were inversely correlated with admission NIHSS scores (r = -0.56; p = 0.016 and r = -0.62; p = 0.006, respectively). None of the ABG parameters were related to angiographic or clinical outcome.

**Conclusions:** Blood sampling distal to the occluded segment is feasible during mechanical thrombectomy. Although ABG analyses provide little clinically relevant information, further refinement of this approach with detailed metabolomic analyses might provide an insight regarding ischaemia pathophysiology and treatment response.

**Trial registration number:** N/A

## AS07-063

### MECHANICAL THROMBECTOMY IN PATIENTS WITH MALIGNANCY RELATED STROKE

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**Background and Aims:** The role of mechanical thrombectomy in acute stroke cases with proximal vessel occlusion secondary to underlying cancer related hypercoagulability is not established. Some observations suggested higher rates of failed recanalization in these cases, without any significant difference in terms of clinical outcome when compared to rest of the thrombectomy population. We investigated whether procedural and clinical results of thrombectomy differed in patients suffering from an embolic stroke in the setting of a malignancy.

**Methods:** We extracted records of ischemic stroke patients treated with thrombectomy in our institution from our prospectively gathered database. We stratified the patients according to stroke etiology (malignancy associated stroke vs. others) and compared the procedure time

(duration between groin puncture and completion of procedure), reperfusion success and clinical outcome.

**Results:** Out of 113 patients treated with thrombectomy, we identified twelve (10.6%) cases with malignancy related stroke. Their age ( $67 \pm 12$  years), gender (F: 66%) and admission median (IQR) NIHSS score [21 (15-22)] was similar to those of remaining patients [age:  $67 \pm 15$  years; F: 62.3%; NIHSS: 19 (4-23)]. No significant difference between malignant and non-malignant groups was detected regarding median (IQR) procedure time [105 (65-125) vs. 94 (61-128) minutes;  $p = 0.75$ ], successful reperfusion rate (mTICI 2b, 2c or 3: 75% vs. 77.2%;  $p = 0.86$ ), or favorable clinical outcome (90-day mRS 0-2: 45.4% vs. 24.2%;  $p = 0.19$ ).

**Conclusions:** The procedural and clinical results of acute stroke thrombectomy is not different in cancer related stroke. Thus, we recommend not to refrain from thrombectomy procedure in patients with malignancy in the settings of acute ischemic stroke.

**Trial registration number:** N/A

### AS07-031

#### MIDDLE CEREBRAL ARTERY STENTING IN HYPERACUTE ISCHEMIC STROKE: SINGLE CENTER EXPERIENCE

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**Background and Aims:** Current guidelines for treatment of acute ischemic stroke recommend mechanical thrombectomy (MT) in selected patients with large vessel occlusion. Atherosclerotic occlusions of the middle cerebral artery (MCA) frequently reocclude after thrombectomy, and require additional angioplasty and stenting. However, the safety and effectiveness of acute intracranial stenting is not yet proved. We aimed to describe our experience with acute MCA stenting as rescue therapy in hyperacute ischemic stroke.

**Methods:** We retrospectively selected, from our prospective registry, acute stroke patients with MCA occlusion, who underwent MT and intracranial stenting as rescue therapy. The degree of recanalization, clinical variables and outcome at 3 months were described, as well as safety parameters [procedure complications and symptomatic intracranial hemorrhage (sICH)].

**Results:** In our center, 820 patients underwent MT from January 2016 to December 2018. Recurrent re-occlusion after thrombectomy of an MCA occlusion occurred in 6 patients, requiring intracranial stenting. A loading dose of aspirin and a glycoprotein IIb/IIIa receptor inhibitor were acutely administered. Mean age was  $66 \pm 15.2$ , mean NIHSS was  $11 \pm 8.8$ , and median ASPECTS was 8.5. All patients had successful recanalization [thrombolysis in cerebral infarction (TICI) score 2b/3]. There were no procedural complications, but one patient with late stent occlusion and sICH. Three-month follow-up was available in 5 patients with no mortality, two patients with mRS = 3, but only one had mRS3 (mRS = 1).

**Conclusions:** Intracranial stenting as a rescue therapy in acute MCA occlusions is infrequent, however appears to be feasible and safe. Additional studies are warranted to evaluate the benefits in outcome for patients undergoing hyperacute intracranial stenting.

**Trial registration number:** N/A

### AS07-048

#### REPEATED ENDOVASCULAR THROMBECTOMY IN ACUTE ISCHEMIC STROKE PATIENTS: A CASE SERIES

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**Background and Aims:** Acute ischemic stroke patients treated with endovascular thrombectomy (EVT) may be treated with repeat EVT in case of recurrent large vessel occlusion (LVO). The risk of recurrent LVO after EVT is unclear but could be significant in this high-risk vascular group. Our aim is to report on frequency, timing and outcome of repeated EVT in a large nation-wide multicenter registry.

**Methods:** In the Netherlands, EVT treated stroke patients have been registered since 2002 (MR CLEAN pre-trial registry, MR CLEAN trial and MR CLEAN Registry). We retrospectively reviewed these databases for anterior circulation repeated EVT cases. Patient characteristics, procedural data, and functional outcome (modified Rankin Scale (mRS) at 90 days) were analyzed.

**Results:** In our database, of 4307 patients treated between 2002 and 2017, 28 (0.65%) had undergone repeated EVT. Median time between first and second procedure was 59 (1-1122) days. Cardioembolism was the most common etiology (14 out of 28 patients (50%)). In 18 out of 28 patients (64%) the recurrent occlusion occurred ipsilateral to the previous occlusion. At 90 days after last EVT procedure, 41% of the patients achieved functional independence (mRS 0-2), and 33% had died. Adverse events were relatively low; 2/28 (7%) intracranial hemorrhage, 2/28 (7%) pneumonia.

**Conclusions:** In our dataset, 28 patients had undergone repeated EVT. Most of the patients suffered from cardiovascular comorbidity. Recurrent LVO occurred mostly ipsilateral. In daily practice, repeated EVT is safe and likely has similar benefit compared to single treated cases.

**Trial registration number:** N/A

### WITHDRAWN

information. Predictors of delayed stent thrombosis and of clinical outcome at discharge were analyzed using univariate and multivariate analyses.

**Results:** We identified 81 patients treated for tandem lesions (63(77.7%) atheroma, 17(20.9%) dissection, 1(1.2%) carotid web). TICI 2b-3 recanalization was achieved in 70(86.4%) cases. Thirty-five patients (43.2%) were independent (modified Rankin scale  $\leq 2$ ) at discharge.

Among 73 patients with intracranial recanalization and patent stent at the end of the procedure, delayed stent thrombosis was observed in 14(19.1%).

Stent occlusion rates were 11/39(28.2%) for peri-procedural aspirin treatment versus 3/34(8.8%) for aspirin and clopidogrel ( $p = 0.04$ ).

Delayed stent thrombosis was independently associated with higher admission NIHSS score (OR 1.1;95%CI 1.01-1.28), diabetes (OR 6.07;95%CI 1.2-30.6) and presence of in-stent thrombus on the final angiographic run (OR 6.2;95%CI 1.4-27.97). Delayed stent thrombosis (OR 19.78;95%CI 2.78-296.83), higher admission NIHSS score (OR 1.27;95%CI 1.12-1.51) and symptomatic hemorrhagic transformation (OR 23.65;95%CI 1.85-3478.94) were independent predictors of unfavorable clinical outcome at discharge.

**Conclusions:** We observed a non-negligible rate of delayed stent thrombosis with significant negative impact on clinical outcome. Future studies should systematically measure and report stent patency rates.

**Trial registration number:** N/A

## WITHDRAWN

### AS07-068

#### DIMINISHED LIKELIHOOD OF FAVORABLE STROKE OUTCOMES FOLLOWING ENDOVASCULAR THERAPY IN OCTOGENARIANS

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**Background and Aims:** Randomized controlled trials data suggest a benefit of endovascular therapy (EVT) in older patients with anterior circulation large vessel occlusion (acLVO), real world evidence is lacking. We aimed to explore the likelihood of favorable stroke outcome in octogenarians undergoing EVT for acLVO.

**Methods:** We prospectively studied ischemic stroke patients  $\geq 80$  years who were considered for EVT due to acLVO at our tertiary stroke center (01/2016-06/2018). We compared clinical characteristics and efficacy outcomes including 90-days functional independence (mRS 0-2) and 90-days survival among patients who underwent EVT and those who did not.

**Results:** 185 patients  $\geq 80$  years were screened for EVT during the 30-months period: median age was 84 years (IQR, 82-88); 30% were men; median NIHSS was 18 (IQR, 14-21) points. Of these patients, 97 (52.4%) were treated for proximal acLVO. The main reasons to withhold EVT were large infarct size (54.6%), recanalization (30.7%), unknown time window (5.7%), lack of perfusion mismatch or collaterals (4.5%) and early clinical improvement (2.3%). There were no differences according to vascular risk factors, baseline imaging and clinical variables. There was a non-significant trend toward survival (50.6% versus 37.3%,  $p = 0.09$ ) but not functional independence (9.9% versus 5.3%,  $p = 0.39$ ) at 90 days in patients who underwent EVT compared with the non-EVT group. In the multivariable model, favorable outcomes were not predicted by pre-stroke disability, stroke severity, infarct size or treatment with intravenous tPA.

**Conclusions:** While age alone should not exclude patients from endovascular therapy, diminished likelihood of favorable outcomes may challenge postacute stroke care in octogenarians.

**Trial registration number:** N/A

### AS07-069

#### HOW MANY PATIENTS WITH ACUTE ISCHEMIC STROKE ARE ELIGIBLE TO APPLY DAWN AND DEFUSE 3 MISMATCH CRITERIA? RESULTS FROM A PROSPECTIVE STROKE CENTER DATABASE

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**Background and Aims:** The DAWN and DEFUSE 3 trials have select patients with anterior circulation large vessel occlusion (acLVO) for EVT beyond 6 h from symptom onset. We sought to determine how many patients qualify to apply DAWN or DEFUSE 3 imaging criteria.

**Methods:** We analyzed patients (01/2016 to 12/2017) screened for EVT from our prospective database. We identified patients with onset-to-CT time 6-24 hours, age  $> 18$  years, pre-morbid mRS score  $\leq 1$ , NIHSS score  $\geq 10$  (DAWN); or onset-to-CT time 6-16 hours, age 18-90 years, pre-morbid mRS score  $\leq 2$ , NIHSS score  $\geq 6$  (DEFUSE-3), respectively. Of these, we identified patients with acLVO on CTA and early

ischemic changes (EIC) on NCCT in  $\leq 1/3$  of the middle cerebral artery territory or NCCT-ASPECTS  $> 6$ , respectively.

**Results:** Among 1011 patients, 363 patients (36%) had onset-to-CT times between 6–24 hours and 244 patients (24%) between 6–16 hours. In the 6–24 hour cohort, 62 patients had an NIHSS score  $\geq 10$ , 30 acLVO, 16 premorbid mRS  $\leq 1$ , 7 EIC  $\leq 1/3$  of the MCA territory. In the 6–16 hours cohort, 69 patients had an NIHSS score  $\geq 6$ , 33 acLVO, 27 premorbid mRS  $\leq 2$ , 14 NCCT-ASPECTS  $> 6$ . Only 15 patients (1.5%) of the complete cohort fulfilled criteria to apply advanced imaging criteria based on DAWN or DEFUSE-3 trials, of whom 10 patients received perfusion CT and 8 patients subsequent EVT. Among 320 patients with EIC  $\leq 1/3$  of the MCA territory, no acute vascular imaging was performed in 108 patients.

**Conclusions:** Only a minority (1.5%) of patients would have qualified to apply advanced imaging criteria based on DAWN or DEFUSE-3 trials.

**Trial registration number:** N/A

## AS07-070

### DOOR-IN-DOOR-OUT TIME IS NOT ASSOCIATED WITH ELIGIBILITY FOR ENDOVASCULAR THERAPY OR FUNCTIONAL OUTCOME IN PATIENTS WITH ACUTE ISCHEMIC STROKE WHO ARE TRANSFERRED FOR EVT

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**Background and Aims:** Extern procedure time is an important quality marker for patients with an acute ischemic stroke who are transferred for endovascular therapy (EVT). We sought to determine whether the door-in-door-out time in spoke hospitals is associated with the performance of EVT at the hub site and functional outcome in a stroke-network.

**Methods:** We analyzed consecutive patients (01/2016 to 12/2018) from our prospective database who had an acute proximal anterior circulation large vessel occlusion (acLVO) and were transferred to our neurovascular center to be screened for potential EVT. We determined door-in-door-out times at the referring hospitals and analyzed their association with the percentage of patients in whom EVT was performed after repeated imaging at our center and 90-days favorable functional outcome (mRS scores 0–2).

**Results:** Of 360 patients (median age 76 years, 48% female, median NIHSS score 17) who were transferred from remote hospitals for potential EVT, the median door-in-door-out time was 110 minutes (IQR; 49). Among 184 patients with door-in-door-out-time  $\leq 110$  minutes (median time 87 minutes, IQR 27), 112 patients (60.9%) underwent EVT and 56 patients (30.4%) had a favorable outcome. The EVT rate (96/176; 54.5%) and percentage of patients with a favorable outcome (58/176; 33%) was similar among patients with a door-in-door-out time  $> 110$  minutes ( $p = 0.24$  and  $p = 0.65$ , respectively)

**Conclusions:** Door-in-door-out time was not associated with EVT-rate and favorable functional outcome in patients who were transferred for potential EVT in our stroke network.

**Trial registration number:** N/A

## WITHDRAWN

## AS07-072

### FIRST PASS EFFECT SHOULD BE THE NEW GOLD STANDARD OF MECHANICAL THROMBECTOMY. A CLINICO-PATHOLOGICAL STUDY

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**Background and Aims:** The goal of mechanical thrombectomy (MT) should be to achieve fast and complete recanalization of the occluded vessel. Recently a new measure for thrombectomy devices has been introduced: the first pass effect (FPE). FPE is defined as a single pass/use of the device, effective revascularization of the large vessel occlusion (LVO) and no need for rescue therapy. The purpose of this study is to evaluate if there are differences in functional outcomes in patients achieving FPE, to evaluate the correlation between FPE and histopathological analysis of the clot and other factors that may predict FPE in our series of MT.

**Methods:** Retrospective analysis of a prospective database of patients harboring ischemic stroke with anterior LVO treated with MT. The association between FPE, good functional outcome (mRs  $\leq 2$ ) at three months and the histopathological analysis of clot was established. Clinicoradiological variables considered potential predictors of FPE and variables related with functional outcome were included in the multivariate analysis.

**Results:** 117 patients were included. FPE was achieved in 65 (55.5%) and was associated with red clots in the histological study ( $p = 0.038$ ). Hyperdense cerebral arteries were significantly more frequent in patients

with red and mixed clots ( $p = 0.033$ ). In multivariate analysis FPE patients showed the best functional prognosis (OR 2.23; 95% CI 1.037-4.83,  $p = 0.05$ ); an independent predictor of FPE was intravenous thrombolysis (OR 6.249; 95% CI 1.77-22.02,  $p = 0.004$ ).

**Conclusions:** First pass effect was an independent predictor of good clinical outcome and related to histological composition of the clots. Intravenous thrombolysis was the highest predictor of FPE.

**Trial registration number:** N/A

## AS07-113

### DIRECT MECHANICAL THROMBECTOMY IN THROMBOLYSIS ELIGIBLE STROKE PATIENTS: THE OPTIMUS PRIME STUDY

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**Background and Aims:** Whether intravenous thrombolysis (IVT) prior to mechanical thrombectomy (MT) may provide benefit over direct MT remains unclear. We aimed to compare consecutive tPA eligible stroke patientstreated with IVT prior to MT (IVT+MT) or with optative direct therapy (ODT) in our centre.

**Methods:** The OPTIMUS PRIME (OPTative Treatment in MCA acUte Stroke with PRIMary thrombEctomy) study was a retrospective analysis of consecutive patients with acute stroke undergoing MT in our centre from January 2012 to December 2017. Patients with contraindications to IVT were excluded. We compared periprocedural times, recanalization rates, complications and functional outcome between patients treated with ODT and IVT+MT. Data were collected prospectively.

**Results:** N = 140. ODT = 33 (23.6%). NIHSS score on admission: median 18 (7-15IQR). Post-treatment TICI score 2b-3:85%. Main reasons for ODT were immediate availability of MT (51.5%) and tandem occlusion (30.3%). ODT was associated with shorter time from symptoms onset to recanalization (median 150 minutes (90IQR) versus 275 minutes (125IQR) for IVT+MT;  $p < 0.001$ ) and lower rate of hemorrhagic complications (18.6% versus 46.7% for IVT+MT;  $p < 0.01$ ). No significant differences were found in number of attempts required to complete recanalization, successful recanalization rates, functional outcome and mortality. When we analysed the subgroup of patients with M1 segment occlusion, follow-up infarct volume was lower in the ODT group (median 4.6 (8.8IQR) vs 7.85 (19.5IQR) for IVT+MT;  $p < 0.05$ ).

**Conclusions:** ODT may offer comparable efficacy as compared with IVT+MT. It might lead to shorter recanalization times when MT is immediately available and a reduction in the risk of intracranial hemorrhage. Randomized controlled trials are warranted.

**Trial registration number:** N/A

## AS07-117

### MECHANICAL THROMBECTOMY IN ANTERIOR CIRCULATION STROKE: ARE M1 AND M2 OCCLUSION REALLY DIFFERENT?

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**Background and Aims:** Whether mechanical thrombectomy (MT) is equally safe and effective in patients with occlusion of the M2 segment of the middle cerebral artery (MCA) compared with M1 remains unclear.

We aimed to compare outcomes and complications from MT of M2 segments with those of M1 segment.

**Methods:** Retrospective study of consecutive patients with acute stroke treated with MT in our centre from January 2012 to December 2017. We compared technical aspects and functional outcome between patients with M1 and M2 occlusions. We performed a subgroup analysis to identify differences between superior and inferior division, dominant and nondominant M2 branch occlusions. Data were collected prospectively.

**Results:** N = 295. M2 occlusion = 17.6%. Patients with M2 occlusion presented with lower mean NIHSS scores ( $p < 0.001$ ), longer time to recanalization ( $p < 0.05$ ) and there was a trend towards higher risk of subarachnoid haemorrhage ( $p = 0.058$ ) after MT. No significant differences were found in successful recanalization rates, follow-up infarct volume, and functional outcome. Subgroup analysis showed a better mRS3m in patients with inferior M2 division occlusion (median mRS3m 1(1-4) versus 2(1-2.8) for M1 [ $p = 0.02$ ]). No differences were found between dominant and nondominant M2 division occlusions as compared to M1 occlusions.

**Conclusions:** In our study, although clinical presentation was milder in the group of patients with M2 occlusion, functional outcome after MT were similar as compared to M1. The prognosis could be better when the inferior M2 division is occluded. MT in M2 occlusions could be technically more difficult but probably similar in efficacy and safety, so it should be seriously considered in these patients.

**Trial registration number:** N/A

## AS07-056

### FREQUENCY AND REASONS TO DECIDE AGAINST THROMBECTOMY AFTER SECONDARY TRANSFER FROM A PRIMARY STROKE CENTER TO A COMPREHENSIVE STROKE CENTER

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**Background and Aims:** Patients with acute stroke due to large vessel occlusion (LVO) are currently transferred from primary stroke centers (PSC) to comprehensive stroke centers (CSC) to receive endovascular treatment (EVT). However, often procedure is finally not performed. Our aim was to determine frequency and reasons to withhold EVT.

**Methods:** We retrospectively collected data from 2018/02-2018/12 for patients transferred from 11 PSC participating in the telestroke network TEMPIs (Germany) to 5 CSC for EVT. Patients had acute ischemic stroke with CTA-confirmed LVO and symptom onset < 6h (anterior circulation) or < 24h (posterior circulation). EVT was indicated centrally via telemedicine.

**Results:** A total of 105 patients fulfilled inclusion criteria and were transferred to CSC. Imaging was repeated in 59% (n = 62/105) at arrival. Among all 32% (n = 34/105) did not receive EVT. Reasons to decide against EVT after arrival in CSC were recanalization of occluded artery (n = 18/34), large hypodensity in repeated computertomography scan (n = 7/34), no remaining mismatch in perfusion imaging (n = 1/34), thrombus migration in distal part of artery (n = 2/34), refusal of patient (n = 3/34), clinical improvement without recanalization (n = 1/34), intracerebral hemorrhage (n = 1/34) and no accessibility of occluded artery (n = 1/34).

**Conclusions:** Rate of transfers not resulting in EVT is high, more frequently due to improvement (20%; including recanalization, thrombus

migration, clinical improvement) than to deterioration (10%, including large hypodensity, no remaining mismatch). Predictors will need to be determined to avoid unnecessary transfers. Moreover, as early deterioration is mostly caused by time lost during transfer, new facilities and network structures are needed to ensure accessibility of EVT for eligible patients in PSC.

**Trial registration number:** N/A

## AS07-052

### CAROTID STENT OCCLUSION AFTER EMERGENT STENTING DURING NEUROTHROMBECTOMY: FREQUENCY, PREDICTORS AND CLINICAL RELEVANCE

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**Background and Aims:** Emergent stenting placement is an extended strategy for the treatment of carotid occlusions. Our aim was to investigate the frequency, predictors and clinical relevance of extracranial carotid stent occlusion after acute stenting during neurothrombectomy.

**Methods:** Data from 99 patients treated with emergent stenting of carotid occlusions were retrospectively analyzed from a single-center prospective registry. Carotid stent occlusion was defined as complete occlusion in post-procedural vascular imaging. Pretreatment, procedural and outcome variables (including final infarct volume and 90-day clinical outcome) were recorded and analyzed through logistic regression.

**Results:** A total of 22 of the 99 included patients (22%) had stent occlusion in follow-up vascular imaging. In multivariate analysis the variables independently associated with stent occlusion were a lower use of post-stent placement angioplasty (adjusted-OR = 13.2, 95%CI = 2.59-67.05, p = 0.002) as well as the degree of residual stenosis (adjusted-OR = 2.2, 95%CI = 1.37-3.56, p = 0.001) and an mTICI score 0-2a (adjusted-OR = 7.9, 95%CI = 1.02-60.7, p = 0.048) at the end of the endovascular procedure. Stent occlusion at follow-up was independently associated with poorer ordinal distribution of the 90-day modified-Rankin scores (adjusted-OR = 3.9, 95%CI = 1.32-11.28, p = 0.014) and with an increased risk of symptomatic intracranial hemorrhage (OR = 12.0, 95% CI = 1.18-121.91, p = 0.035). Final infarct volume was higher in those patients with stent occlusion and poorer intracranial vessel patency (TIMI < 3) at follow-up MRI (p = 0.024).

**Conclusions:** Carotid stent occlusion after emergent stenting of acute extracranial carotid symptomatic occlusion during neurothrombectomy is not infrequent and may lead to poor outcomes. Further investigation is warranted for the evaluation of strategies aimed to prevent carotid stent occlusion.

**Trial registration number:** N/A

## AS07-077

### GREATER INFARCT GROWTH-LIMITING EFFECT OF MECHANICAL THROMBECTOMY IN STROKE PATIENTS WITH POOR COLLATERALS

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**Background and Aims:** Stroke patients with good collateral circulation achieve the best recovery after mechanical thrombectomy (MT), but

strict imaging selection may leave untreated patients that could benefit from MT. We assessed whether the extent of collaterals had modifying effects on the amount of ischemic tissue saved from infarction with MT over best medical treatment (BMT).

**Methods:** Single-center cohort of consecutive patients (n = 339) with proximal occlusions in the carotid territory. Patients were categorized according to a 4-category scale in CT-angiography as having good (scores 2-3) or poor (scores 0-1) collaterals. The primary outcome measure was the interaction between collaterals and MT on infarct growth. The secondary outcome assessed the treatment effect of MT over BMT on functional status in relation to the collateral status. The safety outcomes were mortality and symptomatic intracranial hemorrhage.

**Results:** Collaterals had a modifying effect of MT on infarct growth (p = 0.004), with greater reduction in 96 patients with poor collaterals (38.8 ml) than in 243 patients with good collaterals (1.9 ml). There was also a significant (p < 0.001) interaction between the effect of MT and functional outcome in relation to the collateral status, with more benefits of MT in patients with poor collaterals. MT was associated with lower mortality than BMT in patients with poor collaterals only.

**Conclusions:** Compared to BMT, the use of MT in large vessel stroke results in a more substantial limitation of infarct growth in patients with poor collaterals.

**Trial registration number:** N/A

## AS07-136

### THROMBECTOMY IN LVO STROKE –DOES AGE MATTER?

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**Background and Aims:** The role of endovascular treatment (EVT) in large vessel occlusion (LVO) stroke in the elderly is still uncertain. There is some evidence that a strict upper age limit seems unjustified. Our primary aim was to assess the role of age in respect of neurological improvement and long-term outcome adjunct to EVT.

**Methods:** 236 patients were treated with EVT for LVO stroke. The clinical outcome was assessed using the National Institutes of Health Stroke Scale (NIHSS), long-term clinical outcome was assessed by modified Rankin scale (mRS). Linear regression analyses and partial regression plots with locally estimated smoothing were used to study the roles of clinical and procedural variables in prediction clinical outcome.

**Results:** NIHSS at admission was 17 (range 0 – 41), after EVT 13 (range 0 – 41) and at dismissal 6 (range 0 – 24). The initial response to EVT was unaffected by age (p = 0.28, Figure 1). Median mRS at three months was 3 (range 0 – 6); adjusting for other clinical variables, higher age was associated with increasing mRS (p < 0.001, Figure 2). When excluding patients dying within three month after their stroke this association was attenuated (p = 0.040, Figure 3), after adjustment for procedural outcomes absent (p = 0.43). Factors associated with long-term functional outcome were history of stroke, successful technical reopening, stroke-severity and age.

**Conclusions:** Age seems not to be associated with worse neurological improvement in patients with LVO stroke, treated with EVT. Yet, in the elderly the initial neurological improvement does not translate into likewise good functional outcome at 3 month.

**Trial registration number:** N/A

**AS07-095****STENT RETRIEVERS PREVENT DISTAL EMBOLISM EFFECTIVELY DURING MECHANICAL THROMBECTOMY****C. Riedel<sup>1</sup>, L. Naomi<sup>1</sup> and O. Jansen<sup>1</sup>**<sup>1</sup>UKSH- Kiel Campus, Dept. of Radiology and Neuroradiology, Kiel, Germany

**Background and Aims:** The purpose of this study was to determine whether mechanical thrombectomy by distal aspiration alone is more likely to result in peripheral embolism compared to distal aspiration used with retriever stents.

**Methods:** We analyzed the initial nonenhanced CT (NECT) images, Computed tomography angiograms and interventional DSA images of 132 patients with an acute ischemic stroke in the anterior cerebral circulation who were treated using mechanical thrombectomy with either distal aspiration alone or with distal aspiration during retriever stents maneuvers. Clot representations were first segmented from thin-slice NECT reconstructions and superimposed on the CTA images in order to determine the initial position of the clot. In the next step, the DSA images were registered with the CT angiograms using a 3D/2D registration technique. Using these image registrations, distal emboli that occurred during thrombectomy were separated from those that were already identifiable before the intervention.

**Results:** Fifty-one of our patients were treated with distal aspiration alone, the remaining 81 patients were treated with distal aspiration during retriever stent maneuvers. In 14 (27%) of the patients treated only with distal aspiration distal emboli not present in the initial CT angiograms were identified. In the patients treated with stent retrievers and distal aspiration, only 7 patients (9%) had distal emboli that were attributed to the recanalization procedure.

**Conclusions:** Stent retrievers form a barrier for clot fragments that form during the retrieval maneuver. Thus, they are effective protection devices preventing distal embolism during mechanical thrombectomy.

**Trial registration number:** N/A**AS07-093****CLINICAL RESULTS OF A PILOT PROGRAM FOR MECHANICAL THROMBECTOMY IN STROKE IN THE PUBLIC HEALTH SYSTEM IN SANTIAGO – CHILE.**

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**Background and Aims:** Mechanical Thrombectomy (MT) is a standard of care in stroke with large vessel occlusion (LVO). Chile is a developing country in which MT is still not globally funded and implemented in the public health system. We started a pilot program with the government to guarantee access to MT in a metropolitan area of Santiago. The purpose of this study is to show the results of this protocol.

**Methods:** We developed a network with a single MT center (Instituto de Neurocirugía Dr. Asenjo -INC-) and five primary stroke centers (PSC) using a drip and shift model. We performed a descriptive transversal analysis of our results between 20/09/2017 and 12/01/2019, using Stata SE 13.0

**Results:** We treated 56 patients, with ages ranging from 30–83 years old, mainly females (32/56). 42/56 patients received IV thrombolysis at PSC. Mean NIHSS at admission was 17 points. The main occluded vessel

segment was middle cerebral artery M1 (27/56). We received 6 tandem and 10 T type occlusions. All patients were treated using a stentriever with 51/53 good vessel opening (TICI 2B-3). NIHSS at 24h dropped to a mean of 10 point ( $p < 0.05$ ). Two patients presented with symptomatic intracranial hemorrhage and two other went to craniectomy after malignant hemispheric infarct. 4/56 died during evolution and follow up.

**Conclusions:** Our clinical results in MT are consistent with other international experiences. We developed a stroke attention model that suits and fulfill the local needs. We are willing to expand MT to all the public health network in our country.

**Trial registration number:** N/A**AS07-127****MECHANICAL THROMBECTOMY FOR ACUTE BASILAR ARTERY OCCLUSION: A CASE SERIES**

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**Background and Aims:** Acute basilar artery occlusion (BAO) is associated with high mortality and poor outcome. Early recanalization has been demonstrated to be the major goal of acute ischemic stroke treatment. After intravenous thrombolysis (IVT) early recanalization in BAO occurs only in 13% with high poor-outcome-rates. The efficacy and therapeutic window of mechanical thrombectomy (MT) for BAO has not yet been established.

**Methods:** We retrospectively analyzed thirteen BAO consecutive patients admitted to our centre within the last 12 months.

**Results:** Mean age was 64 years and median admission-NIHSS was 23. Two patients have proximal BAO, three have middle BAO and eight have distal BAO. In eight cases collateral flow through posterior communicating artery was observed. MT was performed in twelve patients, four performed also IVT and one patient only IVT. Successful recanalization (TICI $\geq$ 2b) was achieved in eleven patients. The median onset-to-recanalization-time (OTR) was 9 hours. One artery dissection and three embolization in posterior cerebral artery occurred. No symptomatic hemorrhages were observed. Despite of good recanalization rate (92%), five patients had poor outcome (mRS  $>3$ ) and five died. Only one patient had excellent outcome (mRS 0), because of young age, low admission-NIHSS and good collateral flow.

**Conclusions:** Age, admission-NIHSS, collateral flow, patient selection based on magnetic resonance (MR) and OTR are all predictors of good outcome. Our data confirmed only admission-NIHSS as good outcome predictor, but our OTR was longer than reported in literature and we do not systematically use MR for patient selection, probably explaining our high rate of poor outcome.

**Trial registration number:** N/A**AS07-050****EVALUATION BY BAROPODOMETRY OF STROKE PATIENT WITH IN SUBACUTE PHASE**

**J. Rodriguez Hernandez<sup>1</sup>**

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**Background and Aims:**

**Introduction:** Stroke triggers numerous deficits in patient generating partial or complete dependence. Alterations in postural control take priority in neurorehabilitation in order to reduce the impact of the disease on the person and their environment.

**Objective:** Determine if baropodometry can be useful to demonstrate changes in postural control of stroke patients in subacute phase, admitted in medium-long stay hospital

**Material and methods:** We performed a longitudinal prospective pilot study with pre and post intervention assessment. Fourteen participants admitted to La Fuenfria Hospital were included. The experimental intervention was performed for eight weeks through a combined protocol with conventional treatment of physiotherapy and occupational therapy. The protocol included 24 sessions with commercial video games linked to the Xbox 360 game console and the Kinect® device.

Each session was increased in intensity-time and motor requirements. To quantify "Postural Control" the T-plate® podometer was used, which provided information on the pressure exerted by each point of the sole, distribution and plantar symmetry by means of a static standing test.

This test records the center of pressures at a given time, offering information on the load distribution (%) and the support surface (cm<sup>2</sup>).

**Results:** We found statistically significant data in baropodometry in the variables 'load distribution' and 'support surface' ( $p = 0.03$  and  $p = 0.01$ , respectively). Objective changes in body alignment and support symmetry could be determined.

**Conclusions:** Our results suggested that baropodometry could be an effective tool to quantify postural control, highlighting an admissible and viable cost in the hospital approach of the stroke patient in subacute phase

**Trial registration number:** N/A

**AS07-101****BALLOON-EXPANDING STENTING, A NEW APPROACH FOR HYPERACUTE EXTRACRANIAL INTERNAL CAROTID ARTERY LESION TREATMENT IN THE SETTING OF TANDEM OCCLUSIONS.**

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**Background and Aims:** Hyperacute endovascular treatment (EVT) of extracranial internal carotid artery (ICA) lesion in the setting of tandem occlusions (TIO) is a challenge due to 2 competing rationales: establishing and maintaining ICA patency, and avoiding hemorrhagic transformation (HT). We aimed to determine efficacy and safety of balloon-expanding (BX) stent, without the need of early antiplatelet treatment, compared to self-expanding (SX) stent and angioplasty alone (AA) in TIO undergoing EVT.

**Methods:** Prospective, observational cohort study of 113 consecutive patients with TIO undergoing EVT during a 5-year period. Extracranial ICA lesion was treated with AA, SX or BX-stents. Extracranial ICA patency and HT were prospectively recorded at 24h. Primary outcome was a combined positive outcome composed by efficacy (high-grade restenosis) and safety (absence of HT). Secondary outcomes included efficacy, safety, and favorable functional outcome (90d mRS≤2).

**Results:** The combined positive outcome occurred more frequently in BX-stents than in SX-stent and AA groups (21[70.0%], 26[60.5%], and 8 [18.6%], respectively;  $P < 0.001$ ). Extracranial ICA high-grade lesions

undergoing BX or SX stenting presented less high-grade restenosis/reocclusion than those treated with AA (6[20.0%], 10[23.2%], and 33[82.5%], respectively;  $P < 0.001$ ). HT and favorable functional outcome were similar among groups. Absence of extracranial ICA high-grade restenosis (OR 45.2, 95% CI 2.7-356.7) and previous antiplatelet treatment (OR 91.1, 95% CI 4.3-156.4) were independently related to favorable functional outcome.

**Conclusions:** Hyperacute extracranial ICA BX-stenting in the setting of TIO seems to be more effective and safe than treatment with SX-stenting or AA. These findings support the rationale of testing the three different treatments in randomized clinical trials.

**Trial registration number:** N/A

**AS07-105****UPDATE ON TRENDS FOR ENDOVASCULAR TREATMENTS IN ACUTE ISCHAEMIC STROKE IN ITALY**

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**Background and Aims:** Selection criteria for endovascular treatment (ET) in acute ischemic stroke (AIS) are rapidly evolving due to the results of recent trials. We aimed to explore the impact of these changes on clinical practice in Italy.

**Methods:** The Italian Registry of ET for AIS consecutively collects data of patients treated with ET in 43 comprehensive stroke centres. Efficacy measures are 3-month mRS 0-2, and TICI score 2b-3. Safety measures include symptomatic intracranial hemorrhage (sICH), procedural adverse events and death.

**Results:** From 2011 to 2017, 5559 patients were treated, median age 72 years, 51% male patients. Median baseline NIHSS was 18. TICI 2b-3 was achieved in 75%, and 3-months mRS 0-2 in 46% of patients. SICH and procedural adverse events accounted respectively for 8% and 4%. Death rate was 20%. From 2011 to 2017 patients aged ≥80 increased from 8% to 27%, as well as patients sent from Spoke Centres, from 20% to 37%. Time-based contraindication to intravenous fibrinolysis declined from 22% in 2011 to 14% in 2017. The use of thromboaspiration devices steeply raised from 17% in 2011 to 54% in 2017. A significant decline in time-to-groin puncture from 255 to 216 minutes and time-to-end of procedure from 351 to 290 minutes was observed through years.

**Conclusions:** Our results highlight changes in real-world management of AIS patients treated with ET in our Country over time.

**Trial registration number:** N/A

## AS07-131

### COMPARISON OF DIFFERENT SERVICE DELIVERY FOR ENDOVASCULAR TREATMENT FOR ACUTE ISCHAEMIC STROKE IN ITALY

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**Background and Aims:** There is no clear evidence on the best model for delivering endovascular treatment (ET) to eligible acute ischemic stroke (AIS) patients. We aimed to compare outcomes of patients directly admitted to a Comprehensive Stroke Centre (CSC) for ET with those of patients referred from Spoke Centres in Italy.

**Methods:** The Italian Registry of ET for AIS consecutively collects data of patients treated with ET in 43 comprehensive stroke centres. We divided patients in two groups according to access modality to a CSC, direct or indirect after Spoke selection. Efficacy measures include 3-month mRS 0–2, and TICI score 2b-3. Safety measures are symptomatic intracranial haemorrhage (s-IICH), and death.

**Results:** From 2011 to 2017, 5559 patients were treated, 72% presented directly to CSC and 28% were referred by a Spoke Centre. Median age was 72 in Hub and 71 in Spoke patients, median NIHSS respectively 17 and 18. Median time-to-groin puncture was 225 minutes in Hub patients vs 290 minutes in Spoke patients. No significant differences between the two groups were observed for outcome measures (TICI 2b-3, 75% vs 74%, and 3-months mRS 0–2, 45% vs 47%), nor for S-IICH (7% vs 9%). Death rate was 21% in Hub vs 18% in Spoke patients.

**Conclusions:** Despite delay in access to angio-suite for patients referred from Spoke Centres, our data show similar results for outcome in AIS patients treated with ET in both paradigms.

**Trial registration number:** N/A

## WITHDRAWN

### THROMBECTOMY FOR PATIENTS TRANSFERRED FROM 4 REMOTE SPOKE PSC (PRIMARY STROKE CENTER) HOSPITAL WITH AIS FOR A LVO OF THE ANTERIOR CIRCULATION: 4 YEARS EXPERIENCE

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**Background and Aims:** We analyzed the results of endovascular treatment in term of arterial recanalization (TICI) and outcome (mRS at 3 months) for 66 patients suffering from an acute ischemic stroke (AIS) due to large vessel occlusion (LVO) of the anterior circulation, transferred from 4 different remote ( $\geq 80 \leq 120$  km) Spoke Hospitals in the period 2013–2017

**Methods:** Criteria for centralization were: stroke onset  $\leq 6$  hours, NIHSS  $\geq 6$ , a documented LVO at computed tomography angiography (CTA), an ASPECT score  $\geq 7$  and good collateral circulation on multiphasic CTA. For patients with an unknown stroke onset or onset  $> 6$  hours a perfusion CT scan was required (CTP). Patients eligible for i.v thrombolysis received it in a "drip and ship" model. The mean baseline NIHSS was 18. The arterial site of occlusions was M1 in 51.5%, Carotid Siphon in 15.1%, M2 in 12.1% and a tandem occlusion in 21%. Upon arrival at the hub center, patients underwent a new CT scan to apply a new ASPECT score and exclude hemorrhagic complication as well as a CTP to quantify the ischemic penumbra.

**Results:** The median time of centralization was 95 minutes. A good recanalization (TICI 2b/3) was obtained in 71.2% of the patients. Median time from symptoms onset to the end of the procedure was 373 minutes. 44% of patients had a mRS score 0–2 at 3 months and the mortality rate was 21.2%.

**Conclusions:** Despite substantial delay time transfer patients had a good mRS at 3 months similar to those directly admitted

**Trial registration number:** N/A

## AS07-022

### CAROTID ANGIOPLASTY AND STENTING WITH MECHANICAL THROMBECTOMY FOR TANDEM OCCLUSION OF EXTRACRANIAL OCCLUSION OF INTERNAL CAROTID ARTERY AND MIDDLE CEREBRAL ARTERY IN ACUTE STROKE PATIENTS

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**Background and Aims:** In case of tandem symptomatic extracranial occlusion of internal carotid artery (ICA) and middle cerebral artery (MCA), clinical benefit of mechanical thrombectomy (MT) following carotid angioplasty and stenting (CAS) has been not yet enough established. Moreover if combined with prior IV thrombolysis. Thus we aimed to analyze clinical outcomes and complications in patients treated with this combined endovascular approach.

**Methods:** Consecutive AIS patients were enrolled in retrospective bi-center study. Stroke severity was scored with the NIHSS and 90-day clinical outcome with the modified Rankin Scale (mRS) with score 0–2

for good outcome. Symptomatic intracerebral hemorrhage (SICH) was assessed according to the SITS-MOST criteria.

**Results:** Of 925 enrolled patients, 69 patients (44 males, mean age 65.1 ± 9.8 years) with median of admission NIHSS 15 points were treated with CAS + MT. 50 (78.3%) patients received IVT prior endovascular treatment. The recanalization (TICI 2b-3) was achieved in 60 (87.1%) patients. 45 (63.2%) patients had good 3-month clinical outcome. ICH was present in 17 (24.6%) and SICH in 6 (8.7%) patients. 9 (13%) patients died within 3 months. Early reocclusion of ICA after stenting was observed in 10/65 (15.3%) patients and prior IVT or previous use of antiplatelets or anticoagulants did not affect this rate.

**Conclusions:** CAS with MT might be safe and effective treatment for tandem symptomatic extracranial ICA and MCA occlusions and with reasonable rate of early ICA reocclusions. Acknowledgment: Supported by the grant of Ministry of Health of Czech Republic n. 17-30101A, IGA-KZ-2016-1-2, IGA-KZ-2017-1-2 and by the grant IGA LF UP\_008\_2019.

**Trial registration number:** N/A

## AS07-084

### ENDOVASCULAR THROMBECTOMY IN THE REAL WORLD: PROSPECTIVE, OBSERVATIONAL COHORT STUDY (PAETAS REGISTRY)

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**Background and Aims:** Endovascular thrombectomy (EVT) became standard care in 2015 after positive trials in patients presenting with acute ischemic stroke and large vessel occlusion 0–6h and in 2018 for selected patients up to 24h. We formed a prospective registry to determine safety, timelines, technical and functional outcomes related to EVT performed in the real world as compared to the randomised control trials.

**Methods:** PAETAS (*Princess Alexandra Endovascular Thrombectomy for Acute Ischemic Stroke*) Registry is an ongoing prospective, observational registry collecting data for patients receiving EVT for large vessel occlusion in anterior and posterior circulation in the South Brisbane network of 7 hospitals (6 referral centres and 1 EVT-capable hub), Australia which serves 1.6 million

**Results:** Of 193 patients who underwent EVT from April 2015 to June 2018 at the EVT hub center, 13 were excluded from analysis as their baseline mRS (modified Rankin Scale) was >1. The mean age was 64.4 years. Median National Institutes of Health Stroke Scale (NIHSS) was 16 (9-21) on admission and 7 (2-18) on day 1. Median door-to-puncture time was 67 minutes (32-107). Thrombolysis in Cerebral Infarction (TICI) ≥2b was achieved in 88.9%. At 90 days, 48.4% achieved excellent functional outcome (mRS 0-1), 58.3% achieved good functional outcome (mRS 0-2) and 65.6% achieved favorable outcome (mRS 0-3). Median acute length of stay (LOS) was 5 days. All-cause mortality was 20.5% and 3.9% suffered symptomatic intracerebral hemorrhage (ICH).

**Conclusions:** This is the first Australian registry confirming real world reproducibility of results from randomised control trials

**Trial registration number:** N/A

## AS07-012

### THROMBECTOMY AND THROMBOLYSIS OF ISOLATED POSTERIOR CEREBRAL ARTERY OCCLUSION: COGNITIVE, VISUAL AND DISABILITY OUTCOMES.

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**Background and Aims:** Limited data exist on acute revascularization treatment with IV thrombolysis (IVT) and/or endovascular treatment (EVT) in stroke from isolated posterior cerebral artery occlusion (IPCAO). We aimed at investigating efficacy and safety of IVT and EVT in our single centre cohort of IPCAO.

**Methods:** We selected all consecutive patients with IPCAO from ASTRAL registry (acute stroke admitted < 24h from onset/last-seen-well) between 2003 and 6/2018.

Inclusion criteria were:

-proximal occlusions potentially accessible to EVT (i.e. proximal to bifurcation in parieto-occipital and calcarine arteries).

-no concomitant acute occlusion of basilar artery or other intracranial arteries.

We retrospectively compared 1)IVT to conservative treatment (CT) and 2) EVT to best medical therapy (BMT, i.e. CT or IVT) in term of subacute cognitive deficit, 3-months visual and disability outcomes. Unadjusted analysis, multivariable logistic regression and propensity score-matched analysis were performed.

**Results:** Among 106 patients with IPCAO, 21 received EVT (13 bridging), 34 IVT alone and 51 CT. Median age was 76 years, 47% were female, and median NIHSS was 7. Complete recanalization at 24 hours was more often achieved with IVT than CT (51% vs. 9%, p < 0.005), and with EVT compared to BMT (68% vs. 34%, p < 0.05). Haemorrhagic complications and mortality didn't increase with IVT nor EVT. Higher proportions of good cognitive, visual and disability outcomes were observed in IVT vs. CT and in EVT vs. BMT (see Table).

	Total (n=85)	IV thrombolytic (n=34)	Conservative treatment (n=51)	Unadjusted OR (95% CI)	Adjusted OR <sup>a</sup> (95% CI)	Propensity score adj. OR (95% CI)
Intracranial recanalisation at 24h	19/55 (34.5%)	17/33 (51.5%) <sup>b</sup>	2/22 (9.1%) <sup>b</sup>	<b>10.62 [2.13-52.92]*</b>	n.c.	n.c.
SICH	1/61 (1.6%)	1/34 (2.9%)	0/27 (0%)	— <sup>c</sup>	n.c.	n.c.
≤2 cognitive domains impaired	9/56 (16.1%)	5/22 (22.7%)	4/34 (11.8%)	2.21 (0.52-9.34)	2.94 (0.35-24.4)	1.86 (0.39-8.99)
3 months visual field normalization	17/67 (25.4%)	10/29 (34.5%) <sup>d</sup>	7/38 (18.4%) <sup>d</sup>	2.33 (0.76-7.16)	2.01 (0.58-7.01)	3.55 (0.97-13.03)
3-months mRS 0-1	34/84 (40.5%)	14/34 (41.2%)	20/50 (40%)	1.05 (0.43-2.55)	1.65 (0.60-4.52)	1.94 (0.70-5.41)
3-months mortality	13/85 (15.3%)	6/34 (17.6%)	7/51 (13.7%)	1.35 (0.41-4.42)	1.31 (0.35-4.91)	1.24 (0.34-4.54)
	Total (n=106)	Mechanical thrombectomy (n=21)	Best medical therapy (n=85)	Unadjusted OR (95% CI)	Adjusted OR <sup>a</sup> (95% CI)	Propensity score adj. OR (95% CI)
Intracranial recanalisation at 24h	32/74 (43.2%)	13/19 (68.4%) <sup>b</sup>	19/55 (34.5%)	<b>4.11 [1.35-12.53]*</b>	n.c.	n.c.
SICH	2/82 (2.4%)	1/21 (4.8%)	1/61 (1.6%)	3.00 (0.18-50.21)	n.c.	n.c.
≤2 cognitive domains impaired	15/68 (22.1%)	6/12 (50%)	9/56 (16.1%)	<b>5.22 [1.37-19.9]*</b>	4.37 (0.72-26.53)	2.00 (0.38-10.41)
3 months visual field normalisation	25/83 (30.1%)	8/16 (50%) <sup>d</sup>	17/67 (25.4%)	2.94 (0.96-9.05)	<b>4.28 [1.00-18.29]*</b>	3.00 (0.67-13.4)
3-months mRS 0-1	45/104 (43.3%)	11/20 (55%)	34/84 (40.5%)	1.80 (0.67-4.80)	1.44 (0.51-4.10)	1.63 (0.47-5.60)
3-months mortality	17/106 (16%)	4/21 (19.1%)	13/85 (15.3%)	1.30 (0.38-4.50)	2.15 (0.54-8.47)	1.00 (0.21-4.67)

Table. Outcome differences between conservative treatment and IV thrombolysis group (upper panel) and best medical therapy and endovascular treatment (lower panel). n.c. not calculated. SICH= symptomatic intracranial hemorrhage (ECASS definition). \*OR significant at P<0.05 level.

<sup>a</sup>OR adjusted for age, baseline NIHSS, pre-stroke cognitive deficit (cognitive outcome), baseline NIHSS, stroke topography, chronic ischemic lesion (visual outcome), age, baseline NIHSS, stroke topography (mRS), age, baseline NIHSS (mortality). <sup>b</sup>24h control imaging available for 29, 1 and 2 patients respectively. <sup>c</sup>not calculated because zero events in the CT group. <sup>d</sup>no visual field defect at baseline in 13 and 5 patients respectively. <sup>\*</sup>OR adjusted for same variables as in analysis one, plus IV thrombolysis, visual field analysis also adjusted for onset-to-door time.

**Conclusions:** Both EVT and IVT are associated with higher rate of 24h recanalization, without increase of haemorrhagic complications. Cognitive, visual and functional outcomes seem better with IVT than CT, and best with EVT.

**Trial registration number:** N/A

## AS07-132

### IMPORTANCE OF COMORBIDITIES IN PATIENTS WITH ENDOVASCULAR TREATMENT FOR ACUTE ISCHEMIC STROKE AND THEIR ASSOCIATION WITH MORTALITY AT THREE MONTHS

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**Background and Aims:** Chronic diseases such as stroke often are accompanied by other comorbidities which can alter the prognosis and management of our patients. The objective of our study is to assess the prevalence of the principal comorbidities, multimorbidity ( $\geq 5$  diseases) and if higher comorbidity is associated with mortality at 3 months in patients with endovascular treatment (EVT) for acute ischemic stroke.

**Methods:** Retrospective observational study including data from every patient with acute ischemic stroke secondary to occlusion of middle cerebral artery that received EVT in Aragon, Spain from June 2015 to June 2018. We define high comorbidity as a Charlson Comorbidity Index (CCI)  $\geq 2$  without scoring age.

**Results:** Of 102 patients (mean age 73.8 years; 57.8% female), the mean number of comorbidities per patient was 4.8 (SD 2.9); atrial fibrillation (AF) and hypertension were the more prevalent comorbidities (67.9% and 65.3% respectively), follow up by dyslipemia (45.3%) and non AF cardiac diseases (36.5%). Chronic respiratory diseases were present in 11.9% and 16.8% had an antecedent of cancer. Multimorbidity was present in 49.4% of our patients. High CCI ( $\geq 2$ ) was associated with increased odds of death at 3 months (OR 4.4; CI 95% 1.2-17.4).

**Conclusions:** An acute ischemic stroke is not an isolated entity. High CCI is associated with a greater risk of death at 3 months in patients with EVT. In our approach to these patients, we should pay special attention to multimorbidity and cardiac diseases, which are frequent in these patients. CCI can be useful to stratify the risk of death in these patients.

**Trial registration number:** N/A

## AS07-123

### PROGNOSTIC VALUE OF COLLATERAL CIRCULATION IN CRITICAL REGIONS IN PATIENTS WITH MCA STROKE TREATED WITH THROMBECTOMY: IS PATHS SCALE SUPERIOR TO OTHER FACTORS?

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**Background and Aims:** The collateral circulation (CC) grade is a strong predictor in stroke, but its practical utility remains unclear. We aimed to study the prognostic value of a new CC scale, PATHS (Perfusion

Acquisition for Thrombectomy Scale), which assesses CC at critical regions, compared with other known prognostic factors in MCA thrombectomy treated patients.

**Methods:** Retrospective study of patients with MCA stroke and MI/terminal carotid occlusion treated with thrombectomy in our center. Data were prospectively evaluated by a stroke neurologist blinded to clinical data. PATHS is applied in CT perfusion source images, allowing a dynamic evaluation of CC in three regions: sylvian, post-sylvian and paracentral. In each region we studied the maximum cortical and subcortical opacification (PATHS score from 0 to 6). The prognostic value was compared to many other factors.

**Results:** N:202. Mean age:72 years (59-80), women 57.4%, mean NIHSS 18(14-23), TICI>2a 88.8%. Median PATHS 5(4-6). A better PATHS score was correlated with mRS-3m (Spearman's Rho = 0.460; p < 0.001), this correlation was stronger than with other quantitative variables, and similar to pre-treatment NIHSS. The OR for functional independence at 3 months (3m-mRS < 3) was also higher for good CC with PATHS (OR = 5.123; CI = 2,789-9,439) and that was just exceeded by final recanalization (OR = 6.714; CI = 2,168-20,787). In multivariate analysis PATHS was an independent predictor of 3m-mRS  $\leq 3$  (p < .001). The time from onset to recanalization was not correlated with prognosis.

**Conclusions:** PATHS showed a strong prognostic value in our study, greater than other known predictive factors, including time of stroke evolution. Our results suggest that the use of PATHS scale might be considered for outcome prediction in thrombectomy suitable patients.

**Trial registration number:** N/A

## AS07-027

### MECHANICAL THROMBECTOMY IN ACUTE BASILAR OCCLUSION: PROGNOSTIC FACTORS.

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**Background and Aims:** Acute basilar artery occlusion (BAO) has an unfavorable prognosis for mortality and dependence. The role of the different treatments is not yet well defined. We analyze prognostic associations in patients with BAO treated with thrombectomy.

**Methods:** A retrospective multivariate analysis is performed on a cohort of 75 patients with acute ischemic stroke due to basilar artery occlusion who underwent endovascular treatment at our center during the period February 2009 to March 2018.

**Results:** We included 75 patients (40% women) with BAO (22 proximal third, 17 middle and 36 distal), with a median age of 66 (IQR 56-76) and an initial NIHSS of 10 (IQR 6-20). 40% of the patients were intubated (ETI) in the first assessment, 90% being due to a low level of consciousness. 24% received rTPA prior to endovascular procedure. The recanalization rate (TICI  $\geq 2b$ ) is 66.7%, with symptomatic hemorrhagic transformation of 9.33%. At 3 months 40% reached independence and 36% had died. In multivariate analysis adjusted for age, sex and location of occlusion, TICI 2b-3 revascularization (OR 4.63) and absence of ETI due to low level of consciousness (OR 4.06) were associated with a higher rate of mRS 0-2 at 3 months. There is an association between the presence of low level of consciousness and proximal occlusion (p = 0.009).

**Conclusions:** In acute BAO treated with thrombectomy, TICI 2b-3 revascularization and absence of ETI are associated with a higher rate of functional independence at three months. There is an association between low level of consciousness and proximal occlusion.

**Trial registration number:** N/A

**AS07-064**

**MECHANICAL THROMBECTOMY (MT) AND LOW ALBERTA STROKE PROTOCOL PROGRAMME EARLY CT SCORE (ASPECTS). EXPERIENCE IN A COMPREHENSIVE STROKE CENTER**

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**Background and Aims:** MT indication in ischemic strokes with ASPECTS minor or equal to 5 is controversial, reaching only IIB grade recommendation in STROKE guidelines. That is because of the lack of patients with low ASPECTS in clinical trials (CT), being included only by MR CLEAN CT. Nevertheless, some retrospective series and the preliminary data of TENSION CT might suggest some clinical benefit to these patients.

**Methods:** Retrospective descriptive and comparative analysis of prognostic items in patients with ischemic stroke due to anterior territory large vessel occlusion treated with MT, being divided in those with low ASPECTS (minor to 6) and favourable ASPECTS (7 or more). SPSS 22.0 and statistical test  $\chi^2$  are used.

**Results:** 13 of 140 patients analysed had ASPECTS minor to 6. Eight patients scored 5, four patients scored 4 and one patient scored 3. We did not find statistical differences in demographic characteristics, previous treatment, occluded vessel or recanalization rate between the groups. Modified Rankin Scale (mRs) showed statistical tendency to be worse in low ASPECTS group, although it did not reach statistical significance. In the same way, no statistical differences were found in symptomatic hemorrhage or mortality.

**Conclusions:** MT in patients with ischemic stroke and ASPECTS minor to 6 seems to be as safe as if done in patients with favourable ASPECTS. We did not find difference in clinical outcome (mRs) between the groups.

**Trial registration number:** N/A

**AS07-128**

**DECOMPRESSIVE HEMICRANIECTOMY IN MALIGNANT SYNDROME OF MCA: A META-ANALYSIS OF RANDOMIZED TRIALS**

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**Background and Aims:** A large middle cerebral artery (MCA) stroke with space-occupying infarction could result in high rate of death and poor functional outcome. The decompressive hemicraniectomy (DHC) is a surgical procedure that contributes to reduce the mortality, while its effect on functional outcome is still controversial. In this pooled analysis we explored the impact of DHC on death and functional outcome.

**Methods:** A literature search was conducted including PubMed, Embase, and the Cochrane Library databases. Only randomized controlled trials were included in this pooled analysis. We considered the patients treated with DHC as interventional group. Primary and secondary endpoints were represented by good functional outcome and death at 90 days from stroke. We applied a fixed- or random-effects analytical approach to perform the pooled analysis.

**Results:** In this analysis we included 8 RCTs with a total of 314 patients (n. 151 treated with DHC). The DHC reduced significantly the mortality rate at 12 months (OR: 0.17; 95%CI: 0.10 – 0.27; p < 0.0001). Similarly, we observed also a benefit of surgical procedure for the good functional outcome at one-year follow-up (OR: 0.47; 95%CI: 0.25 – 0.89; p: 0.02) and this effect was higher if DHC was performed within 48 hours from symptom onset (OR: 0.38; 95%CI: 0.20 – 0.73; p: 0.004).

**Conclusions:** In this meta-analysis of RCTs, the DHC in strokes with space-occupying infarction due to MCA occlusion resulted of benefit both for mortality reduction and increased good functional outcome. Further RCTs considering the DHC as preventive treatment in selected stroke patients are needed.

**Trial registration number:** N/A

**AS07-054**

**THE ASSOCIATION BETWEEN BLOOD PRESSURE AND SIGNIFICANT EARLY NEUROLOGICAL IMPROVEMENT IN ACUTE STROKE PATIENTS TREATED WITH MECHANICAL THROMBECTOMY**

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**Background and Aims:** There is no yet clear recommendation what type of anesthesia is preferable for acute stroke patients undergoing mechanical thrombectomy (MTE). Some data have shown that marked reduction of blood pressure (BP) during MTE is associated with poor outcome. The aim of our study was to estimate the association between blood pressure (BP) and early neurological improvement during MTE in acute stroke patients.

**Methods:** 248 consecutive acute stroke patients treated with MTE in 2 Vilnius hospitals during 2013 – 2018 years were included. Primary end point was significant early neurological improvement, that was defined as NIHSS score decreasing  $\geq 4$  points within 24 h or 0–1 point on 24 h after MTE. BP was recorded on onset, during MTE, and after 2 and 4 h after MTE. BP variability was measured as standard deviation, coefficient of variation and successive variation. Logistic regression was used to identify the independent predictors of good outcome.

**Results:** 138 patients (55.6%) had significant early neurological improvement. Both groups were similar at baseline. After adjustment to baseline data the independent predictors of significant early neurological improvement were shorter onset-to-recanalization time (OR 0.78, 95%CI 0.69–0.9), BP variability for each 10-mmHg decrement (OR 0.6, 95%CI 0.37–0.95) and higher rate of successful recanalization (OR 4.2, 95%CI 1.6–11.2).

**Conclusions:** Our study showed that high BP variability during MTE leads to poor prognosis. This finding has to be considered when choosing the type of anesthesia.

**Trial registration number:** N/A

**AS07-100**

**ESTIMATED POTENTIAL OUTCOME AUGMENTATION AND HEALTH ECONOMIC BENEFITS OF A WEARABLE STROKE ALARM**

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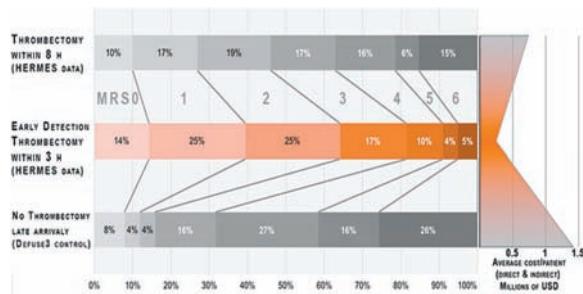
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**Background and Aims:** Although recent advances have provided effective treatments for ischemic stroke, a majority of patients are not treated because of arrival beyond the time window for reperfusion treatment. Based on a health-economic model, we estimated the potential outcome and costs by shortening time to thrombectomy for Large Vessel Occlusions (LVO) using bilateral bracelet accelerometers that can detect stroke within 30 minutes of onset.

**Methods:** Outcome-data for thrombectomy of anterior circulation LVO were obtained from meta-analysis of recent randomized trials (HERMES-collaboration). Outcome-data for untreated LVO patients were obtained from the DEFUSE3 trial. Health economic effects were based on cost estimation (including QALY) for each level on the MRS-scale by Mangla et al 2016.

**Results:** The average direct and indirect costs/patients was 253.307 USD for thrombectomy within 3h, 734.778 USD for thrombectomy within 8h and 1.416.581 USD for LVO patients that was not treated with thrombectomy. The potential treatment outcome benefit is substantial with treatment within 3h of onset instead of 8h (Figure), which may be possible by detection within 30–60 minutes of onset. The average cost reduction by early treatment would be 481.470 USD/patient for the populations within the HERMES collaboration. However, the greatest effect would come from allowing patients not treated due to late arrival to hospital to be treated within 3h of onset (Figure). The average cost reduction in this group would be 1.162.000 USD/patient.



**Conclusions:** Early detection of major stroke within 30 minutes by using a wearable stroke alarm would potentially augment LVO thrombectomy outcome profoundly, with substantial health economic savings.

**Trial registration number:** N/A

## AS07-021

agent both for CT-angiography (CTA) ± CT-Perfusion) and MT. The incidence of acute kidney injury (AKI) in these patients is not known.

**Methods:** We retrospectively assessed the rate of AKI (defined as increase of serum creatinine  $\geq 25\%$  or  $\geq 0.5 \text{ mg/dl}$  from baseline) in 1092 consecutive AIS patients (mean age 72.9 years) treated with MT after CTA at our neurovascular center from 01/2015-12/2017.

**Results:** Data on kidney function was available in 1020 (93.4%) patients. Of these, 59 (5.8%) patients developed AKI, four (0.4%) of which needed hemodialysis. Patients with AKI had significantly more often known chronic kidney disease ( $p = 0.002$ ), diabetes mellitus ( $p = 0.018$ ), and received MT for tandem occlusion of ACI and ACM ( $p = 0.003$ ). Patients with additional CT-Perfusion ( $n = 105$ ) had no significantly higher rate of AKI. NIHSS score at discharge was non-significantly higher (median 6 vs. 4,  $p = 0.052$ ) and in-hospital mortality was significantly higher in patients with AKI (20.3% vs. 7.0%,  $p < 0.001$ ). In multivariate logistic regression analysis, only diabetes mellitus was an independent predictor for AKI, while higher age, higher NIHSS score at admission, AKI, and contrast agent volumes (CAV)  $> 150\text{ml}$  during MT were independent predictors for death. CAV  $> 150\text{ml}$  were due to significant longer MT procedures ( $90 \pm 48 \text{ min}$  vs.  $30 \pm 22 \text{ min} \leq 150\text{ml}$ ).

**Conclusions:** AKI is rare in AIS patients receiving CTA and MT and most often transient. Only 0.4% needed hemodialysis. AKI is associated with higher mortality, but 8/12 deaths were caused by large brain infarction or SICH.

**Trial registration number:** N/A

## AS07-021

### REPEATED ENDOVASCULAR THROMBECTOMY FOR EARLY RECURRENT INTRACRANIAL LARGE VESSEL OCCLUSION

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**Background and Aims:** Early recurrent intracranial large vessel occlusion (LVO) is uncommon and is associated with poor outcome. The aim of this study was to describe the clinical and radiological features of patients with early recurrent LVO managed with repeated endovascular thrombectomy.

**Methods:** A retrospective analysis of ischaemic stroke patients with LVO and more than one endovascular procedure within 10 days, treated at 9 endovascular thrombectomy centres in New Zealand, Australia, Taiwan, Finland and Canada were included.

**Results:** There were 31 patients [15(48%) were female; median age 67 (interquartile range, IQR: 50–74) years; 20(65%) anterior circulation, 9 (29%) posterior circulation, 2(6%) both anterior and posterior circulation LVO] included, of whom 17(55%) had cardioembolism as the cause of the stroke. Most re-occlusions (23 patients (74%)) occurred in the same target vessel while 8(26%) patients had LVO in a previously unaffected

## AS07-026

### INCIDENCE AND SHORT-TERM OUTCOME OF CONTRAST-INDUCED NEPHROPATHY IN 1020 ACUTE ISCHEMIC STROKE PATIENTS RECEIVING MECHANICAL THROMBECTOMY AFTER CT-ANGIOGRAPHY ± CT-PERFUSION

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**Background and Aims:** Patients with acute ischemic stroke (AIS) undergoing mechanical thrombectomy (MT) receive iodinated contrast

vessel. Vessel irregularity after the first procedure was evident in 12(52%) patients with re-occlusion of the same target vessel. The median time between procedures was 44(IQR 9–110) hours and one patient had three procedures. Functional outcome at 90-days was good (modified Rankin Scale, mRS: 0–2) in 10(32%) and favourable (mRS 0–3) in 16(52%) patients. Outcome did not differ significantly between patients with re-occlusion of the same vessel or new LVO ( $p=0.52$  for good outcome and  $p=0.63$  for favourable outcome). Ten patients (32%) had died by 3 months. One patient (3%) had symptomatic intracerebral haemorrhage after the third procedure.

**Conclusions:** Early recurrent LVO can be safely managed with repeated endovascular thrombectomy with favourable clinical outcome.

**Trial registration number:** N/A

## WITHDRAWN

## WITHDRAWN

## AS07-045

### FRONT-LINE THROMBECTOMY FOR ACUTE LARGE VESSEL OCCLUSION WITH UNDERLYING SEVERE INTRACRANIAL STENOSIS: STENT-RETRIEVER VERSUS CONTACT ASPIRATION

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**Background and Aims:** We aimed to compare procedural characteristics and outcomes between patients that received a stent-retriever thrombectomy (SRT) and patients that received a contact aspiration thrombectomy (CAT), as the front-line approach for treating large vessel occlusion (LVO) due to severe underlying intracranial atherosclerotic stenosis (ICAS).

**Methods:** One hundred and thirty patients who presented with acute LVO and underlying severe ICAS at the occlusion site were included. Procedural characteristics and treatment outcomes were compared between patients treated with front-line SRT ( $n=70$ ) and those treated

with front-line CAT ( $n=60$ ). The primary outcomes were the rate of switching to alternative thrombectomy, time from groin puncture to initial reperfusion, and procedure duration. Initial reperfusion was defined as revealing the underlying culprit stenosis with an antegrade flow after thrombectomy.

**Results:** The rate of switching to alternative thrombectomy after the front-line technique failed was significantly higher in the CAT than in the SRT group (40% vs. 4.3%; OR 2.543,  $P < 0.001$ ). The median time from puncture to initial reperfusion (17 min vs. 31 min,  $P < 0.001$ ) and procedure duration (39 min vs. 75.5 min,  $P < 0.001$ ) were significantly shorter in the SRT group than in the CAT group. In the binary logistic regression analysis, a longer time from puncture to initial reperfusion was an independent predictor of a 90-day poor outcome (per 1-minute increase, OR 1.029,  $P = 0.006$ ).

**Conclusions:** Our results suggest that SRT may be more effective than CAT for identifying underlying culprit stenosis and therefore considered the optimal front-line thrombectomy technique in acute stroke patients with LVO and severe underlying ICAs.

**Trial registration number:** N/A

## AS07-080

### ASSOCIATION OF PRETREATMENT DIFFUSE PONTINE INFARCTION WITH EXTREME POOR OUTCOMES AFTER ENDOVASCULAR THROMBECTOMY IN PATIENTS WITH ACUTE BASILAR ARTERY OCCLUSION

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**Background and Aims:** In patients with acute basilar artery occlusion (BAO) who are undergoing endovascular thrombectomy, whether diffuse pontine infarction (DPI) on baseline imaging study is associated with poor treatment outcomes is unknown. We aimed to investigate the clinical impact of DPI revealed on pretreatment DWI in a large cohort of patients with acute BAO who underwent endovascular thrombectomy.

**Methods:** We retrospectively analyzed clinical and DWI data from 102 patients who underwent thrombectomy for treatment of acute BAO. DPI was defined as a DWI hyperintense lesion occupying  $\geq 80\%$  of the pons on more than two sections. Association between DPI and extreme poor outcomes (defined as 90-day mRS 5 and 6) was assessed. Binary logistic regression analysis was performed to identify independent predictors of mortality at 90-day.

**Results:** DPI was found in 15 patients. Successful reperfusion (m-TICI 2b or 3) was achieved in all patients with DPI. All patients with DPI on pretreatment DWI had mRS 5 ( $n=6$ ) or mRS 6 ( $n=9$ ) at 90-day. Patients with DPI on pretreatment DWI had a higher incidence of extreme poor outcomes (100% vs. 24.1%; relative risk 4.413, 95% confidence interval [CI] 2.854-6.013,  $P < 0.001$ ) than those without DPI. 90-day mortality was 17.6% (18/102). On binary logistic regression analysis, DPI was an independent predictor of 90-day mortality (odds ratio 6.787, 95% CI 1.746-26.387,  $P = 0.006$ ).

**Conclusions:** DPI on pretreatment DWI was associated with extreme poor outcomes and mortality in patients with acute BAO even if successful reperfusion occurred after endovascular thrombectomy.

**Trial registration number:** N/A

## AS07-114

### NOVEL LIQUID EMBOLIC MATERIAL FOR THE USE OF ENDOVASCULAR TREATMENT: AN ORGANIC POLYMER COMPOSITE ACTIVATED BY THE CA2+ IN THE BLOOD

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**Background and Aims:** To evaluate a New Generation Liquid Embolic Material (NGLEM), which is a clear liquid that immediately forms a solid hydrogel once exposed to Ca<sup>2+</sup> in the blood. It is DMSO free and has minimal risk of catheter-entrapment. The material was evaluated using an *in vitro* vascular model as well as an *in vivo* experimental model using rat.

**Methods:** Experiment 1) A silicon vascular model with multiple aneurysms were connected to a programmable pulsatile flow pump, and isotonic aqueous solution containing 2 mM calcium chloride was circulated. A microcatheter was placed in the aneurysm model, and NGLEM was injected. The behaviors of the injected material and the visibility under fluoroscopy were recorded. Experiment 2) A rat renal artery was catheterized with a microcatheter, and NGLEM was injected under fluoroscopy. Angiographical evaluation was performed.

**Results:** Experiment 1) The injected NGLEM formed spherical shaped gel and occluded the aneurysm. Once the injection was completed, the catheter was withdrawn without entrapment. The NGLEM mixed with contrast medium showed sufficient radiopacity under fluoroscopy. Experiment 2) A total of 4 renal arteries in 2 rats were successfully treated with NGLEM. All vessels were completely occluded with NGLEM, and the total volume required for the occlusion was between 0.4 ml to 0.8ml. No increased thrombogenicity was observed during the procedure. Post procedure aortogram showed complete occlusion of the treated arteries.

**Conclusions:** NGLEM, which is a DMSO free, non-adhesive material can be a potential embolic material used in the endovascular procedure.

**Trial registration number:** N/A

## WITHDRAWN

**AS14-012****FACILITATING LEARNING AND CHANGE IN DAILY LIVES: A COMPARATIVE ANALYSIS OF MUNICIPAL STROKE REHABILITATION SERVICES IN NORTHERN NORWAY AND CENTRAL DENMARK**

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<sup>1</sup>Department of health and care sciences, UiT The Arctic University of Norway, Tromsø, Norway

**Nursing, Allied Health Professionals And Carers  
WITHDRAWN**

**Background and Aims:** This study describes and compare the professionals working in municipality stroke rehabilitation services ability to facilitate learning and change in the daily living of stroke survivors and their families in northern Norway and central Denmark.

**Methods:** Semi-structured individual interviews were conducted with survivors both 3 and 9 months after discharge from in-patient care. By contrast, field observations and focus group interviews were completed with professionals on multidisciplinary teams in the two municipalities. A sociocultural perspective on learning was applied during data analysis.

**Results:** Altogether, the ability of municipal health services to facilitate learning and change for stroke survivors during the first year generally depended upon developing comprehensive integrated rehabilitation plans and ensuring access to coordinated, qualified multidisciplinary teams with professional knowledge and skills. However, Danish stroke survivors seemed positioned to be more active, proactive and empowered, and their processes of learning and change seemed more closely co-constructed with professional support.

**Conclusions:** Findings reveal considerable differences in municipal stroke rehabilitation services in northern Norway and central Denmark and their ability to support stroke survivors and families in performing self-management.

**Trial registration number:** No

**AS14-036****NOVEL ORAL ANTICOAGULANTS (NOAC) AND DYSPHAGIA: AN EXPERT NURSE SURVEY**

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<sup>3</sup>Brain Injury, Crt, Montevarchi, Italy

**Background and Aims:** In Stroke, Neurology and Neurosurgery units the prevalence of dysphagia may be significant. The crushing of tablets seems a frequent countermeasure for patients with nasogastric tube. The crushing in is known some cases may modify the bioavailability of the drug compared with whole tablets.

**Methods:** we administered to 62 Italian board certified nurses from eleven different regions an online questionnaire regarding the perception of dysphagia prevalence in their wards, the diffusion of Novel Oral Anticoagulants (NOAC) and the way of somministration of the NOAC in the last 5 years.

**Results:** We received 62 replies to the online form. In 71.6% of interviewed nurses the use of NOAC in the last 5 years is increased.

The median prevalence of dysphagia according to the experts was 50%; in 47.5% of answers the local guidelines reported crushing as a standard measure for nasogastric tube feeded patients. In 34.4% of answers local guidelines did not provide indications on the topic. In the last 16.4% the tablet crushing was reported as a frequent procedure even if not reported in guidelines.

**Conclusions:** The tablet manipulation and crushing seem a frequent procedure in many Italian wards. The local guidelines provide partial indication on the coadministration of tablets in dysphagic subjects. Further efforts are needed to address this topic. Since the prevalence of dysphagia in the hospitalized population seem very high and the use of NOAC steadily increasing.

**Trial registration number:** N/A

## AS14-011

### PREVENTION OF EARLY DVT FOLLOWING HOSPITALIZATION DUE TO STROKE

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**Background and Aims:** Deep venous thrombosis (DVT) often occurs in lower extremities in stroke patients with severe disability and DVT probably causes symptomatic venous thrombosis (VT). Therefore, DVT must be prevented. We aimed to investigate the efficacy of our current DVT prevention.

**Methods:** We included acute stroke patients

1) who were admitted from March 2017 to March 2018, 2) who did not start to take any anticoagulants within 3 days after admission, and 3) who examined D-dimer within 3 days after admission (D-dimer1), which was less than 1 ng/L then. They were regarded as patients without DVT and wore elastic knee stockings and underwent foot pumping in bilateral lower legs to prevent DVT, particularly while they sat on the wheelchair. We examined D-dimer again (D-dimer2) until 8 days after admission in them. When the D-dimer2 was 1 or more ng/L in some patients, we performed ultrasonography (US) in them and found patients with DVT.

**Results:** During study period, 645 patients were admitted and 339 among them met our inclusive criteria. Among them, 284 patients underwent D-dimer2 examination, which was 1 or more in 138 among them (48.6%; 138/284). Among 138, 116 patients underwent US and DVT was found in 14 among 116 (12.1%; 14/116). Therefore, we estimated 16.7 patients had DVT in 138 patients with D-dimer of 1 or more and DVT positive rate as 5.9% (16.7/284). No symptomatic VT occurred during study period.

**Conclusions:** Our current DVT prevention achieved low incidence of ultrasonographic DVT and no symptomatic VT.

**Trial registration number:** N/A

## AS14-013

### TO ADOPT A JHNEBP (JOHNS HOPKINS NURSING EVIDENCED-BASED PRACTICE) MODEL INTO PRACTICE – A SUSTAINABLE HYDRATION PRACTICES TO ACUTE STROKE PATIENTS AT ASU.

**K.Y.L. Chow<sup>1</sup>**

<sup>1</sup>Karin Chow- KF Chan- KY Chan- MM Wong- Jenny Cheung- Dr. Michael Fu, Acute Stroke Unit- Department of Medicine & Geriatrics- Tuen Mun Hospital- New Territories West Cluster- Hospital Authority, Hong Kong, China

**Background and Aims:** Dehydration has been cited as a large problem among institutionalized stroke patients especially in a busy medical unit

like Hong Kong. We hypothesized that a systemic clinical workflow for hydration screening (BUN/creatinine ratio), extra fluid fed round, education on the importance of rehydration to carer would meet their estimated fluid requirements.

**Methods:** Retrospective data retrieved from 1st July to 31st August 2018 for control group while data from 1st October to 30<sup>th</sup> November 2018 retrieved for intervention group. Total 217 patients admitted to Tuen Mun Hospital of ASU with their first ischemic or hemorrhagic stroke. All recruited patients have 2 sets of blood taken for BUN/creatinine ratio on day of admission and on day 4–7 of hospitalization. A new clinical workflow adopted for intervention group to increase fluid fed round and maintenance of intravenous fluid.

**Results:** Among 154 patients meeting inclusion criteria. Patients with BUN/cr ratio > 15 is decreased from 69.6% to 60.9% as compared. Before program, the mean BUN/cr ratio is increased from 17.05 to 19.07 (p-value < 0.02). After program, the mean BUN/cr ratio of patients is decreased from 16.21 to 14.57 (p-value < 0.03).

**Conclusions:** Although dehydration is common, initiation and maintenance of fluid supplementation is limited and poor oral fluid intakes in many patients were ignored. This EBP project provides a foundation for a system improvement in targeting extra fluid fed round to IVF administration as well as the development of a fluid resuscitation algorithm for future prospective trials as we attempt to improve clinical outcome.

**Trial registration number:** N/A

## AS14-007

### PREDICTORS OF DEPENDENCY AFTER STROKE: A PROPOSAL OF IMPROVING THE DISCHARGE PLANNING COORDINATION BETWEEN HEALTH AND SOCIAL CARE

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<sup>1</sup>Institut Català de la Salut, Primary Care, Tortosa, Spain; <sup>2</sup>Universidad Miguel Hernández Elche, Primary Care, Elche, Spain; <sup>3</sup>Institut Català de la Salut, Primary Care, Tortosa, Spain; <sup>4</sup>Institut Universitari d'Investigació en Atenció Primària IDIAP Jordi Gol, Primary Care, Barcelona, Spain;

<sup>5</sup>Universitat Rovira Virgili, Primary Care, Tortosa, Spain

**Background and Aims:** After a stroke families require the coordinated assistance of health and social care. There is a lack of comprehensive evaluation and assessment tools to identify discharge needs and there is separate management of the health and social resources, and access to these services is variable between regions.

The main objective of this study was to assess the factors associated with dependency after stroke and propose a suitable instrument for identifying patients at higher risk for needing formal care from health and/or social care providers.

**Methods:** This was a 2-year prospective and community study of a stroke cohort. The primary outcome was recognized dependency. The potential predictors were considered in a multivariate regression, and receiver operating characteristic (ROC) curves were used to predict dependency.

**Results:** Overall, 233 patients were included, 49.8% of whom were women. The total rate of dependency was 31.5 (95% CI 26.1–37.7) cases/100 person-year, but 30.4% became dependent prior to the stroke. The independent factors associated with dependency outcome were: age >80 years (HR 2.03, 95% CI 1.32–3.12, p = 0.001), Pfeiffer score ≥4 (HR 1.82, 95% CI 1.25–1.266, p = 0.002), Barthel score < 60 (HR 1.79, 95% CI 1.21–2.66, p = 0.003), and Charlson score ≥3 (HR 1.49, 95% CI 1.02–2.16, p = 0.039). The AUC was 0.84 (95% IC 0.79–0.89; p < 0.001), and the App Health+Social was associated with time-savings.

**Conclusions:** The use of alarm conditions can ease the burden for the application to Dependency by supporting the integrated role of social and health services.

**Trial registration number:** ClinicalTrials.gov number NCT03451357. Date of clinical registration March 1, 2018.

## AS14-031

### INCIDENCE OF PRESSURE INJURY IN A LEVEL III STROKE UNIT OF A DEVELOPING COUNTRY

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**Background and Aims:** Pressure injury (PI) is a common complication in bedridden patients and has a great impact on the individual's prognosis. The aim was to verify the incidence of PI in patients hospitalized in a Brazilian Stroke Unit (SU).

**Methods:** Prospective study with consecutive patients hospitalized at SU from January/2017 to December/2018. The PI presence was evaluated daily according to skin integrity, hyperemia and patient's nutritional status by the responsible nurse. Fugulin scale (FS) was used to verify the patient's dependence degree according to nursing care. The incidence was calculated using the formula: number of new PI cases/number of patients at risk for developing PI x 100.

**Results:** In the period, 650 patients were hospitalized, of which 532 had developing PI risk according to FS. The length of stay was  $6.88 \pm 3.8$  days. In this period, no patient developed PI. The 0% incidence rate of PI in the SU reflects the success of the prevention work to the appearance of PI of the multidisciplinary team, mainly, of nursing. Regarding specific prevention care, we can mention: the placement of pyramidal mattress and cushion for all patients over 60 years or with some paretic member; change of position every 2 or 3 hours and multiprofessional team intensive treatment, with protocols of early and adequate care of physiotherapy, speech therapy and occupational therapy, in addition to nutritional intervention according to recent guidelines.

**Conclusions:** We conclude that well-designed multidisciplinary prevention work can significantly reduce the incidence rate of pressure injury in a stroke unit.

**Trial registration number:** N/A

## AS14-034

### QUALITY ASSISTANCE INDICATORS OF A LEVEL III STROKE UNIT OF A DEVELOPING COUNTRY

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**Background and Aims:** Stroke is one of the leading causes of death in the world and hospital care quality can impact the patient's prognosis. The aim is to evaluate the quality indicators according to Resolution No.665 for implementation in stroke treatment published by the Brazilian Ministry of Health in 2012, in a level III Brazilian Stroke Unit.

**Methods:** Prospective study in which 13 quality indicators were analyzed from January to December/2018. Of the indicators, were highlighted: door-to-CT scan time; door-to-needle time; length of stay; percentage of patients admitted with cerebrovascular disease; deep vein thrombosis (DVT) prophylaxis; use of antiplatelet agents until 48 hours; pneumonia rate and hospital mortality. The unit has capacity for 10 beds monitored, neurology/neurosurgery and thrombolysis 24h per day, 7 days a week, and full multiprofessional team. It is referenced and focuses on stroke acute phase, etiological investigation, complication prevention and rehabilitation with a maximum 15 days length of stay.

**Results:** A total of 275 patients with median age of 69 (59-78) years were included, 56.4% male, 19.4% were thrombolysed, 78.5% admitted with acute cerebrovascular disease, 87.2% with door-to-CT scan time < 25 minutes, 57.1% with door-to-needle time < 60 minutes, length of stay of 6 (4 - 9) days, 92% of the patients received DVT prophylaxis, 95% had antiplatelet use until 48h of hospitalization, a pneumonia rate of 6.9% and hospital mortality of 4%.

**Conclusions:** The results allowed to evaluate the parameters required by Brazilian Ministry of Health, enabling the weaknesses knowledge, facilitating the management work and allowing the service improvement.

**Trial registration number:** N/A

## AS14-045

### NURSE LED STROKE DROP IN CLINICS FOR PATIENTS POST DISCHARGE

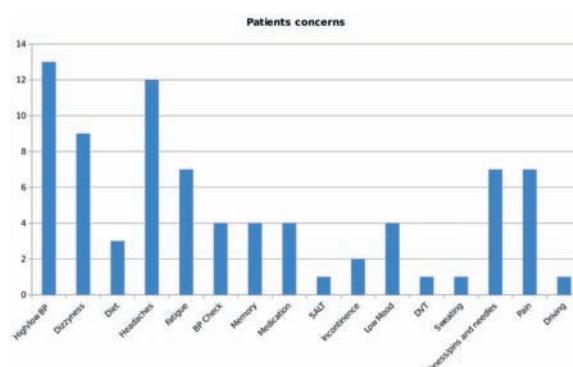
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**Background and Aims:** Stroke patients discharged from the unit at 6 months were found to have a poor retention of information and specific advice relating to their stroke. There is usually a gap in contact between healthcare professionals and patients post discharge. Our aim was to reduce this gap, provide contact opportunities for patients and their family, and improve the awareness for secondary prevention and lifestyle changes

**Methods:** Informal Drop-in sessions were advertised and held a month. This service is entirely Nurse led with support from medical and therapy services along with representation from the local Stroke association.

**Results:** 130 patients attended the drop-in clinic during 2018. That is an average of 10.8 per month. A broad range of patient and family concerns were addressed (Figure 1). The service generated extremely positive comments from the user groups. A common consensus from the group was the reduction in patient and carer anxiety knowing there was a service they could access without any appointments. Patients also felt more supported meeting other stroke survivors and the clinic was also an opportunity to make the 6 month follow up more targeted and relevant depending on the issues identified earlier.



**Conclusions:** This service is extremely valuable for patients and families who lack a point of contact post discharge. We have been able to address a wide range of issues, reduce patient anxiety and the service has received excellent feedback. This clinic also provides an opportunity to emphasise on secondary prevention and makes the 6 month follow up more targeted.

**Trial registration number:** N/A

## WITHDRAWN

appropriate stakeholders agreed that the Hyper Acute Stroke nursing staff should incorporate this scale into their clinical assessments, and at organisational level it was agreed that pregnant or post partum women should be admitted to HASU.

**Results:** Pregnant or post partum patients are appropriately cared for in the Hyper Acute Stroke Unit where appropriate. Links with our sister Maternity hospitals allows for ease of access for visitation of newborns into HASU, and increases communication between the two organisations.

**Conclusions:** Collaboration with stakeholders and upskilling of nursing staff increases awareness and safety of pregnant or post partum stroke patients, and their care in the Hyper Acute Stroke Unit.

**Trial registration number:** N/A

## WITHDRAWN

### AS14-038

#### PREGNANT AND POST PARTUM STROKE – CONSIDERATIONS FOR HYPER ACUTE STROKE NURSING

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**Background and Aims:** Incidence of Stroke in pregnant or post partum women is estimated at between 11–34 incidences per 100,000 deliveries (Leffert et al, 2016; Petitt et al, 1997; James et al, 2005, Davie et al, 2008). The Hyper Acute Stroke Unit (HASU) had no exclusion admission criteria (except those needing Intensive Care / ventilator support), however this Academic Hospital has restrictions on what units pregnant or post partum patients may be admitted to.

**Methods:** The Irish Maternity Early Warning System (IMEWS) is a nationally agreed system developed for early detection of life threatening illness in pregnancy and the postnatal period. Negotiations with

### AS14-041

#### DO HEALTH PROFESSIONALS ASSESS STROKE SURVIVORS' ABILITY TO SELF-MEDICATE ON AN ACUTE STROKE UNIT? AN AUDIT OF CURRENT PRACTICE.

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**Background and Aims:** People that experience a stroke or transient ischemic attack are at increased risk of a future stroke and compliance

with medications are important to reduce this. Stroke may cause impairments that affect the person's ability to self-medicate safely and independently. United Kingdom national guidelines advise a stroke survivor's ability to self-medicate should be assessed including the domains of cognition, manual dexterity and swallowing prior to discharge from hospital to home. This audit aims to assess current practice of assessing stroke survivors' ability to self-medicate on an acute stroke unit, with a view to identifying further improvement of practice.

**Methods:** A retrospective audit was completed of documentation for stroke survivors admitted within a two month period. This included the proportion of stroke survivors who prior to their stroke were self-medicating; the proportion who were assessed during their admission; and the proportion who were independent with this on discharge.

**Results:** 33 stroke survivors' notes were audited. Initial results found 75% were self-medicating prior to admission and only 6% were self-medicating on discharge. 1% were assessed to self-medicate within their admission. Further results to be presented.

**Conclusions:** Self-medication assessment is inadequate and to maximise effective secondary prevention and reduced care dependency this needs to become a routine part of high quality stroke care.

**Trial registration number:** N/A

## WITHDRAWN

## AS14-004

### POST STROKE PAIN: IDENTIFICATION AND ASSESSMENT IN APHASIC PATIENTS

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**Background and Aims:** Public hospitals in Catalonia (Spain) recommend using the Spanish version of the Pain Assessment in Advanced Dementia (PAINAD-Sp) scale for assessing pain in adult patients unable to self-report. However, since its inclusion in Catalonian nursing care plans in 2010, there have been no training programs for nurses, contributing to its current underuse. The aim of this study was to assess the impact of a nurse training intervention on the PAINAD-Sp scale in aphasic inpatients post-stroke

**Methods:** We used a before-after study design, evaluating the use of the PAINAD-Sp scale over two six-month periods before and after an online training intervention for nurses in February 2017. Data were collected from patient records in a University Hospital. The primary outcome was the number of patients receiving PAINAD-Sp assessments during admission. Secondary outcomes were: the number of assessments undertaken per patient during admission, the total (0 to 10) and item-specific (0 to 2) PAINAD-Sp score, and pharmacological treatment administered

**Results:** There were 341 nurses who took part in the training program, 99% of the participants correctly answered the questions from the course quiz, with a mean score of 94.6/100. Over the study period, 80 patients received PAINAD-Sp assessments: 23 in the pre-intervention period and 57 in the post-intervention period ( $p < 0.0001$ ). Administration of analgesics and antipyretics increased ( $p < 0.001$ ) after the intervention, as did use of hypnotic drugs and sedatives

**Conclusions:** The course may be an effective way to improve nurses' approach to identifying, assessing, and managing pain in aphasic patients after stroke

**Trial registration number:** N/A

## WITHDRAWN

**WITHDRAWN**

**Background and Aims:** OSCARSS is a cluster randomised controlled trial of a professionally-delivered intervention to support caregivers of stroke survivors (abstracts submitted separately). A Research User Group (RUG), made up of carers, was established in Dec 2015 to act as key collaborators for study planning, setup, management, data interpretation and dissemination.

**Methods:** The RUG meet regularly with the research team and are represented on the Trial Management Group. Early meetings established group rules and understanding of research aims. Agenda items and accessible documents are sent in advance of meetings, as needed, to help group members prepare and contribute.

**Results:** The group has developed into a committed and cohesive team, empowered to confidently exchange views and experiences with the researchers. Particular achievements of the RUG include: co-developing the research intervention; designing accessible study materials; training staff; choosing meaningful outcome measures; refining processes to maximise study recruitment and retention; supporting interpretation of qualitative interview findings; engaging in social media and dissemination to promote the project.

**Conclusions:** The RUG has a unique and important role in OSCARSS. This collaboration presents a learning opportunity for how other professionals can meaningfully involve service users in research. The ongoing relationship increases confidence that carer voices will be heard, however there is potential for a lack of fresh ideas due to the fairly fixed membership. Overall, we believe the RUG collaboration has benefitted OSCARSS and members have personally gained from their involvement. RUG will continue to support analysis and dissemination of OSCARSS to September 2019.

**Trial registration number:** ISRCTN58414120

**AS14-010**

### **APPLICATION VALUE OF STROKE EMERGENCY NURSES IN EMERGENCY TREATMENT OF ACUTE ISCHEMIC STROKE PATIENTS**

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**Background and Aims:** We evaluate the effects of Stroke Emergency Nurses (ESN) in Emergency Treatment of Acute Ischemic Stroke (AIS) Patients.

**Methods:** A total of 194 AIS patients treated with intravenous thrombolysis or endovascular treatment (EST) were recruited from December 2017 to November 2018. We divided patients into 2 groups: treatment without ESN ( $n=107$ ) and with ESN ( $n=87$ ). We compared door-to-needle time (DNT), door-to-imaging time (DIT), imaging-to-needle time (INT), onset-to-treatment time (OTT), door-to-puncture time (DPT), the rate of reaching standard ( $DTN \leq 60$  min,  $DTP \leq 90$  min) and the rate of modified Rankin score (mRS)  $\leq 2$  in the two groups. Logistic regression model was used to detect the factor associated with qualified rate of treatment.

**Results:** There was no significant difference in age, sex, medical history and NIHSS score at admission between the two groups (all  $P > 0.05$ ). The DNT, INT, OTT and DPT in patients with ESN were shorter than those without ESN. There is a higher qualified rate of treatment and a higher functional outcome at hospital discharge and 3 months in patients with ESN compared with those without ESN (all  $P < 0.05$ ). However, there were no significant difference in DIT and in hospital mortality between the two groups ( $P > 0.05$ ). Logistic regression showed that the shorter door to catheter time and office time was significant associated with high qualified rate of treatment.

**AS14-032**

### **CARING FOR CARERS: RESEARCH USER GROUP COLLABORATORS IN A CLUSTER RANDOMISED CONTROLLED TRIAL, ORGANISING SUPPORT FOR CARERS OF STROKE SURVIVORS (OSCARSS)**

**K. Burke<sup>1</sup>, K. Woodward-Nutt<sup>2</sup>, A. Bowen<sup>3</sup>, E. Patchwood<sup>3</sup>; on  
behalf of the OSCARSS research team**

<sup>1</sup>Service User Representative, Stroke Association Ambassador, Manchester, United Kingdom; <sup>2</sup>NIHR Collaboration for Leadership in Applied Health Research and Care CLAHRC Greater Manchester, Stroke Programme, Manchester, United Kingdom; <sup>3</sup>University of Manchester, Division of Neuroscience and Experimental Psychology, Manchester, United Kingdom

**Conclusions:** The leading role of emergency stroke nurses can shorten the DNT, DPT and OTT time and save time for the treatment of acute ischemic stroke patients in the treatment time window.

**Trial registration number:** N/A

#### AS14-035

#### SINGULARLY DELICIOUS: COOKING FOR STROKE SURVIVORS

**V. Termont<sup>1</sup>, A. Leyman<sup>2</sup>, D. Hemelsoet<sup>2</sup>, V. De Herdt<sup>2</sup>, I. Daniël<sup>2</sup> and B. D'haeze<sup>2</sup>**

<sup>1</sup>Ms, Neurology, Ghent, Belgium; <sup>2</sup>University Hospital Ghent, Neurology, Ghent, Belgium

##### Background and Aims: Background

Stroke is often a devastating disease with severe residual motor symptoms including hemiplegia. Although physiotherapy and occupational therapy can help to recover and to deal with the residual symptoms, it can be still difficult for stroke patients to reintegrate into normal life and pick-up activities of daily living due to motor difficulties.

##### Aim

- 1) To develop a cookbook for people suffering from hemiparesis following a stroke.
- 2) To adapt existing culinary recipes making them applicable when using kitchen aids developed for people with a handicap.
- 3) To promote stroke burden awareness by involving stroke patients and various community stakeholders in the development and promotion of the cookbook.

**Methods:** N/A

**Results:** The Stroke Team of the Ghent University Hospital developed a cookbook for one-handed cooking, called "Singularly Delicious". The book shows how to work in the kitchen with a single hand using handicap-specific aids. This book facilitates a boost to confidence, independence, self-respect and social interactions. The joint project by the Ghent University Hospital, community stakeholders (public health insurance, Ghent University, restaurant business) and patients was developed in connection with European Stroke Awareness Day and received national and international attention. Unexpectedly, the book also received a lot of interest from patients with non-stroke handicaps.

**Conclusions:** A stroke patient-oriented cookbook project was developed in order to promote stroke survival awareness. Following the national success and the international attention, an English translation is presented at ESOC 2019. Proceeds from this book will be donated to a patient organisation for stroke survivors.

**Trial registration number:** N/A

#### AS14-044

#### "QASC EUROPE" THE FIRST RESULTS OF THE STUDY IN ITALY: COMPARATIVE ANALYSIS OF THE DATA OBTAINED FROM THE OBSERVATIONAL STUDY OF TWO DIFFERENT HOSPITALS

**A. Urso<sup>1</sup>, G. Di Vito<sup>2</sup>, F.R. Pezzella<sup>3</sup>, M.P. Del Grosso<sup>2</sup>, E. Salvi<sup>2</sup>, L. Mitello<sup>4</sup>, F. Scatena<sup>2</sup>, A.R. Marucci<sup>4</sup>, M. Conti<sup>2</sup>, F. Cuomo<sup>4</sup>, A. Amitrano<sup>4</sup> and L. Casertano<sup>1</sup>**

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<sup>3</sup>San Camillo Forlanini Hospital, Stroke Unit, Rome, Italy; <sup>4</sup>San Camillo Forlanini Hospital, Health Professions Department, Rome, Italy

**Background and Aims:** The Quality in Acute Stroke Care (QASC) Trial, has shown, in the countries where the study was conducted, that multidisciplinary nurse-led interventions to manage fever, hyperglycaemia

and swallow difficulties following acute stroke, significantly improved health outcomes. Results showed that supported implementation of the Fever, Sugar, Swallow (FeSS) Clinical Protocols resulted in 16% decreased death and dependency at 90-days, and in-hospital: reduced mean temperatures, reduced mean glucose levels and improved swallow screening management. There also was a non-significant reduction in length of stay by two days

The Italian study was conducted at the San Camillo Forlanini Hospital in Rome and at the Hospital of Avezzano, which are two very different hospitals for localization and approach to the Stroke.

**Methods:** We proceeded, as envisaged by the International Protocol QASC, to the first phase of the study, which is the observational study, with the audit of 42 patient records of patients hospitalized in the two Centers during 2018 with diagnosis of acceptance of the ICD 10.

**Results:** While at the Hospital of Avezzano great attention is paid to the detection and management of fever and glycemia, at San Camillo Forlanini Hospital nurses are much more attentive to swallowing disorders secondary to a stroke.

**Conclusions:** These results demonstrate the importance of nationwide adoption of nursing protocols that recalculate treatment inequalities and base nursing care on scientific evidence, to reduce complications and increase the benefits for stroke victims in Italy

**Trial registration number:** N/A

#### AS14-005

#### EVOLVING SENIOR NURSE ROLES IN ACUTE STROKE SERVICES: AN EXPLORATION OF PAST PRESENT AND FUTURE IN ENGLISH HOSPITALS (SEVERN REGION)

**L. Vincent<sup>1</sup> and L. Shaw<sup>1</sup>**

<sup>1</sup>Royal United Hospitals NHS Foundation Trust, Stroke Medicine, Bath, United Kingdom

**Background and Aims:** United Kingdom stroke services have improved since the creation of a stroke sub-speciality in 1999, but audits show there is vast regional variation. Twenty years ago, stroke coordinators signposted patients to rehabilitation services, supported service development and comprised a regional network which shared knowledge/expertise. These roles either disappeared as specialist services became established or evolved into advanced practitioner roles as thrombolysis/thrombectomy became the focus. Unlike their emergency department counterparts, these posts don't have standardised competency frameworks. Prior to introducing stroke nurse competencies, we explored the contemporary issues encountered by local hospitals and their evolution over time.

**Methods:** Qualitative telephone survey of advanced stroke nursing roles in six hospitals comprising one UK region

**Results:** Each site had evolved different types of advanced nursing roles which lacked role definition, competencies, standardised validated training, or mentorship. Shifts towards acute stroke services had afforded less time for service development and has been instrumental in dissolution of the stroke coordinators' network. Overall individuals were feeling isolated and overwhelmed, limiting their ability to focus on service development and innovation.

**Conclusions:** We have identified a clear need for standardisation of advanced acute stroke nursing roles. We recommend that further work should include a national role definition, scope of practice and competency framework. This would support development from junior nurse right up to fully trained nurse practitioners, adept at leadership/service development. Support is required from structured mentorship and a nationally/ professionally validated MSc programme. The rejuvenation of a local nurse practitioner network would improve education, service development and morale.

**Trial registration number:** N/A

**Pathophysiology of Stroke****WITHDRAWN**

(44 total). Of those undergoing echocardiography no LV thrombi were identified

**Conclusions:** The prevalence of atrial fibrillation amongst patients with retinal artery occlusion in this study appears to be lower than the expected value. This may suggest that AF is not necessarily a risk factor associated with RAO and electrocardiographic and echocardiographic investigation may be better targeted at a specific cohort, possibly those under 40.

**Trial registration number:** n/a

**AS19-007****ASSOCIATIONS BETWEEN BLOOD PRESSURE VARIABILITY AND STROKE SEVERITY OR SUBTYPE IN PATIENTS WITH A RECENT ISCHAEMIC STROKE**

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**Background and Aims:** Blood pressure (BP) variability (BPV) is increased in ischaemic stroke and is associated with adverse outcomes. Treatments to reduce BPV are yet to be established, and whether potential treatments might benefit all ischaemic stroke patients, or only certain subgroups has not been investigated.

**Methods:** Adults with a recent ischaemic stroke (N = 181) underwent clinic BP measurement and daytime ambulatory BP monitoring (ABPM). A subgroup (N = 67) also underwent 10 minutes beat-to-beat BP monitoring. BPV was derived as standard deviation (SD) and coefficient of variation (CV). NIHSS score, Oxford Community Stroke Project (OCSP) classification, and affected cerebral hemisphere were recorded to classify stroke severity and subtype. Exploratory univariate testing for relationships between BPV parameters and these variables was conducted, with multivariate testing where results were significant.

**Results:** There was a negative correlation between NIHSS score and daytime ABPM systolic BPV ( $SD\ r=-0.24$  [ $p < 0.01$ ],  $CV\ r=-0.28$  [ $p < 0.01$ ]), but no relationship with other measurements. Similarly, there were significant between-group differences in OCSP classification for daytime ABPM systolic BPV ( $SD\ p = 0.002$ ,  $CV\ p = 0.001$ ) Post hoc testing indicated BPV was greatest in lacunar stroke (LACS). These findings remained significant on multivariate analyses. Results for diastolic BPV were similar. There was no relationship between affected cerebral hemisphere and BPV from any method.

**Conclusions:** BPV was associated with stroke severity, with variability increased in LACS compared to other OCSP categories. Further work to establish if there is a causal link between LACS and increased BPV would be valuable, and could help direct the use of treatments to reduce BPV.

**Trial registration number:** N/A

**AS19-014****RETINAL ARTERY OCCLUSION AND ATRIAL FIBRILLATION: ARE WE OVER-INVESTIGATING? EXPERIENCE FROM A DISTRICT GENERAL HOSPITAL**

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**Background and Aims:** Central and branch retinal artery occlusion (RAO) are ocular equivalents of cerebral stroke and, as such, require a thorough clinical work-up.

Atrial fibrillation (AF) is a well-known risk factor associated with cerebral ischaemic stroke and cardiac monitoring is a routine investigation for patients presenting with a stroke affecting the large vasculature. Current RCP guidance suggests cardiac monitoring for all patients eligible for secondary prevention for 12 hours if aetiology is known and 24 hours for cryptogenic strokes. Echocardiogram for suspected LV thrombus remains more clinician dependent.

**Methods:** All cases of retinal artery occlusion presenting to the Royal Bournemouth Hospital over a ten-year period (2008-2017 inclusive) were identified by searching local records for relevant clinic codes.

**Results:** Of 110 cases with data available, 16 had confirmed AF, giving a prevalence of 14.5%. Of these patients, 11 were previously known to have AF. 5 new cases were identified via electrocardiographic investigation. Single ECG detected 2 and ambulatory cardiac monitoring detected 3. Of these 3 cases, 1 was detected on 72 hour monitoring and 2 were detected on 7 day monitoring. No cases were detected via 24 hour tape

**AS19-020****PLATELETS AND VON WILLEBRAND FACTOR ARE KEY COMPONENTS IN ACUTE ISCHEMIC STROKE CLOTS**

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**Background and Aims:** Previous studies assessing acute ischemic stroke (AIS) clot composition have characterised clot histological composition in terms of percentage red blood cell (RBC), white blood cell (WBC) and fibrin. However platelets and platelet-related factors such as von Willebrand factor are key components of coagulation and thus are likely also important in AIS clots. This study investigated the relationship between the expression levels of von Willebrand factor (vWF) and platelets (CD42b) in AIS clots.

**Methods:** Sequential 3µm sections from AIS clots ( $n=55$ ) were stained for platelets (CD42b) and vWF. Immunohistochemical staining for vWF (1:200) and CD42b (1:200) was performed using a Ventana Discovery autostainer. Expression levels were quantified using Machine Learning software (Orbit Image Analysis, [www.orbit.bio](http://www.orbit.bio)). Descriptive statistics and correlation analysis ( $R^2$ ) for comparison were generated on GraphPad Prism.

**Results:** Platelets and vWF account for a significant proportion of the composition of the clots. The median (IQR) platelet content was 29.0% (14.3-40.3%) with a range of 1.7-89.4%. The median (IQR) vWF content was 18.6% (12.5-32.3%) with a range of 1.3-79.4%. A significant positive correlation ( $R^2=0.459$ ) was found between the expression of platelets and vWF ( $F(1, 53)=44.90$ ;  $p < 0.0001$ ).

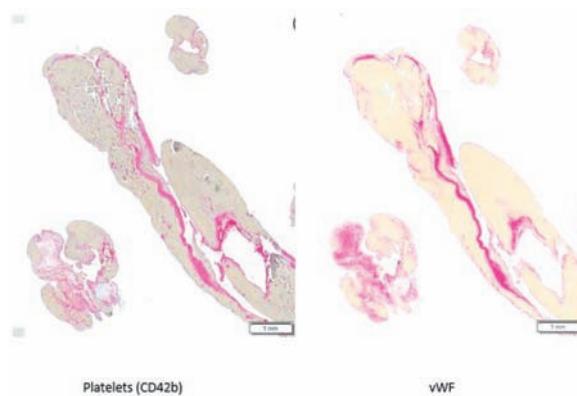


Figure 2: An example showing regions of co-localisation for CD42b and vWF

**Conclusions:** These initial results suggest that platelets and vWF are major components of AIS clots. The expression levels of both platelets and vWF appear to be related to each other, although variability has been observed. Better understanding of key clot components and composition may ultimately lead to better device design and/or novel thrombolytic agents.

**Acknowledgements:** Science Foundation Ireland (13/RC/2073) and Cerenovus.

**Trial registration number:** N/A

**AS19-036****THE DIFFERENT HEMODYNAMIC RESPONSE OF THE CAROTID AND VERTEBROBASILAR CIRCULATION TO THE VALSALVA MANEUVER IN HEALTHY YOUNG SUBJECTS**

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**Background and Aims:** High frequency of posterior lesions are described in PFO-related strokes. Our project aims to confirm preliminary data indicating that this could be due to a different hemodynamic response to Valsalva maneuver of the vertebro-basilar compared to the carotid circulation system.

**Methods:** Measurement of the diameter ( $\emptyset$ ) and of the blood flow ( $\Phi$ ) of internal carotid artery (ICA) and vertebral artery (VA) at rest and after Valsalva maneuver (VM) in 30 young healthy subjects (M:F 1:1; average age  $26,61 \pm 3,71$  years) using ultrasound B-Mode US and Color Doppler imaging techniques.

**Results:** Compared to the rest state after VM we observed:

- 1 – a statistically significant ( $p < 0,001$ ) decrease of ICA  $\emptyset$  (0.40 vs 0.47 cm) and increase of VA  $\emptyset$  (0,35 vs 0,32 cm);
- 2 – a statistically significant ( $p < 0,001$ ) decrease of ICA  $\Phi$  ( $\Phi$  systolic peak 65,33 vs 83,95 cm/s;  $\Phi$  diastolic peak 26,19 vs 34,31 cm/s), a stable VA  $\Phi$  ( $\Phi$  systolic peak 61,73 vs 61,43 cm/sec;  $\Phi$  diastolic peak 19,86 vs 18,93 cm/sec).

**Conclusions:** We confirmed the existence of a different hemodynamic response of the carotid and vertebral circulation systems to Valsalva maneuver, supporting the hypothesis that this mechanism may partially explain the high prevalence of posterior brain cerebral infarcts in patients with PFO.

**Trial registration number:** N/A

**WITHDRAWN**

**Conclusions:** High serum levels of the S100B protein in the acute period of pediatric ischemic stroke mean severe brain damage and the risk of developing long-term severe complications from CNS.

**Trial registration number:** 17.00418.80.11A/27.05.2017

### AS19-013

#### IN SITU VASCULAR SMOOTH MUSCLE GENE EXPRESSION BETWEEN HUMAN MIDDLE CEREBRAL AND CORONARY ARTERY

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**Background and Aims:** Human cerebral arteries smooth muscle cell layer has unique embryologic, histologic, physiologic and pathologic characteristics compared to coronary arteries, and it is presumed that there are different mechanisms for the fatal outcome, such as atherosclerosis. However, there are no study about the difference in gene expression between the cerebral artery and the coronary artery muscle cell layer.

**Methods:** In this study, vascular smooth muscle layer of the middle cerebral artery and left anterior descending coronary artery obtained from the same individual were extracted by autopsy ( $n=10$ ), and gene expression was compared by cDNA microarray ( $n=3$ ).

**Results:** The total gene expression in the two blood vessels showed 341 different expression levels. Of the 341 genes expressed relatively differently in the cerebral artery, 256 were increased and 85 were decreased. Vascular muscle cells of the cerebral artery were found to be rich in the expression of genes involved in angiogenesis, extracellular matrix, cell migration, neurogenesis, and inflammatory response as compared to coronary arteries. Ingenuity Pathway Analysis (IPA) revealed top pathways associated with atherosclerosis signaling in cardiovascular system. In this study, it was confirmed that the vascular muscle cells of human middle cerebral artery and coronary artery showed different gene expression.

**Conclusions:** The discovery of some genes involved in atherosclerosis, which is characteristically highly expressed in middle cerebral artery, can be interpreted as an understanding of the differentiation of arterial function regulation and susceptibility to vascular diseases such as atherosclerosis and diabetes.

**Trial registration number:** N/A

### AS19-023

#### THE S100B PROTEIN IN THE ISCHEMIC PEDIATRIC STROKE

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**Background and Aims:** Biochemical markers provide us with additional information about the degree of brain injury. The S100B protein participates in many processes that take place in the brain. PURPOSE: The assessment of the changes in the serum level of the S100B protein in ischemic stroke patients for determination of its role in the assessing the degree of the brain damage.

**Methods:** Where investigated 61 patients with ischemic stroke (with the age from 4 weeks to 5 years old) diagnosed based on imaging investigations. The degree of the damage to the state of consciousness has been appreciated after the Glasgow scale. The PedNIHSS scale was used to evaluate the clinical outcome of the stroke. The S100B protein was evaluated from serum collected in the first 3 days of hospitalization. For comparison of S100B protein values, it was measured in 25 healthy children.

**Results:** Serum values of the S100B protein were much higher in patients with ischemic stroke (average value – 0.516 ng / mL) compared with the healthy children (average value – 0.122 ng / mL). An inverted correlation was attested between the high values of the S100B and the Glasgow score. In patients with extremely high levels of S100B (between 0.679 – 4.39 ng / mL), a severe degree of coma and long-term adverse neurological outcomes (paresis, paralysis, epilepsy) have been reported.

### AS19-011

#### HIGH BLOOD VISCOSITY IN ACUTE ISCHEMIC STROKE WITH LARGE VESSEL DISEASE

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**Background and Aims:** High blood viscosity has been reported as a risk factor for stroke. Some authors suggested hyperviscosity is associated with stroke patients with small vessel disease or atrial fibrillation. However, hyperviscosity in large artery stroke still remains uncertain. We aimed to find whether hyperviscosity has an effect on large artery disease.

**Methods:** From January 2017 to December 2017, we retrospectively reviewed patient record consecutively admitted to our hospital with large artery stroke. Patients with larger artery stroke according to TOAST classification and performed blood viscosity study were selected. Whole blood viscosities measured at a high or low rate using a scanning capillary tube viscometer were referred as systolic blood viscosity (SBV) and diastolic blood viscosity (DBV), respectively. Association between

blood viscosity and large artery stroke according to lesion pattern (stenosis or occlusion) and lesion distribution (anterior or posterior circulation territory) were assessed.

**Results:** A total of 154 patients (mean age  $68.07 \pm 12.61$  years) were enrolled. Of whom 107 (69.5%) were male. Large artery diseases were involved in intracranial ICA ( $n=52$ , 33.8%), MCA ( $n=58$ , 37.7%), ACA ( $n=4$ , 2.6%), PCA ( $n=8$ , 5.2%) and vertebrobasilar artery ( $n=32$ , 20.8%), respectively. Of them 101 vessels were stenotic (65.5%) and remaining 53 vessels (34.4%) were occluded. Although there was no association between lesion distribution and blood viscosity, SBV was significantly higher in patients with occlusion than those with stenosis ( $p=0.045$ ) and DBV showed slightly increased in the former ( $p=0.061$ ).

**Conclusions:** Blood viscosity in high blood flow state in the patient with large artery occlusion is elevated than those with stenosis.

Trial registration number: N/A

## WITHDRAWN

$p = 0.045$ , when compared to the controls.

**Conclusions:** rs112735431 was associated with ICAS in the Korean population, and rs1800470 was associated with ICAS and ECAS, respectively. Further studies are needed to identify the role of rs2179357 and rs1800470.

Trial registration number: N/A

## AS19-032

### INHIBITION OF VESICULAR GLUTAMATE TRANSPORTERS PROMOTES THE DEVELOPMENT OF TOLERANCE TO BRAIN ISCHEMIA AND REDUCES ISCHEMIC INJURY IN RATS

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**Background and Aims:** Glutamate (Glu) excitotoxicity is a key player in brain ischemia. The Glu neurotransmission depends on the activity of vesicular glutamate transporters (VGLUTs), responsible for the Glu uptake into synaptic vesicles. We hypothesized that a single intraventricular administration of Chicago Sky Blue (CSB6B), which inhibits VGLUTs activity, before or after transient focal cerebral ischemia in rats may induce a development of tolerance to brain ischemia or reduce brain injury, respectively.

**Methods:** Ninety-minutes middle cerebral artery occlusion (MCAO) in male Sprague-Dawley rats was used as a focal brain ischemia model.

**Results:** The effects of CSB6B on the infarct volume, neurological deficits as well as expression of the VGLUTs (VGLUT1, VGLUT2, and VGLUT3) were compared to the effects of the reference preconditioning strategies: ischemic preconditioning and chemical preconditioning with 3-nitropionic acid. Administration of CSB6B significantly decreased both infarct volumes and neurological deficit scores evoked by a 90-min MCAO, when administrated either 2 hours before and 1,5h after cerebral ischemia. These beneficial outcomes of CSB6B administration were accompanied by the modulation of VGLUT1, VGLUT2 and VGLUT3 expressions in the frontal cortex, hippocampus and dorsal striatum of the ischemic brain.

**Conclusions:** These results showed that inhibition of VGLUTs activity, which influences their expressions may promote the development of tolerance to brain ischemia in rats and reduce cerebral injury. The obtained results suggest that VGLUTs may become the future targets of novel pharmacotherapy of brain ischemia.

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Trial registration number: N/A

## AS19-039

### CORRELATIONS BETWEEN WHOLE BLOOD VISCOSITY AND PERFUSION LESIONS IN ACUTE ISCHAEMIC STROKE.

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**Background and Aims:** Tissue perfusion is affected by the whole-blood viscosity (WBV), particularly in capillaries where red blood cells must deform in order to pass through the narrow lumen of the vessel. WBV may be chronically elevated before a stroke and may also be elevated acutely by inflammatory cascades triggered during cerebral ischaemia. This study aimed to measure WBV in acute stroke patients, and

assess correlations between WBV and perfusion parameters assessed by CT-perfusion.

**Methods:** WBV was measured in centipoise (cP) at a shear rate of  $20\text{s}^{-1}$  (corresponding to small arterioles and capillaries) in blood samples collected before any acute therapy (if given). Patients received non-contrast CT, dynamic CT-angiography and -perfusion scans acutely. Image characteristics, as core, mismatch, Cerebral Blood Volume (CBV), Cerebral Blood Flow (CBF) and Delay Time (DT) were collected.

Tissue was classified according to the parameters in Table I using MIStar. Table I: CTP parameters used to classify ischaemic tissue

Tissue classification	DT	CBF
Core	$\geq 3\text{s}$	< 30%
Mismatch	$\geq 3\text{s}$	> 30%
Severely-hypoperfused	$\geq 8\text{s}$	Any

**Results:** Acute WBV ranged from 2.99 to 9.27cP (mean = 5.85cP, SD = 1.54cP). In patients with an M1 occlusion, DT8 volumes were correlated with WBV ( $\beta = 19.65$ ,  $p = 0.039$ ,  $N = 9$ ) after correcting for collateral status (ASPECTS collateral). Other parameters (core, mismatch, total lesion volume) were not significantly correlated with WBV (nominal p-values  $>0.05$ ).

**Conclusions:** WBV may affect perfusion parameters, in particular the severity of tissue hypoperfusion, and lowering WBV may improve cerebral perfusion during ischaemic stroke. Recruitment for this study is ongoing so that a larger dataset can be examined.

**Trial registration number:** N/A

## AS19-037

### TEMPORAL PROFILE OF SYSTEMIC MARKERS OF INFLAMMATION AFTER LARGE VESSEL OCCLUSION STROKE TREATED WITH MECHANICAL THROMBECTOMY: DATA FROM THE HIBISCUS-STROKE COHORT

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**Background and Aims:** Ischemic damages lead to an inflammatory response with the activation of microglia and the production of pro-inflammatory cytokines, and chemokines, which may enhance the expression of adhesion molecules upon endothelial cells and hence support the initial invasion of blood-derived cells such as leukocytes into the infarct area. This immune response exerts a beneficial effect as tissue repair, and remodeling, but, in most cases, is excessive and exacerbates neural damage. Some studies have described the temporal profile of systemic markers of inflammation but data are scarce and have been performed before use in current practice of intravenous thrombolysis and mechanical thrombectomy. We aim to describe the temporal profile of systemic markers of inflammation, endothelial dysfunction and blood-brain barrier

damage after large vessel occlusion (LVO) stroke from HIBISCUS-STROKE cohort data.

**Methods:** HIBISCUS-STROKE is a cohort study including all consecutive patients admitted in the Lyon Stroke Unit for LVO stroke treated with mechanical thrombectomy and/or intravenous thrombolysis between 15/10/2016 and 23/10/2018. Plasma measurement of C-reactive protein (CRP), interleukin (IL)-6, IL-8, IL-10, soluble tumour necrosis factor receptor I (TNF-RI), Monocyte Chemoattractant Protein-1 (MCP-1), p-selectin, vascular cellular adhesion molecule-1 (VCAM-1) and matrix metalloproteinase-9 (MMP-9) were obtained from blood samples drawn at admission, 6 hours, 24 hours, 48 hours and 90 days later. All patients underwent MRI at admission including perfusion-weighted imaging and at 6 days.

**Results:** 100 patients were included. Mean age was 69.4 years (+/-15), 45% were women. Median NIHSS score was 15 [10-19]. The final results will be released during the meeting.

**Conclusions:** -

**Trial registration number:** N/A

## AS19-038

### EFFECT OF SYSTEMIC MARKERS OF INFLAMMATION ON THE COLLATERAL CIRCULATION IN LARGE VESSEL OCCLUSION STROKE TREATED WITH MECHANICAL THROMBECTOMY: DATA FROM THE HIBISCUS-STROKE COHORT

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<sup>6</sup>Hospices civils de Lyon, NeuroBioTec- Hôpital Neurologique Pierre Wertheimer, Bron-Lyon, France; <sup>7</sup>Université Lyon1/INSA Lyon/Hospices Civils Lyon, Carmen- INSERM U.1060/INRA U. 1397/Service d'explorations fonctionnelles Cardiovasculaires, Bron-Lyon, France

**Background and Aims:** Collateral circulation is a key variable during large vessel occlusion (LVO) stroke explaining the large spectrum of infarct growth rates. Good collateral circulation on initial presentation has been associated with reduced infarct core, improved prognosis and better response to recanalization therapy. Studies conducted until now have shown that systemic inflammatory markers and mediators after ischemic stroke are associated with stroke severity and outcome. The aim of our study was to assess the impact of systemic markers of inflammation, endothelial dysfunction and blood-brain barrier damage on collateral circulation in the setting of LVO from the HIBISCUS-STROKE cohort.

**Methods:** HIBISCUS-STROKE is a cohort study including all consecutive patients admitted in the Lyon Stroke Unit for LVO stroke treated with mechanical thrombectomy and/or intravenous thrombolysis between 15/10/2016 and 23/10/2018. Plasma measurement of C-reactive protein (CRP), interleukin (IL)-6, IL-8, IL-10, soluble tumour necrosis factor receptor I (TNF-RI), Monocyte Chemoattractant Protein-1 (MCP-1), p-selectin, vascular cellular adhesion molecule-1 (VCAM-1) and matrix metalloproteinase-9 (MMP-9) were obtained from blood samples drawn at admission. All patients underwent MRI at admission including perfusion-weighted imaging and at 6 days. Collateral circulation assessment was performed using perfusion-weighted imaging on admission MRI.

**Results:** 123 patients were included. Mean age was 68.7 years (+/-15.7), 45% were women. Median NIHSS score was 15 [10-19]. The final results will be released during the meeting.

**Conclusions:** The final conclusions will be released during the meeting.  
**Trial registration number:** N/A

### AS19-009

#### CONFOUNDING OF ASSESSMENT OF CEREBROVASCULAR REACTIVITY BY CHANGES IN BLOOD PRESSURE DURING BREATH-HOLDING AND HYPERVENTILATION IN PATIENTS WITH TIA AND MINOR STROKE

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**Background and Aims:** Impaired cerebrovascular reactivity (CVR) during breath-hold (BH) and hyperventilation (HV) is associated with cerebrovascular disease, but assessment might be confounded by changes in blood pressure (BP) during BH/HV. We identified physiological determinants of CVR in consecutive TIA and minor stroke patients.

**Methods:** At the Oxford Vascular Study (OXVASC) 1-month follow-up, change ( $\Delta$ ) in middle cerebral artery mean flow velocity ( $\Delta$ MFV) was measured by transcranial Doppler (TCD) after 30 seconds BH or HV. Two blinded reviewers independently scored quality. Dependence of  $\Delta$ MFV on change in BP (beat-to-beat –  $\Delta$ BP) and in end-tidal CO<sub>2</sub> ( $\Delta$ etCO<sub>2</sub>) was determined by linear regression and across quartiles.

**Results:** Of 602 patients with adequate bone windows and TCD recorded, 488 (81%) had good quality recordings (available more often in younger participants – 64.6 vs 68.7 years,  $p < 0.005$ ), of whom 426 had hyperventilation tests. Despite increases in CO<sub>2</sub>,  $\Delta$ MFV during BH was not associated with  $\Delta$ CO<sub>2</sub> ( $r = 0.029$ ,  $p = 0.53$ ), but rather with  $\Delta$ MBP ( $r = 0.391$ ,  $p < 0.005$ ). Only in patients with  $\Delta$ MBP < 10mmHg ( $n = 222/488$ ) was  $\Delta$ CO<sub>2</sub> associated ( $r = 0.155$ ,  $p = 0.021$ ). In contrast, during HV,  $\Delta$ MFV was correlated with both  $\Delta$ CO<sub>2</sub> ( $r = 0.364$ ,  $p < 0.005$ ) and  $\Delta$ MBP ( $r = 0.323$ ,  $p < 0.005$ ), although the association with  $\Delta$ CO<sub>2</sub> was again stronger for  $\Delta$ MBP < 10mmHg ( $n = 138/426$ ,  $r = 0.401$ ,  $p < 0.005$ ). Despite the effect of  $\Delta$ BP,  $\Delta$ MFV-BH across quartiles was associated with prognostically-significant patient characteristics (age  $r = -0.252$ ,  $p < 0.005$  aortic PWV  $r = -0.145$ ,  $p = 0.009$ ).

**Conclusions:** HV better reflected the cerebrovascular response to CO<sub>2</sub> due to the confounding effects of  $\Delta$ BP on  $\Delta$ MFV-BH. Despite confounding by  $\Delta$ BP, prognostic significance of  $\Delta$ MFV on BH and HV still needs assessment.

**Trial registration number:** N/A

### AS19-024

#### AP39, A NOVEL H<sub>2</sub>S DONOR, REDUCES AN INFARCT VOLUME, IMPROVES NEUROLOGICAL OUTCOME BY MODULATING NEUROINFLAMMATION AND BLOOD-BRAIN-BARRIER PERMEABILITY.

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**Background and Aims:** Pharmacotherapy in brain ischemia is still limited to recanalization strategies and neuroprotective substances are

urgently needed. There are some data suggesting beneficial effects of hydrogen sulfide (H<sub>2</sub>S) in the animal models of cerebral ischemia. Inorganic donors of H<sub>2</sub>S administered before ischemia onset reduced infarct volume as well as neurological deficits. However, these types of donors are unstable, and H<sub>2</sub>S at higher doses is neurotoxic. Thus, it is very difficult to adjust the precise dosage. Mechanisms underlying protective effects of H<sub>2</sub>S remain unclear but its influence on neuroinflammation and/or mitochondria homeostasis seems to be very likely.

**Methods:** In the current study we evaluated the neuroprotective role of AP39, a novel mitochondrion aimed H<sub>2</sub>S donor, in the rat model of 90-minutes middle cerebral artery occlusion. The compound was administered i.v. at the concentration of 100 nmol/kg b.w. 10 minutes after reperfusion. Neurological deficit was assessed 60 minutes after reperfusion. Next, we evaluated the blood-brain barrier (BBB) permeability (Evans-Blue test), the infarct volume (TTC method) as well as the levels of pro- and antiinflammatory cytokines at 24 hours, 72 hours and 7 days after the reperfusion.

**Results:** At every timepoint infarct volume and neurological deficit were reduced comparing with controls. In the cerebral cortex and in the hippocampus, we observed modulated level of proinflammatory (e.g., IL-1alpha, IL-1beta, IL-2) and antiinflammatory cytokines, which suggest anti-inflammatory effects of AP39. Also, administration of AP39 prevented BBB leakage.

**Conclusions:** Our study clearly indicates that AP39 presented neuroprotective properties in the animal model of focal cerebral ischemia. National Science Center, grant No.2016/21/D/NZ4/03302.

**Trial registration number:** N/A

### AS19-021

#### NON-INVASIVE VAGUS NERVE STIMULATION (NVNS) REDUCES PERI-INFARCT DEPOLARIZATIONS AND IMPROVES STROKE OUTCOME IN RATS

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**Background and Aims:** Vagus nerve stimulation (VNS) has been shown to reduce cortical spreading depression (CSD) (Chen et al., 2016) and improve stroke outcome (Ay et al., 2009). Peri-infarct depolarizations (PIDs), i.e. the pathophysiological equivalent to CSD in acute stroke, strongly contribute to infarct growth in the penumbra by exacerbating local blood flow reduction, inducing metabolic stress, and by triggering excitotoxicity and neuroinflammation (Rakers and Petzold, 2016 JCI). In anesthetized Wistar rats (9-11 w, males), we here aimed to investigate the therapeutic potential of non-invasive (n)VNS on PIDs during middle cerebral artery occlusion (MCAO).

**Methods:** Controlling regional cerebral blood flow (rCBF) by laser speckle contrast imaging, we induced permanent MCAO and analyzed PIDs after transcutaneous nVNS, as well as after invasive VNS (iVNS), by electrophysiology for 4 hours after filament occlusion. Concomitantly, we investigated the effect of nVNS during transient MCAO on motor function and infarct volume.

**Results:** Both VNS approaches (nVNS and iVNS) showed a significant decrease of PID frequency during permanent MCAO. During transient MCAO, nVNS significantly reduced the cortical infarct volume after 72 hours compared to control animals. Accordingly, behavioral data appeared to indicate an improvement of motor function by nVNS.

**Conclusions:** In conclusion, VNS in acute ischemia improves stroke outcome by reducing the frequency of PIDs, implicating nVNS as a potent non-invasive method to mitigate neurological damage after stroke.

**Trial registration number:** N/A

**AS19-034**

**PRELIMINARY DATA FROM SENECA  
(SEARCHING BIOMARKERS FOR CEREBRAL  
ANGIOPATHY): AN ITALIAN NETWORK FOR  
THE STUDY OF CEREBRAL  
AMYLOID ANGIOPATHY.**

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S. Bianchi Marzoli<sup>4</sup>, A. Morotti<sup>5</sup>, L. Pantoni<sup>6</sup>, E.A. Parati<sup>1</sup>,  
A. Bersano<sup>1</sup>; SENECA project**

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**Background and Aims:** The pathogenesis and natural history of cerebral amyloid angiopathy (CAA) are still largely unknown. SENECA (SEarchiNg biomarkErs for Cerebral Angiopathy) is a multicentre observational study aimed at creating a network involved in CAA care to better define clinical phenotypes and disease history and to identify clinical, neuroradiological and cellular markers of disease progression. Herein, we present the available preliminary results of a single center.

**Methods:** 43 Italian centres are involved in the study. Patients with radiologically defined CAA (possible or probable) according to the modified Boston Criteria are being retrospectively and prospectively included. Detailed demographic, clinical and neuroradiological data are being collected at baseline and at follow-up (12 and 24 months). Biological samples (cerebrospinal fluid) will be collected for genetic studies (APOE allele) and neurodegeneration and biomarkers assessment. A panel of endothelial markers, and a neuro-ophtalmological and neuropsychological assessment are being performed in a subgroups of patients.

**Results:** 89 patients (mean age  $70.7 \pm 7.9$ , SD) years; 69.6% males) have been included at IRCCS “Carlo Besta” Neurological Institute (coordinator center) to date. In this preliminary cohort, hemorrhagic stroke and cognitive impairment were the most common index events (55% and 33.7% of cases respectively). Additionally, hypertension (74.2%) and dyslipidemia (51.7%) were the most frequent cerebrovascular risk factors.

**Conclusions:** SENECA is the first Italian CAA Network and is expected to collect 500 patients. A detailed clinical and neuroradiological assessment of a large population together with the collection of biological samples will hopefully contribute to CAA pathophysiology and clinical history characterization and susceptibility markers’ identification.

**Trial registration number:** N/A

**AS19-006**

**EXOSOME AND INFLAMMATORY MEDIATOR  
EXPRESSION IN STROKE PATIENTS-  
ESTABLISHMENT OF BASE LINE VALUES.**

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**Background and Aims:** Stroke is a common cause of death and disability in the U.S. The annual incidence worldwide is well over 1 million. Many stroke survivors sustain long term sequelae from spasticity, memory dysfunction and other complications. Current acute stroke treatment focuses on early revascularization and other interventions to

restore brain perfusion. We theorize that transient ischemia to brain tissue is followed by exosome and inflammatory mediator release from damaged cells causing more widespread cellular damage and the ensuing post-stroke disabilities. The purpose of this study was to identify exosome biomarker activity in ischemic and hemorrhagic stroke patients at admission and prior to discharge. Our 3 goals were to correlate biomarker activity with MRI results. Two, to correlate clinical improvements at discharge with biomarker expression changes compared to admission levels. Finally, we sought to link biomarker expression trends with post-stroke spasticity.

**Methods:** This study enrolled (N = 5) ischemic and (N = 5) hemorrhagic stroke patients. Within 72 hours of admission a peripheral venous blood draw was centrifuged for plasma isolation. Prior to discharge identical blood draws were completed. Biomarker analysis was completed by Nanosomix, Inc. See table I for biomarkers studied.

**Results:** Data will be complete in time for presentation.

**Conclusions:** Understanding a disease process such as stroke from an exosome and biomarker perspective will open new therapy in addition to reperfusion protocols for acute stroke treatment. We foresee in the near future whereby clinicians will target certain Exosomes for their reparative potentials. In other words exosome expression will become the point of early intervention.

**Trial registration number:** N/A

**AS19-035**

**MICRORNAs OF ENDOTHELIAL PROGENITOR  
CELLS ASSOCIATED WITH IMPROVED  
RECOVERY MECHANISMS IN ACUTE  
ISCHEMIC STROKE**

**B. Silva<sup>1</sup>**

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**Background and Aims:** Endothelial Progenitor Cells (EPCs) are circulating stem cells with the capacity to form new vessels after ischemic stroke. This process of neoangiogenesis by EPCs can be quantified in vivo by assessing the subacute blood brain barrier (BBB) permeability. However their exact molecular machinery is not fully understood, particularly the microRNAs (miRNAs). We aimed to identify the miRNAs responsible for promoting EPCs with enhanced functional properties after an ischemic stroke.

**Methods:** We analysed consecutive patients with acute nonlacunar ischemic strokes with 18 to 80 years old. We then identified a subset of patients with improved recovery mechanisms (i.e., high subacute BBB permeability and Modified Rankin Scale at three months  $\leq 2$ ). EPCs were isolated by the expression of CD34 in peripheral blood, on day zero and miRNAs were compared to clinical and neuroimaging data. Statistical significance was set at  $p < 0.05$ .

**Results:** Forty-five patients met inclusion criteria. We then identified a subset of 3 patients with good and 3 other with poor recovery mechanisms. Twenty-four miRNAs were differentially regulated between these two groups and nine, were expressed only in patients with good outcome. The differentially downregulated miRNAs modulate pathways such as Hippo signalling as well ECM-receptor interactions and adherens junctions. Cell adhesion molecules and axon guidance pathways are the most shared pathways amongst the upregulated miRNAs.

**Conclusions:** Different miRNAs regulate cellular responses in EPCs associated with improved recovery mechanisms after ischemic stroke, mainly through the modulation of the angiogenesis and cell migration.

**Trial registration number:** N/A

**AS19-026****ASSOCIATION OF MMP AND TIMP LEVELS WITH CEREBRAL OEDEMA VOLUME AT 24H: RE-ANALYSIS OF THE MAGIC STUDY**

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**Background and Aims:** A new automated method can objectively measure cerebral oedema in stroke patients [Harston et al. Stroke 2018]. It can potentially identify patients at risk of clinical deterioration at 1-week (presence of 4.8mL oedema at 24 hours). This study uses data from the MAGIC Study [Inzitari et al. Stroke 2013] to explore the relationship between baseline (before rtPA administration) serum Matrix Metalloproteinases (MMPs) and MMP-Tissue inhibitor (TIMPs) levels and oedema volume.

**Methods:** All patients with a CT Scan available at baseline and 24hours were included in the analysis. Lesion masks were defined at 24 hours by two clinicians with a radiologist resolving any discrepancy. The images were co-registered for each patient to enable the quantification of oedema at 24h from stroke onset. Appropriate statistical tests were used to explore the correlation between oedema volume, and MMPs (1,2,3,7,8,9) and TIMPs (1,2,4).

**Results:** Significant associations are presented: only baseline MMPI (Spearman rho -0.25, p=0.01) and TIMP2 (Spearman rho -0.20, p=0.04) correlate with oedema volume at 24h. Paired sample t-Test showed that the mean baseline MMPI (but not TIMP2) was significantly lower in the group of patients at high risk of clinical deterioration (mean 3.5 ng/mL v 14.9 ng/mL; p=0.008).

**Conclusions:** In this cohort of rtPA treated patients, baseline MMPI (but not MMP2 or MMP9) and TIMP2 levels were strongly correlated with oedema volume at 24h. Only baseline MMPI levels were associated with the group of patients at high risk of clinical deterioration at 1-week. This requires validation in a separate cohort.

**Trial registration number:** N/A

at 1-week (presence of 4.8mL oedema at 24 hours). This study uses data from the MAGIC Study [Inzitari et al. Stroke 2013] to explore the relationship between baseline (before rtPA administration) serum inflammatory markers and oedema volume.

**Methods:** All patients with a CT Scan available at baseline and 24h were included in the analysis. Lesion masks were defined at 24h by two clinicians with a radiologist resolving any discrepancy. The images were co-registered for each patient to quantify oedema at 24h from stroke onset. Appropriate statistical tests were used to explore the association between oedema volume and – Interleukins (IL1B, IRA, 4, 6, 8, 10, 12, 17); interferons (IFN $\gamma$  and IFN $\gamma$ -IP10); monocyte chemo-attractant protein 1; macrophage inflammatory protein 1 $\beta$ ; tumor necrosis factor- $\alpha$ ; C-reactive protein; alpha2 macroglobulin; serum amyloid-P; haptoglobin. All biomarker levels were log-transformed for analysis.

**Results:** Significant associations are presented: only baseline IL6 correlated with oedema volume at 24h (p = 0.007), even after correction for baseline NIHSS (p = 0.04). The mean baseline IL6 was significantly higher in the patients at high risk of clinical deterioration (mean 1.8 ng/mL v 1.2 ng/mL; p = 0.03).

**Conclusions:** In this cohort of rtPA-treated patients, only baseline IL6 levels were strongly correlated with oedema volume at 24h, and were associated with the group of patients at high risk of clinical deterioration at 1-week. This requires validation in a separate cohort.

**Trial registration number:** N/A

**AS19-030****ASSOCIATION OF THE TEMPORAL CHANGES IN MMP, TIMP AND MMP:TIMP IMBALANCES WITH CEREBRAL OEDEMA VOLUME AT 24H: RE-ANALYSIS OF THE MAGIC STUDY**

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**Background and Aims:** A new automated method can objectively measure cerebral oedema in stroke patients [Harston et al. Stroke 2018]. It can potentially identify patients at risk of clinical deterioration at 1-week (presence of 4.8mL oedema at 24 hours). This study uses data from the MAGIC Study [Inzitari et al. Stroke 2013] to explore the relationship between oedema volume and temporal changes in serum levels of Matrix Metalloproteinases (MMPs), MMP-Tissue inhibitor (TIMPs), and the balance between MMPs and TIMPs.

**Methods:** All patients with a CT Scan available at baseline and 24hours were included in the analysis. Lesion masks were defined at 24 hours by two clinicians with a radiologist resolving any discrepancy. The images were co-registered for each patient to enable the quantification of oedema at 24h from stroke onset. Appropriate statistical tests were used to explore the correlation between oedema volume and temporal changes in MMPs (1,2,3,7,8,9), TIMPs (1,2,4), and the ratio of individual MMPs to their specific TIMP.

**Results:** Significant associations are presented: the change over 24h in MMP3(p = 0.02), TIMP1(p = 0.01), TIMP4(p = 0.04) and MMPI:TIMPI (p = 0.04) correlates with oedema volume at 24h. Mean MMPI:TIMPI (p = 0.014), MMP3:TIMPI(p = 0.032), MMP8:TIMPI(p = 0.027), MMP9:TIMPI(p = 0.010) and MMP9:TIMP2(p = 0.047) were significantly lower in the group of patients at high risk of clinical deterioration.

**AS19-029****ASSOCIATION OF MARKERS OF INFLAMMATION WITH CEREBRAL OEDEMA VOLUME AT 24H: RE-ANALYSIS OF THE MAGIC STUDY**

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**Background and Aims:** A new automated method can objectively measure cerebral oedema in stroke patients [Harston et al. Stroke 2018]. It can potentially identify patients at risk of clinical deterioration

**Conclusions:** In this cohort of rtPA treated patients, the temporal change in the ratio of a range of MMPs with TIMP1 were strongly associated with the group of patients at high risk of clinical deterioration at 1-week, in addition to individual MMPs and TIMPs. This requires validation in a separate cohort.

**Trial registration number:** N/A

## AS19-033

### ASSESSMENT OF NEUROPROTECTIVE EFFECTS OF $\alpha$ 1-GABA-A RECEPTOR LIGANDS IN HUMAN PLURIPOTENT STEM CELLS- POSSIBLE THERAPEUTIC STRATEGY AGAINST ISCHEMIC STROKE

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**Background and Aims:** Despite remarkable progress in drug discovery and decades of clinical studies, there is no effective pharmacotherapy available to promote the recovery from stroke. Therefore, development of novel therapeutic agents, remains an urgent clinical need.

Animal studies revealed that following stroke onset, the expression of  $\alpha$ 1-GABA-A receptor is increased, accompanied by enhanced density of  $\alpha$ 1-GABA-A containing synapses. Inhibiting increasing phasic GABA current provided by  $\alpha$ 1-GABA-A receptor activation, improves the motor and behavioral recover in animal models of ischemic stroke. Sub-clinical doses of  $\alpha$ 1-GABA-A positive allosteric modulator zolpidem to stroke survivors, improved neurological functions. Thus, modulation of  $\alpha$ 1-GABA-A receptor activity makes it a relevant target for therapeutic application in supporting the recover after ischemic stroke.

Here we described *in vitro* pharmacological studies focus on the evaluation of neuroprotective potential of novel  $\alpha$ 1-GABA-A ligands.

**Methods:** By using biochemical methods and iPS cells (human induced pluripotent stem cells) we determined the basic oxidative stress and apoptosis markers.

**Results:** Our studies show that  $\alpha$ 1-GABA-A ligands exert neuroprotective properties by inhibition of cellular reactive oxygen species (ROS) generation on iCell GABA-neurons.  $\alpha$ 1-GABA-A ligands effectively reduced intracellular calcium concentration and the level apoptotic enzymes: caspase 3 and 7. At the same time  $\alpha$ 1-GABA-A ligands display anti-neuroinflammatory properties by reducing ROS, NO and interleukin IL-1 $\beta$  levels following the lipopolysaccharide induced inflammation on microglia BV2 cell line.

**Conclusions:** The obtained results suggest the promising therapeutic potential of  $\alpha$ 1-GABA-A ligands and GABA-A receptor as a valuable target for further investigation.

Acknowledgement:

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**Trial registration number:** N/A

## AS19-010

### PATHOPHYSIOLOGY OF CEREBRAL SMALL VESSEL DISEASE: CEREBRAL COLLATERAL EFFICIENCY AND MARKERS OF SMALL VESSEL DISEASE

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**Background and Aims:** Cerebral small vessel disease (CSVD) is a microvascular process with distinct MRI markers: white matter hyperintensities (WMH), cerebral microbleeds (CMB), lacunes, and enlarged perivascular spaces (EPVS). It has important clinical and cognitive implications. Its pathophysiology is incompletely understood but has been linked to cardiovascular risk factors; ischemia is thought to play a central role. We undertook this analysis to explore the association between cerebral collateral circulation status and CSVD burden.

**Methods:** Retrospective cohort of consecutive patients with anterior circulation large vessel occlusions. We identified presence and burden of individual CSVD markers and global CSVD burden on MRI obtained in the acute stroke phase in the contralateral hemisphere using established imaging criteria. We used the Tan Collateral score (CS) in CT Angiogram (original and modified version). We performed univariable and multivariable adjusted analyses to explore the association between CS and CSVD.

**Results:** 127 patients ( $63.5 \pm 17.7$  years, 49% female) were included. WMH was the most prevalent marker (76%) followed by basal ganglia EPVS (61%). Older age had the most potent association with individual CSVD markers and higher total CSVD burden. Lower mean CS was associated only with presence of WMH ( $4.19 \pm 1.98$  vs  $5.19 \pm 2.54$ ,  $p = 0.02$ ). This association was maintained in multivariable logistic regression (OR 0.75, 95%CI:0.58,0.95,  $p = 0.01$ )

**Conclusions:** We found that lower CS is associated with WMH presence but not other CSVD markers or total CSVD burden. This finding lends support to the notion that WMH might be indeed ischemic in nature. Better collaterals may be protective against development of WMH.

**Trial registration number:** N/A

## Prevention – Excluding Clinical Trial Results

### AS09-026

### BLOOD PRESSURE CONTROL IN POST STROKE PATIENTS ON ANTICOAGULANTS

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**Background and Aims:** Anticoagulants are effective for secondary stroke prevention in atrial fibrillation (AF), however bleeding risk is problematic, with uncontrolled hypertension being the main risk for intracerebral haemorrhage. Most guidance recommend BP of <130/80 mmhg for all post stroke.

The purpose of the study was to assess BP control pre discharge in ischemic stroke (IS) with AF on anticoagulation.

**Methods:** Electronic records of admissions to Addenbrooke's Hospital in 2017 with IS and AF discharged on anticoagulants.

Demographics, clinical characteristics, BP medications and readings were collected.

**Results:** 100 patients were included in the study. 75 (75%) had a history of prior hypertension. Mean BP at presentation was 150.4 mmhg ( $SD = 27.4$ ) over 79.7mmhg ( $SD = 16.64$ ). During the last 12 readings before hospital discharge mean BP was 134.8 ( $SD = 19.35$ ) over 71.6 ( $SD = 10.49$ ). 51 had at least 1 SBP >160. 33 had mean SBP >140; this group had mean age 82.8 ( $=/-10.7$ ) years (Vs 81.2  $=/-10$ ) (p NS), had greater SBP variation [max- min SBP 63.2 ( $=/-24$ ) mmhg, vs 51 ( $=/-20.8$ ,  $p = 0.01$ )] similar NIH score (8.8 Vs 8.9) but more BP medications -1.9 vs 1.3 ( $p = 0.01$ ).

**Conclusions:** BP control at discharge post stroke is suboptimal. Those with mean SBP > 140 have greater SBP range suggesting high BP variability might be a barrier to control. Achieving target BP before discharge in patients treated with anticoagulants should be a priority.

**Trial registration number:** N/A

**AS09-002****THE DIMENSION OF PREVENTABLE STROKE IN A LARGE REPRESENTATIVE PATIENT COHORT**

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**Background and Aims:** In patients presenting with stroke/TIA, data on pre-event risk factor control and lifestyle are sparse. Our aim is to analyse the frequency of inadequately treated risk conditions in patients presenting with ischaemic stroke/TIA and to estimate the number of events potentially avertable by guideline-compliant preventive therapy in a large representative cohort.

**Methods:** A large prospective observational cohort of 1730 patients from the STROKE-CARD trial (NCT02156778) with acute ischaemic stroke or TIA were recruited between 2014 and 2017. We analyzed eight risk conditions amenable to drug therapy and three lifestyle risk behaviours in all patients regarding pre-event status.

**Results:** The mean number of inadequately treated risk conditions per patient was 1.36 and increased to 2.30 upon consideration of key lifestyle risk behaviours. Numbers were higher in patients with a recurrent stroke/TIA compared to first-ever events (1.59 vs. 1.30;  $p < 0.001$ ). Proportions of patients with at least one risk condition were 79.5% and 95.1% – lifestyle considered. The estimated degree of stroke preventability was high at 37.1% for risk conditions amenable to drug therapy and 32.4% for proper management of lifestyle risk behaviours.

**Conclusions:** Our study confirms the existence of a considerable gap between risk factor control recommended by guidelines and real-world stroke prevention. This gap applies to patients with first-ever events and even broadens in patients with recurrent stroke/TIA. Our study intends to increase awareness among physicians about stroke preventability and provides a quantitative basis for the emerging discussion on how to best tackle this challenge to reduce the global burden of stroke.

**Trial registration number:** N/A

already on lipid-lowering therapy). Up to 79% had an  $\text{LDLc} > 1.8 \text{ mmol/l}$  and 39% had hypertriglyceridemia ( $> 1.7 \text{ mmol/l}$ ). We found 84% of patients followed analytical controls in their primary medical center between 4 to 6 months after stroke unit discharge. Only 8.7% had a total cholesterol  $> 200 \text{ mg/dl}$  but 22% had  $\text{LDLc} > 2.6 \text{ mmol/l}$  and up to 57% probably with  $\text{LDLc} > 1.8 \text{ mmol/l}$  in spite of treatment with statins. (half of patients have already been treated with very high-intensity statins). About 18% persisted with suboptimal triglyceride levels.

**Conclusions:** There is a subgroup of patients with a very high vascular risk that remains at LDL-cholesterol levels over recommended levels of secondary prevention after stroke (22-57% according to the latest objective of LDL-cholesterol and latest recommendations). Almost half of them presents a suboptimal control that might justify the treatment with antiPCSK9, as the main therapeutic alternative.

**Trial registration number:** N/A

**WITHDRAWN****AS09-022****IS THERE A PLACE FOR MONOCLONAL ANTIBODIES (ANTI PCSK9) IN THE STROKE UNITS?**

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**Background and Aims:** A 25% of strokes have an atherothrombotic etiology, being dyslipidemia one of the main associated factors (30%). We do not know the correct control of dyslipidemia in patients with atherothrombotic stroke admitted in our stroke unit and follow-up.

**Methods:** A total of 1012 patients with ischemic stroke were admitted in our stroke unit between January 2014 to July 2017, we analyzed 201 patients with atherothrombotic etiology. We assessed the incidence of dyslipidemia in the laboratory test during admission and hospitalization, after discharge during control in general practitioner, the type and dose of lipid-lowering treatment

**Results:** At the time of admission, 21% patients had total cholesterol levels  $> 200 \text{ mg/dl}$  and 36% had an  $\text{LDL-cholesterol} > 100 \text{ mg/dl}$  (18% had

**AS09-037****HAEMODYNAMIC RESPONSE TO SHORT-TERM DAILY CANNABIDIOL****S. Sultan<sup>1</sup>, S. O'Sullivan<sup>1</sup> and T. England<sup>1</sup>**<sup>1</sup>University of Nottingham, Vascular Medicine- Division of Medical Sciences and GEM, Derby, United Kingdom

**Background and Aims:** Single dose Cannabidiol (CBD, 600mg) reduces blood pressure (BP) at rest and in response to stress. We aimed to assess haemodynamic response to repeated CBD dosing.

**Methods:** 26 healthy men, aged 26.3 (SD 5.6) years received CBD or placebo (600mg od, 7 days) in a randomised, placebo-controlled, double-blind, parallel study (13/group). Continuous beat-to-beat haemodynamics (Finometer) was assessed after acute and repeated (chronic) dosing at rest and in response to stress (isometric exercise). Secondary outcomes included cerebral blood flow (CBF, transcranial doppler), pulse wave velocity (PWV, Vicorder) and flow mediated dilatation (FMD, ultrasound).

**Results:** Compared to placebo, CBD significantly reduced mean arterial pressure (mean difference [MD] -2 mmHg, p = 0.01), with a trend to lower systolic BP (MD -2.28 mmHg, p = 0.08) and diastolic BP (MD -1.76 mmHg, p = 0.06) after acute but not repeated dosing at rest. In response to stress, CBD lowered systolic BP acutely (MD -6 mmHg, p = 0.007) and chronically (MD -5.7 mmHg, p = 0.01). Repeated CBD increased internal carotid artery (ICA) diameter (MD 0.55 mm, p = 0.01) with trends to increase ICA flow volume (MD 0.12 l/min, p = 0.07). In the CBD group, PWV decreased (-0.44 m/s, p = 0.05, n = 11) and FMD increased (3%, p = 0.05, n = 6) over 7 days. Middle cerebral artery velocity was not significantly affected by CBD.

**Conclusions:** CBD reduces BP acutely at rest and during stress. BP reduction during stress persists with repeated dosing, whilst carotid dilation increases without affecting CBF. Repeated CBD reduces arterial stiffness and improves endothelial function, findings that warrant investigation in populations with atherosclerosis.

**Trial registration number:** N/A

**AS09-017****ORAL ANTICOAGULANT THERAPY IN CLINICAL PRACTICE: THE MULTICENTER RESTAIC REGISTRY**

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**Background and Aims:** After the development of the novel oral anti-coagulants (NOAC) for stroke prevention, prospective registries to evaluate the results of their implementation in clinical practice are mainly based on primary prevention. Our aim is to explore the long-term outcomes differences according to the oral anticoagulation (OAC) in secondary cardioembolic stroke prevention.

**Methods:** A prospective, multicentric, registry including IS patients who were discharged under OAC. Three months follow-up was scheduled at outpatient clinic with subsequent annual phone interviews for 3 years. Principal outcomes: stroke recurrences, intracranial hemorrhage, major hemorrhage and mortality. Patients were classified and compared into 4 study groups according to OAC at discharge: Vitamin K antagonist (AVK),

Factor Xa inhibitor (FXa-I), direct thrombin inhibitor (DTI) and other OAC.

**Results:** 256 patients were included. Patients under FXa-I were older (age >75: 55.8% vs. 24.8% AVK, 14.5% DTI and 18.6% other OAC P=0.01), had higher frequency of hypertension (48% vs. 33% AVK, 18.8% DTI and 14 % other OAC P=0.001), had higher CHA2DS2-VASc (median 6 vs. 5 in all the other groups; P=0.007), without differences in HASBLED scores. We found low mortality rates (3 death/year), stroke recurrences (5.6 stroke/year), intracranial hemorrhages (0.6 hemorrhage/year) and major hemorrhages (0.6 hemorrhage/year) for the first year, without differences according to the type of OAC. For the second and third year, no intracranial hemorrhages were reported and the incidence rate decline to 0.05 stroke/year.

**Conclusions:** Stroke secondary prevention with OAC is safe without significant differences in stroke recurrence rates at long-term between anticoagulant treatments.

**Trial registration number:** NA

**AS09-003****ESTABLISHMENT OF THE INDIAN STROKE CLINICAL TRIAL NETWORK (INSTRICT)**

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**Background and Aims:** Stroke is a dominant cause of morbidity and mortality in India. A compelling need to initiate a national stroke clinical trial network to conduct studies exclusively in Indian population was felt. INSTRICT was formed with the help of Indian Council of Medical Research (ICMR).

**Aims**

1. Establish a national state of the art stroke clinical trial network.
2. Conduct pharmacological and non-pharmacological stroke clinical trials.

**Methods:** Several expert group meetings were conducted to understand the scope of the network by ICMR. Recognized 25 stroke centers having past experience of clinical trials with annual volume of approximately 200 stroke patients were included. Nodal centers for database management, monitoring and pharmacological dispensing were assigned. The funding was received in March 2017. The Investigators meeting were held in August 2017 and July 2018.

**Results:** Ongoing stroke Clinical trials are:

1. Enhanced Control of Hypertension and Thrombolysis Stroke study (ENCHANTED) is completed.
2. Secondary Prevention by Structured Semi-Interactive Stroke Prevention Package in INDIA (SPRINT INDIA) Trial is ongoing.
3. Ayurveda treatment in the rehabilitation of Ischemic stroke patients in India Trial (RESTORE) is to be initiated.
4. A phase 3, Multi-Arm Multi stage Covariate-Adjusted Response-Adaptive Randomized Trial to determine Optimal Early Mobility Training after Stroke (AVERT DOSE) is to be initiated.

**Conclusions:** In the next 5 years, INSTRICT will develop a portfolio of stroke Trials in the areas of prevention, acute care, rehabilitation and chronic care and work with professional, industry, academic and funding bodies to develop world-class stroke trials.

**Funding:** ICMR, New Delhi

**Trial registration number:** CTRI/2017/05/008507

**AS09-005**
**COMPARATIVE EFFECTIVENESS OF DUAL ANTIPLATELET THERAPY WITH ASPIRIN AND CLOPIDOGREL VERSUS ASPIRIN MONOTHERAPY IN ACUTE NON-MINOR STROKE: A NATIONWIDE MULTICENTER REGISTRY STUDY**

**J.T. Kim<sup>1</sup>, H.J. Bae<sup>2</sup>; on behalf of the CRCS-K investigators**

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**Background and Aims:** We compared the effectiveness of dual antiplatelet therapy with clopidogrel-aspirin to that of aspirin monotherapy in patients with acute non-minor, non-cardioembolic stroke using a prospective, multicenter, stroke registry in South Korea.

**Methods:** Acute non-minor, defined as the NIHSS score of 4–15 within 24 h of onset, and non-cardioembolic stroke patients were enrolled. Propensity scores using IPTW was used to adjust for baseline imbalances between clopidogrel-aspirin group and aspirin monotherapy group. The primary outcome was the composite of stroke, myocardial infarction, and all-cause mortality by 3 months.

**Results:** Among 4,461 patients meeting the eligibility criteria, age was 69 ± 13yr and 57.7% were male. Aspirin monotherapy and clopidogrel-aspirin were administered in 52.5% and 47.5% of patients, respectively. In unadjusted analysis, rates of the 3-month primary outcome event were numerically lower with clopidogrel-aspirin vs aspirin monotherapy, 20.9% vs 22.6% (HR 0.91 [0.80–1.03]), but not statistically significant. The secondary endpoint of stroke was not different among clopidogrel-aspirin group and aspirin monotherapy group (19.3% vs 20.1%, p = 0.35). In propensity-weighted Cox proportional hazards regression with robust estimation, clopidogrel-aspirin was not associated with a lower risk of the primary event outcome (HR 0.91 [0.79–1.04]). There was no treatment heterogeneity in predefined subgroups, though more benefits with clopidogrel-aspirin among patients with moderate-to-severe arterial stenosis (HR 0.66 [0.49–0.89]) were observed.

**Conclusions:** Dual antiplatelet therapy with clopidogrel-aspirin did not reduce the risk of composite vascular events in the 3 months following a presenting non-minor, non-cardioembolic, acute ischemic stroke. A benefit may be potentially presented in patients with moderate-to-severe stenosis (>50%) of relevant artery.

Trial registration number: N/A

**AS09-031**
**SYSTEMATIC REVIEW OF C-REACTIVE PROTEIN (CRP) AND RISK OF RECURRENT STROKE AND VASCULAR EVENTS AFTER ISCHAEMIC STROKE OR TRANSIENT ISCHAEMIC ATTACK (TIA)**

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**Background and Aims:** CRP is independently-associated with risk of first-ever stroke. CRP identified patients with coronary disease who responded to canakinumab, an interleukin-1B antagonist, for prevention of vascular events in the CANTOS trial. It is unclear whether CRP predicts recurrent stroke (RS) or vascular events (RVEs) after stroke/TIA.

**Methods:** We searched EMBASE and Ovid Medline, from 1970–January 2019, for studies relating CRP after stroke or TIA with risk of RS or RVEs. All publications were assessed by 2 reviewers, with disagreements resolved by consensus.

**Results:** We identified 2,520 publications. 36 publications from 32 studies met inclusion criteria (24 prospective observational cohort studies, 1 case-control study, 5 cohort studies within randomized control trials (RCTs), 2 case-control studies within RCTs). Outcome was RS in 27 studies (n = 22,530 patients), and RVEs in 19 studies (n = 12,345 patients). Index event-to-phlebotomy interval was < 7 days in 16, 7–90 days in 6, and >90 days in 3 studies (unclear in 7). There was marked inter-study variability in the definition of CRP exposure variables, which did not allow valid meta-analysis (risk above/below specified threshold [n = 10], differences in means/medians [n = 8], per 1 mg/dL increase [n = 5], per standard deviation increase [n = 4], per quartile [n = 3], per tertile [n = 3], not specified [n = 3]). Only 1 study reported fully-adjusted analyses for age, BMI, smoking, diabetes, lipids, hypertension. 63% (12/19 publications) reported positive association of CRP and RVEs, and 48% (13/27) reported positive association with RS.

**Conclusions:** The prognostic value of CRP after stroke and TIA remains unclear. Standardised methods and fully-adjusted multivariable analysis are needed in future prognostic studies.

Trial registration number: N/A

**AS09-036**
**SYSTEMATIC REVIEW OF INTERLEUKIN-6 (IL-6) AND RISK OF RECURRENT STROKE AND VASCULAR EVENTS AFTER ISCHAEMIC STROKE OR TRANSIENT ISCHAEMIC ATTACK (TIA)**

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**Background and Aims:** Inflammation is thought to play an important role in atherosclerotic stroke mechanisms. There is growing interest in

the prognostic value of inflammatory biomarkers as risk factors for recurrent vascular events (RVEs) or recurrent stroke (RS), after stroke or TIA. **Methods:** We searched EMBASE and Ovid Medline, from 1970–January 2019, for studies relating Interleukin-6 (IL-6) after stroke or TIA, with risk of RS or RVEs. All reports were assessed by 2 independent reviewers, with disagreements resolved by consensus.

**Results:** We identified 2,520 publications. 111 studies met our inclusion criteria (8 prospective observational cohort studies, 1 cohort study within a randomised control trials (RCT), 1 case-control study within a RCT, 1 prospective case-control study). Outcomes included RS in 8 studies ( $n = 5,862$  patients), and RVEs in 5 studies ( $n = 3,717$  patients). Index event-to-phlebotomy interval was < 7 days in 3, 7–90 days in 5, and >90 days in 1 study (unclear in 2). There was marked inter-study variability in the definition of IL-6 exposure variables, which did not allow valid meta-analysis (risk above/below specified threshold [ $n = 2$ ], differences in means/medians [ $n = 2$ ], per unit increase [ $n = 2$ ], per standard deviation increase [ $n = 2$ ], per quartile [ $n = 3$ ], per tertile [ $n = 2$ ], or not specified [ $n = 1$ ]). Only 1 study reported fully-adjusted analyses for age, body mass index, smoking, diabetes, lipids, hypertension. 80% (4/5 publications) reported positive association of IL-6 and RVEs, and 50% (4/8) reported positive association with RS.

**Conclusions:** The prognostic value of IL-6 after stroke remains uncertain. Standardised methods and fully-adjusted multivariable analysis are needed in future prognostic studies.

**Trial registration number:** N/A

## AS09-014

### DIURNAL VARIATION IN PERFORMANCE ON TELEPHONE COGNITIVE SCREENING IN OLDER SUBJECTS

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**Background and Aims:** Cognitive screening tools, such as the MoCA and TICS-M, are commonly used in prevention trials in patients with TIA and stroke. Some studies have suggested that cognitive performance exhibits diurnal variation, being better in the morning than in the afternoon, but it is uncertain whether such an effect would be sufficiently large to necessitate same-time-of-day testing for repeat assessments in clinical trials or other research studies. We therefore determined whether time-of-day affected the results of telephone cognitive testing in older individuals at risk of stroke.

**Methods:** Older subjects ( $\geq 70$  years) with hypertension enrolled in an ongoing trial of blood pressure lowering completed telephone cognitive assessments (T-MoCA; TICS-M) between 9am and 6pm according to availability of the participant and assessor. Assessments in the morning (before 12pm) and the afternoon (after 12pm) were compared after adjusting for age, sex and level of education.

**Results:** Telephone cognitive assessments were completed for 1003 subjects at baseline, 912 at 6-months and 880 at 12-months. 399 (39.8%) baseline assessments were completed in the morning and 604 (60.2%) in the afternoon. Lower cognitive scores were associated with male gender, low education and increasing age (T-MoCA – all  $p < 0.001$ , TICS-M – all  $p < 0.001$ ), but not with the time of day the test was undertaken (T-MoCA  $p = 0.190$ , TICS-M  $p = 0.332$ ). Similar results were found at the 6-month and 12-month assessments.

**Conclusions:** Time of day does not appear to affect telephone cognitive assessment scores of older subjects with hypertension. However, these results might not be generalizable to more cognitively impaired populations.

**Trial registration number:** N/A

## AS09-010

### CORRELATION BETWEEN WARFARIN CONTROL AND DAILY VITAMIN K INTAKE ACCORDING TO VKORC1 GENOTYPE.

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**Background and Aims:** The restriction of oral vitamin K (VK) intake is essential for patients with warfarin anticoagulation. However, the ideal daily intake of VK for each patients were not established. On the other hand, an excessive restriction of VK may cause pathological osteoporosis or abnormal calcification of vessel wall.

In this study we evaluated the correlation between warfarin control and daily VK intake from the perspective of the VK epoxide reductase complex subunit 1 (VKORC1) genotype.

**Methods:** We enrolled 84 patients (29 females, average age 75.6) under warfarin anticoagulation for more than one year, and measured the serum VKI concentration and VKORC1 genotype with informed consent. The original questionnaire about average daily food menu was contrived to estimate the daily VK intake. Baseline characteristics of each patients were also extracted and analyzed.

**Results:** The VKORC1 genotype AA and AG were found in 81% and 19% respectively. The patients with AG had significantly higher VKI concentration ( $1.43 \pm 0.60$ vs $1.84 \pm 0.96$  ng/ml; $p < 0.001$ ) and average warfarin dosage compared to those with AA ( $2.37 \pm 0.86$ vs $4.52 \pm 1.48$  mg; $p < 0.001$ ). Whereas there existed a significant correlation between VKI concentration and total VK intake in patients with AG ( $r = 0.61$ ;  $p < 0.001$ ), there was no correlation in patients with AA. Also, we found a significant correlation between VK intake and average warfarin dosage in patients with AG ( $r = 0.63$ ; $p < 0.001$ ), however no correlation was found in patients with AA.

**Conclusions:** The influence of daily oral VK intake for warfarin treatment was differ among patients with VKORC1 genotype. For patients with VKORC1 genotype AA, a strict restriction of VK may not need.

**Trial registration number:** N/A

## AS09-034

### AGE, GENDER CHARACTERISTICS, COMORBIDITY AND OUTCOMES IN PATIENTS WITH ACUTE STROKE AND TRANSIENT ISCHEMIC ATTACK (REGION REGISTRY DATA)

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**Background and Aims:** To analyse the characteristics and short-term outcomes in patients, hospitalized for acute stroke (AS) and transient ischemic attack (TIA) on a basis of the hospital registry in Moscow.

**Methods:** 900 patients with AS and TIA (age  $70.6 \pm 14.0$ ; 59.4% women), diagnosed in one of the clinics in Moscow were enrolled in the REGION-Moscow registry during 2012–2017 years. Hospital mortality was estimated.

**Results:** Age of men and women was  $66.5 \pm 13.2$  and  $73.3 \pm 13.9$  years ( $p < 0.05$ ). Cardiovascular (CV) risk factors were revealed in most of patients: smoking – 104 (11.6%), family history of CV diseases – 10 (1.1%), obesity – 193 (21.4%), hypercholesterolemia – 58 (6.4%) and

diabetes – 181 (20.1%). Hypertension was diagnosed in 856 (95.1%) cases, coronary artery disease – 517 (57.4%), chronic heart failure – 164 (18.2%), atrial fibrillation – 268 (29.8%). 216 (24%) patients had a history of stroke and 197 (21.9%) – history of myocardial infarction. 75% of AS were ischemic, 10% – hemorrhagic, 2% – mixed type. 13% of patients had a TIA. Average level of the hospital mortality during 2012–2017 period was 24.0%. There was a sharp increase of mortality in 2013 (34.3% of patients), which coincided with the organization of the hospital “Vascular Center”, with progressive decrease in 2014–2017 period up to 19% (p value for trend < 0.05).

**Conclusions:** REGION study revealed high incidence of cardiovascular risk factors and diseases in patients with AS and TIA. Organization of the “Vascular Center” led to the following significant decrease of hospital mortality in these patients.

**Trial registration number:** N/A

## AS09-020

### INFLUENCE OF ORAL ANTICOAGULATION IN STROKE SEVERITY AND OUTCOMES: A PROPENSITY SCORE MATCHED CASE-CONTROL STUDY

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**Background and Aims:** Oral anticoagulants (OAC) such as antivitamin K (AVK) and direct oral anticoagulants (DOAC) remain the essential treatment for prevention of cardioembolic stroke. We studied incident strokes from cardioembolic source, to describe its characteristics and outcomes according to pre-stroke OAC treatment.

**Methods:** Retrospective observational study of patients with cardioembolic stroke admitted to a stroke center from 2014 to 2017. Demographic data, vascular risk factors, pre-stroke treatments, reperfusion therapies and outcomes were analysed. We performed propensity score-matching on baseline characteristics to compare: patients under adequate AVK anticoagulation (determined by INR) vs inadequate AVK anticoagulation; patients under inadequate AVK anticoagulation vs no OAC; and patients under AVK vs DOAC.

**Results:** We included 462 patients (mean age  $76 \pm 11.6$  years). 255 (55%) patients had a known major cardioembolic source before stroke, and only 150 (59%) of them were under OAC on admission (126 AVK and 24 DOAC). Six other patients were under AVK treatment for other reasons. From those taking AVK, 92 (70%) had an inadequate anticoagulation on admission. After propensity score-matching, we found no significant differences in stroke severity, reperfusion treatments, mortality or independence at 3 months, across different anticoagulation modalities. However, patients under DOAC showed milder NIHSS scores on admission (median 6 vs 11, p = 14) and lower mortality at 3 months (5.3% vs 13%, p = 16) compared with those under adequate AVK anticoagulation.

**Conclusions:** We found no significant differences in stroke severity and outcomes after case-control matching. Whether DOAC therapy is associated with milder strokes and lower mortality at 3 months should be confirmed in a larger cohort.

**Trial registration number:** N/A

## AS09-035

### DUAL ANTIPLATELET THERAPY IN HIGH RISK PATIENTS WITH TIA OR MINOR STROKE

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**Background and Aims:** Recent literature has shown that early dual antiplatelet therapy can safely reduce recurrence in high-risk patients with transient ischemic attack (TIA) or minor stroke. We present an observational study.

**Methods:** Prospective registry of ischemic stroke attended at our Stroke Unit from January 2017 to December 2018. We selected patients with high risk TIA (ABCD $\geq 4$ ), or minor stroke (NIHSS $\leq 5$ ) treated with dual antiplatelet therapy (aspirin + clopidogrel for 3 weeks). We analyzed baseline clinical characteristics, recurrence and safety at 3 months.

**Results:** We included 2201 patients with ischemic stroke. Sixty-eight patients fulfilled inclusion criteria (67.6% males) with a mean age 71.6 (SD 11.7), 72.1% had hypertension, 32.4% DM type 2, 54.4% dyslipidemia and 38.2% were smokers. Twenty-five patients were previously taking antiplatelet agents (primary prevention in 6 and secondary prevention in 19). Twenty-five (36.8%) had high-risk TIA with median ABCD 2 5 (range 4–7) and 43 (63.2%) minor stroke with mean NIHSS 2.2 (SD 2.3). At 3 months follow-up 2 patients had recurrent stroke (3%). There were 3 minor bleeding events (4.4%) which did not require blood transfusion (2 hematurias and 1 local bleeding in the context of hip fracture). In 2 patients dual antiplatelet therapy was discontinued due to detection of atrial fibrillation. There was one death during follow-up not related to treatment.

**Conclusions:** In clinical practice dual antiplatelet therapy with aspirin and clopidogrel seems safe and effective for patients suffering high risk TIAs and minor stroke.

**Trial registration number:** N/A

## AS09-030

### USE OF THE VASCULAR POLYPILL IN SECONDARY PREVENTION OF CEREBROVASCULAR DISEASE AFTER HOSPITAL DISCHARGE

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**Background and Aims:** The use of the vascular polypill, a fixed-dose combination treatment, may improve adherence and, consequently, reduce vascular risk factors in patients with cerebrovascular disease. Studies on the polypill use in the real-life setting are lacking.

**Methods:** A retrospective analysis of the electronic database of our stroke unit outpatient clinic that included patients admitted due to acute ischemic stroke from 2017 to 2018 and who were prescribed a polypill (aspirin 100 mg, atorvastatin 20/40 mg, ramipril 2.5/5/10 mg) in secondary prevention. Changes in blood pressure and low-density lipoprotein cholesterol (LDL-c) from baseline, recurrence, adherence and satisfaction were recorded.

**Results:** Fifty-four patients (65% male, with a mean age of  $68 \pm 13$  years) were included. Final diagnosis was atherosclerotic stroke in 15 (28%), cryptogenic stroke with vascular risk factors in 30 (56%) and lacunar stroke in 9 (17%). At the moment, after 3 month's follow-up, goals of

blood pressure (< 140/90) have been achieved by 87% and goals of LDLc ( $\leq 70$ ) in 50% of patients. No recurrences or deaths have been recorded. Polypill treatment has been stopped in 10 (18%): due to adverse effects in 4, atrial fibrillation onset in 2, poor vascular risk factors control in 2, coronary disease in 1 and poor adherence in 1. Forty-nine patients (90%) were satisfied with the use of the polypill.

**Conclusions:** In our experience, the use of the vascular polypill is a useful alternative in the prevention of recurrent stroke after hospitalization discharge. It is necessary to reevaluate level of LDL cholesterol and blood pressure at three months in order to optimize treatment.

**Trial registration number:** N/A

## AS09-006

### SAFETY AND SHORT-TERM EFFICACY OF VIDEOTHORACOSCOPIC EPICARDIAL LEFT ATRIAL APPENDAGE CLOSURE FOR THE PREVENTION OF CARDIOEMBOLISM

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**Background and Aims:** Left atrial appendage closure (LAAC) has emerged as an alternative for stroke prevention in patients with Non-Valvular Atrial Fibrillation (NVAF) and contraindications to oral anticoagulation (OAC). Percutaneous LAAC with Watchman compared to warfarin in NVAF patients with increased stroke risk showed a significant reduction in hemorrhagic stroke and a similar incidence of all-cause stroke or systemic embolism. All studies excluded patients with contraindications to OAC, and device patients required antithrombotic therapy after procedure. Recent data from trial and registry of epicardial LAAC with the AtriClip in AF patients undergoing cardiac surgery, besides demonstrating safety and durability of the procedure, suggest a potential efficacy in reducing stroke incidence.

**Methods:** We report data from 13 NVAF patients with history of major bleedings/recurrent stroke in anticoagulation undergoing videothoracoscopic epicardial LAAC with AtriClip Pro2 (AtriCure, Inc., West Chester, PA, USA) and antithrombotic therapy contraindications, enrolled in Mantova, Cremona, and Trento Hospitals since 2012. Mean CHA<sub>2</sub>DS<sub>2</sub>VASc and HAS-BLED scores were 6 and 4.5, respectively.

**Results:** No major peri-procedural complications and one case of pericarditis > 7 days were observed. LAAC was successful in all patients. No patients required antithrombotic therapy after-procedure. Follow-up at a median time of 16 months with Questionnaire stroke free status and by neurological examination showed no ischemic events except a TIA due to ICA stenosis > 70% treated with carotid endarterectomy.

**Conclusions:** AtriClip LAAC in our cohort of patients demonstrated to be safe and efficacious in reducing short-term incidence of stroke. Longer FU is required to demonstrate long-term efficacy.

**Trial registration number:** N/A

## AS09-013

### ADHERENCE TO SECONDARY PREVENTION MEDICATIONS IN ISCHAEMIC STROKE AND TIA PATIENTS IN SINGAPORE

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**Background and Aims:** Secondary stroke-prevention medications proven to reduce stroke recurrence include anti-thrombotics and drugs for risk-factor control. Medication adherence has been shown to be lower in Asian than Western countries. We aimed to study the rate, and factors associated with medication adherence amongst ischaemic stroke and TIA patients in Singapore.

**Methods:** In a prospective cohort study, 100 patients attending post-stroke/TIA outpatient clinic at the Singapore General Hospital over 3 months were surveyed. Medication adherence was assessed using the Medication Adherence Report Scale (MARS-5), with adherence defined as a score of 25. Medication knowledge and adherence to dietary advice were determined through direct questioning. Beliefs About Medicines Questionnaire (BMQ 1-4), Self-Efficacy For Appropriate Medication Use Scale (SEAMS), Trust in Physician Scale (TIPS), Patient Health Questionnaire (PHQ-9) and Hospital Anxiety and Depression Scale (HADS) were also administered.

**Results:** The rate of adherence to secondary stroke-prevention medications was 50%. In the multivariate logistic regression model, age (OR 1.09;95%CI,1.03-1.16), medication knowledge (OR 7.95;95%CI,1.84-34.30), stroke versus TIA (OR 14.02;95%CI,1.08-181.60), atrial fibrillation (OR 0.030;95%CI,0.002-0.53), adherence to dietary advice (OR 41.09;95%CI,4.20-402.24), BMQ-4 (OR 0.70;95%CI,0.54-0.92) and SEAMS (OR 1.08;95%CI,1.01-1.17) scores were independently associated with medication adherence, but history of prior stroke/TIA, polypharmacy, pill-burden, frequency of pill-taking, alternative medication use, living alone, TIPS, PHQ-9 and HADS scores were not.

**Conclusions:** Patients who were younger, presented with TIA and those with atrial fibrillation were less likely to be adherent to medications, and should be targeted for adherence interventions. Potential ways to improve medication adherence include reinforcing knowledge, positive beliefs and self-efficacy regarding medications.

**Trial registration number:** N/A

## AS09-016

### MOYAMOYA DISEASE: WHEN IS THE BEST TIME FOR SURGERY

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**Background and Aims:** Moyamoya disease (MMD) is characterized by an idiopathic progressive narrowing of intracranial ICA and its proximal branches. In consequence, an abnormal network of compensatory collateral vessels develop, originating an angiographic puff of smoke (moyamoya) sign.

**Methods:** Case 1: A 29-year-old woman presents with a 3-week history of left hemiparesis. MRI revealed a right MCA stroke. Conventional angiography demonstrated a severe stenosis of the distal right ICA and proximal M1 associated with hypertrophy of the ipsilateral leptomeningeal and lenticulostriate arteries. Follow-up angioCT revealed progression of right MCA stenosis and involvement of the ipsilateral proximal ACA.

Case 2: A 35-year-old male presents with sudden onset of left hemiparesis and hemihypoesthesia lasting less than 24 hours. CT and MRI did not demonstrate ischemic stroke. Both angioCT and TOF angiography revealed occlusion of proximal right M1 and a bilateral moyamoya pattern.

**Results:** CSF and serum analysis were normal on both cases. Predisposing conditions associated with moyamoya were not identified. Patients were diagnosed with probable MMD (case 1) and MMD (case 2) and started on aspirin 100mg daily.

**Conclusions:** Although the diagnosis of definite MMD requires bilateral presentation, patients with unilateral ICA involvement and no

predisposing pathology may be classified as probable MMD, considering that up to 70% eventually develop contralateral disease over time. Antiplatelet therapy has been successfully used in mild cases, but surgical revascularization is the treatment of choice to prevent stroke and should be considered on both cases. However, there is still lack of evidence on the right timing for surgical treatment.

**Trial registration number:**

**AS09-029**

## ORAL ANTICOAGULATION IN ELDERLY PATIENTS WITH CARDIOEMBOLIC TIA/STROKE: A POPULATION-BASED STUDY IN ARAGÓN, SPAIN

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**Background and Aims:** The benefit of oral anticoagulation (OAC) to reduce the risk of recurrence in cardioembolic stroke in patients with non-valvular atrial fibrillation (NVAF) has been well established, but several complex issues contribute to its underuse in elderly adults. The objective of our study is to examine the characteristics of OAC treatment in elderly patients with NVAF and TIA/stroke in Aragón, Spain (1.3 millions inhabitants, 8.369 patients older than 64 years with NVAF).

**Methods:** Retrospective longitudinal population-based study that worked with data from all patients older than 64 years, registered within the public health system of Aragon (2010-2015) with the diagnosis of cardioembolic stroke. The studied variables were described by sex and age groups (65-74, 75-84, ≥85 years), we also assess recurrence of ischemic stroke, mortality, hemorrhagic stroke, severe systemic bleeding and persistence on OAC therapy.

**Results:** Of 875 patients (44.3% ≥85 years; 56.5% female), 57.1% (500) were prescribed with OAC at hospital discharge, only 38.1% (139) in ≥85 years. DOACs were prescribed in 11% (96). Mean CHA2DS2VASc score of anticoagulated patients was 4.1 (SD 1.4) and the mean number of medications taken per patient in this group was 5.6 (SD 3.6). The mean follow-up time was of 728 days, incidence rates of ischemic stroke, mortality, hemorrhagic stroke and severe systemic bleeding were higher in those not prescribed with OAC (96.1 vs 23.6, 475.5 vs 133.5, 10.3 vs 6.2 and 15.5 vs 10.8 respectively). Persistence on OAC therapy was of 49.6% (248), being lower in ≥85 years (44.6%).

**Conclusions:** OAC in elderly patients with a NVAF cardioembolic stroke is underused in Aragón, especially in patients of 85 years or older. Recurrence of ischemic stroke, mortality, hemorrhagic stroke and severe systemic bleeding are higher in those without OAC.

**Trial registration number:** N/A

**AS09-033**

## IDENTIFYING FACTORS EXPLAINING PRACTICE VARIATION IN SECONDARY STROKE PREVENTION IN PRIMARY CARE – A COHORT STUDY OF ALL STROKE PATIENTS IN STOCKHOLM COUNTY

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### Background and Aims:

**Introduction:** Adherence to guidelines varies between care units and care givers. In Stockholm region the dispensation of statins vary 3-fold among primary care centers (figure). Although this may influence the patient outcome, little is known of which factors induce the variation.

**Aims:** To describe differences in dispensation of secondary stroke preventive drugs between patients at different primary care centers (PCCs) in Stockholm County and to identify factors on PCC-and patient level that may explain the variation.

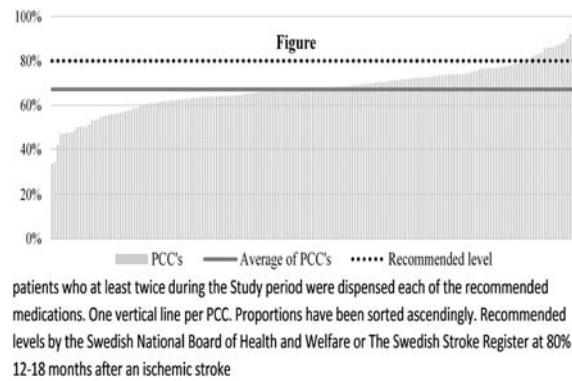
### Methods:

**Material and Methods:** A cohort study using data from the Central Regional Data Warehouse of Stockholm County on 7562 patients listed at 187 PCCs in Stockholm County. Patients with an ischemic stroke treated in hospital between 2009 and 2014 were studied. The exclusion criteria were: deceased patients, age < 18, haemorrhagic stroke and/or changing PCC. The impact of PCC organisation variables and patient characteristics on the dispensation of statins, antiplatelets, antihypertensives and anticoagulants were analysed.

**Results:** Factors associated with lower level of dispensed statins were privately run PCCs and the patient being female. Increased statin use was correlated with higher number of specialists in Family Medicine at the PCC and higher proportion of patient listings at a specific physician and not only at the PCC-unit.

**Conclusions:** Factors, both at patient-and PCC-level, may influence practice variation in secondary stroke prevention. We identified female sex and the PCC being privately run to be associated with lower dispensation of preventive drugs. Factors suggesting good continuity of care and high competence in treating physician were positively associated with dispensation of stroke-preventive drugs.

Dispensation of statins to all PCC's patients in Stockholm County. Proportions of all 187 PCC's stroke



**Trial registration number:** No

### Prognosis and Outcome After Stroke

**AS17-077**

## EARLY AND LATE RECANALIZATION IN PATIENTS WITH CEREBRAL THROMBOSIS – RESULTS OF A PROSPECTIVE COHORT STUDY

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**Background and Aims:** The rate of venous recanalization over time and its role in the outcome of patients with cerebral venous thrombosis (CVT) is not well established.

**Methods:** Pathophysiology of Venous Infarction-PRediction of InfarctiOn and RecanallzaTion in CVT (PRIORiTy-CVT) was a prospective cohort study of adult patients with diagnosis of acute CVT. Standardized MR was performed at inclusion, day 8 and day 90. Thrombus load was assessed using a previously designed score. Recanalization was evaluated for each thrombosed segment.

**Results:** Prespecified MRI protocol was completed in 68 (92%) of 74 included patients. Parenchymal lesion was present in 41% of patients and the median thrombus load score at inclusion was 4.0 (2-6). All patients received anticoagulation. At day 8, 25% had persistent occlusion (s), 70% had at least a minimal degree of recanalization of all affected vessels and 5% of patients showed full recanalization. Median thrombus load score was 1.8 (0-3). At day 90, 48% of patients had full recanalization and 48% had at least a minimal degree of recanalization of all affected vessels. Patients without persistent occlusions at day 8 had more often improvement of brain lesions (OR 2.7, p = 0.29). Persistence of venous occlusion was associated with worsening or development of new non-haemorrhagic parenchymal lesions at day 8 (p = 0.015). These patients also showed a trend towards worse functional prognosis (mRS 2-6) at day 8 (p = 0.19) but not at day 90 (p = 0.88).

**Conclusions:** Early recanalization is common in patients with CVT receiving therapeutic anticoagulation. Early venous recanalization was not associated with improved functional outcome at day 90.

**Trial registration number:** N/A

## AS17-076

### CT PATTERN OF INFARCT LOCATION AND NOT INFARCT VOLUME DETERMINES OUTCOME AFTER DECOMPRESSIVE HEMICRANIECTOMY FOR MALIGNANT MIDDLE CEREBRAL ARTERY STROKE

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**Background and Aims:** Malignant middle cerebral artery [MMCA] infarction has different topographic distribution that might confound the relationship between lesion volume and outcome.

**Methods:** Retrospective study to determine multivariable relationship between computerized tomographic [CT] infarct location, volume and outcomes in decompressive hemicraniectomy [DHC] for MMCA infarction. The MCA infarctions were classified into four subgroups by CT, subtotal, complete MCA [co-MCA], Subtotal MCA with additional infarction [Subtotal MCAA] and co-MCA with additional infarction [Co MCAA]. Maximum infarct volume [MIV] was measured on the pre-operative CT. Functional outcome was measured by the modified Rankin Scale

[mRS] dichotomized as favorable 0-3 and unfavorable ≥4, at three months.

**Results:** In 137 patients, from least favorable to favorable outcome were co-MCAA, subtotal MCAA, co-MCA and subtotal MCA infarction. Co-MCAA had the worst outcome, 56/57 patients with additional infarction had mRS ≥ 4. Multiple comparisons Scheffe test showed no significant difference in MIV of subtotal infarction, co-MCA, Subtotal MCAA but outcome was significantly different. Multivariate analysis confirmed coMCAA [6.74 (2.72 – 16.73), p = 0.001] as the most significant predictor of poor outcomes where as MIV was not significant [OR, 0.99 (0.99 – 01.00), p = 0.317]. Other significant independent predictors were age <sup>3</sup> 55 years [6.10 (2.20 – 16.92), p = 0.001, uncal herniation [OR, 4.57 (1.59 – 13.13), p = 0.005] and septum pellucidum deviation of >1cm [OR, 3.10 (1.17 – 08.25), p = 0.023].

**Conclusions:** Our data shows that CT infarction location and not the MIV is the major determinant of functional outcome after DHC. Subgroups of patients undergoing DHC had different outcomes despite comparable infarction volumes.

**Trial registration number:** N/A

## AS17-150

### OUTCOME OF THE TREATMENT WITH MECHANICAL THROMBECTOMY IN OCTOGENARIANS: EIGHT YEARS OF EXPERIENCE

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**Background and Aims:** Although advance age is not an exclusion criterion for the performance of mechanical thrombectomy (MT), it is known that elderly patients have a less favorable outcome after a stroke. The purpose of this study is to compare clinical outcomes between octogenarians and younger patients after MT.

**Methods:** 769 patients, submitted to MT between April 2010 and August 2018, were analyzed retrospectively. The patients were divided into two groups: under 80s and octogenarians. Clinical-demographic characteristics, procedure data and outcome variables were compared.

**Results:** 144 patients (10, 7%) were octogenarians, being 59% of them women. High blood pressure, dyslipidemia and antiaggregation were more frequent in octogenarians (p = 0.000, 0.005, 0.000 respectively), whereas previous atrial fibrillation, active smoker and alcoholism were less frequent (p = 0.000, 0.000, 0.035 respectively). Octogenarians had higher NIHSS (15.5 vs 16.5 p = 0.030) and systolic blood pressure (145 vs 139, p = 0.007). Time from onset of symptoms to groin puncture was lower (205 min vs. 242 min, p = 0.05), but procedure time was longer (47.5 min vs. 29 min, p = 0.011). There were no differences in administration of intravenous thrombolysis, nor symptomatic intracerebral hemorrhage. TICI≥2, death and modified Rankin scale at 3 months were significantly worst in octogenarians (87 %vs 94%, 28.1 vs. 16.4%, p = 0.002, p = 0.001 and 63.9 vs. 44%, p = 0.000).

**Conclusions:** In our experience, octogenarians have a longer procedure time and worse rates of recanalization. Death and functional dependence after ischemic stroke is higher in this group of patients.

**Trial registration number:** N/A

**AS17-114****THIRTY- DAY READMISSION AFTER STROKE DOUBLES THE RISK OF FUTURE DEATH A RETROSPECTIVE COHORT STUDY FROM A SINGLE TERTIARY CENTER****D. Al Qarni<sup>1</sup> and M. Almekhlafi<sup>2,3</sup>**

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**Background and Aims:** We investigated the frequency, predictors, and impact of 30-day readmission after hospitalization for stroke.

**Methods:** This was a retrospective cohort study over a five-year period at King Abdulaziz University Hospital. All stroke patients who were readmitted within 30 days of index stroke were included. Clinical, radiological, and outcome data were collected and analyzed using descriptive statistics and logistic regression modeling.

**Results:** Out of 548 patients, 133 patients (24.7%) required readmission within 30 days. The mean time from discharge to readmission was 19.2 days. The mean (SD) age was 64.2 (19.2) years. Females represented 44.4% of the readmission cohort ( $p = 0.5$ ). The most common cause of readmission in our cohort was infections (sepsis, pneumonia or UTI) which accounted for 18.1% of all readmissions, followed by recurrent stroke symptoms (15.8%) and cardiovascular problems (MI, heart failure, etc.) in 11.3%. Seizures accounted for 3% and pulmonary embolism in 1.5%. Fifty patients of those who required readmission died during the follow up period (37.6%). This was almost double of the risk in the cohort who did not require readmission ( $p < 0.0001$ ).

In a multivariable logistic regression model, discharge on clopidogrel was associated with a lower odds of readmission (OR 0.6,  $p = 0.03$ ). Readmission was one of the strongest predictors of mortality in our cohort: OR 32.1 (CI95 12.9 to 79.7,  $p < 0.0001$ ).

**Conclusions:** There is a high likelihood of readmission within 30 days following discharge in our cohort; mostly due to infections. Readmission was a strong predictor of death.

**Trial registration number:** N/A

**AS17-153****BENEFITS OF EARLY DIAGNOSIS AND TREATMENT OF OBSTRUCTIVE SLEEP APNEA-HYPOPNEA SYNDROME IN PATIENTS WITH ACUTE ISCHEMIC STROKE: SASS (SLEEP APNEA IN STROKE PATIENTS STUDY)**

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**Background and Aims:** Obstructive sleep apnea-hypopnea syndrome (OSAHS) may influence the prognosis of acute ischemic stroke (AIS). Our objective is to study the impact of early screening and treatment of OSAHS in AIS at the stroke unit.

**Methods:** 24 patients with AIS < 72 hours were included. The sample was divided in two groups ( $n = 12$  in each arm). The protocol in the active group (A) included a cardiorespiratory polygraphy and CPAP if OSAHS was detected. In the control group (C) patients received

standard clinical care. Epidemiological and clinical data was collected in both groups.

**Results:** Both groups were homogeneous in sex, age, prevalence of vascular risk factors, baseline NIHSS and percentage of large-vessel occlusions, thrombolysis and thrombectomy. In the group A, OSAHS prevalence was 100% and more than half were moderate or severe obstructive cases (medium apnea-hypopnea index 21.12). Mean saturation and CT90% was 11.2 and 92.6% respectively. The sensitivity of Berlin questionnaire was 66%. Mortality was 16.6% in C (pneumonia and myocardial infarction) and 0% in A. Mean three-month mRS and Barthel were 1.10 and 90.83 in A vs 2.58 and 80.50 in C ( $p = 0.33$ ). Quality of life parameters were better in A than in C according to SF-36 test (the percentage of patients that reported good health was twice in A).

**Conclusions:** Acute polygraphy is feasible in patients with AIS. Early treatment of OSAHS could improve stroke outcome, although larger multicentric studies are necessary to confirm these results.

**Trial registration number:** N/A

**AS17-157****RETURN TO WORK AFTER ISCHEMIC STROKE TREATED WITH THROMBECTOMY**

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**Background and Aims:** Endovascular thrombectomy (EVT) is associated with better overall functional outcome after ischemic stroke with large vessel occlusion (LVO). In this study we aimed to determine the influence of EVT on the return to paid work after stroke.

**Methods:** We included consecutive ischemic stroke patients with LVO treated in a comprehensive stroke center between 2015 and 2017, that had age below 70 years and paid employment immediately before stroke onset. Return to work and functional status was assessed one year after stroke and compared with a group of working-patients aged below 70 years and LVO who were not treated with EVT, after adjustment for confounders. A  $p < 0.05$  was considered statistically significant.

**Results:** We included 101 patients treated with EVT, mean age  $54.30 \pm 10.76$  years, 56.4% male, mean admission NIHSS  $16.88 \pm 7.76$ . One year after stroke, 52(51.5%) were professionally active, 57(56.4%) were functionally independent and 44(43.6%) had no disability. In univariate analysis, employability one year after stroke was associated with younger age ( $51.06 \pm 10.75$  vs.  $57.73 \pm 9.75$ ,  $p = 0.02$ ) and lower mRS ( $1.14 \pm 0.16$  vs.  $1.91 \pm 0.27$ ,  $p < 0.001$ ).

The control group included 75 patients (mean age  $59.57 \pm 9.56$ , 53.3% males, admission NIHSS  $13.85 \pm 7.32$ ). One year after stroke, these patients were less frequently employed (51.5% vs. 28.0%,  $p = 0.002$ ). After adjusting for possible confounders, EVT was associated with a higher frequency of paid employment (OR: 4.07, 95%CI: 1.84-8.99,  $p = 0.001$ ).

**Conclusions:** Thrombectomy in patients with large vessel occlusion was associated with significantly more employability one year after stroke, reinforcing its social impact.

**Trial registration number:** N/A

**AS17-022****PREDICTING LONG-TERM INDEPENDENCE FOLLOWING STROKE: ADDED VALUE OF INCREASED BPV ASSESSED FROM ENHANCED CASUAL BP**

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**Background and Aims:** Blood pressure variability (BPV) in acute stroke may inform neurological, functional and cognitive outcomes, though current evidence suggests a complex mechanistic interplay. In determining its clinical significance, we explored the long-term prognostic significance of BPV following acute ischaemic stroke (AIS) and transient ischaemic attack (TIA).

**Methods:** In this multi-centre prospective observational study, enhanced-casual blood pressure (BP) was measured at baseline ( $\leq 48$ hrs) using the OMRON 705-IT in 232 AIS and TIA patients. BPV was defined as standard deviation (SD) and coefficient of variation (CoV) of systolic BP, diastolic BP, mean arterial pressure (MAP) and pulse pressure. Functional outcome was assessed at 12 months post-stroke using the modified Rankin Scale (mRS); functional independence (mRS < 2) and dependence (mRS  $\geq 3$ ) were determined. Odds ratio (OR), 95% confidence intervals and p-values have been reported from the multivariate regression analysis.

**Results:** At 12 months follow-up, 156 patients were independent [median (IQR) age 70 years (63–77); 99 (64.5%) male; 140 (89.7%) white British] and 37 dependent [median (IQR) age 80 (76–83); 20 (54.1%) male; 35 (94.6%) white British]. Dependent patients were significantly older (80 vs. 70 years,  $p < 0.0001$ ), with a higher burden of pre-morbid conditions, took more cardiovascular drugs, had increased pre-morbid and baseline dependency, and increased stroke severity. In our adjusted multivariate regression analysis, only increased BPV values defined by MAP\_SD [OR 1.21 95% CI 1.00-1.46,  $p = 0.04$ ] was associated with 12-month dependency.

**Conclusions:** Increasing BPV, derived from baseline enhanced-casual BP values of MAP\_SD, predicts functional dependence (mRS  $\geq 3$ ) at 12 months following AIS and TIA.

**Trial registration number:** N/A

**AS17-023****INCREASING BPV FROM DAY-TIME ABPM PREDICTS LONG TERM FUNCTIONAL OUTCOME FOLLOWING ACUTE STROKE**

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**Background and Aims:** Increasing blood pressure variability (BPV) in acute stroke may be of prognostic significance. In this prospective observational study, we investigated the long-term prognostic significance of BPV post-acute ischaemic stroke (AIS) and transient ischaemic attack

(TIA) using day-time (0700 to 2159) ambulatory blood pressure monitor (ABPM) values.

**Methods:** Blood pressure (BP) recordings at baseline ( $\leq 48$ hours) had 20 minute intervals between readings; acceptability for successful readings using the Spacelabs 90207 ABPM was defined ( $\geq 14$  readings). We described BPV using standard deviation (SD) and coefficient of variation (CoV) of systolic BP (SBP), diastolic BP, mean arterial pressure (MAP) and pulse pressure. Functional outcome was assessed at 12 months with the modified Rankin Scale (mRS), independence (mRS < 2) and dependence (mRS  $\geq 3$ ) were determined. Odds ratio (OR), 95% confidence intervals and p-values are reported from the adjusted multivariate regression analysis.

**Results:** At 12 months, acceptable day-time ABPM readings were completed in 115 independent [median (IQR) age 69 years (63–76); 77 (67%) male; 100 (87%) white British] and 17 dependent [median (IQR) age 79 years (65–79); 9 (52.9%) male; 17 (100%) white British] patients. Dependents (mRS  $\geq 3$ ) were significantly older, with a higher burden of pre-morbid conditions, increased pre-morbid and baseline dependency, and increased stroke severity. Increasing BPV, defined as the CoV of the SBP [OR 1.44 95% CI 1.02-2.03,  $p = 0.037$ ], and MAP [OR 1.46 95% CI 1.02-2.08,  $p = 0.037$ ] independently predicted poor functional outcome at 12 months post-event.

**Conclusions:** Increasing baseline day-time variability of ABPM values predicts long-term dependence (mRS  $\geq 3$ ) following AIS and TIA.

**Trial registration number:** N/a

**AS17-024****INCREASING BPV MEASURED FROM 24-HOUR ABPM IMPROVES PREDICTION OF LONG-TERM FUNCTIONAL OUTCOME COMPARED TO ENHANCED CASUAL BP**

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**Background and Aims:** Increasing blood pressure variability (BPV) following acute ischaemic stroke (AIS) and transient ischaemic attack (TIA) may be of prognostic significance. In this multi-centre prospective observational study, we investigated its prognostic significance by evaluating the associations of BPV derived from enhanced-casual blood pressure (BP) and 24-hour ambulatory blood pressure monitor (ABPM).

**Methods:** Supine BP assessments completed at baseline ( $\leq 48$ hrs) used the OMRON 705-IT and Spacelabs 90207 for enhanced-casual BP and ABPM recordings. Poor functional outcome at 12 months was defined as modified Rankin Scale (mRS) score  $\geq 3$ ; BPV was defined as standard deviations (SD) and coefficient of variation (CoV). The odds ratio (OR), 95% confidence intervals and p-values are reported from the multivariate regression analyses.

**Results:** At 12 months, 156 participants were independent;dependent ( $n = 37$ ) participants were significantly older [median age 80 vs. 70 years,  $p < 0.0001$ ], with a higher burden of pre-morbid conditions, pre-morbid and baseline dependency, and stroke severity. ABPM values of DBP\_SD [OR 2.3, 95% CI 1.08-4.9,  $p = 0.032$ ], MAP\_SD [OR 1.72, 95% CI 1.09 -2.72,  $p = 0.02$ ] and MAP\_CoV [OR 1.76, 95% CI 1.05 -2.94,  $p = 0.031$ ] independently predicted dependency. However, only increasing enhanced-casual MAP\_SD [OR 1.21, 95% CI 1.00-1.46,  $p = 0.04$ ] independently predicted dependency. ABPM variability parameters remained independent predictors when compared to enhanced-causal values: DBP\_SD [OR 2.5, 95% CI 1.11-5.63,  $p = 0.026$ ], MAP\_SD [OR 1.75, 95% CI 1.11-2.75,  $p = 0.016$ ] and MAP\_CoV [OR 1.72, 95% CI 1.04 -2.86,  $p = 0.035$ ].

**Conclusions:** Increasing BPV following AIS and TIA were associated with an increased risk of 12-month dependency; 24-hour ABPM variability was more predictive of outcome by comparison with those derived from enhanced-casual BP monitoring.

**Trial registration number:** n/a

## AS17-185

### WHETHER THE SPEED OF SYMPTOMS DEVELOPMENT IN PATIENTS WITH CONVENTIONALLY TREATED BASILAR ARTERY OCCLUSION CAN DETERMINE A GOOD FUNCTIONAL OUTCOME?

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**Background and Aims:** Conventional treatment of symptomatic basilar artery occlusion is associated with a poor outcome in almost 80% of patients. More than 67% of basilar artery occlusion patients are presented >3 hours after symptom onset due to ill-defined symptoms and diagnostic difficulties. The aim of our study was to investigate the effect of the speed of symptoms development on the functional outcome in patients with conventionally treated basilar artery occlusion.

**Methods:** A total of 31 patients with CT angiography verified basilar artery occlusion, were divided according to the speed of symptoms development into two groups – with rapid (<3 hours) development ( $n=16$ ) and with gradual development ( $n=15$ ). The modified Rankin scale (mRS) was used as a measure of outcome, with mRS  $\leq 2$  defined as a good outcome and mRS 6 as dead. The follow-up period was 3 months after stroke onset.

**Results:** No difference between two groups of patients was found in the rate of death (rapid development 25% vs. gradual development 13.3%,  $p = 0.654$ ), while the rate of patients with good functional outcome (mRS  $\leq 2$ ) was significantly higher in the group with gradual development (0% vs. 40%,  $p = 0.007$ ).

**Conclusions:** There is no significant difference in fatal outcome regarding the speed of symptoms development in patients with conventionally treated basilar artery occlusion. The good outcome is higher in the group of patients with gradual symptom development.

**Trial registration number:** N/A

## AS17-084

### LIMITATIONS IN SOCIAL PARTICIPATION AND GENERAL HEALTH AS PERCEIVED BY STROKE PATIENTS

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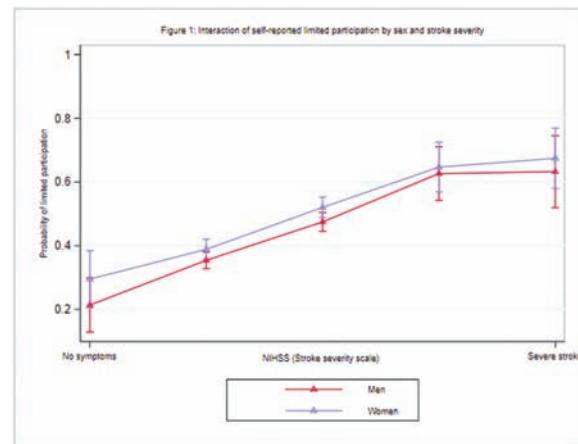
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**Background and Aims:** The International Classification of Functioning, Disability and Health (ICF) framework highlighted the importance of participation, for measuring health. We explored the relationship between participation and health perception in stroke patients.

**Methods:** Data were obtained from 2,514 patients (46% women; mean age 69 years (SD:14)), South London Stroke Register (1995–2018). Participation was assessed by the Short Form 12 (SF-12), item 'Has your health limited your social activities?' and recoded as binary ('All of the time', 'Most of the time' and 'A good bit of the time') versus ('Some of the time', 'A little of the time' and 'None of

the time'). Mixed effects models were used, and all estimates were adjusted for sociodemographic factors, age and stroke severity.

**Results:** Around 41% (SD:2.47%) of men and 46% (SD:3.45%) of women reported limited participation between 3 months to 10 years after stroke. Limited participation was significantly associated with self-reported health as *poor/fair*, as opposed to *excellent to good* (adjusted odds ratio (aOR) 2.98, 95% Confidence Interval (CI): 2.66 to 3.52,  $p < 0.001$ ). Men were significantly less likely to report limited participation compared women. Self-reported limited participation interacts with stroke severity for both sexes. Figure 1.



**Conclusions:** The high prevalence of limited participation, and the strong association with self-rated health require an evaluation of self-management and other interventions to improve quality of life for stroke patients.

**Trial registration number:** N/A

## WITHDRAWN

**AS17-083****LONG-TERM COST OF MYOCARDIAL INFARCTION DURING FOLLOW-UP AFTER TIA OR ISCHAEMIC STROKE: PROSPECTIVE POPULATION-BASED COHORT**

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**Background and Aims:** Up-to-date data on the cost of myocardial infarction after TIA or ischaemic stroke would facilitate measures of cost-effectiveness of secondary prevention, especially for recent costly second-line treatments.

**Methods:** In a population-based cohort in Oxfordshire, United Kingdom (Oxford Vascular Study) of consecutive TIA or ischaemic stroke patients from 2002 to 2014 treated according to current secondary prevention guidelines, we determined the cost of myocardial infarction during 10-year follow-up overall and in relation to baseline clinical characteristics (baseline event [TIA versus stroke], sex, prior coronary, peripheral artery disease and diabetes).

**Results:** Among 2555 TIA/stroke patients, there were 118 myocardial infarctions during 13,071 patient-years of follow-up. The total mean (SD) hospital cost of myocardial infarction was €7,235 (10,051). The 10-year mean hospital cost of myocardial infarction averaged across all patients was €334 (95% CI 262–414) per person and was higher in the subgroups with prior coronary (€620, 389–906; vs. €257, 185–342,  $p = 0.009$ ), peripheral artery disease (€704, 347–1,160; vs. €304, 227–391,  $p = 0.05$ ) or diabetes (€720, 821–1225; vs. €255, 190–328,  $p = 0.005$ ) than those without, all due to their increased risk of myocardial infarction rather than to greater cost of treatment of individual events. Neither the 10-year mean cost of myocardial infarction, nor the 10-year risk, varied markedly with sex or type of baseline event.

**Conclusions:** After TIA or ischaemic stroke, the long-term risk and cost of myocardial infarction is significantly increased in patients with prior coronary or peripheral artery disease or diabetes.

**Trial registration number:** N/A

**AS17-038****IMPACT OF HIGH-SENSITIVITY CARDIAC TROPONIN ON COGNITIVE FUNCTIONING AND DECLINE UP TO THREE YEARS AFTER FIRST-EVER ISCHEMIC STROKE: THE PROSPECTIVE COHORT WITH INCIDENT STROKE BERLIN**

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**Background and Aims:** Cardiac troponin T (cTnT) is a sensitive biomarker for myocardial injury and has been linked to incident dementia and severity of white matter lesions. We aimed to assess whether cTnT is associated with cognitive function and decline in first-ever ischemic stroke.

**Methods:** We used data from the Prospective Cohort with Incident Stroke Berlin (PROSCIS-B; NCT01363856). Patients with severe stroke (NIHSS > 15), recent myocardial infarction, baseline use of dementia medication, and renal insufficiency were excluded from analysis. cTnT was measured using a high-sensitivity assay (hs-cTnT, Roche Elecsys®). Cognitive function was assessed by Mini-Mental-State-Examination (MMSE) at baseline and TICS-m (Telephone Interview for Cognitive Status-modified) during three-year follow-up. Patients were categorized into hs-cTnT quartiles. We performed unadjusted and adjusted (sex, age, cardiovascular risk factors) logistic regression to calculate odds ratios with 95%-CI of mild cognitive impairment (MCI; MMSE < 27). A linear mixed model was used to assess the impact of hs-cTnT on cognitive decline.

**Results:** We included 555 patients (mean age 67 years, 62% male). Median MMSE was 27 (IQR:24-29) for the highest hs-cTnT quartile (43.0% MCI) and 29 (IQR:28-30) for the lowest quartile (15.3% MCI). Adjusted odds ratio for MCI at baseline was 2.4 (95%-CI:1.2-4.7) for the highest quartile compared with the lowest. TICS-m scores were lower for the highest quartile compared with the lowest ( $\beta = -2.37$ , 95%-CI: -4.32 to -0.42) during three years of follow-up.

**Conclusions:** In non-demented patients with mild-to-moderate first-ever ischemic stroke, higher hs-cTnT was associated with a higher prevalence of MCI at baseline, and lower TICS-m during three years of follow-up.

**Trial registration number:** NCT01363856

**WITHDRAWN**

**AS17-061**

**A WRISTWATCH-LIKE ACTIGRAPHIC SYSTEM TO MONITOR MOTOR PERFORMANCE AFTER ACUTE ISCHEMIC STROKE AND PREDICT THREE-MONTH OUTCOMES: A NEW DEVICE FOR STROKE UNIT MULTIMODAL CONTINUOUS MONITORING?**

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C. Simbolotti<sup>2</sup>, G. Reale<sup>4</sup>, M. Ferrarin<sup>2</sup> and P.M. Rossini<sup>4</sup>

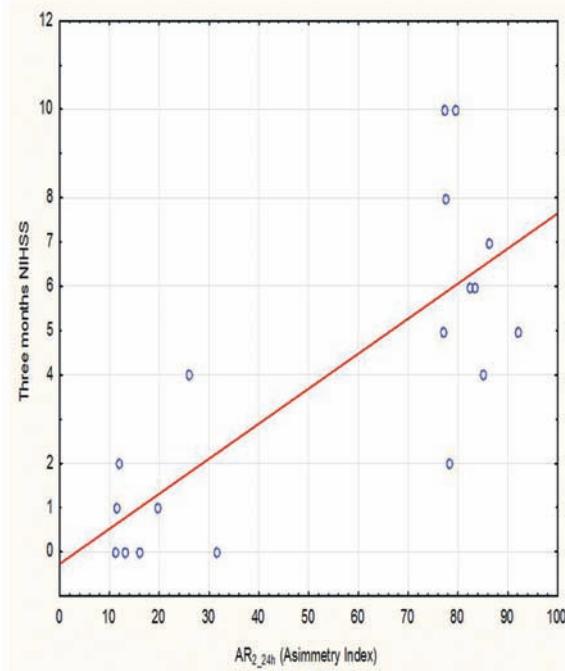
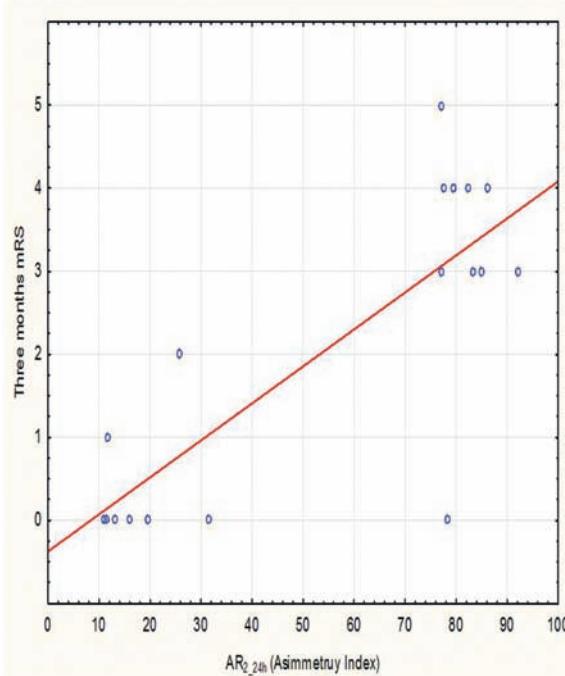
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**Background and Aims:** A motor performance continuous monitoring system is not available in Stroke Units. Our aims were: 1) defining an actigraphic index able to detect the paretic limb and to monitor its motor performance; 2) assessing the relationship between the index and short-term clinical outcomes.

**Methods:** For twenty consecutive acute ischemic stroke patients, we recorded the 24h upper limbs motor activity using two wristwatch-like programmable actigraphic systems.

A firmware calculated two motor activity indices for each 1-minute epoch: MA<sub>e1</sub> (Motor Activity index 1) -sensitive to linear accelerations- and MA<sub>e2</sub> (Motor Activity index 2) -sensitive to linear and angular accelerations. We described the whole 24h motor performance as the mean of MA<sub>e1</sub> and MA<sub>e2</sub> values (respectively MA<sub>1\_24h</sub> and MA<sub>2\_24h</sub>). To identify the paretic limb, we obtained an Asymmetry Rate Indices for MA<sub>e1</sub> and MA<sub>e2</sub> (AR<sub>24h</sub> and AR<sub>2\_24h</sub>, respectively). NIHSS was obtained before (NIHSS<sub>T0</sub>) and after (NIHSS<sub>T1</sub>) the 24h recordings and at three-month follow-up (together with mRS).

**Results:** MA<sub>1\_24h</sub> and MA<sub>2\_24h</sub> were reduced in the paretic limb (respectively,  $p = 0.004$  and  $p = 0.004$ ). AR<sub>2\_24h</sub> was superior to AR<sub>24h</sub> in identifying the paretic limb (Phi Coefficient: 0,698). Positive correlation between AR<sub>2\_24h</sub> and NIHSS<sub>T0</sub> total scores ( $r: 0.714$ ,  $p < 0.001$  for NIHSS) and between AR<sub>2\_24h</sub> and the sub-score relative to the paretic upper limb ( $r: 0.812$ ,  $p < 0.001$ ) were found. Finally, positive correlation between AR<sub>2\_24h</sub> and NIHSS<sub>T1</sub> and mRS at three months was found.



**Conclusions:** The described actigraphic system can identify the paretic upper limb and give clues about the recovery, being potentially suitable for implementation in multimodal monitoring systems.

**Trial registration number:** N/A

**AS17-200****VISUAL DEFECTS RECOVERY AFTER POSTERIOR CEREBRAL ARTERY ISCHEMIC STROKE: PREDICTORS OF PROGNOSIS**

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**Background and Aims:** Few studies have investigated the evolution of visual defects after a posterior cerebral artery (PCA) ischemic stroke (IS). Our objective was to evaluate the frequency of visual defects (VD) recovery after a PCA IS and to identify predictors of prognosis.

**Methods:** Consecutive adult patients with PCA-IS were included retrospectively. We include 101 patients with VD secondary to a confirmed PCA IS. All patients with a basal visual kinetic perimetric evaluation (VKPE) between 2002 and 2017 were included. To assess visual defect recovery, patients underwent a VKPE at least 3 months after the initial VKPE (1 to 205 months, mean 22 months). Logistic regression analysis was conducted to determine visual recovery predictors after stroke, by analyzing demographic characteristics, stroke etiology (TOAST classification) and perimetric visual pattern.

**Results:** We studied 101 patients (mean age  $49 \pm 16$  years (54.5% women)). The most frequent risk factors were diabetes (17%) and hypertension (40%). According to TOAST, undetermined etiology was found in 30%. After a median of 33 months of follow-up, significant spontaneous visual improvement was seen in 16.8% of patients, whereas 79% remained without changes. Age < 50 years was a good predictor for recovery VD (OR 4.6), while complete homonymous hemianopia was a poor prognosis predictor (OR 0.2).

**Conclusions:** In patients with PCA IS, age < 50 year is a good predictor for recovery visual defects. Future studies are required to determine other prognosis factors, that allow to implement early rehabilitation measures and with this, having more possibilities of visual improvement for patients.

**Trial registration number:** N/A

**AS17-092****FIVE-YEARS RISK OF MAJOR ISCHEMIC AND HEMORRHAGIC EVENTS AFTER INTRACEREBRAL HEMORRHAGE**

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**Background and Aims:** We aimed to determine incidences and predictors of major vascular events in intracerebral hemorrhage (ICH) survivors.

**Methods:** We did a prospective observational cohort study in patients with spontaneous ICH from the Prognosis of IntraCerebral Hemorrhage (PITCH) cohort in Lille, France. We studied incidences and predictors of long-term vascular events (cerebral and extra-cerebral, ischemic and hemorrhagic) in patients alive at 30 days with a pre-specified subgroup analysis according to ICH location. We performed multivariable analyses (competing risk analyses, with death during follow-up as a competing event).

**Results:** From the 560 patients with spontaneous ICH enrolled between Nov 2004 and March 2009, we included 310 patients (median age 70 years). Eighty-two patients presented at least one major vascular event leading to an incidence rate of 20.0 % (95% CI 15.7–24.7) at 5 years after ICH. In the overall cohort, ischemic events were more frequent than hemorrhagic events. However, the incidence strikingly differed according to ICH location: deep ICH was associated with future ischemic events (subhazard ratio [SHR] 1.85; 95% CI 1.01–3.40), while lobar ICH was with hemorrhagic events (SHR 2.38; 95% CI 1.17–4.86). In deep ICH, the incidence of ischemic events at 5 years was six times higher than the incidence of hemorrhagic events.

**Conclusions:** ICH survivors are at high risk of both cerebral and extra-cerebral vascular events. The ischemic or hemorrhagic risk profile varies according to the index ICH location with a stronger ischemic risk in deep ICH. Secondary prevention, tailored on ICH location, should target not only cerebral recurrences, but also extra-cerebral vascular events.

**Trial registration number:** N/A

**AS17-195****CLINICAL AND FUNCTIONAL OUTCOMES OF MECHANICAL THROMBECTOMY IN ELDERLY PATIENTS**

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**Background and Aims:** The efficacy and safety of mechanical thrombectomy (MT) for acute ischemic stroke in octogenarians is still to date controversial. The baseline characteristics in elderly patients ( $\geq 80$  years) could worsen the functional outcomes. We compared clinical and prognostic parameters between elderly and younger patients.

**Methods:** Retrospective analysis of consecutive patients presenting an acute anterior circulation stroke due to large vessel occlusion who were treated with MT in an Endovascular Capable Center between May 2016 and September 2018. Data on the characteristics of demographic, clinic, of imaging, complications and functional outcome were collected.

**Results:** Of 291 patients treated with MT, 67 (23%) had  $\geq 80$  years. The proportion of females was higher in the elderly group (36% vs 60%,  $p = 0.0008$ ). Embolic source (40% vs 64%,  $p = 0.001$ ) due to atrial fibrillation (33% vs 58%,  $p = 0.0003$ ) was the main etiology of stroke in the elderly group. A higher baseline National Institute of Health Stroke Scale (NIHSS) was found in the elderly group (16 [10-20] vs 18 [13-21],  $p = 0.0213$ ). The frequency of pneumonia during admission was higher in the elderly group (14% vs 26%,  $p = 0.0370$ ). No differences were found in intracranial hemorrhage (19% vs 25%,  $p = 0.4557$ ), functional independence (modified-Rankin score  $\leq 2$ ; 59% vs 44%,  $p = 0.1227$ ) and mortality (17% vs 25%,  $p = 0.1227$ ) at 90 days.

**Conclusions:** Our findings suggest that MT in elderly patients might be as safe and effective as in younger patients, although the median baseline NIHSS and the rate of pneumonia and cardioembolic strokes was higher in the first group.

**Trial registration number:** N/A

**AS17-111**

## NEUTROPHIL-TO-LYMPHOCYTE RATIO PREDICTS THE COMPOSITE CARDIOVASCULAR OUTCOME IN OLDER PATIENTS WITH MINOR STROKE OR TIA

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**Background and Aims:** The risk of recurrent stroke following a minor stroke or transient ischemic attack (TIA) is high, where inflammation might play a role. We aimed to evaluate the value of neutrophil-to-lymphocyte ratio (NLR) in predicting composite cardiovascular outcome in older patients with minor stroke and TIA.

**Methods:** Consecutive patients aged over 60 years (older patients) with acute minor stroke or TIA during a 5-year period were retrospectively identified. We calculated the NLR dividing absolute neutrophil counts by absolute lymphocyte counts within 24-hours of admission. NLR  $\geq$ 4th quartile was defined as high NLR. A composite outcome was defined as ischemic stroke, acute coronary syndrome or death from cardiovascular causes within 1 year. We explored associations between NLR and the composite outcome in univariate and multivariate analyses.

**Results:** 612 patients (median age 73 years; 59.2% males) were enrolled. The median NLR was 2.76 (interquartile range, IQR 1.96-4.00). 148 (24.2%) patients had high NLR. The composite cardiovascular outcome occurred in 77 (12.6%) patients, who were more likely to have a high NLR (39.0% versus 22.1%;  $p = 0.001$ ) than those without. In multivariate logistic regression, high NLR (adjusted odds ratio 1.83; 95% confidence interval 1.008-3.303;  $p = 0.047$ ) was independently associated with the composite cardiovascular outcome.

**Conclusions:** In older patients with acute ischemic minor stroke or TIA, a higher NLR is an independent predictor of composite outcomes of ischemic stroke, acute coronary syndrome or vascular death. The NLR may help to identify high-risk patients and inform secondary prevention.

**Trial registration number:** N/A

**AS17-008**

## SUBOPTIMAL ATRIAL FIBRILLATION TREATMENT ACCOUNTS FOR 1 IN 10 DEATHS FOLLOWING ISCHEMIC STROKE

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**Background and Aims:** Despite strong evidence of the efficacy of oral anticoagulation (OAC) in reducing stroke risk for patients with atrial fibrillation (AF), OAC remains significantly underutilized. Proper OAC use could prevent severe strokes and even death. We sought to determine the frequency and characteristics of AF among patients who died following ischemic stroke.

**Methods:** A retrospective study was conducted on a registry of patients with death following ischemic stroke. We assessed frequency of AF, prior diagnosis of AF before the index stroke, and use of OAC medication. CHA2DS2-VASC scores were calculated and risk factors were reviewed.

**Results:** 162 patients were in the stroke mortality registry. 69 patients (43%) with AF were identified, 32 having a prior diagnosis of AF and 37 with new AF diagnosis. Mean age of the AF patients was 74.9 years (46% women), and the frequency of hypertension and diabetes was 94% and 35%, respectively. Mean CHA2DS2-VASC score was 4.3 in the prior diagnosis

cohort and 3.9 in the new AF diagnosis cohort. Antiplatelet use was similar between the prior and in-house diagnosis cohorts (46.9% vs 48.7%). The rate of OAC use was 46.9% for patients with a prior AF diagnosis.

**Conclusions:** Among patients who died following ischemic stroke, 43% have a diagnosis of AF. Among patients with a prior diagnosis of AF, less than half were prescribed OAC medication. These results suggest that 1 in 10 ischemic stroke deaths are potentially preventable if AF stroke prevention efforts are optimized. This serves as a wake-up call for the medical community.

**Trial registration number:** N/A

**AS17-048**

## A LITERATURE REVIEW OF BURDEN ASSOCIATED WITH LARGE HEMISPHERIC INFARCTION (LHI) FROM THE PATIENT'S PERSPECTIVE

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**Background and Aims:** Large hemispheric infarction (LHI) is a type of ischemic stroke with high mortality and morbidity, of which space-occupying severe cerebral edema is a frequent complication. The objective of this review is to summarize the current literature about the burden of LHI from the patient's perspective.

**Methods:** A targeted review of literature published between 2008 and 2018.

**Results:** One systematic review (with 16 studies) and 6 additional studies were included. These studies were conducted in Europe, North America, and India, with the majority involving patients who underwent decompressive craniectomy (DC). Sample size of individual studies tended to be small (< 51 patients). In addition to the general quality-of-life instruments, stroke-specific, symptom-specific and patient satisfaction instruments were also used. While DC improved survival, the studies showed that LHI survivors after DC not only had significant impairments in physical health but also had poor mental health (Table 1). Self-reported depression was common. Despite impaired functioning, most patients and their caregivers were satisfied with DC and would retrospectively consent again.

Table 1: Summary of Outcomes Measured by the 36-Item Short Form Survey (SF-36) after Decompressive Craniectomy in Patients with Large Hemispheric Infarction

Author, Year (Sample size)	SF-36 domain scores, mean (SD)								Physical Component Summary Mental Component Summary
	PF	RP	BP	GH	VT	SF	RE	MH	
<b>Staubach, 2015</b>									
Speech-dominant side infarction (n=11)	37.5 (17.5)*	38.9 (13.2)*	45.3 (11.7)*	50.5 (12.5)*	52.9 (11.8)*	43.3 (14.6)*	35.2 (15.9)*	51.1 (12.7)*	42.2 (8.0) / 47.7 (6.7)
Non-dominant side infarction (n=11)	24.7 (9.0)*	47.5 (7.2)*	38.4 (13.9)*	45.0 (12.7)*	44.0 (10.8)*	45.4 (13.5)*	37.5 (12.5)*	44.9 (15.0)*	36.9 (8.4) / 46.8 (9.1)
von Sarowinski, 2012 (N=11)	11.8 (NR)	11.4 (NR)	64.8 (NR)	50.3 (NR)	57.3 (NR)	56.8 (NR)	66.7 (NR)	68.4 (NR)	NR
Shaghaghian, 2008 (N=12)*	29.8 (NR)	5.5 (NR)	71.3 (NR)	55.5 (NR)	50.1 (NR)	74.9 (NR)	53.7 (NR)	71.3 (NR)	NR

\*Scores calculated using the US norm (1998) where 50 points were the mean score.

Data derived from a figure using Plot Designer.

Note: Higher scores indicate better quality of life.

Abbreviations: BP, bodily pain; GH, general health; MH, mental health; NR, not reported; PF, physical functioning; RP, role physical; SF, social functioning; VT, vitality

**Conclusions:** Current literature suggests that LHI has a significant burden on patients' physical and mental health. Published studies mainly focused on patients who received DC, for which only a small portion of LHI patients were eligible. More data are needed for the general LHI survivors to understand the disease burden from the patient's perspective.

**Trial registration number:** N/A

**AS17-090****ESTIMATED GLOMERULAR FILTRATION RATE AND OUTCOME IN PATIENTS AFFECTED BY ISCHEMIC STROKE TREATED WITH MECHANICAL THROMBECTOMY**

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**Background and Aims:** The aim of this work is to analyse the effect of renal impairment on clinical outcome, mortality and symptomatic intracerebral haemorrhage in a small retrospectively collected group of patients with an ischemic stroke treated with mechanical thrombectomy.

**Methods:** 89 patients with acute ischemic stroke treated with endovascular procedure were included in this analysis: 69 patients with an estimated glomerular filtration rate eGFR > 60 ml/min/1.73m<sup>2</sup> and 15 with an eGFR < 60 ml/min/1.73m<sup>2</sup>.

**Results:** Our study population treated either primary or combined mechanical thrombectomy with intravenous fibrinolysis was relatively small. The univariate analysis showed a not statistically trend to a poor outcome (modified Rankin Scale 3-6) and 3-month mortality ( $p = 0.078$ ) e ( $p = 0.053$ ) in the group with eGFR < 60 ml/min/1.73 m<sup>2</sup> [TABLE 1].

TABLE 1

Univariate analysis of thrombectomy treated patients.

BASELINE CHARACTERISTIC	POOR OUTCOME	MORTALITY	SICH
AGE	1.094 (0.993-1.077) $p$ value 0.113	1.044 (0.997-1.092) $p$ value 0.065	0.989 (0.926-1.064) $p$ value 0.838
SEX/MALE	0.854 (0.119-1.086) $p$ value 0.065	0.584 (0.223-1.57) $p$ value 0.272	1.289 (0.217-7.35) $p$ value 0.800
ONSET TO TIME	0.995 (0.989-1.002) $p$ value 1.185	1.006 (0.999-1.013) $p$ value 0.349	1.009 (0.993-1.018) $p$ value 0.537
NHSS	1.091 (0.194-1.186) $p$ value 0.005	1.138 (0.129-1.237) $p$ value 0.011	1.187 (0.122-1.304) $p$ value 0.026
NHSS 2	1.097 (0.193-1.182) $p$ value 0.028	1.121 (0.160-1.196) $p$ value 0.001	1.171 (0.155-1.328) $p$ value 0.015
NHSS 24	1.146 (0.109-1.240) $p$ value 0.001	1.159 (0.173-1.255) $p$ value 0.002	1.144 (0.104-1.259) $p$ value 0.002
SBP	1.010 (0.990-1.038) $p$ value 0.110	1.008 (0.987-1.029) $p$ value 0.078	0.984 (0.923-1.056) $p$ value 0.189
DBP	1.079 (0.972-1.048) $p$ value 0.528	1.095 (0.977-1.076) $p$ value 0.099	0.989 (0.887-1.059) $p$ value 0.485
GLUCOSE	1.002 (0.993-1.014) $p$ value 0.207	1.006 (0.995-1.027) $p$ value 0.207	0.984 (0.970-1.056) $p$ value 0.377
DIABETES	1.481 (0.379-5.821) $p$ value 0.573	3.372 (0.369-25.78) $p$ value 0.050	0.988 (0.107-9.099) $p$ value 0.990
SMOKE	0.864 (0.124-2.877) $p$ value 0.737	0.480 (0.92-2.180) $p$ value 0.531	-
UND	0.468 (0.181-1.361) $p$ value 0.175	0.639 (0.204-1.961) $p$ value 0.244	1.394 (0.228-7.413) $p$ value 0.748
HYPERTENSION	1.558 (0.589-4.060) $p$ value 0.555	1.071 (0.997-2.066) $p$ value 0.885	0.557 (0.102-2.852) $p$ value 0.555
ATRIAL FIBRILLATION	0.703 (0.255-1.342) $p$ value 0.498	1.082 (0.584-3.049) $p$ value 0.885	1.229 (0.211-7.365) $p$ value 0.839
PREVIOUS STROKE OR TIA	0.053 (0.176-0.490) $p$ value 0.001	0.053 (0.176-0.490) $p$ value 0.001	0.9 (0.364-4.142) $p$ value 0.246
ANTITHROMBOTICS	0.729 (0.255-2.129) $p$ value 0.568	1.106 (0.369-3.113) $p$ value 0.857	1.073 (0.392-21.998) $p$ value 0.508
CKD-EPI decreasing GFR by 10 ml/min/1.73mg	1.089 (0.833-1.389) $p$ value 0.495	1.190 (0.942-1.521) $p$ value 0.348	1.186 (0.796-1.709) $p$ value 0.428
LOW GFR	6.559 (0.810-51.024) $p$ value 0.078	1.150 (0.393-10.994) $p$ value 0.253	2.5 (0.434-51.106) $p$ value 0.318

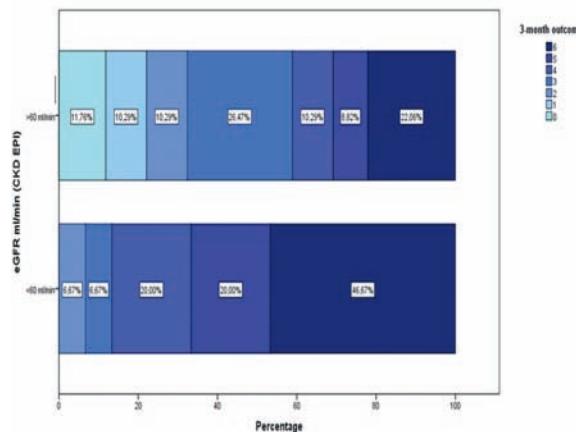
Multivariate analysis confirmed that the progressive reduction of glomerular filtrate is not a significant predictor of poor outcome and 3-month mortality [TABLE 2] [FIGURE 1].

TABLE 2

Multivariate analysis of thrombectomy treated patients.

Baseline characteristics	Poor Outcome	Mortality	SICH
AGE	-	-	-
SEX/MALE	-	-	-
NHSS	1.175 (1.050-1.312) $p$ value 0.003	1.129 (1.007-1.242) $p$ value 0.012	1.157 (1.027-1.304) $p$ value 0.016
SBP	-	-	-
GLUCOSE	-	-	-
DIABETES	-	NS	-
SMOKE	-	-	-
UND	-	-	-
HYPERTENSION	-	-	-
ATRIAL FIBRILLATION	-	-	-
PREVIOUS STROKE OR TIA	-	NS	-
ANTITHROMBOTICS	-	-	-
CKD-EPI decreasing GFR by 10 ml/min/1.73mg	-	-	-
LOW GFR	NS	NS	-

FIGURE 1 - mRS score at 3 months after ischemic stroke



**Conclusions:** Estimated glomerular filtration rate value was not a reliable predictor of three months poor outcome and 3-month mortality in patients treated with mechanical thrombectomy for an ischemic stroke; the small number of patients could have affected our results. Randomized prospective trials will be determinant to clarify the effect of renal impairment on this population.

**Trial registration number:** N/A

**AS17-032****MEDIUM-TERM PROGNOSIS IN PATIENTS WITH ACUTE ISCHEMIC STROKE SUBMITTED TO MECHANICAL THROMBECTOMY WITH OR WITHOUT INTRAVENOUS THROMBOLYSIS**

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**Background and Aims:** Mechanical thrombectomy (MT) improves functional outcome of patients with acute ischemic stroke and large

vessel occlusion. Intravenous thrombolysis (rtPA) within 4.5h is recommended before or during MT, in the absence of contraindications. Our aims were to identify the reasons for not using rtPA on patients undergoing MT and evaluate their 90-days outcome.

**Methods:** Retrospective review of prospectively collected data for consecutive patients submitted to MT between January 2015 and August 2018 in a tertiary centre. Population was divided in two groups: previously treated with rtPA and not-treated with rtPA. Data analysed included demographics, reasons for non-thrombolysis, vascular risk factors, NIHSS score and modified Rankin scale at different timepoints and 90-day mortality.

**Results:** From 473 patients submitted to acute treatment, 107 underwent MT. The latter were divided in two groups: MT(N=56, mean age:69.6 ± 20.5years, 67.8%male, 70%TACI) and rtPA+MT(N=51, mean age:69.6 ± 19.6years, 58.8%male, 67.6%TACI). MT group presented an increased frequency of auricular fibrillation, type 2 diabetes and alcohol ingestion. The main reasons for non-thrombolysis were: treatment with anticoagulants (n=18), >4.5h from symptoms onset (n=10), prothrombin time>15secs (n=5), INR>1.7(n=4) and previous gastrointestinal and intracranial haemorrhages (n=4). Complete perfusion rates were slightly higher on rtPA+MT group, without statistically significant differences (50.0%Vs22.6%, p=0.23). The most prevalent treatment complication was intracranial haemorrhages, with no statistically differences but rtPA+MT presenting twice more than MT group (n=14 Vs n=7, p=0.25) Ninety-day functional independence was similar, while mortality was slightly increased on MT group (17.5% Vs12.8%, p=0.72).

**Conclusions:** Although patients included in each group had different clinical characteristics, there were no differences on functional independence and mortality at three months, albeit with an increase of haemorrhagic complications on rtPA+MT group.

Trial registration number: N/A

## AS17-068

### COGNITION AFTER ACUTE CEREBROVASCULAR DISEASES: ONE-YEAR EXPERIENCE IN AN ITALIAN STROKE UNIT

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**Background and Aims:** Even though vast efforts are dedicated to acute stroke treatments, the burden of stroke problems remains in the chronic phase, which represents a much longer period of the lives of stroke survivors and of their caregivers. Cognitive dysfunction is a very common and disabling consequence of stroke<sup>1</sup>: services dedicated to the assessment of neuropsychiatric consequences of cerebrovascular diseases are essential to stroke patients management.

Beginning on January 2018, we implemented a cognitive evaluation of our Stroke Unit (SU) inpatients in acute phase and during follow up.

**Methods:** Patients admitted to the SU underwent a comprehensive baseline assessment, including a screening cognitive evaluation and pre-morbid functional, cognitive and neuropsychiatric status; a similar assessment was repeated after 3 months (Table 1).

**Results:** Two-hundred-and-fifty patients (mean age 75.9 ± 12.4 years, 48% males) have been admitted to our SU in 2018 (19 transient ischemic attacks, 204 ischemic strokes, 23 intracerebral hemorrhages, 4 cerebral venous thrombosis). Prestroke cognitive impairment was present in 40% (25% mild cognitive impairment, 15% dementia). Seventeen patients died, 16 were transferred to nursing homes, 37 were lost at follow up (FU); 120 patients attended the first follow up visit at the VAS-COG clinic (after approximately 3 months). Incidence of cognitive impairment was

36.2% (33.7% mild cognitive impairment, 2.5 % dementia). Table 2 shows factors associated with increased risk of cognitive impairment.

**Conclusions:** Pre- and post-stroke cognitive impairment are relevant issues. Cognitive evaluation is an essential part of stroke patients assessment.

Trial registration number: N/A

## AS17-117

### THE INCIDENCE, SEVERITY AND RECOVERY OF APHASIA FOLLOWING ACUTE STROKE IN A TERTIARY HOSPITAL

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**Background and Aims:** Aphasia is present in about 30% of patients in the acute setting following stroke (1). However, recent advancements in acute stroke management might have altered the frequency of post-stroke aphasia.

The aim of this study is to re-estimate the incidence, severity and recovery of aphasia following stroke in the acute setting in a tertiary hospital.

**Methods:** All patients admitted to the Stroke Unit of the Ghent University Hospital following a first stroke are enrolled in a prospective observational study. Patients receive standard acute stroke care, including the use of reperfusion therapies (IV thrombolysis, IA thrombectomy), as indicated. The presence of aphasia is confirmed based on the National Institutes of Health Stroke Scale (NIHSS) reported by the attending neurologists at hospital admission, after acute stroke care and at day 7. Additionally, a speech-language pathologist performs a bedside language screening and standardized assessments including ScreeLing and BNT.

**Results:** Since 10 March 2018, 93 of 125 consecutively enrolled first strokes received acute care within 48 hours post-stroke at Ghent University Hospital. Based on the NIHSS score, aphasia was present in 23.3% (95% CI, 15.8 – 33.1) of patients at hospital admission. After acute stroke care, the incidence of aphasia was 14.1% (95% CI, 8.5 – 22.7) and 15.1% (95% CI, 9.2 – 23.7) according to the bedside screening. In 12.4% (95% CI, 7 – 20.8) of patients, aphasia persisted at day 7 (5.6% mild-moderate, 4.5% severe and 2.2% global aphasia).

**Conclusions:** These preliminary results indicate a decreased aphasia frequency following acute stroke in a tertiary hospital.

Trial registration number: Clinicaltrials.gov: NCT03472625

## AS17-109

### ACUTE KIDNEY INJURY AFTER ACUTE ISCHEMIC STROKE: A PARADIGM SHIFT?

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**Background and Aims:** Current data suggests that approximately 11% of patients hospitalized with acute stroke (AS) are affected by acute kidney injury (AKI). Etiology of AKI in these patients is multi-factorial and associated with an estimated threefold risk of mortality in those with Acute Ischemic Stroke (AIS). Based on results of recent interventional trials in AIS, there has been a significant increase in the use of CT angiography (CTA) and Endo-Vascular Therapy (EVT) and as a result the number of patients receiving nephrotoxic contrast agents is expected to increase in the future.

**Methods:** Glenrose Rehabilitation Hospital (Edmonton, Alberta, Canada) is a tertiary referral center and has a well-established 35-bed stroke unit. It encompasses a large catchment area including 3 acute stroke units in the Edmonton zone. This set-up provides a unique opportunity to study and follow the course of AKI in patients with recent stroke. For the purpose of this study we prospectively collected data on 22 patients with AKI. AKI was defined using 2012 guidelines from the Kidney Disease Improving Global Outcomes.

**Results:** The mean observational time in this study was 28 days. None of the patients in this group required dialysis.

analysis showed higher prevalence of abnormal values in RBANS ( $p=0.044$ ) and FIS ( $p=0.018$ ) in patients with NMDARI-AB. There was no association with pathological BDI values ( $p=0.309$ ). Binary logistic regression analysis including covariates NIHSS at 24h, Essen Stroke Risk Score and time from stroke to follow-up in days showed that NMDARI-AB seropositivity was independently associated with pathological RBANS ( $p=0.035$ ) and pathological FIS ( $p=0.024$ ).

**Conclusions:** NMDARI-AB might play a role in the development of cognitive decline and fatigue after ischemic stroke.

**Trial registration number:** N/A

## WITHDRAWN

Findings	No. of Patients (%)
Ischemic stroke	19 (86%)
Intracerebellar hemorrhage	3 (14%)
Contrast use	20 (91%)
• CT/CTA	18 (82%)
• Cardiac Angiogram	2 (9%)
Resolved AKI	17 (77%)
Unresolved AKI	5 (23%)
Cautionary drug use	
(ACEI, ARB, Diuretics, NOACs)*	19 (86%)
Hypertension	17 (77%)
Diabetes	8 (36%)

\*ACEI: Angiotensin converting enzyme inhibitors, ARB: Angiotensin receptor blockers, NOACs: Novel oral anticoagulants.

**Conclusions:** In our cohort of stroke patients, AKI resolved in most but remained unresolved in a significant number of patients during the observed time. In the future, we will need further studies to clarify the expected shift in incidence, risk factors and outcome of AKI after AIS. Finally, close monitoring and follow-up of renal function is extremely important in these patients.

**Trial registration number:** N/A

## AS17-120

### SEROPREVALENCE OF ANTI-NMDARI AUTOANTIBODIES IS ASSOCIATED WITH NEUROPSYCHOLOGICAL LONG-TERM OUTCOME IN ISCHEMIC STROKE PATIENTS

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**Background and Aims:** Pre-existence of autoantibodies against N-methyl-D-aspartate-receptor subunit NR1 (NMDARI-AB) in serum of ischemic stroke patients was associated with smaller lesion size, likely due to acute reduction of excitotoxicity. Chronic exposure to NMDARI-AB, however, could lead to impaired brain function. We investigated whether NMDARI-AB seropositive stroke patients have inferior outcome regarding cognition and neuropsychiatric complications.

**Methods:** In 114 ischemic stroke patients, undergoing treatment at Hannover Medical School, blood samples were collected within 24h after symptom onset. NMDARI-AB seropositivity was analyzed by 3 independent raters using an established assay (Euroimmun). Cognitive outcome was assessed after 1–3 years using RBANS (Repeatable Battery for the Assessment of Neuropsychological Status). Depression and fatigue were assessed using Beck's Depression Inventory (BDI) and the Fatigue Impact Scale (FIS).

**Results:** NMDARI-AB (IgM, IgA, or IgG) were detected in 27 patients (23.4%). Median NIHSS at 24h was 4 [0-17] in patients with NMDARI-AB and 3 [0-22] in patients without NMDARI-AB ( $p=0.852$ ). Univariate

## AS17-156

### FINDING THE BEST APPROACH TO ANALYZE THE NIHSS AT 24 HOURS TO MEASURE TREATMENT EFFECT IN TRIALS OF ACUTE STROKE

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Netherlands; <sup>9</sup>Erasmus MC University Medical Center, Public Health, Rotterdam, The Netherlands

**Background and Aims:** NIH stroke scale (NIHSS) is increasingly used as outcome in RCTs of acute stroke treatment, but no consensus exists on how to analyze the effect of treatment on NIHSS. Our aim is to study what the best approach is to analyze this important early indicator of treatment effect.

**Methods:** We used the data from the MR CLEAN trial ( $n = 500$ ). NIHSS was analyzed with 8 different approaches identified in the literature. For the approaches that used regression models, unadjusted and adjusted estimates for age, baseline NIHSS, pre-stroke mRS and collateral score were calculated. We added the effect on mRS for comparison. We compared the different effect estimates and their Z statistics as a measure that combines strength of the effect and precision.

**Results:** Adjusted Z values ranged from 1.8 (delta-NIHSS) to 4.9 (NIHSS < 10) (table).

Outcome	Analysis	Unadjusted estimate	Z	Adjusted estimate	Z
NIHSS continuous	t-test	1.6	1.9	n.a.	n.a.
NIHSS continuous	Rank-sum test	-	2.9	n.a.	n.a.
NIHSS continuous	Linear regression	1.7	2.0	1.3	1.8
NIHSS continuous	Ordinal logistic regression	.62	3.0	.61	3.1
Log transformed NIHSS continuous	Linear regression	-.22	3.1	-.19	3.0
Dichotomized (NIHSS <5)	Binary logistic regression	2.5	3.3	2.9	3.5
Dichotomized (NIHSS <10)	Binary logistic regression	2.5	4.3	2.9	4.4
Dichotomized (NIHSS <15)	Binary logistic regression	1.9	3.5	2.0	3.5
Dichotomized (Improvement $\geq 4$ points or NIHSS=0)	Binary logistic regression	2.4	4.7	2.6	4.9
Dichotomized (Improvement $\geq 8$ points or NIHSS=0)	Binary logistic regression	2.3	3.7	2.5	4.0
Change from baseline (delta-NIHSS) continuous	Linear regression	1.1	1.5	1.3	1.8
Modified Rankin Scale	Ordinal logistic regression	1.7	3.2	1.7	3.2

**Conclusions:** Use of delta-NIHSS seems not efficient. Dichotomizing the NIHSS in good outcome or improvement seems efficient and promising, but the best cut-point may vary unpredictably, depending on the patient population and chance. By definition, analyzing the full NIHSS optimally uses the available information. Analysis of the effect of treatment on the full NIHSS scale with ordinal regression or linear regression on log-transformed data provides an efficient way to analyze early treatment effects with the NIH stroke scale. This needs to be confirmed in simulation studies.

**Trial registration number:** ISRCTN10888758

## AS17-030

### EARLY NEUROLOGICAL IMPROVEMENT AS AN OUTCOME MEASURE IN ENDOVASCULAR THROMBECTOMY PATIENTS RECEIVING GENERAL ANESTHESIA

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**Background and Aims:** Stroke trials have used early neurological improvement as an outcome measure, commonly defined as a reduction

in the National Institute of Health Stroke Scale (NIHSS) score of 8 or more points from baseline to 24 hours, or a 24-hour NIHSS of 0–1. However, in endovascular thrombectomy patients, the residual effects of general anesthesia (GA) may mask neurological improvement at 24 hours. We compared the discriminative ability of absolute and percentage change in NIHSS to predict 3-month outcomes in thrombectomy patients receiving GA or conscious sedation/local anesthetic (CS/LA).

**Methods:** Consecutive thrombectomy patients from a prospective database were included. Absolute and percentage NIHSS changes from baseline to 24-hours were calculated. Receiver operating characteristic curves were constructed to compare the prognostic performance of absolute and percentage change in NIHSS. Functional independence was defined as modified Rankin Scale scores of 0–2 at 3 months.

**Results:** There were 291 thrombectomy patients, of whom 174 (59.8%) achieved functional independence at 3 months. Thrombectomy was performed with GA in 261 (89.7%) patients and CS/LA in 30 (10.3%) patients. Superior prognostic performance was observed in CS/LA patients compared to GA patients for both absolute (AUC 0.913 versus 0.733,  $p = 0.008$ ) and percentage change (AUC 0.969 versus 0.799,  $p < 0.001$ ) in NIHSS.

**Conclusions:** Early neurological improvement has only modest prognostic performance in thrombectomy patients receiving GA. Care should be taken when communicating prognosis on the basis of early NIHSS change in GA treated patients. Early neurological improvement may not be a good outcome measure in clinical trials that include thrombectomy patients receiving GA.

**Trial registration number:** N/A

## WITHDRAWN

**AS17-013****THE E-SMRSQ APP – VALIDATION OF AN ELECTRONIC VERSION OF THE SIMPLIFIED MODIFIED RANKIN SCALE QUESTIONNAIRE (SMRSQ) BY NON-CERTIFIED RATERS FOR MRS SCORING****D. Dutta<sup>1</sup>, C. Foy<sup>2</sup>, G. Ramadurai<sup>1</sup>, M. Obaid<sup>1</sup> and A. Bruno<sup>3</sup>**<sup>1</sup>Gloucestershire Royal Hospital, Stroke, Gloucester, United Kingdom;<sup>2</sup>Gloucestershire Research Support Service and SW Research Design Service, Medical Statistics and Research, Gloucester, United Kingdom;<sup>3</sup>Medical College of Georgia at Augusta University, Neurology, Augusta, USA

**Background and Aims:** The modified Rankin scale (mRS) is the most widely used global stroke outcome measure. To facilitate stroke outcome assessments further, we developed and tested a smartphone/web application of the simplified mRS questionnaire (e-smRSq). The e-smRSq guides the rater towards a final score according to the smRSq algorithm, and offers hints for scoring based on the original mRS concepts.

**Methods:** Three experienced mRS certified raters prepared 30 clinical vignettes of unstructured patient interviews, and a consensus reference score was determined. Using the e-smRSq, 16 raters of varied professional backgrounds (3 junior physicians, 1 specialist nurse and 12 allied health clinical professionals, mainly physio/occupational therapists) without formal mRS training scored the mRS for 24 randomly selected vignettes. Cohen's and Fleiss's kappa (K), weighted kappa (Kw) and intra-class correlation (ICC) were used to compare rater's scores with reference scores and assess inter-rater reliability.

**Results:** The raters stroke experience ranged from 0.5 to 16 years and only 4 (25%) used the mRS regularly. Before the vignette consensus scores were established, the K (Fleiss) was 0.73 and the ICC 0.91(CI 0.85-0.95) for the 3 certified vignette authors. For the 16 raters using the e-smRSq, the K (Fleiss) was 0.62 and ICC 0.87(CI 0.80-0.93). Comparing rater's scores with reference scores (table1), Cohen's K was 0.68 and Kw 0.90.

Table 1: agreement between reference and rater's scores (percentage agreement in brackets)

Reference Score	e-smRSq rater's scores					
	0	1	2	3	4	5
0	44 (91.7%)	4				
1	3	13 (81.3%)				
2		34	83 (64.8%)	11		
3	4	5	24	76 (67.9%)	3	
4			1	3	37 (77.1%)	7
5						32 (100%)

**Conclusions:** The e-smRSq appears to have very good reproducibility and validity metrics, including among non-certified mRS raters, possibly owing to its simplicity. Further testing in stroke patients is warranted.

**Trial registration number:** N/A

**AS17-131****CHANGE IN FUNCTIONAL STATUS OVER TIME IN INTRAVENTRICULAR HEMORRHAGE: AN EXPLORATORY ANALYSIS OF THE CLEAR III TRIAL****J. Acosta<sup>1</sup>, R. Noche<sup>2</sup>, E. Kirsch<sup>2</sup>, V. Torres Lopez<sup>2</sup>, A. Leasure<sup>2</sup>, C. Matouk<sup>3</sup>, L. Sansing<sup>2</sup>, D. Hwang<sup>2</sup>, W. Ziai<sup>4</sup>, D. Hanley<sup>5</sup>, T. Gill<sup>6</sup>, K. Sheth<sup>2</sup> and G. Falcone<sup>2</sup>**<sup>1</sup>FLENI, Department of Neurology, Buenos Aires, Argentina; <sup>2</sup>Yale School of Medicine, Department of Neurology, New Haven, USA; <sup>3</sup>Yale School of Medicine, Department of Neurosurgery, New Haven, USA; <sup>4</sup>Johns Hopkins University School of Medicine, Department of Neurology, Baltimore, USA; <sup>5</sup>Johns Hopkins University School of Medicine, Division Of Brain Injury Outcomes, Baltimore, USA; <sup>6</sup>Yale School of Medicine, Department of Internal Medicine, New Haven, USA

**Background and Aims:** Studies of stroke evaluate functional outcomes at 90 or 180 days to account for recovery over time. However, there are limited data regarding change in functional status in patients with intraventricular hemorrhage (IVH). We aimed to quantify this change and identify predictors of improvement and worsening.

**Methods:** We performed an exploratory analysis of CLEAR-III, a randomized trial that evaluated intraventricular tPA in patients with IVH, either primary or associated with small intraparenchymal hemorrhage. Patients that survived to day 30 and had complete outcome data were included. We used an increase or decrease in modified Rankin Scale (mRS)  $\geq 1$  between days 30 and 180 to classify patients as improved, stable (no change) or worsened. Multinomial regression models were fitted to identify predictors of improvement or worsening.

**Results:** Among 500 patients enrolled in CLEAR III, 58 (12%) died before day 30 and 15 (3%) were missing outcome data. Of the 427 remaining patients (mean age 58 [SD 11], female sex 198 [46%), white 260 [61%]), 250 (58%) improved, 109 (26%) were stable and 68 (16%) worsened. Independent predictors of improvement included white race (versus all others, OR 2.33, 95% CI 1.4-3.9;  $p = 0.001$ ) and lower admission NIH Stroke Scale (OR 0.98, 95% CI 0.96-1.00;  $p = 0.03$ ). Age was an independent predictor of worsening (OR 1.04,  $p = 0.02$ ), whereas intraventricular tPA was associated with decreased odds of worsening (OR 0.45, 95% CI 0.2-0.9;  $p = 0.02$ ).

**Conclusions:** The majority of IVH patients improve their functional status over time. The known disparities between race/ethnicity and outcome in IVH continue after hospital discharge.

**Trial registration number:** ClinicalTrials.gov NCT00784134

**AS17-187****THE IMPACT OF HYPERACTIVE DELIRIUM IN THE FUNCIONAL OUTCOME OF PATIENTS WITH SPONTANEOUS INTRACEREBRAL HEMORRHAGE****C. Félix<sup>1</sup>, A. André<sup>1</sup>, P. Azevedo<sup>1</sup>, H. Machado<sup>1</sup>, F. Ferreira<sup>1</sup>, C. Basílio<sup>1</sup> and H. Nzwal<sup>2</sup>**<sup>1</sup>Algarve's University Hospital Centre, Neurology Department, Faro, Portugal; <sup>2</sup>Algarve University, Biomedical Sciences and Medicine Department, Faro, Portugal

**Background and Aims:** Delirium is common among patients with spontaneous intracerebral hemorrhage (sICH). Previous studies have suggested a correlation between its occurrence and poor outcome but robust evidence is lacking. We aim to evaluate the impact of hyperactive delirium (HD) in the functional outcome of patients with sICH.

**Methods:** Observational study of consecutive sICH patients admitted to a tertiary center (2009–2015). Patients were stratified as ever-delirious

or never-delirious. Functional outcomes and mortality were evaluated; relevant variables were included in a logistic regression to access HD as an independent predictor.

**Results:** We included 540 patients (64.1% males); mean age  $71.4 \pm 12.5$  years. HD was documented in 17.8% (n = 96). HD was commoner in patients with higher ranking at admission ( $p < 0.001$ ), lower Glasgow coma scale ( $p = 0.013$ ), illicit drugs consumption ( $p < 0.001$ ), dementia ( $p = 0.001$ ), psychotropic drugs use ( $p < 0.001$ ). HD patients had longer lengths of stay ( $p < 0.001$ ). On the univariate analysis HD was associated with higher ranking at discharge ( $p = 0.008$ ) and higher levels of dependency ( $mRS > 2$  vs  $mRS \leq 2$ ) ( $p < 0.001$ ), no impact on mortality was found ( $p = 0.3$ ). On the multivariate analysis we could not identify HD as an independent predictor of poor outcome.

**Conclusions:** HD was a frequent complication in our cohort. We could not identify HD as an independent predictor of poor outcome. Despite this, patients who develop HD seem to have a poorer outcome than those who do not. We hypothesize that the occurrence of HD could be related to worse prior cognitive status and more severe presentation of sICH and therefore its power as an independent predictor is dissolved.

**Trial registration number:** N/A

## AS17-190

### PREDICTORS OF HYPERACTIVE DELIRIUM IN PATIENTS WITH SPONTANEOUS INTRACEREBRAL HEMORRHAGE

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**Background and Aims:** Delirium is a common complication of acute spontaneous intracerebral hemorrhage (sICH) and is associated with poor outcome. Few studies have accessed the predictors of delirium after sICH. We aim to identify predictors hyperactive delirium (HD) in the acute phase of sICH.

**Methods:** Observational study of consecutive sICH patients admitted to a tertiary care hospital (2009–2015). Baseline patient characteristics and clinically relevant factors associated with delirium ( $p < 0.05$ ) were included in a logistic regression model to identify independent predictors.

**Results:** Of the original cohort, 540 patients (98.4%) were included (mean age  $71.4 \pm 12.5$  years, 64.1% males). HD occurred in 96 (17.8%) of patients and was associated with increased length of hospitalization ( $p < 0.001$ ). Age, gender, hypertension, diabetes, hematoma volume  $> 30\text{cm}^3$ , hematoma localization and intraventricular dissection were not associated with HD. Lower admission Glasgow Coma Score ( $p = 0.003$ ), illicit drug use (OR 11.7, 95% CI 1.5-92.2,  $p = 0.019$ ), prior to sICH dementia (OR 5.42, 95% CI 1.7-17.6,  $p = 0.005$ ), any infection (OR 2.48 95% CI 1.1-5.4,  $p = 0.023$ ) and acute kidney failure (OR 4.17, 95% CI 1.25-13.9,  $p = 0.02$ ) were shown to be independent predictors of HD.

**Conclusions:** HD was common among our cohort of patients with sICH. Non preventable factors such as admission decreased level of consciousness and prior to sICH characteristics determine the occurrence of HD. Importantly, potentially preventable factors (infections and acute kidney failure) predict the occurrence of sICH highlighting the need for prevention and early management of these complications.

**Trial registration number:** N/A

## AS17-057

### CLASSIFYING STROKE MECHANISMS IN SYMPTOMATIC INTRACRANIAL ATHEROSCLEROTIC DISEASE: THE REPRODUCIBILITY AND CLINICAL CORRELATES

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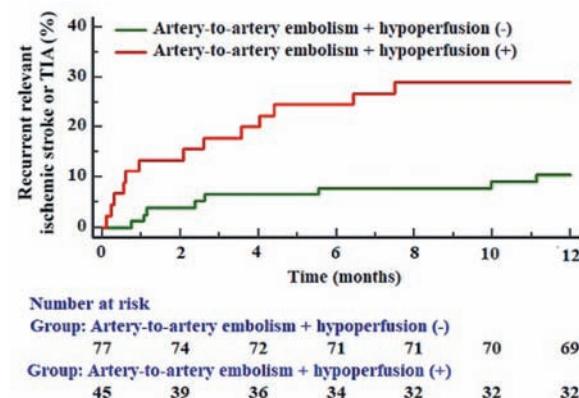
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**Background and Aims:** In patients with symptomatic intracranial atherosclerotic stenosis (ICAS), identifying the underlying stroke mechanisms may inform secondary prevention. We aimed to propose reproducible classification criteria for stroke mechanisms based on routine neuroimaging in symptomatic ICAS and explore their associations with stroke recurrence.

**Methods:** We recruited patients with acute ischemic stroke attributed to 50–99% ICAS in anterior circulation from two centers. Two investigators independently classified probable stroke mechanisms as parent artery atherosclerosis occluding penetrating artery, artery-to-artery embolism, hypoperfusion, and mixed mechanisms, with prespecified criteria based on infarct topography and MR/CT angiography. These stroke mechanisms were correlated with recurrent relevant ischemic stroke or transient ischemic attack (TIA) within 1 year.

**Results:** Among 153 patients recruited, the most common stroke mechanisms were hypoperfusion (35.9%), and mixed mechanism of artery-to-artery embolism and hypoperfusion (35.9%) that was associated with higher incidence of dyslipidemia ( $p = 0.045$ ) and hypertension ( $p = 0.030$ ) than patients with other stroke mechanisms. The proposed criteria showed substantial to excellent intra-rater and inter-rater reproducibilities (kappa 0.715-0.871) in 122 cases. Overall, 31 patients received interventional treatment of the diseased intracranial artery; 122 received medical treatment, among whom a mixed mechanism of artery-to-artery embolism and hypoperfusion at baseline was associated with higher risk of recurrent relevant ischemic stroke or TIA within 1 year (HR 3.09; 95% CI 1.26-7.60; log-rank  $p = 0.007$ ; Figure), than other mechanisms combined.



*Cumulative probabilities of recurrent relevant ischemic stroke or transient ischemic attack (TIA) by different stroke mechanisms at baseline.*

**Conclusions:** Artery-to-artery embolism and hypoperfusion commonly coexist in ischemic stroke attributed to ICAS, which may be associated with a higher risk of stroke relapse.

**Trial registration number:** N/A

**AS17-104****NEUROLOGICAL DEFICIT MINOR STROKE (NDMS SCORE): A NEW RISK PREDICTION TOOL**

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**A. Bilbao Gonzalez<sup>5</sup>, M. Erburu Iriarte<sup>4</sup>,**  
**P. Rodrigo Armenteros<sup>4</sup>, D.A. Alguizola Tamayo<sup>3</sup>,**  
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**Background and Aims:** About 30–40% of minor strokes (MS) have significant disability at discharge (mRankin $\geq 2$ ). NIHSS scale is used to assess the initial neurological deficit (ND), but its usefulness in this population is limited.

**Objective:** To develop a risk prediction tool using ND variables in the Emergency Room to classify patients according to functional prognosis (FP).

**Methods:** All patients with acute ischemic MS and no baseline disability (mRankin < 2) consecutively admitted during a 4-year period in two stroke units were included. Variables included Rankin on discharge and ND recorded as absent, mild and moderate-severe for impairment in Motor, Sensory and Visual function, Language, and Ataxia. Any other ND was registered as minor symptom.

Two cohorts were designed, derivation ( $n=353$ ) and validation ( $n=352$ ). In the derivation cohort, a multivariate logistic model was performed to predict functional status at discharge. From this model a risk score was derived, and we studied its performance in the validation cohort. The risk score was categorized into three risk levels.

**Results:** Based in the multivariate model, we derived a risk score (NDMS) (range, 0–25) with an AUC (95% CI) of 0.83 (0.78–0.87) and 0.76 (0.71–0.81) in the derivation and validation cohorts, respectively. The percentage of Rankin >2 at discharge ranged from 11.32% in the low risk group to 71.90% in the high risk group ( $p < 0.0001$ ; AUC = 0.80). Considering a cutoff point  $\geq 4$ , we obtained AUC (95% CI) 0.78 (0.74–0.82); sensitivity, 87.67%; and negative predictive value, 88.68%.

**Conclusions:** NDMS is able to identify patients with MS with poor FP, which may allow optimizing therapeutic strategy in this population.

**Trial registration number:** N/A

**AS17-106****MISSING OUTCOME DATA MANAGEMENT IN ACUTE STROKE TRIALS TESTING IV THROMBOLYTICS. IS THERE RISK OF BIAS?**

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**R. L. MacIsaac<sup>4</sup>, P.D. Lyden<sup>5</sup>, K.R. Lees<sup>6</sup>; on behalf of the VISTA Collaborators.**

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**Background and Aims:** Missing outcome data (MOD) may undermine interpretation of randomized clinical trials by weakening power and limiting apparent effect size. We assessed bias and inefficiency of two

imputation methods commonly used in stroke trials and how these may affect apparent efficacy of treatment (OR).

**Methods:** We searched VISTA-Acute for ischaemic stroke patients with 90-day mRS as an outcome, and known thrombolysis status. We excluded any with missing 30-day mRS. We planned two analyses. First, we calculated OR for outcome thrombolysis versus not thrombolysed from imputed-only data, a) among patients with missing mRS90, and b) among matched patients with intact data (using propensity score methods and relevant covariates). Imputation approaches were last observation carried forward (LOCF) or multiple imputation MI. Outcome comparisons used dichotomization and shift analysis. Thereafter, we calculated whole-population OR using LOCF and MI (also through dichotomization and shift analysis); first with the original 1.5% MOD, then artificially increasing the MOD burden (5%; 10%; 20%; 30%).

**Results:** We considered 9,657 patients, 3,034 (31%) thrombolysed. MOD replacement by LOCF with analysis by dichotomization gave a high estimate of thrombolysis influence (OR 1.72 [1.45–1.99]  $p = 0.001$ ). Imputing an increasing burden of MOD progressive raised the OR estimates, though thresholds for overestimation were 10% MOD burden for LOCF; 20% for MI.

**Conclusions:** Replacing missing outcome data tended to overestimate outcome differences of thrombolysed versus non-thrombolysed patients, especially if *last observation carried forward* rather than *multiple imputation* and *dichotomization* rather than *shift analysis* was used; but had minimal impact below a 10% burden of missing data.

**Trial registration number:** N/A

**AS17-125****COGNITIVE IMPAIRMENT AS A PREDICTOR OF RECOVERY AFTER STROKE: A META-ANALYSIS OF STROKOG STUDIES**

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**Background and Aims:** Cognitive impairment is common after stroke, but studies on recovery and long-term outcomes of stroke survivors with these impairments are limited. We have evaluated associations between cognitive impairment three-months after first stroke and adverse outcomes up to five years later, from studies in the Stroke and Cognition (STROKOG) consortium.

**Methods:** STROKOG is a group of longitudinal studies of cognitive impairment following stroke or TIA. Individual patient data were obtained from seven studies that agreed to participate and had information on cognitive impairment three months after stroke (Mini-Mental-State-Examination, Abbreviated-Mental-Test) and disability (Barthel Index, modified Rankin), depression (Hospital Anxiety and Depression Scale, Hamilton Depression Scale, Geriatric Depression Rating Scale) or death between one and five years after stroke. A two-step meta-analysis was undertaken to assess the association between cognitive impairment and recovery, assessed by disability, depression and survival. In the first

stage all confounding variables available in each study were adjusted for. At stage two the effect estimates across studies were combined.

**Results:** Seven studies provided information on 4,039 individuals. The pooled prevalence of cognitive impairment three months after stroke was 29% (95% confidence interval = 22%-37%). Cognitive impairment was associated with 51% increased risk of depression (odds ratio = 1.51, 95% CI = 1.10-2.08) and a borderline 37% increased risk of being disabled (OR = 1.37, 95% CI = 0.97-1.95) at one year. The risk of death five years after the index stroke did not differ significantly by cognitive impairment status.

**Conclusions:** Individuals who are cognitively impaired three months after stroke have poorer recovery in terms of disability in long-term follow-up and depression.

**Trial registration number:** N/A

## AS17-034

### INFLUENCE OF DIABETES MELLITUS IN BRAIN DAMAGE AND REPAIR BIOMARKERS LEVELS IN ACUTE STROKE: THE GLIAS-II STUDY

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**Background and Aims:** To analyze the influence of Diabetes Mellitus (DM) in brain damage and repair biomarkers levels in acute ischemic stroke (IS).

**Methods:** Secondary analysis of GLIAS-II study: a multicentre observational prospective study. We analyzed circulating biomarkers related to inflammation (interleukin-6 [IL-6], interleukin-4 [IL-4], interleukin-10 [IL-10], tumor necrosis factor- $\alpha$  [TNF- $\alpha$ ], transforming growth factor beta [TGF-B] and C-reactive protein [CRP]); prothrombotic activity (plasminogen activator inhibitor [PAI-1]); endothelial dysfunction (vascular cell adhesion protein [VCAM], intercellular adhesion molecule [ICAM]); blood-brain barrier rupture (matrix metalloproteinase 9 [MMP-9]); cell death (annexin V, Abcam); and repair processes (vascular endothelial growth factor [VEGF], brain-derived neurotrophic factor [BDNF] and anti-NogoA) at 24–48 hours and 72–96 hours.

**Results:** 213 patients were included. 64 (30%) had a previous history of DM. No significant differences in biomarkers levels between DM and non-DM were found. Higher IL-6 at 24 and 72 hours were associated with poor outcomes (modified rankin scale  $\geq 3$ ) at 3 months regardless of DM (OR 1 CI 95% 1.001-1.013 and OR 1.01 CI 95% 1.006-1.024) in logistic regression analysis.

**Conclusions:** Biomarkers levels did not differ in patients diagnosed with DM. Higher levels of biomarkers were found in patients with poor outcome independently of DM.

**Trial registration number:** N/A

## AS17-135

### PATIENT SATISFACTION WITH STROKE CARE IN THE GERMAN “TRANSREGIONAL NETWORK FOR STROKE INTERVENTION WITH TELEMEDICINE” (TRANSIT-STROKE)

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**Background and Aims:** Patient satisfaction is an important factor to determine quality of care. We analyzed patient satisfaction and its determinants in a tele-medical network in Bavaria, Germany.

**Methods:** Data were collected within TRANSIT-Stroke, comprising 12 hospitals in a mainly rural region. Hospitals without a Stroke-Unit receive tele-medical support by supra-regional Stroke-Units. Consecutive stroke/TIA patients with informed consent were followed-up at three months (FU03). Patient satisfaction was documented with the “Satisfaction-with-Stroke-Care-Questionnaire” containing two subscales: inpatient care and care after discharge. Demographic and clinical characteristics at baseline as well as changes in disability between hospital admission and discharge and hospital discharge and FU03 were analyzed in a logistic regression model to determine impact factors on satisfaction.

**Results:** Between October 2014 and December 2017, 2,780 patients were included (mean age  $70.5 \pm 12.4$  years; 40.1% female; ischemic stroke 74.9%; intracerebral haemorrhage 2.7%, TIA 22.0%; undefined stroke 0.4%) in 10 hospitals. Overall, 88.1% were satisfied with inpatient stroke care and 73.9% with care after discharge. Most patients (97.3%) felt treated with kindness and respect. 68.6% stated that they had all information needed after discharge. Inpatient-satisfaction was influenced positively by having a TIA ( $p = 0.0187$ ) and negatively by higher age ( $>85$  vs  $<65$ ) ( $p = 0.0006$ ). Satisfaction after discharge was predominantly associated with inpatient-satisfaction ( $p < 0.0001$ ). Higher age ( $p = 0.0273$ ) and sex (women) ( $p = 0.0084$ ) contributed in a negative way while improving stroke-related disability after discharge ( $p = 0.0513$ ) showed a positive effect on satisfaction.

**Conclusions:** Overall satisfaction with stroke care was high in TRANSIT-Stroke. Age, stroke-subtype and hospital-satisfaction were important factors influencing satisfaction with stroke care.

**Trial registration number:** N/A

**AS17-175****IMPACT OF PHYSICAL EXERCISE AND MEDITERRANEAN DIET PRIOR TO STROKE ON THE PROGNOSIS OF PATIENTS UNDERGOING ENDOVASCULAR TREATMENT**

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**Background and Aims:** Physical activity (PA) and some dietary patterns like Mediterranean Diet (MeDiet) are associated with a decreased stroke risk but there are limited data on their association with stroke characteristics and prognosis. We aimed to study the association of pre-stroke PA and adherence to MeDiet with different outcome variables in patients with acute ischemic stroke (IS) treated with endovascular therapy

**Methods:** We included consecutive patients with IS in 12 NORDICTUS (Stroke network of North Spain) hospitals. Inclusion criteria were: MCA and/or TICA occlusion and baseline mRS 0–1. Degree of PA prior to stroke was evaluated with Spanish Short Version of the Minnesota Leisure Time Physical Activity Questionnaire and adherence to the MeDiet with PREDIMED 14-points questionnaire. Clinical, radiological and prognostic variables were prospectively collected by blind investigators.

**Results:** From 1/15/2018 to 10/30/2018, 239 patients were included (mean age 71 years, 48% women, median NIHSS 16). Low adherence to MeDiet was associated with atherotrombotic etiology. Daily intake of red wine was associated with a higher probability of complete recanalization ( $p = 0.048$ ). In multivariable analysis, use of olive oil as the principal source of fat was independently associated with mRS  $\leq 2$  at 3 months, OR 3.2 [1.2–8.7]. Patients with a lower activity level prior to stroke (sedentary) had more frequently cardioembolic stroke and a higher incidence of symptomatic intracranial hemorrhage. No associations were found between PA or MeDiet and collateral grade, final infarct volume or mortality.

**Conclusions:** PA and some MeDiet patterns may act as preconditioning factors improving prognosis after stroke.

**Trial registration number:** N/A

**AS17-176****ACUTE ISCHEMIC STROKE IN SUBJECTS ON DIRECT ORAL ANTICOAGULANTS**

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**Background and Aims:** The use of direct oral anticoagulant (DOAc) is increasing and clinicians will face of more and more with AIS (acute ischemic stroke) recurrence in patients under DOAc. Aim of our study was to prospectively evaluate epidemiological data and clinical features of these patients.

**Methods:** We included all individuals with AIS who were taking DOACs, evaluated in the Neurological Division of our Hospital from 1 January 2016 to 31 December 2018. Following data were collected: clinical-demographical records, neuroradiological findings, type and dosage of DOAc, modified Rankin Scale (mRS) at 3 months, incidence of intracranial hemorrhage and mortality rate.

**Results:** Among a cohort of 995 consecutive AIS, 86 subjects (mean age 79) were under DOAc (9%). Forty-one percent of those patients took a low dosage of DOAC and 46% of them without a real contraindications for full dose. Two patients underwent i.v. thrombolysis, not reporting complications. We observed 15 intracerebral hemorrhages (ICH), but only two cases of SICH. In comparison with a control group of AIS patients not taking oral anticoagulants. DOAc patients showed lower mean basal NIHSS (9 Vs 11.5), higher overall mortality rate at 90 days (24% Vs 22.5%) and worse functional outcome (mRS  $\leq 2$ ) at 90 days in 31% Vs 34% in the control group.

**Conclusions:** Occurrence of AIS in patients taking DOAc is not a rare event and leads to worse clinical outcome and higher mortality rate compared to AIS non anticoagulated group. Reasons for occurrence of AIS among DOAc patients need further studies, erroneously underdosage of DOAc play an important role.

**Trial registration number:** NA

**AS17-177****SCREENING FOR APHASIA IN STROKE – NEED FOR DETAILED LANGUAGE EVALUATION?**

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**Background and Aims:** An efficient tool to identify aphasia in stroke is imperative to facilitate patient communication, treatment and rehabilitation. Screening tools must be quick and easy to perform but may be insufficient in detecting aphasia. We investigated how well the two screening tools, the National Institutes of Health Stroke Scale (NIHSS) sub-item 9 and the Language Screening Tool (LAST) could detect aphasia compared with the detailed language test Comprehensive Aphasia Test (CAT).

**Methods:** 211 patients with first-ever acute ischemic stroke were consecutively included prospectively in the Lund Stroke Register Study and screened for aphasia. Patients with aphasia in the acute phase after stroke (day 2–7, n = 62) according to NIHSS item 9 and/or LAST were reassessed 4–6 weeks post stroke with NIHSS item 9, LAST and CAT (total n = 52; n = 7 deceased, n = 3 drop-out). In addition, 55 control subjects without stroke nor aphasia were assessed with CAT.

**Results:** 39 of 52 patients were diagnosed with remaining aphasia 4–6 weeks post stroke according to CAT in comparison to 29 patients according to LAST and 26 patients according to NIHSS item 9. Word finding difficulties and reading comprehension were the most common aphasia symptoms (86% and 71%), however word finding difficulties were also present in 10% of the subjects in the control group.

**Conclusions:** A detailed language test detects more patients with remaining aphasia compared to screening tests. Screening tools for aphasia may underestimate the incidence of aphasia.

**Trial registration number:** N/A

**AS17-128****DEPRESSION AND ANXIETY IN ACUTE THALAMIC STROKE PATIENTS PROSPECTIVELY EXAMINED OVER ONE YEAR**

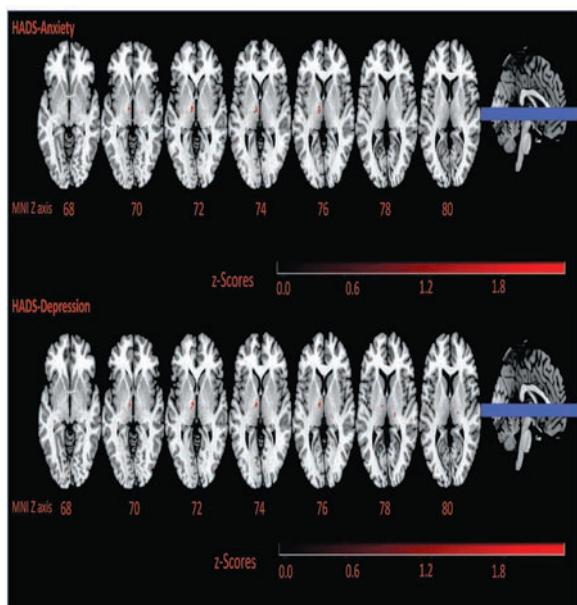
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**Background and Aims:** Emotional consequences of thalamic stroke have poorly been examined in relation to stroke topography.

**Methods:** In 38 patients with acute first-ever ischemic stroke in the thalamus and 38 control patients who were in-patient at the University Hospital Essen, Germany, we assessed symptoms of depression and anxiety 1, 6, and 12 months after stroke using the Hospital Anxiety and Depression Scale (HADS). Control patients were matched for age and exclusion criteria were any forms of central nerve system diseases. Thalamic stroke patients were categorized into anterior ( $n = 5$ ), inferolateral ( $n = 21$ ) and paramedian ( $n = 12$ ) thalamic stroke using MRI performed at 1 month. Voxel-based lesion-symptom mapping (VLSM) was performed to determine associations between HADS score and stroke topography.

**Results:** Anterior thalamic strokes had significantly higher HADS anxiety (median = 11.0, IQR = 8.0; 14.5) and depression (median = 8.0, IQR = 7.5; 10.5) scores at 1 month than control patients (median = 5.0, IQR = 3.0; 8.25, and median = 4.0, IQR = 2.0; 7.0, respectively). Anxiety and depression were not increased in inferolateral (median = 5.0, IQR = 2.5; 7.5, and median = 4.0, IQR = 1.0; 7.0, respectively) and paramedian (median = 4.5, IQR = 2.25; 9.0, and median = 4.5, IQR = 1.5; 7.5, respectively) thalamic stroke. Both in patients and controls, anxiety and depression scores did not significantly change over 12 months. VLSM confirmed the association of abnormal anxiety and depression with anterior thalamic stroke (Fig. 1).



**Fig. 1:** VLSM showing the association of abnormal anxiety and depression with anterior thalamic stroke.

**Conclusions:** Our results suggest an association of post-stroke anxiety and depression with anterior, but not paramedian and inferolateral thalamic stroke.

**Trial registration number:** N/A

**AS17-099****ASSOCIATION BETWEEN LOW BLOOD PRESSURE AND OUTCOME IN PATIENTS WITH ACUTE ISCHEMIC STROKE: A POST-HOC ANALYSIS OF THE PREVENTIVE ANTIBIOTICS IN STROKE STUDY (PASS)**

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**Background and Aims:** Low blood pressure is uncommon in patients with acute ischemic stroke (AIS). We assessed the association between baseline low blood pressure and outcomes in patients with AIS.

**Methods:** Post-hoc analysis of patients with AIS in the multicenter Preventive Antibiotics in Stroke Study (PASS). We compared patients with low (< 10<sup>th</sup> percentile) baseline systolic blood pressure (SBP) to those with normal SBP ( $\geq 10^{\text{th}}$  percentile and < 185 mmHg). Outcomes included in-hospital mortality, complications within 7 days of stroke onset and a shift towards poor 90-day functional outcome assessed with the ordinal modified Rankin Scale (mRS) score. We adjusted for potential confounders.

**Results:** Of 2124 patients with AIS, 212 (10%) had low SBP (70–129 mmHg, median 120; IQR 112–124) and 1440 (68%) had normal SBP (130–185 mmHg, median 156; IQR 144–170). Patients with low SBP had higher baseline NIHSS (median 6 vs. 5;  $p = 0.001$ ), more often cardio-embolic stroke (33% vs. 24%;  $p = 0.016$ ) and less often a history of hypertension (46% vs. 53%;  $p = 0.047$ ). Low SBP was associated with an increased risk of in-hospital mortality (8% vs 4%, aOR: 1.6, 95% CI: 1.1–2.2) and complications (16% vs 7%, aOR: 2.6, 95% CI: 1.6–4.2), compared to normotensive patients. Specifically, heart failure (15% vs. 2%, aOR: 8.5, 95% CI: 1.4–49.5) and gastrointestinal bleeding (12% vs. 1%, aOR: 11.9, 95% CI: 1.3–112.7) were more common. 90-day functional outcome was non-significantly worse in patients with low SBP (shift towards poor outcome: aOR: 1.2, 95% CI: 0.9–1.6).

**Conclusions:** Patients with low SBP and AIS have an increased complication rate and risk of in-hospital mortality. Clinicians should be vigilant for potentially treatable complications in these patients.

**Trial registration number:** N/A

**WITHDRAWN**

neuronal plasticity and thus impair clinical outcome independently of SBP-values.

**Trial registration number:** N/A

## AS17-152

### ACHIEVING HIGH RESPONSE RATES IN ASSESSING PATIENT REPORTED OUTCOME MEASURES THREE MONTHS AFTER STROKE: EXPERIENCES FROM THE “TRANSREGIONAL NETWORK FOR STROKE INTERVENTION WITH TELEMEDICINE” (TRANSIT-STROKE)

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**Background and Aims:** Patient reported outcome measures (PROMs) are important for determining outcome of stroke patients. A high response rate is a prerequisite for valid information, but is often challenging. We report experiences in establishing an algorithm to achieve high response rates for measuring PROMs three months after stroke and to estimate potential selection bias by comparing patient groups according to their willingness to respond to different follow-up (FU) approaches.

**Methods:** Data were collected within TRANSIT-Stroke, a telemedical network comprising 12 hospitals in a mainly rural region in Bavaria, Germany. Patients providing informed consent were centrally followed up three months after stroke using following algorithm: First, an initial questionnaire was mailed. Non-responders were reminded after 3 and 5 weeks. “Reminder” was defined as three contact attempts by phone and one by mail. Information about demographics and disability at FU at different reminder-stages were compared using multivariable logistic regression.

**Results:** Between 01/2015 and 03/2018, 4,377 patients were contacted. Overall, 3,796 questionnaires were returned or death was notified (response rate: 86.7%). Differentiated by reminder-stage the response rate after first, second and third contact was 53.2%, 28.0%, 5.5%, respectively. Responders being repetitively reminded tended to be more severely disabled at FU ( $p=0.08$ ), were more likely to be dependent ( $p<0.001$ ), younger ( $p<0.001$ ) and female ( $p=0.03$ ). No significant differences were found between responders of the first and second reminder.

**Conclusions:** The response rate increased substantially by several reminders, comprising information from more disabled patients at later reminder stages. Thus, strategies to remind patients are essential for valid usage of PROMs.

**Trial registration number:** N/A

## AS17-100

### SIGNIFICANCE OF INITIAL BLOOD PRESSURE AND BURDEN OF CEREBRAL SMALL VESSEL DISEASE FOR CLINICAL OUTCOME AFTER ACUTE ISCHEMIC STROKE

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**Background and Aims:** The prognostic significance of blood pressure (BP) during the acute phase of stroke remains an issue of controversy. One explanation might be that the degree of small vessel disease (SVD)-burden influences the tolerability of the ischemic penumbra relating to BP-levels during the acute phase and thus clinical outcome. Here, we examine whether there is an interaction between SVD and BP regarding stroke outcome.

**Methods:** Out of 509 consecutive stroke survivors, 385 were enrolled in this prospective study. Favorable outcome was defined as modified Rankin Scale < 2, determined 12 months after stroke. SVD, i.e., white matter lesions (WML) and cerebral microbleeds (CMB), was rated on MR-scans. The influence of mean systolic BP over the first 72 hours (SBP<sub>72hours</sub>) after stroke on clinical outcome was calculated and the interaction between BP and SVD-burden was assessed. Post-hoc analyses were done using SBP on admission (SBP<sub>admission</sub>).

**Results:** A multiple regression model yielded no significant impact of SBP<sub>72hours</sub> on clinical outcome ( $p=0.789$ ). In contrast, CMB-burden was significantly associated with an unfavorable outcome ( $p=0.014$ ), whereas WML-burden was not ( $p=0.625$ ). Additionally, there were no significant interactions between SBP<sub>72hours</sub> and CMB ( $p=0.838$ ) or SBP<sub>72hours</sub> and WML ( $p=0.524$ ) regarding stroke outcome. Post-hoc analyses suggested the same pattern of results when using SBP<sub>admission</sub> instead of SBP<sub>72hours</sub>.

**Conclusions:** The missing impact of BP after acute stroke on outcome might be the result of adequate BP-reduction after stroke. Furthermore, changes in brain parenchyma such as CMB might determine

**AS17-107**

**PATIENT REPORTED OUTCOME MEASURES (PROM'S): ENGLAND PILOT TO INFORM NATIONAL STRATEGY AND ASSESS PATIENT NEEDS AGAINST DELIVERY OF THE NHS LONG TERM PLAN FOR STROKE**

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**Background and Aims:** Patient Reported Outcome Measures (PROM's) are vital to inform stroke service provision. Little is known of the burden of stroke and long term outcomes in England. A patient centered improvement program is underway to deliver the NHS Long Term Plan incorporating PROM's.

To perform a pilot study of patient designed PROM's prior to a nationwide study.

**Methods:** A patient and carer focus group designed and edited a series of 52 questions. 700 patients who suffered a stroke in the preceding 2 years were selected consecutively from 2 distinct regions in England. A third of questionnaires were distributed face to face (ftf) by a health care worker, the rest by post. Responses were analysed independently by a third party.

**Results:** 178/700 (25%) responses received. 60% from ftf group. 88% of respondents had experienced a stroke within the past year. 12% < 2 years. 70% felt they received enough rehabilitation in hospital. 13% did not recall or did not understand their diagnosis. 45% of respondents had a review within a week of discharge. 73% agreed that they received enough rehabilitation after leaving hospital.

**Conclusions:** A third of patients described not receiving enough rehabilitation in either hospital or the community. Most patients were unable to distinguish MDT professionals. Over 80% of patients were satisfied with the care they received in hospital, and felt staff understood the effects of stroke upon them. Delivering PROMS's ftf improved the response rate and should be considered for future patient questionnaires.

**Trial registration number:** n/a

**AS17-088**

**EFFECT OF RECANALIZATION ON CEREBRAL EDEMA, LONG-TERM OUTCOME AND QUALITY OF LIFE IN PATIENTS WITH HEMISPHERIC INFARCTION AFTER LARGE VESSEL OCCLUSION**

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**Background and Aims:** Space-occupying cerebral edema is the main cause of mortality and poor functional outcome in patients with acute large cerebral artery occlusion. We aimed to determine whether recanalization would augment cerebral edema and the impact on functional outcome and quality of life (QoL).

**Methods:** Prospectively, 43 patients with large middle cerebral artery territory infarction or NIHSS ≥ 12 on admission were included. Degree of recanalization was assessed by CT-angiography or ultrasound, cerebral edema volume was measured by computer-based planimetry. Mortality and modified Ranking Scale (mRS) were analyzed at discharge and 12 months (FU). QoL was recorded by 36-item short form survey (SF-36).

**Results:** Cerebral edema was 333 ± 141 ml (mean ± SD) in patients without recanalization (n = 13, group 1) and 276 ± 140 ml in those with partial or complete recanalization (n = 30; group 2; p = 0.23). There was no significant difference, neither in mortality at discharge (38% group 1 versus 23% group 2; p = 0.31) and at FU (58% group 1 versus 48% group 2; p = 0.56) nor in functional outcome at discharge (mRS 0–3: 0% both; mRS 4–5: 62% versus 77%) and at FU (mRS 0–3: 0% versus 11%; mRS 4–5: 42% versus 41%). Mean physical component score in SF-36 was 26 ± 6, psychological component score was 42 ± 14.

**Conclusions:** Recanalization is not associated with augmentation of cerebral edema after large artery occlusion. It is unlikely that reperfusion is an independent reason of fatal brain swelling. Low QoL is mainly caused by physical disability.

**Trial registration number:** N/A

**WITHDRAWN**

**AS17-181****RISK OF RECURRENT DISABLING ISCHEMIC STROKE IN PATIENTS WITH TIA OR MINOR STROKE – THE TIAREGISTRY.ORG**

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**Background and Aims:** In the 21<sup>st</sup> century cardiovascular disease remain the challenge of the health system. After the age of 25 years one person in four will have a stroke.

**Methods:** A total of 3847 patients with TIA or minor stroke were followed for 5 years. We evaluated the risk of recurrent ischemic stroke divided by disabling (Rankin scale mRS>1) and non-disabling stroke (mRs 0–1), as well as the predictors for poor outcome (defined as mRs >1) at five years.

**Results:** Of the 3847 patients included in this analysis (mean age 66 years) mRs was performed on 3500 patients at 1 year and on 2958 patients at 5 years. At 1 year 7.9% (276/3500) had a mRs >1 and at 5 years 19% (562/2958), 7.6% (225 /2958) were dead. There were 196 recurrent strokes at 1 year and 31,1% were responsible of a poor outcome, mRs>1. At 5 years there were 345 recurrent strokes and 35.1 % had a mRs >1. Factors associated with mRs>1 were risk factors such as age, diabetes, dyslipidemia but also the delay to first evaluation by a stroke specialist, living alone or in the rural area and the level of education.

**Conclusions:** Our study shows that five years after a TIA or stroke two patients in ten will have a disability and in case of stroke recurrence, one third will have a poor outcome. Prevention therapies should have a significant effect on important outcome like “death” or “significant disability” such as stroke with mRs>1

**Trial registration number:** N/A

**AS17-149****ASSOCIATION BETWEEN HAPTOGLOBIN GENOTYPE AND CASE FATALITY, HAEMORRHAGE AND PERIHAEMATOMAL OEDEMA VOLUME AFTER SPONTANEOUS INTRACEREBRAL HAEMORRHAGE**

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**Background and Aims:** Haptoglobin (Hp) is a haemoglobin-scavenging protein that binds and neutralises free haemoglobin. It also modulates inflammation and endothelial progenitor cell function. A *HP* gene copy number variation (CNV) generates *HPI* and *HP2* alleles; the *HPI* allele is hypothesized to improve outcome after intracerebral haemorrhage (ICH). We investigated the associations of the *HP* CNV genotype with haematoma volume, perihaematomal oedema (PHO) volume, and case fatality after ICH.

**Methods:** We included patients with available DNA and follow-up from the CROMIS-2 study, a multicentre prospective observational study. We classified them into three groups according to the *HP* CNV genotype: 1–1, 1–2 or 2–2 and used the dichotomized variable to assess the strength of *HPI* effect. We measured ICH and PHO volume on computed tomography by a semi-automated threshold-based approach (PHO was measured by oedema extension distance at a mean of 10 hours from ICH onset). We investigated the association between the possession of any *HPI* allele (*HPI*-1/2-1 vs. *HP2*-2) and 6-months case fatality.

**Results:** We included 731 patients (mean age 73.4, 43.5% female). Distribution of *HP* CNV genotype was: *HPI*-1 n = 132 (18.1%); *HP2*-1 n = 342 (46.8%); and *HP2*-2 n = 257 (35.2%). On multivariable analysis case fatality was lower among those with *HP* allele (*HPI*-1 or *HP2*-1, OR 0.55, 95% CI 0.31-0.95, p = 0.03) compared to *HP2*-2. The *HP* CNV was not associated with either ICH or PHO volume.

**Conclusions:** The *HPI* allele is associated with lower 6-months case fatality after ICH, but this association does not seem to be mediated via lower ICH or PHO volume.

**Trial registration number:** NA

**AS17-168****CONVEXITY SUBARACHNOID HAEMORRHAGE AND FUTURE STROKE RISK: AN INTERNATIONAL INDIVIDUAL PATIENT-DATA POOLED ANALYSIS**

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**Background and Aims:** Nontraumatic convexity subarachnoid haemorrhage (cSAH) in older people is an increasingly recognised presentation of cerebral amyloid angiopathy (CAA). Data on risks of future intracranial bleeding and ischaemia are needed to inform prognosis and management. We investigated the frequency, time-course and predictors of symptomatic intracerebral haemorrhage (sICH), recurrent cSAH, and ischaemic stroke (IS) after cSAH.

**Methods:** Systematic literature review and individual patient-data pooled analysis in patients with cSAH. We used a Cox proportional hazards model using a frailty term to account for between-cohort differences. Probable CAA was diagnosed on baseline MRI using modified Boston criteria.

**Results:** We included 277 patients (mean age 70 years; 49.8% female) from 13 centres with 519.5 patient-years of follow-up (mean 1.9 years). The risks of each outcome (per patient-year) were: sICH 12.5% (95% CI 9.7-15.9); IS 4.3% (95% CI 2.7-6.6); and recurrent cSAH 9.1% (95% CI 6.6-12.3). The proportions of early recurrences (within one month) for ICH and recurrent cSAH were 23.1% and 11.4%, respectively. In multivariable models, patients with probable CAA had a higher risk of sICH (HR 3.25, 95% CI 1.31-8.02, p=0.01) but not IS (HR 0.64, 95% CI 0.23-1.78, p=0.39); there was a non-significant increased risk of recurrent cSAH (HR 1.78, 95% CI 0.77-4.09, p=0.18).

**Conclusions:** Patients with acute cSAH are at high risk of future sICH and recurrent cSAH, with high early risk. Probable CAA is associated with increased sICH risk; IS risk is lower than that of sICH, regardless of CAA status. Our data can inform and guide management decisions (e.g. regarding antithrombotic therapy) after cSAH.

Trial registration number: NA

## AS17-069

### “FAKE NEWS” IN THE PCA TERRITORY – CAN WE TRUST THE NIHSS TO PREDICT OUTCOMES?

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**Background and Aims:** Lower baseline NIHSS and mRS at 90 days have independently proved as robust predictors of good clinical outcome in stroke patients. However, NIHSS may not be as reliable in predicting outcomes in PCA strokes, making “cut point” adjustments in NIHSS necessary to better reflect disability following an ischemic infarct. We aimed to identify such an appropriate NIHSS “cut point” as means for inclusion of patients with PCA strokes in future clinical trials, by assessment of their disability at 90 days.

**Methods:** Manual sort of MCA and PCA strokes based on a standard atlas and imaging review was performed. Patients presenting with acute ischemic stroke were included and a 90-day mRS was obtained. Patients with TIA, ICH, SAH, acute ischemic stroke involving the ACA territory or the brainstem were excluded. We defined our outcome ratio as the baseline NIHSS divided by mRS at 90 days, with a lower score indicative of a more “potent” cause of disability.

**Results:** We divided our data into two cohorts as follows:

MCA cohort had 487 patients with an average NIHSS of 8.8 and an average mRS of 2.5. The outcome ratio overall was 3.52 (Right: 3.15, Left: 3.875, bilateral: 2.82).

PCA cohort had 54 patients with an average NIHSS of 5.1 and an average mRS of 2.3. The outcome ratio overall was 2.21 (Right: 1.54, Left: 2.44, bilateral: 4.40).

**Conclusions:** In our cohort, PCA strokes had less rehabilitation potential when compared to MCA strokes and thus may benefit more from inclusion in trials with lower NIHSS thresholds.

Trial registration number: N/A

## AS17-136

### NUTRITIONAL STATUS MEASURED BY PREALBUMIN LEVEL AND PROGNOSIS IN ISCHEMIC STROKE PATIENTS

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**Background and Aims:** Although serum prealbumin level (sPA) has emerged as a useful marker of undernutrition, whether it holds prognostic value for ischemic stroke remains open to debate. We investigated whether baseline sPA is related to the survival or occurrence of post-stroke complications.

**Methods:** We retrospectively selected a total of 1,520 patients with ischemic stroke whose baseline sPA information was available. Based on the baseline sPA, patients were stratified into 2 groups (cut-off value: 100mg/L). Survival analysis of outcome events (mortality or stroke recurrence, myocardial infarction, and major adverse cardiovascular events [MACE]) according groups stratified based on sPA was performed by using Kaplan-Meier method. Multivariate Cox proportional-hazards models were constructed to investigate the relationship between sPA and outcome events.

**Results:** Low baseline sPA (<100mg/L) group turned out to be associated with higher risk of mortality (Hazards ratio[HR] 2.00; 95% confidence interval [CI] 1.43-2.78) and MACE (HR 1.89; 95% CI 1.36-2.64) along with body mass index, serum albumin level (sAL), and C-reactive protein (CRP) level. Low baseline sPA (<100mg/L) was predictive of the future risk of mortality related to stroke recurrence (HR 2.72; 95% CI 1.66-4.46), while body mass index, sAL and CRP level did not exert its predictive role in stroke recurrence.

**Conclusions:** Patients with low baseline sPA (<100mg/L) appears to be associated with higher risk of mortality or post-stroke complications. These findings suggest that sPA hold prognostic value in patients with ischemic stroke, especially in predicting mortality related to stroke recurrence.

Trial registration number: N/A

## AS17-042

### EXPANDING ELIGIBILITY IN STROKE PREVENTION TRIALS TO PATIENTS WITH EARLY DISABILITY

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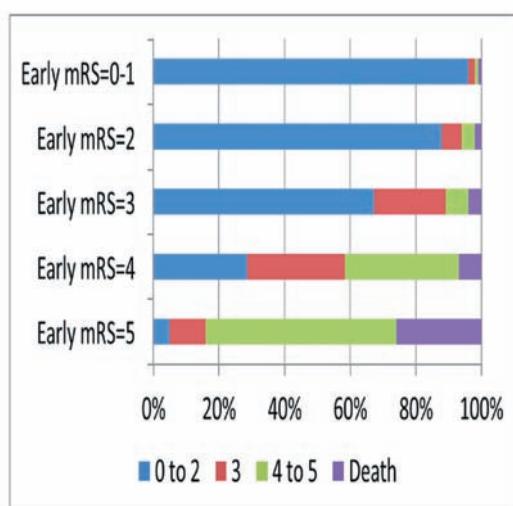
**Background and Aims:** Stroke secondary prevention trials often prohibit the recruitment of nonambulatory patients, limiting their initial access to potential options and impeding trial enrollment. We aimed to determine outcomes after early dependence around the time of transition from acute care to recovery.

**Methods:** Data were obtained from acute stroke clinical trials within the Virtual International Stroke Trials Archive (VISTA-Acute). Early disability was defined by the modified Rankin Scale (mRS) between days 3-10 after onset, representing time of discharge or transition to a rehabilitation-

focused setting. We developed multivariable models to identify factors associated with recovery to independent ambulatory function and recurrent stroke during the 90 days after stroke.

**Results:** 4965 patients were included, with 59% having early disability. Recovery to ambulatory function occurred in 58% with early mRS = 4, compared to only 16% with early mRS = 5. Of those with early mRS = 4, return to independent ambulatory status by 90 days was associated in multivariable analysis with age, diabetes, prior stroke, NIH motor and gaze subscores, and thrombolysis. Recurrent ischemic stroke through day 90 occurred in 4.3% with early dependence compared to 3.1% without, which was not different after adjustment for age, sex, and risk factors (OR 1.27; 95% CI: 0.92–1.73).

Distribution of modified Rankin Scale (mRS) scores at 90 days based on mRS scores obtained early (day 3–10) after onset



**Conclusions:** Favorable outcomes are common among ischemic stroke patients previously enrolled in acute clinical trials despite early dependence (mRS = 4). Further, their risk of recurrent stroke is high in the short term. These patients likely benefit from aggressive post-stroke care and should be actively recruited into secondary prevention trials.

Trial registration number: N/A

## AS17-017

### SOMATOSENSORY DEFICITS AFTER ISCHEMIC STROKE – TIME COURSE AND ASSOCIATION WITH LESION LOCATION

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**Background and Aims:** About 50 to 80 percent of stroke survivors present with somatosensory deficits. Somatosensory deficits due to an ischemic stroke are determined by the infarct location. However, detailed understanding of the long-term effect of lesions on somatosensory performance is lacking.

**Methods:** This prospective observational study enrolled 101 ischemic stroke patients. MRI-FLAIR infarct lesions were segmented within 5 days. Standardized tests (NIHSS and Rivermead Assessment of Somatosensory

Performance) were performed during the acute stage, after three and after twelve months. This included bilateral testing for multiple tactile and proprioceptive somatosensory modalities. We further study the association of acute somatosensory and motor deficit with functional outcome 12 months after stroke. Voxel-based lesion-symptom mapping analyzed association of acute stroke lesions with chronic outcome.

**Results:** Sixty patients showed impairment in at least one somatosensory modality. Light touch was most frequently affected, whereas temperature was least frequently affected. After three months, significant recovery was observed in all somatosensory modalities, with only minor improvements after twelve months. Lesion-symptom mapping revealed associations of lesions in the primary and secondary somatosensory and insular cortex. Acute somatosensory deficit was associated with functional outcome at 12 months. However, including acute motor deficit, somatosensory deficit was no longer an independent predictor of functional outcome.

**Conclusions:** Our study confirms that somatosensory deficits are frequent in acute ischemic stroke but largely recover over time. Infarct lesions in the primary and secondary somatosensory cortex and insula show a robust association with somatosensory impairment. Long-term disability is influenced by somatosensory deficits but driven by motor symptoms.

Trial registration number: N/A

## AS17-118

### STATIN USE AND THE RISK OF CHOLECYSTITIS IN STROKE PATIENTS: A POPULATION-BASED CASE CONTROL STUDY

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**Background and Aims:** Acute cholecystitis after acute cerebral infarction is rare and has not been fully investigated. Previous study showed increased incidence rate in stroke with severe disability. Statin is an established treatment for secondary prevention after ischemic stroke. However, the effects of statin to cholecystitis after acute stroke are not well known. Statin inhibit cholesterol biosynthesis, and thus may prevent gallstone formation, gallstone recurrence, subsequent complications, and cholecystectomy. The purpose of this study was to investigate risk of cholecystitis in stroke patients and early use of statin.

**Methods:** This retrospective cohort study using a nationwide health insurance claim data in South Korea included patients admitted with acute ischemic stroke between 2002 and 2012. Data regarding age, sex, previous gallstone disease, hypertension, diabetes, period of hospitalization was investigated. We performed statistical analysis with Cox proportional-hazards model.

**Results:** We included 13157 patients with acute ischemic stroke. Acute cholecystitis was occurred more frequently in stroke patients compared with control group (1.05% vs 0.80%, p-value < 0.001). Period of hospitalization and diabetes were significantly associated with higher risk of cholecystitis. Early statin use within 1 month after stroke was not associated with risk of acute cholecystitis. Moreover, early statin use was associated with higher risk of acute cholecystitis (HR = 1.35, 95% CI = 1.03–1.75.). High intensity statin use was not associated with risk of acute cholecystitis compared with low intensity statin use.

**Conclusions:** After acute ischemic stroke, acute cholecystitis was occurred more frequently, but early statin therapy was significantly associated with a higher risk of acute cholecystitis.

Trial registration number: N/A

**AS17-011****LONG TERM MORTALITY OF ACUTE ISCHEMIC STROKE AFTER THROMBOLYTIC TREATMENT IN THAILAND****K. Kongbunkiat<sup>1</sup>, N. Kasemsap<sup>2</sup> and S. Tiamkao<sup>2</sup>**

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**Background and Aims:** There are limited data on long-term follow up after rt-PA treatment in acute ischemic stroke patients. This study described long term mortality rate of acute ischemic stroke patient after rt-PA treatment in Thailand

**Methods:** Retrospective cohort study of post rt-PA treatment in acute ischemic stroke patients. Data from National Health Security Office (NHSO), Thailand between October 2004- September 2014 and follow until September 2015. We evaluated associated risk factors, cause of death and mortality rate.

**Results:** The sample size was 6,833 patients. At 1 week survival rate 89% [ 95% CI 0.8813 – 0.8962], 1month survival rate 84 % [ 95% CI 0.8801 – 0.8475], 3 month survival rate 79 % [ 95% CI 0.7811 – 0.8004], 6 month survival rate 75 % [ 95% CI 0.7427 – 0.7630], 1 year survival rate 73% [ 95% CI 0.7163 – 0.7374], 3 year survival rate 63 % [ 95% CI 0.6190 – 0.6434] 5 year survival rate 54 % [ 95% CI 0.5243- 0.5578]. Cause of death in admission such as ischemic stroke, hemorrhagic stroke and heart disease. Cause of death after discharge such as heart disease, infection and old age.

**Conclusions:** After rt-PA therapy, mortality rate at 5 year is 46 %. Age more than 60 years are associated with high mortality rate. Cause of death after discharge is not associated with ischemic stroke.

**Trial registration number:** N/A

**AS17-182****CLOT BURDEN SCORE, COLLATERAL SCORE AND OUTCOME****S. Lakhani<sup>1</sup>, R. Yadav<sup>1</sup>, D. Boulter<sup>2</sup>, V. Shah<sup>1</sup> and D. Gulati<sup>1</sup>**

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**Background and Aims:** Clot extent, location, and collateral integrity are important determinants of outcome in acute stroke. The CBS is a scoring system to define the extent of thrombus found in the proximal anterior circulation by location and is scored on a scale of 0–10. The collateral grading system was scored on a scale of 0–3. The purpose of this study was to compare the relationship of clot extent and collaterals with clinical and radiological outcome.

**Methods:** One hundred stroke patients who underwent endovascular thrombectomy in our institution were reviewed retrospectively. Fifteen patients were excluded due to posterior circulation stroke and absence of CT angiogram (CTA). CBS and CS were calculated on CTA by stroke fellow and vascular neurologist who were blinded about clinical information and radiology reports. Patients were dichotomized using a CBS threshold of >6 as diagnostic performance.

**Results:** There were 85 patients (mean age, 67 years). Higher CBS (>6) is found to be associated with higher percentage of good collaterals as compared to CBS 0–6 (62% vs 39%). CBS >6 is associated with better recanalization rate of TICI score >2b (90% vs 77%). Inhospital mortality is also higher in patients with CBS-0-6 as compared to CBS of >6 (30% vs 17%)

	CBS 0-6 (N=56, 66%)	CBS >6 (N=29, 34%)
Median Age	69yr	66 yrs
Poor Collaterals (CS of 0-1)	34/56 (61%)	11/29 (40%)
TICI score of 2b or 3 — no./total no. (%)	43/56 (77%)	26/29 (90%)
TICI score of 3 — no./total no. (%)	13/56 (23%)	8/29 (23%)
Collateral Grade- Good (CS-2-3)	22/56 (39%)	18/29 (62%)
Female	31/56 (55%)	17/29 (59%)
DM	15/56 (27%)	6/29 (21%)
HTN	39/56 (70%)	18/29 (62%)
Ivtpa	25/56 (45%)	10/29 (34%)
Afib	20/56 (36%)	11/29 (38%)
Inhospital Mortality	17/56 (30%)	5/29 (17%)

**Conclusions:** CBS and CS are useful additional markers predicting clinical and radiologic outcomes and could be potentially used clinically as an adjunct to other imaging and clinical features to stratify patient risk better.

**Trial registration number:** N/A

**AS17-027****DOES ENDOVASCULAR TREATMENT AFFECT COGNITIVE OUTCOME AFTER ISCHEMIC STROKE?****S. Lattanzi<sup>1</sup>, M.G. Coccia<sup>1</sup>, M. Bartolini<sup>1</sup>, F.L. Galli<sup>1</sup>, L. Villani<sup>1</sup>, S. Campa<sup>2</sup>, G. Polonara<sup>2</sup>, M.G. Ceravolo<sup>1</sup> and M. Silvestrini<sup>1</sup>**

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**Background and Aims:** Post-stroke neurocognitive disorders are common and closely related to disability, dependence and institutionalization, even in survivors with successful functional recovery. Endovascular treatment (EVT) of ischemic stroke demonstrated to substantially reduce the severity of post-stroke disability and increase the rate of functional independence. Conversely, the impact on cognitive outcome has not been established, yet. The aim of this study was to investigate the effect of EVT on cognitive outcome in patients with anterior circulation ischemic stroke.

**Methods:** We identified consecutive patients hospitalized for ischemic stroke due to anterior large vessel occlusion who underwent EVT plus intravenous thrombolysis or intravenous thrombolysis alone. Cognitive functions were assessed at 6 months from the index event using a neuropsychological test battery administered by trained neuropsychologists.

**Results:** Compared to patients treated with intravenous thrombolysis alone, patients who received EVT plus intravenous thrombolysis performed significantly better at the neuropsychological tests, including the Controlled Word Association Test, Corsi Block-Tapping Test, Digit Span Test, Stroop Color and Word Test, Colored Progressive Matrices Test, Rey Word Recognition Test and Rey-Osterrieth Complex Figure Test. At multivariable regression analysis, the EVT was independently associated with the 6-month composite cognitive score.

**Conclusions:** At 6 months from anterior circulation ischemic stroke, patients treated with EVT plus intravenous thrombolysis had better cognitive performance than patients treated with thrombolysis alone. EVT can be effective to improve cognitive functioning after ischemic stroke.

**Trial registration number:** N/A

**AS17-073**
**OUTCOMES OF STROKE SURVIVORS WITH INTEGRATIVE TRADITIONAL CHINESE MEDICINE TREATMENTS – A PROPENSITY-SCORE MATCHED ANALYSIS OF 3685 CHINESE PATIENTS IN HONG KONG**

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**Background and Aims:** Strategies to maximize stroke recovery has tremendous impact to stroke patients and society. Integrating Chinese and Western medicine (WM) may improve outcomes of stroke survivors. We analyzed the electronic health records of patients hospitalized in an acute stroke unit who then visited Chinese Medicine (CM) clinics during recovery.

**Methods:** We identified acute stroke patients hospitalized in a university hospital over 3 years from the Clinical Management System and matched the dataset with the Chinese Medicine Information System. Data were acquired 3-months prior to 12-months after index stroke. Propensity score matching (PSM) was performed using covariates age, length of stay, sex, index stroke types, presence of atrial fibrillation, hypertension, diabetes, hyperlipidemia, ischemic heart disease, congestive heart failure and valvular heart disease, with match tolerance set to 0.00001. Mortality and readmission were primary outcome measures.

**Results:** Of 3685 patients (ischemic stroke, n = 2660, 72%; intracerebral hemorrhage, n = 548, 15%; transient ischemic attack, n = 477, 13%), 3382 (92%) survived the index stroke, among which 341(10%) had recurrent admissions (Table 1). 583(15.8%) received integrative CM-VWM during stroke recovery. After PSM (Table 2), 231 matched patients were analyzed. A lower mortality (OR 9.2, p = 0.027) was observed in the integrative medicine group as compared to WM group (overall: 14.7% vs. 24.2%; <= 3 months: 0.9% vs. 4.3%; 4–12 months: 4.3% vs. 6.1%; >12 months: 9.5% vs. 13.9%). No significant difference was observed for readmission rates between two groups (10.4% vs. 9.6%, p = 0.52).

**Table 1. Baseline demographics of 3685 acute stroke patients who underwent western medicine (WM) treatment and integrative western and Chinese medicine (CM) treatment**

		WM (N=3102)	CM before	CM after
			index admission (N=156)	index admission (N=427)
Sex	Female	1388 (44.7%)	100 (64.1%)	194 (45.4%)
Stroke Type	ICH	467 (15.1%)	20 (12.8%)	61 (14.3%)
	IS	2235 (72.1%)	102 (65.4%)	323 (75.6%)
	TIA	400 (12.9%)	34 (21.8%)	43 (10.1%)
Discharge destination	DAMA	11 (0.4%)	0 (0%)	4 (0.9%)
	Death	299 (9.6%)	9 (5.8%)	0 (0%)
	Home	1396 (45%)	82 (52.6%)	145 (34%)
	Rehab	1396 (45%)	65 (41.7%)	278 (65.1%)
Mortality	Died 0-3 months after discharge	165 (5.3%)	4 (2.6%)	4 (0.9%)
	Died 4-9 months after discharge	124 (4%)	5 (3.2%)	7 (1.6%)
	Died 10-12 months after discharge	52 (1.7%)	1 (0.6%)	7 (1.6%)
	Died more than 12 months after discharge	384 (12.4%)	14 (9%)	42 (9.8%)
Risk factors (additional diagnoses)	Atrial Fibrillation	385 (12.4%)	19 (12.2%)	55 (12.9%)
	Hypertension	1297 (41.8%)	81 (51.9%)	189 (44.3%)
	Diabetes	682 (22%)	36 (23.1%)	95 (22.2%)
	Congestive Heart Failure	78 (2.5%)	6 (3.8%)	6 (1.4%)
	Hyperlipidemia	766 (24.7%)	47 (30.1%)	120 (28.1%)
	Ischemic Heart Disease	153 (4.9%)	11 (7.1%)	21 (4.9%)
	Valvular Heart Disease	40 (1.3%)	4 (2.6%)	9 (2.1%)
		Median (IQR)	Median (IQR)	Median (IQR)
Age		74 (62-82)	74 (64-80.5)	68 (60-78)
LOS		5 (3-7)	4.5 (3-6.5)	6 (3-9)

**Table 2. Baseline demographics of stroke survivors who had western medicine treatments (WM) vs. integrative treatment (WM and CM) after propensity score matching.**

		WM (N=231)	CM+WM (N=231)
		N (%)	N (%)
Sex	Female	107 (46.3%)	107 (46.3%)
	ICH	26 (11.3%)	26 (11.3%)
Stroke Type	IS	178 (77.1%)	179 (77.5%)
	TIA	27 (11.7%)	26 (11.3%)
Additional diagnosis (Risk factors)	Atrial Fibrillation	20 (8.7%)	10 (4.3%)
	Hypertension	100 (43.3%)	85 (36.8%)
	Diabetes	43 (18.6%)	49 (21.2%)
	Congestive Heart Failure	3 (1.3%)	0 (0%)
	Hyperlipidemia	47 (20.3%)	53 (22.9%)
	Ischemic Heart Disease	6 (2.6%)	11 (4.8%)
	Valvular Heart Disease	1 (0.4%)	1 (0.4%)
		Mean (SD)	Mean (SD)
	Age (years)	71.74 (11.677)	71.34 (11.593)
	Length of stay (days)	5.1 (3.258)	5.0 (3.037)

**Conclusions:** Stroke survivors who underwent integrative medicine for recovery had a lower mortality without an increase in readmission.

**Trial registration number:** N/A

**AS17-129**
**EDUCATION IMPROVES SHORT AND LONG-TERM COGNITIVE OUTCOMES: UK AND CHINA COHORTS**

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**Background and Aims:** There is large variability in the way stroke affects an individual's ability to function. Brain reserve is hypothesised to be one protective factor of cognitive decline in ageing resulting from neural loss. 'Brain reserve' is assumed to emerge from cognitive taxing experiences across the life-span. The current study aimed to test the contribution of education to brain reserve, ameliorating short and long-term cognitive decline following stroke. This was examined using databases from the U.K and China.

**Methods:** Study 1: 821 stroke survivors from the U.K (age M = 69.92 (18–95), education M = 11.21(3–26)) were assessed within 3 months of stroke, 72 Mandarin (age M = 64.26(41–88), education M = 9.88(0–22)) and 131 Cantonese (age M = 69.03(50–94), education M = 7.45(0–17)) speaking Chinese were assessed within 1 month of stroke. Study 2: 380 of the U.K stroke survivors were re-assessed at 9 months post-stroke. Cognitive abilities were assessed using the Birmingham Cognitive Screen (BCoS), and its Chinese version. Step-wise linear regression

was used to assess the predictive value of years of education on cognitive outcome while controlling for age.

**Results:** Study 1: Education predicted general cognitive outcome in the U.K sample ( $t(820) = 2.82, p = .005$ ), this was driven by language, number and praxis domains. In the Mandarin sample education predicted praxis abilities ( $t(71) = 5.96, p = .05$ ) and in the Cantonese sample it predicted language and memory abilities ( $t(130) > 5, p < .005$ ). Study 2, after controlling for baseline cognition, education predicted 9 month recovery of general cognition ( $t(1,379) = 71.2, p > .001$ ). This was driven by praxis, number and attention domains.

**Conclusions:** The results show that education improves brain reserve leading to better short and long-term cognitive outcome following stroke.

**Trial registration number:** N/A

## AS17-020

### COMPARISON OF LONG-TERM EFFICACY AND SAFETY BETWEEN CILOSTAZOL AND CLOPIDOGREL IN CHRONIC ISCHEMIC STROKE: A NATIONWIDE COHORT STUDY

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**Background and Aims:** Previous clinical trials showed significant difference of efficacy and safety among antiplatelets in acute ischemic stroke (IS). The present study wished to compare the efficacy and safety head-to-head between cilostazol and clopidogrel in chronic IS.

**Methods:** This open prospective cohort study recruited chronic IS patients who had index hospitalization between 2001 and 2013 from Taiwan National Health Insurance Research Database. In the 504,191 hospitalized patients, patients who had missing information and history of atrial fibrillation or rheumatic heart disease, received mechanical valve replacement or anticoagulants, expired during the index hospitalization, received follow-up  $\leq 6$  months or had recurrent stroke within 6 months after index stroke were excluded.

**Results:** Among the 15,968 eligible patients, 502 patients who consistently received either cilostazol or clopidogrel from the 7th month after index stroke were included for analysis after propensity score matching. The 3-year primary outcomes showed similar frequency of recurrent IS, all-cause mortality, and acute myocardial infarction and similar frequency of intracerebral hemorrhage, gastrointestinal bleeding, and major bleeding between cilostazol and clopidogrel group. Subgroup analysis revealed patients with a history of hypertension or gastrointestinal bleeding had a trend of having lower frequency of recurrent IS or major bleeding, respectively, in the cilostazol group.

**Conclusions:** The present real-world study demonstrated no significant difference of efficacy and safety between cilostazol and clopidogrel in the chronic phase of IS. However, cilostazol might be better than clopidogrel in the patients with a history of hypertension or gastrointestinal bleeding.

**Trial registration number:** N/A

## AS17-194

### MILD VERSUS SEVERE EMBOLIC STROKES OF UNDETERMINED SOURCE: STROKE RECURRENCE, MORTALITY AND DETECTION OF ATRIAL FIBRILLATION DURING FOLLOW-UP

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**Background and Aims:** The majority of ESUS patients typically have mild strokes. Still, a considerable proportion of ESUS have severe strokes. We aimed to assess the baseline characteristics, stroke recurrence risk, mortality and the probability of atrial fibrillation detection in ESUS patients in association with the index stroke severity.

**Methods:** We pooled data of all consecutive ESUS patients from 3 prospective stroke registries. Patients with an NIHSS  $\geq 7$  at admission were defined as severe strokes. The outcomes assessed were stroke recurrence and death. We also assessed the probability of detection of atrial fibrillation during follow-up. The association of stroke severity with outcomes was investigated by multivariate stepwise regression and by the Kaplan-Meier product limit method. We also performed a secondary analysis using other NIHSS cut-offs.

**Results:** Among 848 patients (42.9% women) followed for 3,059 patient-years, there were 407(48%) severe strokes. Compared to patients with mild strokes, patients with severe strokes had similar rates of stroke recurrence (3.2 vs 3.7 per 100patient-years respectively, HR:0.98, 95% CI:0.66-1.45) but higher mortality rates (6.5 vs 3.7 per 100patient-years, HR:1.99, 95% CI:1.42-2.78). The probability of AF detection during follow-up was similar (1% vs 0.9% per 100patient-years, HR: 0.80, 95% CI: 0.55-1.17). Compared to patients with mild stroke, patients with severe stroke had higher 10-year cumulative probability of death but similar probability of recurrence.

**Conclusions:** Patients with severe ESUS have higher mortality but similar risk of stroke recurrence. The probability of AF detection was similar between mild and severe strokes.

**Trial registration number:** N/A

## AS17-164

### HOUSING AND STROKE OUTCOMES: ARE HOMEOWNERS BETTER OFF?

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**Background and Aims:** Post-stroke care is expensive and often requires accommodations for physical mobility barriers. Aging homeowners, compared to renters, are more likely to make physical changes to their homes. Little research has considered connections between homeownership and post-stroke outcomes, which may be particularly relevant in minority populations, such as Mexican Americans (MAs), that experience disproportionate stroke burden. We studied whether

neighborhood homeownership mediates the association between a neighborhood inequality dimension (%MA residents) and post-stroke function.

**Methods:** Data included census tract-level %homeownership and %MA from the American Community Survey (2012–2016) and 90-day functional outcome assessed via the Brain Attack Surveillance in Corpus Christi Project (Texas, USA; 2012–2016). Using linear regression we assessed associations adjusted for socio-demographics, pre-stroke factors and stroke severity: Model1) %MA residents and ADL/IADL score, Model2) %MA residents and %homeownership, Model3) %homeownership and ADL/IADL score, and Model4) Model1 adjusting for %homeownership. **Results:** 782 ischemic stroke cases were included (median age 67, 62% MA). Median neighborhood-level ( $n=78$ ) %MA and %homeownership were 63.6 (IQR:49.2-82.7) and 61.4 (IQR:45.6-72.4) respectively. Median ADL/IADL score (range 1–4, higher→worse) was 2.1 (IQR:1.4-3.2). Higher neighborhood %MA was associated with worse ADL/IADL score (mean difference comparing 75th to 25th percentile 0.17 (95% CI:0.05-0.28). Lower neighborhood %homeownership was associated with worse ADL/IADL score (mean difference 0.10 (95% CI:-0.01-0.21)) but not with neighborhood %MA. The %MA-ADL/IADL score association was unchanged after including %homeownership.

**Conclusions:** Neighborhood inequality, assessed by %MA, was associated with worse functional outcome but not through homeownership. Lower neighborhood homeownership was associated with worse functional outcome, consistent with research on positive effects of homeownership.

**Trial registration number:** N/A

## AS17-146

### PLATELET-TO-LYMPHOCYTE RATIO AS A PREDICTIVE INDEX OF NEUROLOGICAL OUTCOMES IN ISCHEMIC STROKE

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**Background and Aims:** Stroke is the second leading cause of mortality and the third leading cause of morbidity worldwide. Of all strokes, 85% are ischemic and intracranial artery occlusion accounts for 80% of these ischemic strokes. Systemic inflammation plays a critical role in the pathophysiological process of ischemic strokes. The platelet-to-lymphocyte ratio (PLR) was introduced as a potential marker to determine increased inflammation. In this study we aimed to evaluate whether the PLR had a prognostic role in stroke patients.

**Methods:** This study was performed in a single teaching hospital. Over one-year period, demographic, clinical findings of 57 consecutive patients with acute ischemic stroke were evaluated. Glasgow coma scale at hospital discharge (GCSdis) was recorded as short-term neurological outcomes. PLR values are calculated from the platelets and absolute lymphocyte count. The correlation between PLR and laboratory indices in ischemic stroke patients was evaluated by Spearman's correlation analysis.

**Results:** The patients were divided into two groups on the basis of a PLR level cut-off value on receiver operating characteristic (ROC) curve. Patients with higher PLR values on Unit stroke admission was significantly associated with worse GCS compared to patients with lower PLR values ( $p=0.05$ ). The patients with low-PLR values had better functional outcomes (Barthel index  $\leq 2$ ) compared with the patients with high-PLR values ( $p=0.04$ ).

**Conclusions:** The platelet-to-lymphocyte ratio could represent inflammatory state in acute ischemic stroke because having a high-PLR values increased the poor prognosis and was associated with worse GCSdis.

**Trial registration number:** N/A

## AS17-102

### CTP IN CROSSED CEREBELLAR DIASCISIS DURING HYPER-ACUTE ISCHEMIC STROKE

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**Background and Aims:** The detection of crossed cerebellar diaschisis (CCD) in acute ischemic stroke (AIS) caused by supratentorial dysfunction of the contralateral hemisphere is important to investigate functional neuronal deafferentation. The aim of the study was to determine CCD in hyperacute AIS (<4.5 hours) with a novel quantitative analysis of the whole cerebellum using CTP imaging and to investigate the relation between CCD and clinical outcome.

**Methods:** A retrospective observational study was conducted on patients admitted between January and September 2016. We analyzed 45 consecutive AIS patients with anterior circulation stroke who underwent CT perfusion within 4.5 hours from symptom onset. CCD was evaluated by CTP image-processing and by calculating the MTT map asymmetry index in the whole cerebellum in the two hemispheres. MTT asymmetry was correlated with clinical outcomes.

**Results:** A retrospective observational study was conducted on patients admitted between January and September 2016. We analyzed 45 consecutive AIS patients with anterior circulation stroke who underwent CT perfusion within 4.5 hours from symptom onset. CCD was evaluated by CTP image-processing and by calculating the MTT map asymmetry index in the whole cerebellum in the two hemispheres. MTT asymmetry was correlated with clinical outcomes.

**Conclusions:** CCD was detectable by CTP in the acute supratentorial ischemic stroke by processing the whole cerebellum volume. CCD perfusion asymmetry was significantly correlated with neurological deficit on admission as well as with clinical outcome in patients.

**Trial registration number:** N/A

## AS17-183

### MULTIMORBIDITY AND OUTCOMES IN PATIENTS WITH HISTORY OF STROKE: DATA OF OUTPATIENT REGISTRY REGION

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**Background and Aims:** To evaluate multimorbidity, outcomes, risk of all cause mortality (MTot), cardiovascular mortality (CVM) in registry of patients with history of stroke (HStr).

**Methods:** 986 patients with HStr (age  $70.6 \pm 10.9$ ; 57% women) were enrolled in the outpatient REGION registry. End points and the mean number of cardiovascular diseases (CVD), nonCVD were estimated.

**Results:** 826 (83.8%) of patients had cardiovascular (CV) multimorbidity. The number of CVD, nonCVD was  $2.6 \pm 0.8$  and  $1.7 \pm 0.5$ . During follow-up ( $2.9 \pm 0.7$  years) 308(31.2%) patients died, including 242(24.5%) from CVD. The next factors were significant for increasing risk of MTot and CVM: age- 1.10(1.09-1.12) and 1.11(1.09-1.13); sex (men): 2.01(1.55-2.62) and 1.86(1.38-2.50); AF: 1.43(1.09-1.86) and 1.55(1.15-2.09); chronic obstructive pulmonary disease (COPD): 1.90(1.34-1.63) and 1.89(1.28-2.79); history of stroke: 1.64(1.23-2.19) and 1.92(1.40-2.63); heart

rate>80/min: 1.51 (1.13-2.03) and 1.63 (1.18-2.25); no antihypertensive treatment (AHT): 2.03(1.42-2.88) and 1.94 (1.30-2.89); low Hb: 2.44 (1.58-3.79) and 2.44(1.49-4.00); diabetes and history of MI (MTot): 1.56 (1.16-2.08) and 1.45 (1.09-1.93). These drugs were significant for decreasing risk of MTot and CVM: ACE inhibitors (ACEI)- 0.60 (0.42-0.85) and 0.62 (0.42-0.93); angiotensin receptor blockers (ARB): 0.26(0.14-0.50) and 0.27 (0.13-0.55); statins: 0.71 (0.51-0.98) and 0.52 (0.35-0.76); beta-blockers (MTot) 0.71(0.50-0.99).

**Conclusions:** The most of patients with HStr had CV multimorbidity. Average number of CVD and nonCVD was 4.3. The risk of MTot and CVM was higher in patients with AF, COPD, history of recurrent stroke, heart rate >80/min, low Hb, no AHT (higher risk of only MTot in cases of diabetes and history of MI). In patients with administration of ACEI, ARB, beta-blockers and statins risk of MTot and CVM was 1.4-3.8 times less.

**Trial registration number:** N/A

## AS17-169

### ESTIMATING FUGL-MEYER UPPER EXTREMITY ASSESSMENT SCORE FROM KINEMATIC MOVEMENT DATA OBTAINED DURING STROKE REHABILITATION IN VIRTUAL REALITY

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**Background and Aims:** Assessing impairment and forming predictions about recovery are big challenges in neurorehabilitation. In clinical studies, effectiveness is usually assessed with established clinical scales, like the Fugl-Meyer Upper Limb Assessment (FMA). Although the FMA shows great specificity and validity, it is time-consuming, subjective and vulnerable to ceiling effects. Virtual reality (VR)-based setups equipped with motion capture systems could overcome these limitations by automating assessment, requiring that FMA scores can be reliably predicted from kinematic data.

**Methods:** To test this hypothesis, we use movement quality parameters that were extracted from kinematic data recorded during rehabilitation sessions performed with the Rehabilitation Gaming System (RGS), a VR rehabilitation tool, that uses the Microsoft Kinect for motion capture. The protocol considered here asks patients to intercept spheres on a computer screen using their upper limbs. In this preliminary analysis, we performed a multivariate regression using clinical data from 98 stroke patients who completed 191 rehabilitation sessions with RGS.

**Results:** We show that the best multivariate regression model for predicting FMA (intercept: 0.39, prediction range: 3.7 – 66.3, standard deviation: 0.60, R<sup>2</sup>: 0.50) includes the predictors chronicity ( $\beta\mu$ : 0.20), finger flexion ( $\beta\mu$ : 0.19), total gaming sessions performed ( $\beta\mu$ : 0.15) and difficulty ( $\beta\mu$ : 0.13). However, the extent to which patients react fast and appropriate to training related events, or reaction strength, is the strongest predictor of FMA scores in all models tested ( $\beta\mu$ : 0.13 to 0.50).

**Conclusions:** These results highlight the predictive power of kinematic data collected during unsupervised motor training and provide insight into new factors underlying recovery.

**Trial registration number:** N/A

## AS17-085

### GLOBAL ATHEROSCLEROTIC CTA BURDEN SCORE AND FUNCTIONAL OUTCOME IN ACUTE STROKE PATIENTS

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**Background and Aims:** Large-vessel atherosclerosis is a major cause of acute ischemic stroke (AIS) worldwide. Large-vessel atherosclerosis may involve intracranial and extracranial vessels and can be diagnosed and graded using Computed Tomography Angiography (CTA). We aimed to determine whether a Global Atherosclerotic CTA Burden Score (GABS) predicts functional neurological status in AIS patients.

**Methods:** A blinded neuroradiologist reviewed CTAs from 85 AIS patients admitted between March-2014 and December-2014. Twenty arterial segments from each patient were analysed and graded: 11 extracranial segments (brachiocephalic trunks, pre-vertebral subclavian arteries, VI segments, common carotid arteries, carotid bulbs and internal carotid arteries) and 9 intracranial segments (intracranial carotid arteries, M1 segments, P1 segments, basilar and V4 segments). Each segment was classified according to the level of stenosis: 50–69% (1 point), >70% (2 points) and occlusion (3 points). Patients were stratified according to GABS in mild (0–8), moderate (9–17) and severe (18–23) atherosclerosis. Poor functional outcome was defined as a modified Rankin scale (mRs) >2 at 90 days after ictus. Logistic regression was used to assess predictors of poor functional outcome.

**Results:** GABS varied between 0 and 24 (median = 2,[0-6]). Patients with worse functional neurologic status (mRs>2) had higher GACBS at admission ( $p = 0.032$ ) and at hospital release ( $p = 0.003$ ). Stratified GABS was associated with worse functional outcome ( $p = 0.017$ ). GACBS was a predictor of Large-vessel Atherosclerosis event according to TOAST criteria ( $p = 0.001$ ) and of anterior syndromes according to Bamford classification ( $p = 0.003$ ).

**Conclusions:** Higher GABS reflects more severe atherosclerotic disease, predicts poor functional outcome and is associated with large-vessel atherosclerosis etiology in AIS patients.

**Trial registration number:** N/A

## AS17-158

### NEUTROPHIL-TO-LYMPHOCYTE RATIO AT ADMISSION AS PROGNOSTIC BIOMARKER ON ENDOVASCULAR STROKE TREATMENT

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**Background and Aims:** Neutrophil-to-lymphocyte ratio (NLR) as an inflammatory biomarker, has been described as a simple, inexpensive and readily available predictor of stroke outcome. Recent studies support the fact that inflammation is implicated on post-ischemic brain injury. This

study assesses relationship between safety and efficacy outcomes in acute stroke patients with large vessel occlusion (LVO) treated with mechanical thrombectomy (MT).

**Methods:** 76 LVO patients treated with MT were recruited and follow-up during a 3-month period. Three-month mortality, parenchymal hematoma (PH, includes PHI-2), and futile recanalization (FR) rates were evaluated.

**Results:** Mean age of patients was  $70 \pm 11$  years, 59% males, with median NLR admission value of 3 (IQR 1.6-5.5). Complete recanalization occurred in 75% of patients (TICI 2b o 3, n = 57) and 42% from them (24/57) had unfavorable prognosis with functional dependence (mRankin scale >2). NLR was higher in patients with FR [median, IQR; 3.6, (2.2-7.8)] than those with successful recanalization [1.7, (1.2-3.3); p = 0.002]. Patients with PH presented higher NLR [5.1; (2.7-8.9)] than patients without any hemorrhage [1.9; (1.4-4.2); p = 0.01]. Moreover, NLR was also higher in patients who died [5.1, (2.2-10.7)] than 3-month-survivors [2.3, (1.3-3.9); p < 0.03]. In ROC analysis a NLR cutoff = 2 predicted FR with 83% Sensibility and 59% Specificity. After adjustment for potential confounders, NLR increase was independently associated with PH [OR, 3.12; 95% CI, (1.3-7.3); p = 0.005].

**Conclusions:** Higher admission NLR is an independent predictor of PH in LVO treated with MT, and it may identify a target group with an increased risk of adverse effects and poor prognosis.

**Trial registration number:** N/A

## AS17-012

### EVOLOLCUMAB IN SECONDARY PREVENTION OF ISCHEMIC STROKE: REAL-LIFE EXPERIENCE

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**Background and Aims:** Proprotein convertase subtilisin/kexin type 9 (PCSK-9) inhibitors reduce ischemic events in patients with cerebrovascular disease. We present our experience with Evolocumab, a PCSK-9 inhibitor, in secondary prevention of ischaemic stroke in a tertiary hospital.

**Methods:** Prospective registry of patients on treatment with Evolocumab in secondary prevention of cerebrovascular disease. Demographic, clinical and analytical data were collected.

**Results:** We included 13 patients with cerebrovascular disease (male 54%, mean age  $69.9 \pm 9.6$  years old) with a follow-up of  $13.3 \pm 7.5$  months. Etiology of previous stroke was atherothrombotic (8 patients, 66.7%), lacunar (2 patient, 16.3%), cardioembolic (1 patient 8.3%) and undetermined because of coexistence of two causes (atrial fibrillation and carotid stenosis) in 2 patients (16.3%). Carotid endarterectomy or stenting was performed in three patients (22.3%). Two patients has total intolerance to statins and 4 patients partial intolerance to statins. One patient had intolerance to ezetimibe. Time from last stroke to the start of treatment with Evolocumab was  $15.1 \pm 12$  months. LDL-cholesterol before the treatment with Evolocumab was  $121 \pm 21$  mg/dL (range 84-145) and LDL-cholesterol after Evolocumab was  $60.7 \pm 13.6$  mg/dL (range 35-80). Ten patients (83%) remains high-intensity statin treatment and three patients has withdrawn statins treatment (all because of statin intolerance). All patients continue in treatment with Evolocumab at the end of the follow-up without adverse events.

**Conclusions:** PCSK-9 inhibitors are a safe treatment in patients without adequate LDL-cholesterol control despite maximum tolerated doses of statins and/or ezetimibe in usual clinical practice.

**Trial registration number:** N/A

## AS17-094

### THE IMPORTANCE OF COLLATERALIZATION IN BASILAR ARTERY STROKE: PROGNOSTIC VALUE OF RADIOLOGICAL SCALES APPLIED IN TWO STROKE CENTERS

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**Background and Aims:** The basilar artery occlusion (BAO) is a medical emergency with a high mortality rate. Our main objective was to study the prognostic value of different radiological scales in patients with BAO treated in two stroke centers. Different radiological scales were studied (pc-CTA and BATMAN), and compared with the BASILISK scale (BASILar Ischemic StroKe scale) created in our center. This scale has 10 points, and they are subtracted according to the lack of opacification of different territories of the vertebrobasilar circulation, with higher value assigned at the absence of posterior communicating artery and cerebellar arteries located at middle BAO as main collateral pathways.

**Methods:** Retrospective study of patients with BAO treated with endovascular therapy in two stroke centers, excluding non-recanalized patients. Pc-CTA, BATMAN and BASILISK scales were applied in CT-angiography. All scales were correlated with outcome, measured with the mRS at 3 months (3m-mRS) using Spearman method.

**Results:** 29 patients. Women 44.8% (n = 13). Mean age 61.6 years old (SD: 15.5). Median NIHSS 9 (1-34), median GSC 13 (3-15), median mRS3m 3 (0-6), three-month death 28.6% (n = 8). Mean time from onset to CT 267.6 min (SD: 260.4), mean time from CT to recanalization 149.5 min (SD: 77.8). Association was found between 3m-mRS and the pc-CTA-scale (Rho Spearman = 0.59, p = 0.001. COR curve: AUC = 0.79, p = 0.019), BATMAN-scale (Rho Spearman = -0.57, p = 0.001. COR curve: AUC = 0.77, p = 0.025) and the BASILISK-scale (Rho Spearman = -0.62, p = 0.000. COR curve: AUC = 0.82; p = 0.01).

**Conclusions:** A strong prognostic correlation, a bit higher with BASILISK scale, was found with the different radiological scales applied in patients with BAO, supporting their prognostic utility. Ongoing studies will define the utility of this new scale in clinical practice.

**Trial registration number:** N/A

## AS17-035

### SMOKING STATUS AND FUNCTIONAL OUTCOMES AFTER ACUTE ISCHEMIC STROKE

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**Background and Aims:** Cigarette smoking is an established risk for ischemic stroke; however, it still remains controversial how it affects post-stroke functional outcomes. We aimed to elucidate the association between smoking status and functional outcomes at 3 months in patients with acute ischemic stroke.

**Methods:** Using a multicenter hospital-based stroke registry in Japan, we investigated 10,286 acute ischemic stroke patients hospitalized between July 2007 and Dec 2017 who had been independent before stroke

onset. Smoking status was categorized into never, former and current smokers. Clinical outcomes included poor functional outcome (modified Rankin scale [mRS] score  $\geq 2$ ) and functional dependency (mRS score 2–5) at 3 months. We adjusted for potential confounding factors by using a logistic regression analysis.

**Results:** The mean (SD) age of patients was 70.2 (12.2) years, and 37.0% were women. We found 4,396 (42.7%) never smokers, 3,328 (32.4%) former smokers and 2,561 (24.9%) current smokers. Odds ratio (OR, [95% confidence interval]) of poor functional outcome after adjusting for confounders increased in current smokers (1.29 [1.11–1.49] vs. never smokers) but not in former smokers (1.05 [0.92–1.21] vs. never smokers). However, among the former smokers, OR of poor functional outcome was higher in those who quitted smoking within 2 years of stroke onset (1.75 [1.15–2.66] vs. never smokers). The risk of poor functional outcome tended to increase as the number of daily cigarettes was increased in current smokers ( $P$  for trend 0.002).

**Conclusions:** Current and recent smoking is associated with an increased risk of unfavorable functional outcomes at 3 months after acute ischemic stroke.

**Trial registration number:** N/A

### AS17-191

#### ADHERENCE TO A MEDITERRANEAN DIET AND 90 DAYS OUTCOME IN ACUTE ISCHEMIC STROKE: A PROSPECTIVE OBSERVATIONAL STUDY FROM THE RECCA REGISTRY

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**Background and Aims:** High adherence to a Mediterranean Diet (MeDi) is associated with reduced incidence and mortality of acute ischemic stroke (AIS) and may also be associated with better prognosis.

**Aim:** To investigate the effect of the adherence to the MeDi on stroke outcomes at 90 days in our prospective stroke registry of patients with AIS.

**Methods:** Consecutive patients with AIS admitted from January 2017 to September 2018 who consented to the RECCA registry were included. We excluded those with incomplete data and transient ischemic attacks. Adherence to MeDi was measured by the Mediterranean Diet Adherence Screener (MEDAS) and categorized as low ( $\leq 6$ ) or high ( $\geq 7$ ). Patients were followed at 90 days with the telephone modified Rankin score (mRS). Adherence group's characteristics were compared with univariate analysis. An ordinal logistic regression adjusting for confounding variables was performed to investigate disability and adherence to MeDi.

**Results:** 231 patients were included; mean age 66.9 (18.0), 94 women (40.7%). 134 (58%) had low adherence to MeDi. Patients with high MEDAS had better 90 days functional outcomes, lower previous disability, lower admission NIHSS, lower frequency of mood disorder, sedentary lifestyle and small vessel disease but higher frequency of cryptogenic strokes. After ordinal logistic regression higher MEDAS score was significantly associated with lower mRS at 90 days (odds ratio for disability

0.42, 95% confidence interval 0.21–0.87) independently of age, previous mRS and admission NIHSS.

**Conclusions:** High adherence to MeDi in our cohort was associated to better functional prognosis at 90 days after AIS.

**Trial registration number:** N/A

### AS17-178

#### PATJ IS NEEDED TO ACTIVATE THE PI3K/AKT/GSK3B PATHWAY IN RESPONSE TO ANGIOGENIC FACTORS IN HUMAN BRAIN MICROVASCULAR ENDOTHELIAL CELLS

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**Background and Aims:** Through genome wide association studies we have recently identified PATJ as the first gene described associated to functional outcome after ischemic stroke. Previous functional studies have shown that PATJ protein regulates tight junction formation and cell polarity in epithelial cells.

**Objective:** To demonstrate the role of PATJ in stroke functional outcome as a key modulator of angiogenesis controlling the PI3k/Akt/GSK3b pathway in human cerebral microvascular endothelial cells (hCMED/D3).

**Methods:** hCMED/D3 cells knockdown (KD) of PATJ were generated by infection of lentiviral particles carrying shRNA. These cells were characterized by expression analysis, angiogenesis studies in vitro and permeabilization assays.

**Results:** Expression analysis showed significant depletions of tubulin cytoskeleton components in PATJ KD cells. These cells evidenced a severe disruption of the microtubule network. Moreover, phosphorylation patterns of the PI3k/Akt/GSK3b pathway were also altered, and PATJ KD cells could not respond to angiogenic stimuli

**Conclusions:** Our results suggest that PATJ modulates tube formation in human brain vascular endothelial cells by controlling the PI3K/Akt/GSK3b pathway. Regulation of PATJ expression may be a potential therapeutic strategy to activate angiogenesis after ischemic stroke.

**Trial registration number:** N/A

### AS17-091

#### RENAL IMPAIRMENT AND AGE IN PATIENTS AFFECTED BY ISCHEMIC STROKE TREATED WITH REPERFUSION THERAPIES

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**Background and Aims:** The aim of this study was to assess the impact of renal impairment on elderly patients who had had an ischemic stroke treated with thrombolysis.

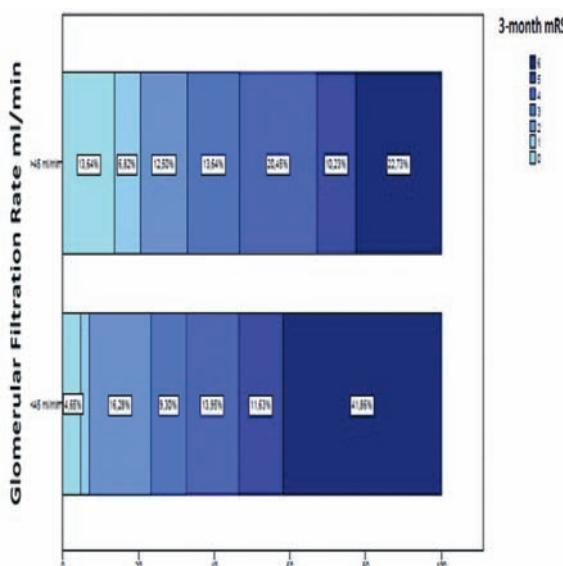
**Methods:** 136 patients from January 2006 to June 2018 were involved in this study. Patients were older than 80 years and were treated with systemic intravenous fibrinolysis within 4.5 hours since the stroke onset. Primary endpoints were poor outcome (modified Rankin Scale mRS 3–6), 3-month mortality and symptomatic intracerebral haemorrhage.

**Results:** Univariate analyses demonstrated that low estimated glomerular filtration rate (eGFR < 45ml/min/m<sup>2</sup>) and every decrease of eGFR by 10 mL/min/1.73m<sup>2</sup> significantly increased the risk of mortality (OR 2.52, 95% CI 1.51–5.52,  $p = 0.021$ , and OR 1.28 95% CI 1.05–1.57,  $p = 0.016$ ). In addition, we did not describe a statistical association between renal impairment and symptomatic intracranial haemorrhage [Tab. I].

BASELINE CHARACTERISTIC	POOR OUTCOME	MORTALITY 3 MONTHS	SICH
AGE	1.331 (1.023-1.256) p value 0.056	1.067 (1.073-1.069) p value 0.167	0.895 (0.449-1.088) p value 0.112
SEX MALE	0.386 (0.156-0.723) p value 0.005	0.787 (0.355-1.746) p value 0.556	1.893 (0.264-1.182) p value 0.537
ONSET TO TIME	1.021 (0.995-1.020) p value 0.558	1.004 (0.996-1.011) p value 0.310	0.985 (0.966-1.006) p value 0.153
NIHSS	1.371 (1.049-1.371) p value 0.023	1.092 (1.054-1.151) p value 0.203	0.990 (0.869-1.129) p value 0.085
NIHSS 2	1.212 (1.134-1.307) p value <0.005	1.149 (1.079-1.222) p value <0.005	1.041 (0.932-1.174) p value 0.315
NIHSS 24	1.251 (1.130-1.338) p value <0.005	1.180 (1.096-1.227) p value <0.005	1.131 (1.028-1.148) p value 0.204
SBP	1.0 (0.986-1.024) p value 0.567	0.981 (0.966-1.006) p value 0.218	0.991 (0.951-1.030) p value 0.644
DBP	0.994 (0.968-1.020) p value 0.647	0.989 (0.969-1.016) p value 0.077	0.985 (0.937-1.059) p value 0.698
GLUCOSE	1.008 (1.059-1.010) p value 0.022	1.039 (1.003-1.016) p value 0.022	1.008 (1.054-1.022) p value 0.252
DIABETES	1.491 (1.550-1.045) p value 0.438	1.746 (0.712-4.203) p value 0.233	14.217 (1.415-142.864) p value 0.024
SMOKE	-	-	-
LIPID	1.484 (0.663-3.224) p value 0.219	0.970 (0.450-2.081) p value 0.598	4.920 (0.486-48.802) p value 0.173
HYPERTENSION	2.333 (1.914-5.990) p value 0.076	1.066 (0.393-3.018) p value 0.574	-
ATRIAL FIBRILLATION	0.709 (0.330-1.908) p value 0.372	1.289 (0.623-2.761) p value 0.534	0.565 (0.267-5.579) p value 0.825
PREVIOUS STROKE OR TIA	1.395 (1.368-3.270) p value 0.028	0.746 (0.194-2.072) p value 0.673	-
ANTITHROMBOTICS	0.940 (0.399-1.802) p value 0.666	0.797 (0.368-1.725) p value 0.564	0.479 (0.046-4.682) p value 0.524
CKD-EPI decreasing GFR by 30 ml/min/1.73m <sup>2</sup>	1.224 (0.928-1.969) p value 0.232	1.253 (1.048-1.370) p value 0.238	1.281 (0.754-2.118) p value 0.379
LOW GFR <45 ml/min	1.069 (0.612-3.259) p value 0.496	2.520 (1.153-5.317) p value 0.021	1.246 (0.250-15.776) p value 0.493

These data were partially confirmed in the multivariate analysis adjusted for all variables with p value < 0.1; only the progressive reduction of the eGFR was associated with the 3-month mortality (OR 1.25, 95% CI 1.01-1.55, p = 0.04) [Tab. 2, Fig. 1].

Baseline characteristics	Poor Outcome	Mortality	SICH
AGE	NS	-	-
SEX MALE	0.378 (0.164-0.873) p value 0.023	-	-
NIHSS	1.108 (1.042-1.175) p value 0.001	1.088 (1.030-1.148) p value 0.002	-
SBP	-	NS	-
GLUCOSE	NS	NS	-
DIABETES	-	-	14.217 (1.415-142.864) p value 0.024
SMOKE	-	-	-
LIPID	-	-	-
HYPERTENSION	NS	-	-
ATRIAL FIBRILLATION	-	-	-
PREVIOUS STROKE OR TIA	-	-	-
ANTITHROMBOTICS	-	-	-
CKD-EPI decreasing GFR by 30 ml/min/1.73m <sup>2</sup>	-	1.253 (1.048-1.370) p value 0.028	-
LOW GFR <45 ml/min	-	NS	-



**Conclusions:** Estimated glomerular filtration rate eGFR < 45 ml/min/1.73m<sup>2</sup> was independently associated with 3-month mortality in elderly patients affected by ischemic stroke who received acute reperfusion therapy.

**Trial registration number:** N/A

## AS17-130

### HEALTH-RELATED QUALITY OF LIFE WITHIN 90 DAYS AFTER ACUTE ISCHEMIC STROKE OR TRANSIENT ISCHEMIC ATTACK: DATA FROM THE SOCRATES TRIAL

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**Background and Aims:** The SOCRATES trial (n = 13,199) provides a unique opportunity to assess the impact with a transient ischemic attack (TIA) or acute ischemic stroke (NIHSS score ≤ 5) with/without subsequent strokes on health-related quality of life over 90 days.

**Methods:** Health status was assessed at randomization, and after 7 and 90 days by the EQ-5D-3L questionnaire and converted to a EQ-5D utility score. The EQ-5D utility score was obtained from patient or proxy and set to 0 after death. Only patients having utility score at all time points were used.

**Results:** The EQ-5D utility score improved over 90 days, from 0.80 to 0.86 for patients with TIA as a qualifying event (n = 3182) and from 0.66 to 0.82 for patients with stroke as a qualifying event (n = 8836).

The improvement of EQ-5D utility score was driven by patients with no subsequent stroke during follow-up, from 0.80 to 0.87 for patients with TIA as qualifying event (n = 3048) and from 0.67 to 0.84 for patients with stroke as qualifying event (n = 8260).

In contrast, for patients with a subsequent stroke, a decline was observed from 0.82 to 0.64 for patients with TIA as qualifying event (n = 134) and remained low (0.57 vs 0.55) for patients with stroke as qualifying event (n = 576).

**Conclusions:** While health utility improved over 90 days in SOCRATES patients without subsequent stroke events, it declined or remained low for patients with subsequent stroke events. Reduction of subsequent strokes is likely to improve quality of life after an acute stroke or TIA.

**Trial registration number:** NCT01994720

**AS17-134****HEALTHCARE RESOURCE UTILIZATION AFTER SUBSEQUENT STROKE IN PATIENTS WITH ACUTE ISCHEMIC STROKE OR TRANSIENT ISCHEMIC ATTACK: DATA FROM THE SOCRATES TRIAL**

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**Background and Aims:** Little is known about the burden of subsequent acute stroke events among patients initially presenting with an acute ischemic stroke/transient ischemic attack (TIA). In the SOCRATES trial ( $n=13,199$ ), patients with a qualifying acute ischemic stroke (NIHSS score of  $\leq 5$ ) or TIA were randomized to ticagrelor or aspirin and followed for 90 days, providing a unique opportunity to estimate the incidence of and resource utilization associated with subsequent strokes.

**Methods:** Healthcare resource utilization was assessed in patients with hospitalization for subsequent stroke. Modified Rankin Score (mRS) was used to categorize patients at 90 days as non-disabled (mRS = 0–1) or disabled (mRS = 2–6).

**Results:** During 90-day follow-up, 900 strokes occurred in 840 patients (690 with stroke and 150 with TIA as a qualifying event); 52 patients had more than 1 stroke. Hospitalization data for 87% of the 900 strokes were available for this analysis. The mean (median) length of stay (LOS) of a subsequent stroke hospitalization was 8.7 (7.0) days for patients with TIA and 14.3 (10.0) days for patients with stroke as qualifying event. For disabled patients, the mean (median) LOS was 10.8 (9.0) for TIA patients and 16.3 (11.0) days for stroke patients. For non-disabled patients, the mean (median) LOS was 6.7 (6.0) vs. 10.5 (8.5) days. Disabled patients had higher level of care and more extended care after stroke hospitalization.

**Conclusions:** In patients with acute ischemic stroke or TIA, subsequent strokes are associated with considerable healthcare resource utilization, which suggests a need for developing new preventive treatments in this population.

**Trial registration number:** NCT01994720

**AS17-031****IMPACT OF BODY TEMPERATURE DURING THE ACUTE STAGE OF STROKE ON CLINICAL OUTCOMES IN PATIENTS WITH ACUTE ISCHEMIC STROKE**

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**Background and Aims:** We aimed to determine whether body temperature during the acute stage of stroke was associated with clinical outcomes after acute ischemic stroke.

**Methods:** Total of 6,376 patients with acute ischemic stroke (mean age 70.3 years, 35.6% women) who had been functionally independent before onset and were hospitalized within 24 h of onset in 7 stroke centers in Fukuoka, Japan, from June 2007 to November 2017, were enrolled. Patients were categorized into quintiles according to mean body temperature during the first 3 days after onset (Q1,  $< 36.6^{\circ}\text{C}$ ; Q2,  $36.60\text{--}36.79^{\circ}\text{C}$ ; Q3,  $36.80\text{--}36.87^{\circ}\text{C}$ ; Q4,  $36.88\text{--}37.13^{\circ}\text{C}$ ; Q5,  $> 37.13^{\circ}\text{C}$ ). Study outcomes included neurological improvement ( $\geq 4$ -point decrease in NIHSS score during hospitalization or 0 at discharge), poor functional outcome (3-month modified Rankin Scale [mRS] score  $\geq 3$ ), and functional dependency (3-month mRS score 3–5). The association of body temperature with clinical outcomes was evaluated after adjusting for potential confounding factors (age, sex, conventional risk factors, previous stroke, stroke severity, stroke subtypes, reperfusion therapy, and CRP on admission by logistic regression analysis).

**Results:** High body temperature was negatively associated with neurological improvement (multivariable-adjusted odds ratios [95% confidence interval] in the highest quintile versus the lowest quintile as a reference: 0.37 [0.31–0.44]), and positively associated with poor functional outcome (4.30 [3.46–5.34]), and functional dependency (4.95 [3.99–6.15]). These trends were maintained irrespective of sex, age, stroke subtypes, or baseline stroke severity.

**Conclusions:** Our findings suggest that high body temperature during the first 3 days after onset is independently associated with unfavorable outcomes after acute ischemic stroke.

**Trial registration number:** N/A

**AS17-006****FREQUENCY, PREDICTORS AND OUTCOME OF PALLIATIVE MANAGEMENT IN ACUTE ISCHEMIC PATIENTS IN A STROKE CENTER**

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**Background and Aims:** There is growing interest in palliative care in stroke patients. However, little is known about predictors for the transition to palliative care in acute ischemic stroke (AIS) patients. Our goal was to analyze the proportion, predictors and the outcome of patients in a tertiary stroke center in patients where a palliative attitude was adopted at some stage during the acute hospital stay.

**Methods:** We retrospectively reviewed all patients with an AIS over 13 years from the prospectively constructed Acute STroke Registry and Analysis of Lausanne (ASTRAL). We compared patients who received a “palliative status” during their stroke unit stay with all others and identified associated variables in the acute and subacute phase with logistic regression analysis.

**Results:** A palliative attitude was adopted in 440/4264 (10.3%) AIS patients. The most powerful predictors of a palliative care decisions were transit through the intensive care unit, pre-stroke handicap, age, admission NIHSS, and initially decreased level of consciousness. In the subacute phase, active oncological disease, fever, and poor recanalization

status were also predictors. 76.6% of these patients died in the stroke unit or ICU, 8% were transferred to old age homes and 6.4% to a specialized palliative care center.

**Conclusions:** Better knowledge of palliative stroke patients and predictors of transition to palliative care can help caregivers in management decisions and discussion with patients and their next of kin. Avoiding futile treatments and timely transition to comfort measures in appropriate cases can potentially improve the quality of life in this population.

**Trial registration number:** N/A

## AS17-147

### PROGNOSTIC CRITERIA FOR STROKE CAUSED BY ATRIAL FIBRILLATION

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**Background and Aims:** Cardioembolic stroke due to atrial fibrillation is the most often cause of mortality and a severe dependence.

**Methods:** 134 patients with cardioembolic stroke were examined. Among these patients 86 persons (64.2%) survived and 48 persons (35.8%) had a fatal outcomes. Clinical-neurological, neuroimagine (MRI, CT), and biochemical methods were used.

**Results:** The following indexes were found to be informative for prognosis of survival (mortality) for patients with cardioembolic stroke: ejection fraction, location of ischemic damage, concentration of soluble fibrin complexes, Quick's value, the scores on the Glasgow Coma Scale, NIHSS and CHADS2 – VASc, number and severity of concomitant diseases (presence or absence of chronic obstructive pulmonary disease, chronic renal disease, pulmonary embolism and acute left ventricle failure). The following indexes were found to be informative ( $p < 0.05$ ) for prognosis of patients' daily living activity that were estimated using Bartel Index and Rankin Scale: NIHSS and CHADS2 – VASc scores, concentration of soluble fibrin complexes, counts of erythrocytes and platelets, hemoglobin level, Quick's value, location of an ischemic damage, heart rate, ejection fraction, concomitant pathology (especially, presence of diabetes mellitus and obstructive pulmonary disease), the number of concomitant diseases.

**Conclusions:** It was found that outcome of cardioembolic stroke did not depend on type of atrial fibrillation. The prognosis of cardioembolic stroke outcome was determined with such factors as gender, age, location and volume of ischemic damage, conditions of a coagulation hemostasis, and comorbidities (heart failure, diabetes mellitus, chronic obstructive pulmonary disease).

**Trial registration number:** N/A

## AS17-160

### COMPARATIVE STUDY IN END OF LIFE CARE STROKE PATIENTS USING DIFFERENT TREATMENT PROTOCOLS: ATNEA-AFTER STROKE STUDY(ADEQUACY OF THERAPEUTIC EFFORT IN TERMINAL PHASE AFTER STROKE STUDY)

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**Background and Aims:** Despite advances in its treatment, stroke is still an important cause of mortality, with few studies dedicated to

palliative care. Adequacy of therapeutic effort measures (ATEM) are those issued to guarantee comfort at the end of life. In a previous study we identified basal characteristics and management of these patients, leading to the development of a new treatment protocol. The aim of our study is to compare ATEM before and after this protocol application, evaluating improvements in care and comfort.

**Methods:** Observational retrospective study collecting data of stroke patients in whom ATEM was used in our hospital, from January 2013 to December 2017. We compared two periods of time: the historical period (HP:2013-2015) with data obtained from our previous study, and the intervention period (IP:2015-2017).

**Results:** N = 236. HP = 141, IP = 95. We did not find any statistically significant differences in patient basal characteristics between periods, such as age (HP:84;IP:86), basal NIHSS(HP:23;IP:23) or GCS after 72 hours (HP:58%;IP:65%). We observed differences regarding withdrawal of artificial nutrition (HP = 74%;IP = 84%;p = 0.042) or vital signs measurement (HP = 58%;IP = 73%;p = 0.004), scheduled administration of midazolam (HP = 19%;IP = 51%;p < 0.001), buscapine (HP = 75%;IP = 89%;p = 0.004), analgesic drugs (HP = 52%;IP = 76%;p < 0.001) or morphine in continuous infusion (HP = 25%;IP = 71%;p < 0.001). In the HP, patients required more rises of morphine dose (HP:1;IP:0;p = 0.02) and secretions aspiration (HP:5;IP:0;p = 0.217). There were no differences in time from stroke onset to ATEM or death.

**Conclusions:** After the previous study, we have identified important changes in the way ATEM was performed in our center. In the intervention period higher doses of medication were used, in a scheduled manner; other parameters suggest greater comfort of these patients. Even with these changes, time from stroke to death was not altered.

**Trial registration number:** N/A

## AS17-197

### FACTORS AFFECTING NEUROLOGICAL DEFICITS SEVERITY AND FUNCTIONAL RECOVERY IN STROKE ASSOCIATED WITH ATRIAL FIBRILLATION

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**Background and Aims:** Stroke associated with atrial fibrillation (AF) is characterized by a greater neurological deficit severity and a worse functional outcome compared to stroke in patients with sinus rhythm. Aims: to determine factors affecting neurological deficit severity and functional recovery of patients with stroke associated with AF.

**Methods:** Retrospective medical records analysis of 200patients with stroke and AFwas performed:96(48%) men,104(52%) women, average age $71 \pm 8$ years. Comorbidities such as: arterial hypertension (AH), chronic heart failure (CHF), chronic kidney disease (CKD), diabetes mellitus (DM), coronary heart disease (CHD), atherosclerosis of brachiocephalic arteries (BCA) were analyzed.CHA2DS2VASc was calculated, pre-stroke drug treatment and biochemical blood parameters were analyzed. Upon admission and after 3weeks, neurological deficits severity was evaluated by National Institutes of Health Stroke Scale (NIHSS), functional outcomes by modified Rankin Scale (mRS). MRI measured the size, localization of cerebral infarction. Statistical analysis was performed using Statistica10(StatSoft, USA).

**Results:** NIHSS on admission and after 3weeks was7(4;10) and3(2;4); mRS-3.5(2;4) and2(1;3).CHA2DS2VASc ranged from 1 to 8, average5 (4;6). Prestroke antithrombotic therapy (ATT) was received by 79(40%) of 200patients;antihypertensive therapy (AHT)-69(38%) of183 patients with 2–3gradeAH. Regular intake of ATT and AHT was associated with a less severe stroke:NIHSS:6(4;9) vs8(5;12) and5(4;8) vs8(6;12),

$p = 0.0001$ , respectively. Patients were divided into 2groups: who achieved functional independence after 3weeks (group1, mRS 0–2; n = 113) and who requires daily assistance (group2, mRS 3–5;n = 77). The groups were comparable in frequency and severity of AH, CHD, CHF, DM, CKD, Aform, CHA2DS2VASc score. Group2 initially had a more severe neurological deficit (NIHSS 11.5(8;14) vs5(3;7),  $p = 0.0001$ ) and lower levels of low-density lipoprotein (1.56 (1.12;1.87) vs 1.72 (1.37;2.14) mmol/l, $p = 0.01$ ). It was found that patients who regularly took ATT, AHT had the best functional outcome by mRS( $p = 0.0001$ ).

**Conclusions:** Severity of neurological deficits in patients with stroke with AF has a direct correlation with previous drug therapy. Regular intake of antithrombotic and antihypertensive drugs is associated with less neurological deficit and better functional recovery.

**Trial registration number:** N/A

## AS17-199

### IMPACT OF PREVIOUS ANTITROMBOTIC THERAPY ON THE SIZE OF CEREBRAL INFARCTION IN PATIENTS WITH ATRIAL FIBRILLATION

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**Background and Aims:** Neurologic deficit severity is strongly associated with the cerebral infarction size. Studies have shown that patients with stroke associated with atrial fibrillation (AF), who regularly took antithrombotic therapy (ATT) have less severe neurological deficit.

**Aims:** To determine impact of previous ATT on the size of cerebral infarction in patients with AF.

**Methods:** A retrospective records analysis of 200patients with stroke and AF was performed:96(48%) men,104(52%) women, average age 71 ±8years. We analyzed prior ATT and outcome of following stroke. On admission stroke severity was determined using "National Institutes of Health Stroke Scale"(NIHSS) and functional outcomes measured with modified Rankin Scale (mRS). Cerebral infarct size and localization was measured by MRI. The analysis of comorbidities was conducted: arterial hypertension (AH),chronic heart failure (CHF), chronic kidney disease (CKD), diabetes mellitus (DM), coronary heart disease (CHD), atherosclerosis of the brachiocephalic arteries (BCA).CHA2DS2VASc score was calculated. Non-parametric analysis were used to analyze data, statistical analysis was performed using Statistica 10(StatSoft, USA).

**Results:** Stroke severity on admission was 7(4;10) NIHSS; mRS-3.5 (2;4).CHA2DS2VASc from1 to 8, average 5(4;6).118 of the 200(59%) patients did not receive ATT or was on short term treatment (Group1). Group2:82(41%) patients who regularly received ATT, in which antiplatelet agents—36(18%), vitaminK antagonists-19(9.5%), direct oral anticoagulants—27(13.5%) patients. The groups were matched by age, sex, frequency, severity of BCA atherosclerosis, AH, CHD, CHF, DM, CKD, CHA2DS2VASc. The groups did not differ in the frequency of localization of infarction (carotid/vertebrobasilar system) and subtype of stroke. According to MRI, Group1 had a larger cerebral infarction (36%vs22%,  $p = 0.035$ ), while the small lesion were prevailed in the Group 2 (32%vs26%,  $p = 0.037$ ). Frequency of medium infarction in both groups were comparable. Neurological deficit was more present in group1:NIHSS8(5;12) vs6(4;8)( $p = 0.0001$ ).

**Conclusions:** Adherence to ATT in patients with AF has an impact on the stroke severity. Regular intake of antithrombotic drugs prior to stroke development is associated with a smaller cerebral infarct size and a less severe neurological deficit.

**Trial registration number:** N/A

## AS17-167

### THE USE OF AN ORAL TRIGLYCERIDE AND GLUCOSE TOLERANCE TEST TO ASSESS THE RISK OF RECURRENT VASCULAR EVENTS AFTER FIRST-EVER ISCHEMIC STROKE

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**Background and Aims:** The association of triglycerides and risk of stroke is controversial. In particular, the value of fasting vs. post-prandial triglyceride levels to predict the risk of recurrent cardiovascular events remains to be investigated.

**Methods:** The prospective, observational "Berlin Cream and Sugar Study" was conducted between January 24, 2009 and July 31, 2017 at three sites of the university hospital in Berlin. First-ever stroke patients received an oral triglyceride tolerance test (OTTT) with blood tests before (t0) as well as three (t1), four (t2), and five hours (t3) after OOTT. Non-diabetic patients received an additional oral glucose tolerance test (OGTT) after t1. Patients were categorized based on quartiles of absolute triglyceride and glucose blood levels. Additionally, we calculated the change in levels over time to analyze high responders by comparing upper to lower tertiles. Recurrent events were defined as stroke, TIA, myocardial infarction, revascularization, and cardiovascular death within one year after stroke. Cox regression models were used to estimate hazard ratios and corresponding 95% confidence intervals.

**Results:** Overall, 54 out of 519 patients with follow-up (10.4%) developed recurrent events. Comparing highest vs. lowest quartile, neither fasting ( $HR_{t0} = 1.45$ , 95% CI 0.69–3.04) nor post-challenge triglyceride levels ( $HR_{t1} = 1.27$ , 95% CI 0.61–2.64) were associated with recurrent events. No significant changes were observed for blood glucose levels. Irrespective of exposure classification, high responders were not associated with increased risk.

**Conclusions:** Fasting or post-challenge levels of triglycerides and glucose as well as the identification of high responders to OOTT and OGTT did not predict recurrent cardiovascular events after first-ever ischemic stroke.

**Trial registration number:** NCT01378468

## AS17-001

### SHORT TERM OUTCOMES OF PATIENTS WITH STROKE ADMITTED TO INTENSIVE CARE UNIT: A FOUR YEAR SURVEY IN URMIA, IRAN

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**Background and Aims:** Stoke is the third cause of death and a main cause of the long-term disabilities. It is divided into two subtypes: ischemic and hemorrhagic. Most studies in this area were conducted in neurology wards, then we aimed to investigate this subject in intensive care units. This study was aimed to investigate the short term outcomes of patients with stroke admitted to intensive care unit

**Methods:** This cross-sectional retrospective study was conducted over a period of four years (2011–2014) in the intensive care unit of Urmia Imam Hospital in west Azerbaijan of Iran. All patients admitted to intensive care unit and information including demographic characteristics (age, gender), underlying disease, the duration of the mechanical ventilation, the length of stay in intensive care units, ventilator-associated pneumonia, upper gastrointestinal bleeding, pressure ulcers, were extracted from patient medical records. The data was analyzed by SPSS software version 20. Results: Of 362 patients, 40.9% of patients were male and 59.1% were female.

**Results:** Of 362 patients, 40.9% of patients were male and 59.1% were female. The average age of patients was  $70.90 \pm 13.11$  years. 66.9% of patients received mechanical ventilation for an average duration of  $20.42 \pm 17.42$  days. The average length of stay in ICU was  $22.78 \pm 20.53$  days and the average duration of a hospital stay was  $24.80 \pm 22.16$  days. The mortality rate was 43.6% (158 cases). There was a significant difference for smoking, heart disease and arrhythmia as predisposing factors between different sex groups.

**Conclusions:** Results of this study generally are acceptable.

**Trial registration number:** N

## AS17-122

### SUDDEN DEATH FROM ANEURYSMAL SUBARACHNOID HAEMORRHAGE

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**Background and Aims:** There is a need to capture sudden deaths from aSAH to identify cases at risk of aneurysm rupture to develop preventative strategies. There are varied estimates of the number of individuals who die suddenly following an aneurysmal subarachnoid hemorrhage (aSAH). It is likely that a large proportion of these people are never admitted to a hospital and are therefore omitted from hospital-based studies. We used a statewide population-based study to explore sudden death from aSAH.

**Methods:** A population-based retrospective cohort study of aSAH cases was undertaken, ascertaining cases from multiple overlapping sources. Sudden death was defined as death with 24 hours of the onset of symptoms without hospital admission. Age standardised mortality rates (ASMR) per 100,000-person years were calculated using the 2011 Australian population. We examined the predictors using log binomial regression.

**Results:** Among 237 aSAHs, (70% women, mean age 61.0 [SD 16.57] 52% (n=123) were deceased by 12-months, with 41 (33%) of these deaths occurring as sudden out of hospital deaths. Sudden and overall deaths had similar ASMR, demonstrating an increased incidence with age. In a multivariable model, those aged >65 years (compared to those aged <40 years) had a higher risk of sudden death (RR 1.41, 95% CI 1.16-1.73).

**Conclusions:** In this population-based study, a third of people with aSAH died suddenly with no opportunity for intervention. This demonstrates that hospital-based studies under estimate mortality rates after aSAH. The finding suggests an urgent need for better identification and

management of people with aneurysms to prevent rupture and sudden death.

**Trial registration number:** N/A

## AS17-019

### LOWER RATE OF POST-STROKE DEPRESSION IN PARTICIPANTS OF RANDOMIZED CONTROLLED WAKE UP TRIAL TREATED WITH ALTEPLASE

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**Background and Aims:** Post-stroke depression affects one third of all stroke patients. Randomized studies that investigate the effect of intravenous thrombolysis on post-stroke depression are rare. WAKE-UP was a randomized placebo-controlled trial that tested efficacy and safety of thrombolysis in unknown symptom onset stroke patients guided by MRI. The Beck Depression Inventory (BDI) measured 90 days after stroke was a secondary endpoint.

**Methods:** Patients with a mismatch between a visible lesion on DWI, but no marked parenchymal hyperintensity on FLAIR (i.e., a “DWI-FLAIR-mismatch”) were randomized to treatment with rtPA or placebo. Patients were categorized as reaching minimal, mild, moderate and severe depression according to the overall BDI score (0–13, 14–19, 20–28, and 29–63) at 90 days after stroke. Differences between groups were analyzed using ordinal logistic regression analysis adjusted for age and baseline National Institutes of Health Stroke Scale (NIHSS).

**Results:** Of 503 randomized patients, BDI scores were available for 418 patients, of whom 215 received alteplase and 203 placebo. Mean BDI sum score was comparable between patients receiving alteplase and those receiving placebo. Based on BDI categories, there was a significant difference between the groups with a shift towards favorable categories (i.e., minimal depression) in patients treated with alteplase (OR 1.88; 95% CI 1.16-3.06; p = 0.011). In the alteplase group, 35 (16 %) patients had mild to severe depression (BDI score >13), compared to 52 (26 %) in the placebo group.

**Conclusions:** In WAKE-UP trial participants, intravenous alteplase was associated with lower frequency of depressive symptoms at 90 days.

**Trial registration number:** NCT01525290

**AS17-067**
**THROMBUS COMPOSITION INFLUENCES  
POST MECHANICAL THROMBECTOMY  
CLINICAL OUTCOME**

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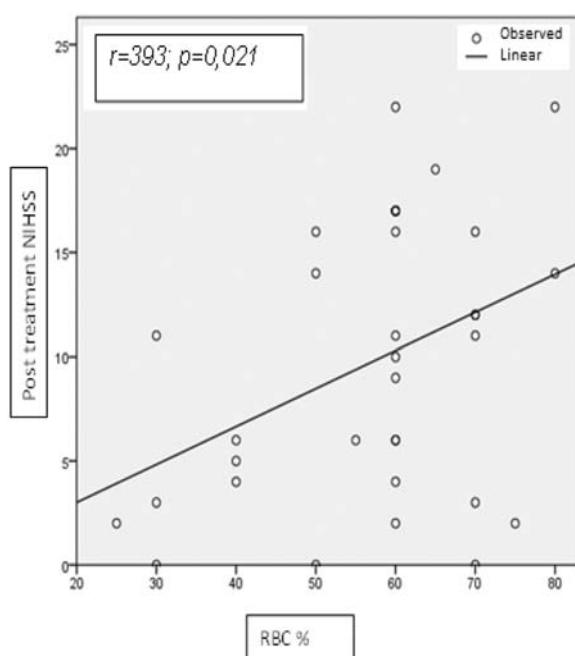
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**Background and Aims:** Thanks to mechanical thrombectomy, we are able to analyse thrombi responsible for large vessel occlusion (LVO) in acute ischemic stroke (AIS). Their composition could be related to AIS severity, clinical outcome and technical success of procedures. Previous studies reported longer and more complex procedures when fibrin and platelets rich thrombi were retrieved, not confirmed by other studies, while no correlation between thrombus histology and clinical outcome was found.

The aim of our study was to evaluate the possible correlation between thrombus composition, procedural success and clinical outcome.

**Methods:** We analysed prospectively thrombi retrieved from LVO in AIS. Patients were recruited within twenty-four hours since the last time seen healthy. Retrieved thrombi were stored in formaldehyde. Physical characteristics and histological composition, in terms of red blood cells (RBC), fibrin and platelets (FP) percentage were determined, eventually presence of other cells was reported. Thrombi composition was correlated with baseline radiological and interventional data and clinical outcome within the first week since AIS.

**Results:** We included 34 patients among 41 recruited. Twenty-five thrombi with prevalent RBC and 9 with prevalent FP composition were collected. We found a significant positive correlation between RBC content and post-treatment NIHSS ( $r = 393; p = 0,021$ ), but not at twenty-four hours and seven days. We did not find any significant correlation between thrombus composition and procedural success.



**Conclusions:** The transient impairment of patients with RBC rich thrombi may be explained by the higher fragility of these thrombi,

making them more prone to fragmentation with possible periprocedural microembolisms.

**Trial registration number:** N/A

**WITHDRAWN**
**AS17-170**
**ENDOTHELIAL PROGENITOR CELLS:  
POTENTIAL BIOMARKERS FOR DIAGNOSIS  
AND PROGNOSIS OF ISCHAEMIC STROKE**

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**Background and Aims:** Endothelial dysfunction, associated with impaired vascular integrity, is implicated in the pathogenesis of ischaemic stroke (IS). Accumulating evidence indicate that endothelial progenitor cells (EPCs) constantly repair endothelial damage and help maintain vascular homeostasis at all times. This study aims to establish whether differences in the number and functional aspects of circulating EPCs may correlate with the severity and outcome of patients with anterior circulation IS.

**Methods:** EPCs are defined as cells co-expressing markers for endothelial maturity (KDR), immaturity (CD133) and stemness (CD34) and counted by flow cytometry in peripheral blood samples obtained from patients or healthy volunteers (HVs). Levels of key elements capable of affecting EPCs characteristics e.g. growth factors (vascular endothelial

growth factor), total anti-oxidant capacity, endothelial nitric oxide synthase (eNOS) activity, inflammatory cytokines and chemokines (TNF-alpha) and angiogenic inhibitors (thrombospondin-1/2) are studied by specific ELISAs in plasma. Proliferative, migratory, tubulogenic (matrigel assay) and clonogenic (colony forming unit assay) capacities indicating EPCs functionality are assessed using specific assays.

**Results:** Early results have shown no significant differences in the level of angiogenic promoters and inhibitors between HVs and IS patients. EPCs expressing KDR alone appear to be significantly different between HVs and patients at acute, subacute, and chronic phases of IS. Tubulogenic activity, a marker of vasculogenesis, appears to be similar in HVs and IS patients.

**Conclusions:** Ongoing studies will (dis) prove these findings and also reveal whether any substantial differences in any of these parameters exist including those pertaining to EPCs counts and inflammatory cytokines correlate with the severity and outcome of stroke.

**Trial registration number:** N/A

## AS17-154

### PILOT EVALUATION OF THE APPLICATION OF THE PROMIS-29 SCALE AT STROKE FOLLOW UP FOR A POPULATION OF PATIENTS WITH ACUTE ISCHAEMIC STROKE

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**Background and Aims:** Improvement in care post stroke is a focus of the recently published NHS Long Term Plan and this process will be facilitated by routine measurement of relevant outcomes at follow-up. Currently, collection of a Modified Rankin Score (mRS) at six months post stroke is recommended but no patient reported measure is mandated.

**Objectives:** We aimed to investigate the application of a validated patient reported outcome tool (Promis-29) in a well-defined stroke population assessed at the time of routine interval follow up after initial presentation with acute ischaemic stroke to our institution.

**Methods:** We studied consecutive patients included in the SIGNAL Registry presenting with acute ischaemic stroke to our stroke centre with small vessel disease on baseline MR imaging and a completed follow up with Promis-29 and mRS.

**Results:** 191 patients were identified (mean age = 72yrs, SD 14.0, 59% male). We found a significant correlation between 6 months mRS and several components of the Promis-29 including physical function ( $p=0.78$ ,  $p < 0.001$ ), depression ( $p=0.306$ ,  $p < 0.001$ ), fatigue ( $p=0.422$ ,  $p < 0.001$ ), social satisfaction ( $p=0.425$ ,  $p < 0.001$ ) and with the Promis-29 total score ( $p=0.557$ ,  $p < 0.001$ ). However, there was no significant association with sleep dysfunction, anxiety and pain measures.

**Conclusions:** Promis-29 assessment at follow up post stroke shows association with mRS measured functional status at hospital discharge and at 6 months follow-up in some but not all components. Promis-29 appears to be a useful tool for assessing post stroke outcomes but further work is needed to evaluate overlap with other outcome tools.

**Trial registration number:** SIGNaL

## AS17-113

### THE EFFECT OF SHORT-TERM EXPOSURE TO PARTICULATE MATTER AIR POLLUTION ON MORTALITY AND POOR PROGNOSIS AFTER ACUTE STROKE

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**Background and Aims:** Particulate air pollution is significantly associated with the risk of stroke. We aimed to determine the effect of PM<sub>10</sub>, PM<sub>2.5</sub>, NO<sub>2</sub>, SO<sub>2</sub>, O<sub>3</sub>, CO & NO<sub>x</sub> on mortality and 180-day outcome after stroke.

**Methods:** It was a case-crossover study, conducted at Neurology Department of All India Institute of Medical Sciences, New Delhi, India from September 2014 to October 2018. Poor outcome was defined as modified Rankin Scale (mRS) score 3 or more. The optimal cut-off points were determined by Youden Index. Logistic regression analysis was used to determine the association between particulate matter and mortality and 180-day outcome after stroke. All the statistical analysis was performed in STATA version 13.0 software.

**Results:** 351 stroke patients were recruited in the study (235- ischemic stroke (IS), 116- hemorrhagic stroke (HS)) with a mean age of 54.47 ± 15.08. NO<sub>2</sub>>92.16µg/máCE (OR 1.96; 95% CI 1.004 to 3.82) was found to be significantly associated with 180-day poor outcome after all stroke. Analysis on the basis of stroke subtype observed PM25>189.31µg/máCE(OR 2.87; 95% CI 1.005 to 8.19), NO<sub>2</sub>>70.93µg/máCE (OR 3.73; 95% CI 1.24 to 11.18) &NO<sub>x</sub>>150.1µg/máCE(OR 4.4; 95% CI 1.56 to 12.38) to be associated with 180-day mortality after IS. A significant association with poor outcome after IS was also observed with NO<sub>x</sub> and after HS was observed with PM10 & O<sub>3</sub> respectively.

**Conclusions:** Our study suggests the effect of particulate air pollution on mortality and 180-day poor outcome after Ischemic Stroke and Hemorrhagic Stroke. Further studies with large sample size are required to validate these findings.

**Trial registration number:** N/A

## AS17-166

### BLOOD PRESSURE LOWERING TREATMENT FOR PREVENTING DEMENTIA IN PATIENTS WITH A HISTORY OF STROKE: A SYSTEMATIC REVIEW AND META-ANALYSIS

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**Background and Aims:** This study aims to assess whether intensive blood pressure lowering treatment is superior to less intensive management or placebo in preventing dementia in patients with stroke.

**Methods:** A comprehensive literature search including PubMed, Medline and Embase was performed according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement. We searched for randomized trials which compared intensive versus less

intensive (or placebo) blood pressure management in stroke patients reporting cognitive outcomes. Primary outcome of interest was dementia as defined by Mini Mental State Examination testing cut-offs.

**Results:** Among 614 potentially eligible articles, 4 randomized controlled trials were included (PROGRESS 2003, PROFESS 2008, SCAST 2013, CATIS 2016); n = 23,852. There was no statistically significant difference between intensive blood pressure lowering treatment compared with the control arm in post-stroke low MMSE scores (odds ratio, OR: 0.99, 95% confidence interval, CI: 0.92–1.07; heterogeneity I<sup>2</sup> = 0%). Subgroup analyses revealed a non-significant effect on low MMSE scores for hyperacute (OR: 1.00, 95% CI: 0.81–1.22; heterogeneity I<sup>2</sup> = 0%) and delayed blood pressure treatment (OR: 0.99, 95% CI: 0.92–1.07; heterogeneity I<sup>2</sup> = 35%). Finally, in participants with a recurrent stroke there was no effect of blood pressure management on low MMSE (OR: 0.86, 95% CI: 0.69–1.08; heterogeneity I<sup>2</sup> = 66%).

**Conclusions:** Taking into consideration the limitations of available evidence, this meta-analysis does not support the hypothesis that the implementations of an intensive blood pressure management prevents dementia after stroke.

**Trial registration number:** n/a

## AS17-025

### INITIAL SARCOPENIA AS A RISK FACTOR OF POOR POST-STROKE FUNCTIONAL OUTCOME IN WOMEN

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**Background and Aims:** It is postulated that sarcopenia can hinder the functional recovery process. The purpose of the present study was to assess the impact of early sarcopenia on the long-term functional outcome and disability level at six months post-stroke.

**Methods:** Patients with the first-ever stroke who had been diagnosed were included. One hundred ninety-four hemiplegic post-stroke patients satisfied the inclusion criteria. Sarcopenia, as assessed by grip strength from the nonhemiplegic hand; and level of functional outcome defined by the modified Rankin Scale (mRS), measured at two weeks post stroke. **Results:** At post-stroke six months, 72.2% of patients belonged to mRS>3, with more women (81.0% vs.66.0%, P = 0.024), showing poor recovery. Moreover, those in the mRS>3 had a higher rate of sarcopenia (47.1% vs. 27.8%, P < 0.01). Both men and women showed a higher rate of sarcopenia in those with mRS>3. Univariate analysis revealed that the presence of sarcopenia was associated with 2.71-fold higher risk of poor recovery at six months. Also, women were associated with 2.18-fold higher risk of poor outcome. Multivariable logistic regression analysis revealed that the presence of sarcopenia was associated with poor functional outcome (OR = 2.61, P = 0.024) in men, but most notably more in women (OR = 9.93, P = 0.032).

**Conclusions:** This study suggests that the presence of sarcopenia at two weeks post-stroke may increase the risk of poor functional outcome six months after stroke. Most notably, women with sarcopenia within two weeks from stroke onset were more significantly likely to show poor mRS after at six months.

**Trial registration number:** N/A

## AS17-124

### FATALITY OF MOYAMOYA BLEEDING IN KOREA

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**Background and Aims:** The reported mortality rates of initial intracranial hemorrhage in Moyamoya disease have ranged from 6.8% to 17.9%. But those are too old data from Japan. We wanted to know recent Korean fatality status, so we performed multicenter study.

**Methods:** For the retrospective study, medical records and images were reviewed in patients who presented with hemorrhage due to Moyamoya disease during last ten years. Initial clinical grade, hemorrhage pattern, angiographic finding, management, cause of death were investigated from 5 training hospital

**Results:** A total 229 patients were identified. Mean mortality rate due to bleeding from 5 hospital was 20% at total. But the mortality rate was different to hospital to hospital, ranging from 11% to 46%. Initial mean Glasgow coma scale was 5.1 (3 to 13). Mean hospital stay was 7.6 day (1-24). Female was predominant: 67 %. Intraventricular hemorrhage was found 83% of patients. Main cause of death is uncontrolled increased intracranial pressure, consecutive infarction and rebleeding. Prominent anterior choroidal artery, anterior cerebral artery occlusion and poor collaterals from the posterior cerebral arteries are the angiographic findings of poor prognosis. Initial good grade, awakening within 48 hours, small amount intracerebral hemorrhage, stable blood pressure were good prognosis factor

**Conclusions:** One fifth of Moyamoya bleeding patients died from bleeding at acute period and it is little bit high compared with previous old reports. More intensive management for the control of increase intracranial pressure, for the prevention of rebleeding or infarction is needed in hemorrhagic Moyamoya disease.

**Trial registration number:** N/A

## AS17-053

### USE OF CEFTRIAXONE IN STROKE PATIENTS, A PREDICTOR OF GOOD OUTCOME IN STROKE PATIENTS: EXPERIENCE FROM A TERTIARY CARE CENTER IN NORTH INDIA

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**Background and Aims:** Use of antibiotics in stroke patients is common. Whether use of any specific class of antibiotics has bearing on the outcome of stroke patient has never been studied. The present study investigates the same on outcome of use of three major classes of antibiotic used at our centre in stroke patients

**Methods:** A cross-sectional prospective study was conducted in a tertiary care centre in India over 18 months. We assessed the outcome of treatment by mRS which grouped in to two categories: mRS with good (0–3) and poor outcome (4–6) at the time of discharge. Patients were grouped into four categories based on the use of antibiotics during hospital stay: Group 1 (patients without antibiotic treatment), Group 2 (Piperacillin tazobactum treatment group ), Group 3 (Ceftrazidine treatment group) and Group 4 (Ceftriaxone treatment group). All the base line data of stroke patient along with stroke severity scales were recorded. Data was analyzed using SPSS software version 25

**Results:** 366 stroke patients were analyzed for outcome with age ranging from 20 to 95 years and out of which 151 were females. Efficacy of antibiotic was analyzed between two groups: poor outcome (mRS 4–6) and good outcome (mRS 0–3) using Pearson's Chi-square and Binary Logistic Regression. It was found that mRS at discharge was significantly

lower in patients treated with ceftriaxone than compared to the other three groups. ( $p = 0.010$ ; odd's ratio = 0.327; 95% CI, 1.270-8.758 respectively).

**Conclusions:** Use of ceftriaxone has better outcome in comparison to Pipracillin tazobactam and Ceftrazidine in stroke patients.

**Trial registration number:** N/A

## AS17-095

### BLOOD GLUCOSE VARIABILITY DURING THE FIRST 24 HOUR AND PROGNOSIS IN ACUTE STROKE PATIENTS TREATED WITH IV THROMBOLYSIS

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**Background and Aims:** Hyperglycemia in acute ischemic stroke decreases the effectiveness of intravenous tissue plasminogen activator (IV-tPA) therapy and increases its hemorrhagic complications. Therefore, optimization of blood glucose (BG) is suggested. But, no consensus is achieved on what BG parameters to be used such as admission BG, post-treatment BG, first day maximum and average BG (maxBG and aveBG), or BG variability indices such as the standard deviation of mean BG (SDBG), coefficient of variation of BG (CVBG) or J-index.

**Methods:** Admission and 24h BG were measured in 145 acute stroke patients (56% female, age:  $70 \pm 13$ ; NIHSS:  $14 \pm 6$ ) treated with IV-tPA. BG variability indices were calculated in those 107 with serial BG measurements available.

**Results:** Diabetes history was elicited in 25% of patients. Hemoglobin A1c (HbA1c) was  $7.2 \pm 1.5\%$  in diabetics and  $5.8 \pm 0.6\%$  in non-diabetics. AveBG ( $145 \pm 51$  vs  $124 \pm 34$  mg/dl,  $p = 0.004$ ) was significantly higher in patients with 3rd month mRS > 2 (53.4%), but admission BG, SDBG, CVBG and J-index were not. An exploratory regression analysis indicated that connection of aveBG to worse prognosis ( $b = -0.155$ ,  $p = 0.045$ ) survived after adjustment of admission NIHSS, age and DM history. No BG parameter predicted symptomatic tPA-associated type-II intracerebral hemorrhage (6.8%), albeit they had numerically higher average BG levels ( $161 \pm 37$  vs.  $133 \pm 44$  mg/dl,  $p = 0.054$ ). Presence of diabetes, HbA1c, admission BG, average first day BG and variability indices had not modified the beneficial (52%) and dramatic response (29%) to IV-tPA.

**Conclusions:** Sustained hyperglycemia, not glucose variability, during the first 24 hour predicts poor prognosis in acute stroke patients treated with IV thrombolysis.

**Trial registration number:** N/A

## AS17-138

### CRP OVER 30MG/L AT ADMISSION WITH STROKE IS STRONGLY ASSOCIATED WITH 1 YEAR MORTALITY

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**Background and Aims:** Elevated CRP, a non specific marker of inflammation and infection, typically occurs conditions such as giant cell arteritis, cancer and endocarditis which cause stroke directly or can be a manifestation of stroke related infectious complications, trauma etc.. The reasons for CPR having prognostic value in stroke are unclear. We measured the frequency of high CRP at admission, the underlying causes and outcomes.

**Methods:** We retrospectively analysed 500 consecutive stroke admissions to Cambridge Hospital from Sept 2017 to mid 2018 (481 had

admission crp), collecting data on admission CRP, creatinine plus age and initial NIHSS. We analysed causes and outcomes using a CRP value cut off of over 30 mg/L versus < 30.

**Results:** 64 (14%) had admission CRP over 30 (30% attributed to pneumonia). 1 year mortality was 50% in high CRP group vs estimated 15% in low CRP group ( $p < 0.0001$ ). High CRP group were non significantly older ( $78 \pm 11$  vs  $75.9 \pm 13$  years), had similar median (IQR) NIHSS 3(1-10) vs 4 (1-11), but higher creatinine  $112 \pm 84$  vs  $88 \pm 44.3$  ( $p = 0.0004$ ).

**Conclusions:** High admission CRP (>30mg/l) in stroke is relatively uncommon but is associated with a significantly elevated 1 year mortality along with impaired renal function. Endocarditis, Giant cell arteritis and new cancer diagnoses occur in this group, albeit at a low frequency. Work on the causes of death in the high CRP group might improve outcomes and mortality.

**Trial registration number:** N/A

## AS17-063

### SMALL VESSEL DISEASE IS ASSOCIATED WITH AN UNFAVORABLE OUTCOME IN STROKE PATIENTS ON ORAL ANTICOAGULATION

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**Background and Aims:** Cerebral small vessel disease (SVD) is an important cause for both ischemic stroke (IS) and intracranial hemorrhage (ICH). To date, knowledge on the impact of SVD on the clinical course in stroke patients treated with oral anticoagulation (OAC) for atrial fibrillation (AF) is limited.

**Methods:** Registry-based prospective study of 320 patients (aged  $78.2 \pm 9.2$  years) treated with anticoagulation following AF-stroke. Patients underwent standardized magnetic-resonance-imaging assessing measures of SVD, including cerebral microbleeds (CMBs) and white matter lesions (WMLs). Median follow-up was 754 days. Using adjusted logistic and Cox regression we assessed the association of imaging measures with clinical outcome including recurrent IS, ICH and death and assessed disability.

**Results:** Recurrent IS was more common than ICH (22 versus 8, respectively). CMBs were related to an increased risk of the composite endpoint (IS, ICH, death: OR 2.05, 95% CI 1.27-3.31;  $p = 0.003$ ), as were WMLs (OR 2.00, 95% CI 1.23-3.27,  $p = 0.005$ ). This was also true in time-to-event analysis (CMBs: HR 9.17, 95% CI 1.39-3.52;  $p < 0.001$ ; WMLs: HR 7.05, 95% CI 1.20-3.17;  $p = 0.007$ ). Both measures were associated with an increased risk for recurrent IS (CMBs: HR 4.4, 95% CI 1.07-18.2;  $p = 0.04$ ; WMLs: HR 5.27, 95% CI 1.08-25.79,  $p = 0.04$ ) and ICH (CMBs: HR 2.43, 95% CI 1.04-5.69;  $p = 0.04$ ; WMLs: HR 2.57, 95% CI 1.11-5.98,  $p = 0.03$ ). Furthermore, confluent WMLs were associated with increased disability (OR 4.03; 95% CI 2.16-7.52;  $p < 0.001$ ) and mortality (HR 1.81, 95% CI 1.04-3.14,  $p = 0.04$ ).

**Conclusions:** In AF-stroke patients treated with oral anticoagulation, SVD is associated with an unfavorable outcome. The presence of microbleeds indicated a risk higher for recurrent ischemic stroke than for intracranial hemorrhage.

**Trial registration number:** N/A

**AS17-140****INSTRUMENTAL TIMED UP AND GO TEST MEASURES FOR FALLS RISK ASSESSMENT IN STROKE PATIENTS**

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**Background and Aims:** Falls are a major public health problem. The Timed Up and Go test (TUG) is widely used to evaluate motor impairment and for fall risk assessment. The instrumental TUG (iTUG) test, i.e. the TUG recorded with inertial sensors allows to measure different motor tasks, such as linear and curvilinear walking. We aimed to assess whether iTUG test can be used to identify fallers.

**Methods:** Sixty-four stroke patients completed the iTUG test before and after rehabilitation and were contacted monthly for nine months after discharge.

Several movement parameters were calculated from the iTUG measures, such as the total iTUG duration and the angular velocity during the turning phases. Differences between fallers (i.e. those patients who fell at least once in the follow up period) and non-fallers were assessed with the Mann-Whitney U test.

**Results:** 21 (out of 64 patients) have fallen at least one in the follow up period. The total iTUG duration was not significantly different in the two patient groups ( $p = 0.08$ ). On the contrary, the vertical angular velocity during the first turning phase of the iTUG test was significantly lower in fallers than non-fallers ( $p = 0.02$ ). No significant difference was found for the other movement parameters.

**Conclusions:** Vertical angular velocity during turning could be a better falls risk indicator in stroke patients.

**Trial registration number:** N/A.

**AS17-029****EARLY CHANGES IN WHITE MATTER INTEGRITY ARE ASSOCIATED WITH STROKE RECOVERY**

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**Background and Aims:** Information on microstructural integrity of cerebral white matter (WM) has been suggested as a promising marker to explain post-stroke recovery beyond clinical measures and focal tissue damage. Especially early dynamic post-stroke WM changes might be promising to improve prediction of outcome.

**Methods:** We investigated 42 patients (mean age = 66.5 years, 40% female, median admission NIHSS = 9.5) with a symptomatic MRI-confirmed middle cerebral artery infarction in the acute stage (1–3 days after symptom onset) and after three months. All patients received recanalization therapy (thrombolysis and/or thrombectomy) and underwent neurological examination and dedicated brain 3T-MRI. 15 healthy controls (mean age = 57.3 years) were also scanned twice.

**Results:** Patients showed significantly lower WM integrity, as assessed by fractional anisotropy (FA), in the hemisphere with acute infarction

1–3 days post-stroke, which further decreased within three months in patients compared to controls. A regression model including baseline information showed that the modified Rankin Scale and mean FA of the genu of the corpus callosum explained 53.3% of variance of stroke recovery, without contribution of lesion volume. Furthermore, early dynamic FA changes of the corpus callosum within the first three months post-stroke independently predicted stroke recovery.

**Conclusions:** Information from advanced MRI measures on changes in WM integrity days after acute stroke, as well as subsequent early dynamic WM degeneration beyond lesion location and extent enhance our understanding of post-stroke reorganization in the affected hemisphere and contribute to an improved prediction of recovery.

**Trial registration number:** N/A

**AS17-078****THE IMPACT OF BODY MASS INDEX ON OUTCOME AFTER ENDOVASCULAR TREATMENT IN ACUTE ISCHEMIC STROKE PATIENTS: A POST-HOC ANALYSIS OF THE MR CLEAN TRIAL**

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**Background and Aims:** Several studies have shown that obesity is associated with better functional outcome after stroke. Whether obesity influences the benefit of endovascular thrombectomy (EVT) in stroke patients is unknown. We evaluated the association between BMI and outcome, and assessed whether BMI affects the benefit of EVT.

**Methods:** This is a post-hoc analysis of the MR CLEAN trial (ISRCTN10888758). BMI was used as a continuous and categorical variable, distinguishing underweight and normal weight ( $BMI < 25$ ), overweight ( $BMI 25–30$ ), and obesity ( $BMI \geq 30$ ). We used multivariable ordinal logistic regression analysis to estimate the association of BMI with functional outcome (shift analysis), assessed with modified Rankin Scale (mRS) at 90 days. The impact of BMI on EVT effect was tested by the use of a multiplicative interaction term.

**Results:** Of 366 patients, 160 (44%) were underweight or normal weight, 145 (40%) overweight, and 61 (17%) were obese. We found no association between BMI and mRS (aOR 1.05 in EVT treated patients and aOR 1.04 in patients without EVT treatment). However, mortality rate was inversely related to BMI; aOR 0.85 (95% CI = 0.74–0.98) in EVT treated patients and aOR 0.94 (95% CI = 0.86–1.03) in patients treated without EVT. There was no interaction between BMI and EVT effect on functional outcome, mortality and other safety outcomes.

**Conclusions:** The obesity paradox was not found in terms of better functional outcome for EVT treated patients with higher BMI, nor was there an interaction between BMI and EVT effect. However, we did find a paradoxical association between BMI and mortality after EVT.

**Trial registration number:** ISRCTN10888758

**AS17-105****MORBIDITY AND MORTALITY RISK FACTORS IN TYPE 2 DIABETES MELLITUS PATIENTS WITH ACUTE ISCHEMIC STROKE****L. Popa<sup>1</sup>, S. Petrescu<sup>1</sup>, M. Popa<sup>2</sup> and C. Panea<sup>1</sup>**<sup>1</sup>Elias Emergency University Hospital, Neurology, Bucharest, Romania;<sup>2</sup>Elias Emergency University Hospital, Endocrinology, Bucharest, Romania

**Background and Aims:** Type 2 diabetes mellitus (T2DM) is a well-established risk factor for ischemic stroke. We aimed to assess the impact of T2DM on morbidity and mortality in patients with acute ischemic stroke admitted to our Neurology department during the last year (2018), as well as associated factors that could lead to a bad prognosis.

**Methods:** We conducted a retrospective study on 194 patients with T2DM and acute ischemic stroke. We used clinical, etiological and imaging scales for categorizing the severity and subtypes of ischemic stroke (modified Rankin Score-mRS, TOAST Classification, Oxford Stroke Classification). We used glycosylated hemoglobin (HbA1c) level, glycemia level at admission and triglycerides level as indicators for the metabolic control of diabetes.

**Results:** The considered indicators of poor metabolic control – HbA1c, triglycerides level and glycemia level at admission – were not associated with a worse outcome. Patients older than 60 appear to have a worse outcome (mRS>3) ( $p = 0,035$ , OR = 3,823, CI95% (1,1;13,25)). Men of all ages showed lower mortality ( $p = 0,015$ , OR = 3,425, CI95% (1,26, 9,2)). We observed an increased risk of mortality in patients presenting atrial fibrillation ( $p < 0,001$ , OR = 9,67, CI95% (3,34;27,97)), cardioembolic stroke ( $p < 0,001$ , OR = 8,83, CI95% (3,06;25,48)), cardiac failure ( $p = 0,006$ , OR = 4,01, CI95% (1,5;10,73)) and healthcare-associated infections ( $p < 0,001$ , OR = 11,308, CI95%(4,16;30,69)).

**Conclusions:** There was no direct causal link between high level of HbA1c, glycemia, or triglycerides at admission and mortality. Immune dysfunction in T2DM predisposes patients to healthcare associated infections, linked to higher morbidity and mortality. T2DM also leads to increased mortality due to chronic cardiac complications.

**Trial registration number:** N/A

**WITHDRAWN****AS17-172****PATTERNS AND PREDICTORS OF LONG-TERM STROKE RECURRENCE AFTER TRANSIENT ISCHEMIC ATTACK****F. Purroy Garcia<sup>1</sup>, Y. Gallego<sup>1</sup>, J. Sanahuja<sup>1</sup> and A. Quilez<sup>1</sup>**<sup>1</sup>Hospital Universitari Arnau de Vilanova de Lleida, Neurology, Lleida, Spain

**Background and Aims:** To determine long-term stroke recurrence (SR) after TIA and to identify the characteristics and factors related to SR.

**Methods:** This was a prospective observational registry of TIA patients admitted to the emergency room of our stroke centre from January 2006 to January 2013. SR was recorded from 90 days after TIA onset until 5 year follow-up. We prospectively recorded clinical characteristics, aetiology and neuroimaging data. We analyse these variables in association with SR

**Results:** A total of 719 subjects were included. SR occurred in 78 (10.8%) cases: 42 (53.8%) at 90 days, 11 (14.1%) between 90 days and 1 year, and 25 (32.1%) after. 80 % of SR happened in the same territory of the index TIA at 90-day follow-up, whereas only 57 % after ( $p < 0,001$ ). Different predictors of SR were identified throughout the follow-up period. Although positive Diffusion weighted imaging was related to SR through all the follow-up [Hazard ratio (HR) 3.18 (1.29-7.85);  $p = 0,012$ ], large artery atherosclerosis disease was only related to 90-day SR (HR 3.14 (1.47-6.67);  $p = 0,003$ ) and previous diabetes mellitus to late SR (HR 3.49 (1.46-8.33);  $p = 0,005$ ).

**Conclusions:** Patterns and predictors of SR differed among the follow-up of TIA patients. Notoriously, up to one out of two SR happened beyond 90 days of follow-up.

**Trial registration number:** N/A

**AS17-052****PROGNOSTIC ROLE OF NEUTROPHIL-LYMPHOCYTE RATIO IN PATIENTS WITH ACUTE ISCHEMIC STROKE****M. Mendes<sup>1</sup>, A.R. Raimundo<sup>1</sup>, R. Jesus<sup>1</sup>, A.G. Velon<sup>1</sup> and A. Veiga<sup>1</sup>**<sup>1</sup>Centro Hospitalar Trás-os-Montes e Alto Douro, Neurology, Vila Real, Portugal

**Background and Aims:** Neutrophil-lymphocyte ratio (NLR) has been reported to be correlated with poor prognosis in patients with acute coronary syndrome. Our aim is to describe the prognostic role of NLR in patients with acute ischemic stroke (AIS)

**Methods:** Data from patients discharged with the diagnosis of AIS, from January 2016 to December 2017 were retrospectively analysed. NLR was defined as the ratio of absolute counts of neutrophils and lymphocytes, at admission. We define poor functional outcome as modified Rankin Scale (mRS).

**Results:** 576 patients were included. Mean age was  $76 \pm 13$  years and 53% (305 patients) were women. The NLR values ranged from 0,01 to 40 (median 3,4; interquartile range (IQR) 2,61). Mean National Institutes of Health Stroke Scale at admission (NIHSSad) was  $10,68 \pm 9,2$ , poor functional outcome at discharge was observed in 56,8% ( $n = 327$ ) of patients and the mortality rate at 3 months was 21,6% ( $n = 126$ ). NLR positively correlates with NIHSSad ( $p < 0,001$ ,  $r = 0,26$ ). NLR was higher in patients with poor functional outcome at discharge ( $p < 0,001$ ) and in patients who died at 3 months, ( $p < 0,001$ ) but there were no significant differences between gender. When the patients were divided into  $\text{NLR} > 3,5$  and  $\text{NLR} < 3,5$  groups, there was a statistically significant association between higher NLR and death at 3 months ( $p < 0,001$ ; OR 5,6).

**Conclusions:** Our results suggested that, for patients with AIS, higher NLR was associated with poorer functional outcome and higher risk of death. Despite being nonspecific, it could be a useful and a cost-effective predictor in this patients.

**Trial registration number:** N/A

## AS17-137

### CIRCULATING AQUAPORIN-4 AS A BIOMARKER OF EARLY NEUROLOGICAL IMPROVEMENT IN STROKE PATIENTS

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**Background and Aims:** Aquaporin-4 (AQP4) is a water channel that has been extensively related with cerebral edema. Since brain swelling has a crucial impact on morbidity and mortality in stroke patients, our aim was to investigate circulating AQP4 levels after stroke and its correlation with infarct growing and neurological outcome.

**Methods:** AQP4 levels were determined by ELISA in serum from 42 t-PA-treated ischemic stroke patients at admission (within 4,5h after symptoms onset and before any treatment was given) and 13 healthy subjects. To assess infarct growth serial brain diffusion-weighted magnetic resonance images (DWI-MRI) were performed at hospital admission and 1-3 days after symptoms onset. Neurological improvement was defined as a  $\geq 4$ -point decrease in NIHSS score compared to the baseline score.

**Results:** Despite stroke patients and healthy controls had similar baseline circulating AQP4 levels, among strokes AQP4 levels at admission negatively correlated with baseline NIHSS score ( $R = -0,336$ ,  $p = 0,029$ ) and with infarct growth after 1-3 days of stroke onset ( $R = -0,364$ ;  $p = 0,018$ ). Furthermore, baseline AQP4 levels were higher in those stroke patients showing a neurological improvement 48h after stroke onset ( $p = 0,030$ ) and at hospital discharge ( $p = 0,037$ ). In logistic regression analysis, adjusted by age, sex and baseline NIHSS, baseline AQP4 levels resulted to be an independent predictor of good neurological outcome at both studied time points (ORadj: 14,325[1,817-112,917],  $p = 0,012$  at 48h; ORadj: 4,859[0,979-24,122],  $p = 0,053$  at discharge).

**Conclusions:** Overall, we have explored circulating AQP4 levels, and our data suggest that AQP4 could be used as a biomarker of good neurological recovery in the acute-subacute phase of ischemic stroke after t-PA.

**Trial registration number:** N/A

## AS17-093

### CONSTRUCT VALIDITY OF THE UTILITY-WEIGHTED MODIFIED RANKIN SCALE AS A PRIMARY OUTCOME MEASURE IN STROKE TRIALS

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**Background and Aims:** The utility-weighted modified Rankin Scale (UW-mRS) is an outcome measure recently proposed to improve statistical efficiency and interpretability of the mRS. It aims to reflect patient perception of quality of life by translating ordinal mRS categories into a utility-weighted scale. Statistical properties of the UW-mRS have been well investigated, but construct validity has yet to be established. We investigated this by assessing variability in utility values within and between mRS categories, over time post-stroke, and by different derivation methods.

**Methods:** UW-mRS was derived using Assessment of Quality of Life (AQoL-4D) and mRS scores at 3 and 12 months ( $n = 2030$ ) from A Very Early Rehabilitation Trial. Receiver operator characteristic (ROC) analysis of the AQoL-4D was conducted to differentiate between sequential mRS categories. Intraclass correlation was used to explore variability in utility values over time post-stroke, UW-mRS values and derivation methods from multiple studies.

**Results:** UW-mRS values for mRS categories 0-6 at 3 months were 0,80, 0,78, 0,63, 0,37, 0,11, 0,03 and 0. Based on AQoL-4D utility values, areas under the ROC curve varied from 0,54 to 0,87. Time post-stroke explained 42%-56% of variability in AQoL-4D utility values in patients with no change in mRS between 3- and 12-months. The choice of the derivation method contributed to 25% of variability in UW-mRS values.

**Conclusions:** High variability in utility values between and within mRS categories, over time post-stroke, and using different derivation methods is not adequately reflected in the UW-mRS. These threats to construct validity warrant caution when using UW-mRS as a primary outcome measure.

**Trial registration number:** ACTRN12606000185561

## AS17-097

### INVESTIGATING THE MODIFIED RANKIN SCALE THROUGH THE QUALITY OF LIFE AND BARTHEL INDEX LOOKING GLASS

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**Background and Aims:** The modified Rankin Scale (mRS) is a single-dimension ordinal scale encompassing a wide range of functional outcomes. Quality of life scales and the Barthel Index (BI) are multivariate instruments where both the total score and the multivariate "signature" combinations of individual domain scores provide meaningful patient

information. We aimed to describe and compare these multivariate "signatures" within and across individual mRS categories.

**Methods:** mRS scores, two domains of BI (Selfcare and Mobility), and four domains of Assessment of Quality of Life AQoL-4D (Independent Living, Relationships, Mental Health and Senses) at 3 months from A Very Early Rehabilitation Trial (AVERT) were utilised. The differences in individual BI and AQoL-4D domain scores across mRS categories were investigated using Kruskal-Wallis test and Receiver Operator Characteristics curves analysis. Domain score-by-mRS category interactions were investigated using random effects linear regression models with respective interaction terms.

**Results:** For both AQoL-4D and BI, individual domain scores were significantly different across mRS categories ( $p < 0.0001$ ). The only individual domains with excellent discrimination (ROC > 0.8) between sequential mRS categories were: AQoL-4D Independent Living domain for mRS 2vs3 (AUC 0.86) and mRS 3vs4 (AUC 0.92), and both BI domains for mRS 3vs4 (AUC 0.89 and 0.91) and 4vs5 (AUC 0.83 and 0.85). There was a significant domain-by-mRS interaction ( $p < 0.0001$ ) for both BI and AQoL-4D.

**Conclusions:** Our findings assist clinically relevant in-depth interpretation of mRS, by emphasising the multivariate nature of patient outcomes behind a single mRS score, where different individual mRS categories display significantly different AQoL-4D and BI domain "signatures".

**Trial registration number:** ACTRN12606000185561

## WITHDRAWN

## AS17-189

### DOES EARLY POST-TREATMENT DATA IMPROVE PRE-TREATMENT FUNCTIONAL PROGNOSTIC SCORE ACCURACY?

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**Background and Aims:** Early recanalization is determinant for a good acute ischemic stroke (AIS) outcome. Nevertheless, patient characteristics and stroke dynamics are important contributors. Several pre-intervention scores for prediction of functional outcome in stroke (DRAGON, Astral, THRIVE) have been independently developed and validated. We aimed to ascertain whether adding stroke dynamics (i.e. 24h imaging and clinical data) would lead to model improvement.

**Methods:** We retrospectively included 179 anterior circulation AIS patients treated with thrombolysis and/or thrombectomy. We collected demographic, clinical and imaging data. We calculated DRAGON, Astral and THRIVE scores, regarding them as continuous variables, and compared areas under the curve (AUC) between models. We built two logistic regression models (pre and post-treatment data) in a backward stepwise fashion. We defined early recovery as a drop  $\geq 4$  NIHSS points at 24h or a 24h-NIHSS  $< 2$ , and good outcome as modified Rankin Scale (mRS)  $< 3$  or no deterioration from baseline on follow-up. We measured 24h-infarct volume by the ABC/2 method.

**Results:** The AUC for DRAGON (0.69), THRIVE (0.74) and ASTRAL (0.76) were not significantly different ( $p = 0.2627$ ). Our pre-treatment model – including sex, age, previous mRS, baseline NIHSS and ASPECTS – had a similar AUC (0.81) when compared to ASTRAL ( $p = 0.0678$ ) and performed better when compared to DRAGON or THRIVE ( $p < 0.02$ ). The addition of 24h-infarct volume (replacing

ASPECTS) and early recovery significantly improved model performance (AUC = 0.869, p < 0.01).

**Conclusions:** Acknowledging the dynamic nature of stroke, represented by the addition of 24h-infarct volume and 24h-neurological recovery to the model, significantly improved 3-month stroke outcome prediction when compared to pre-treatment scores.

**Trial registration number:** N/A

### AS17-043

#### THE INFLUENCE OF COGNITIVE RESERVE ON FUNCTIONAL, PSYCHOLOGICAL AND COGNITIVE ABILITY POST-STROKE

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**Background and Aims:** Cognitive reserve (CR) is a feature of brain structure and function said to mediate the effects of brain pathology or injury on clinical outcomes. Extensively studied in neurodegeneration, CR demonstrates increasing applicability to acute neurological injury, such as stroke, but has not been comprehensively explored. Here we report stroke outcomes at baseline and 3-months for those with low and high CR.

**Methods:** Thirty-three acute, first-ever stroke patients admitted to a specialised stroke unit at the Royal Adelaide Hospital, South Australia, were assessed on CR, cognition, function, quality-of-life and self-efficacy at baseline. Participants were dichotomised into high or low CR-groups based on Cognitive Reserve Index questionnaire criteria. The Fugl-Meyer Assessment (upper-limb) and Montreal Cognitive Assessment were assessed at baseline to describe clinical characteristics of the high/low CR groups. Outcomes measured disability, independence, self-efficacy, and quality-of-life.

**Results:** Baseline characteristics were similar between groups, except for cognitive ability, where those with high CR ( $M = 23.5$ ,  $SD = 4.8$ ) significantly outperformed those with low CR ( $M = 19$ ,  $SD = 1$ ;  $p = 0.01$ ). Preliminary 3-month data shows a trend for the low CR group to demonstrate poorer outcomes ( $M$  difference from baseline) on measures of independence ( $M = -21.5$ ), disability ( $M = +0.17$ ), quality-of-life ( $M = +14.8$ ), and self-efficacy ( $M = -19.7$ ).

**Conclusions:** While current findings are preliminary and should be interpreted with caution, CR may be an important mediator of stroke outcomes. Importantly, CR is modifiable across the lifespan and might demonstrate utility for primary/secondary prevention, and/or facilitate better prediction of capacity for recovery following stroke.

**Trial registration number:** N/A

### AS17-039

#### TIMING AND RELEVANCE OF CLINICAL IMPROVEMENT AFTER MECHANICAL THROMBECTOMY IN PATIENTS WITH ACUTE STROKE

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**Background and Aims:** Stroke outcome prediction following mechanical thrombectomy (MT) is difficult. We aimed to study the relevance of the timing of clinical improvement in the prediction of long-term outcome in patients treated with MT.

**Methods:** We studied a cohort of 423 patients treated with MT. NIHSS scores were assessed before MT, at the end of MT (d0), at day 1 (d1), and

day 7 or discharge (d7). We explored the predictive value for good outcome of different cutoffs based on absolute and percentage changes in the NIHSS at each assessment (d0, d1, and d7), and selected the corresponding most informative cutoffs to define substantial clinical improvement (SCI) over time. Then, we classified patients in SCI subgroups according to the delay from MT to SCI (SCI-d0, SCI-d1, SCI-d7), and analyzed their adjusted ORs for good outcome compared to patients not presenting SCI (no-SCI). Additionally, we identified the independent factors predicting SCI-d0 in multivariate models.

**Results:** The most informative cutoffs were 30% at d0, 40% at d1, and 70% at d7. The adjusted ORs (95% CI) for good outcome were 47.4 (22.1-101.7, n = 172) for SCI-d0, 27.7 (11.8-65.0, n = 76) for SCI-d1, and 12.6 for SCI-d7 (95% CI, 3.8-41.4, n = 17), compared to no-SCI (n = 158). The independent factors predicting SCI-d0 were successful reperfusion (OR 25.79, 95% CI, 12.92-51.47) and shorter time to treatment (OR per hour 0.90, 95% CI, 0.85-0.96).

**Conclusions:** Shorter delay to clinical improvement is strongly related to better chances of good outcome, and an improvement >30% in NIHSS at the end of MT represents a reliable prognostic marker.

**Trial registration number:** N/A

### AS17-040

#### EXTERNAL VALIDATION OF THE PREMISE SCORE IN THE ATHENS STROKE REGISTRY

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**Background and Aims:** A simple score was proposed recently for Predicting Early Mortality from Ischemic Stroke (PREMISE), derived from the Austrian Stroke Unit Registry, could be useful in clinical practice and research. However, its generalizability is uncertain, as it was validated internally only. We aimed to validate the PREMISE score externally.

**Methods:** The analysis was performed in the Athens Stroke Registry. The PREMISE score was calculated as described in the original publication. The outcome was death within 7 days after stroke. Logistic regression analysis was used to estimate the relative death risk in different strata of the PREMISE score using the lowest values (i.e. 0-4) as the reference category. We assessed the score's calibration by the Hosmer-Lemeshow goodness-of-fit test and its discriminatory power by calculating the area under the receiver operating characteristics curve (AUC).

**Results:** In 2,608 patients (median age 71 years, 38.8% women) with acute ischemic stroke treated in the stroke unit, mortality increased with increasing PREMISE score from 0.1% [95% confidence intervals (95% CI): 0-0.2%] in patients with a score of 0-4 to 28.2% (95% CI: 14.1-42.3%) in patients with a score of ≥10. Death risk was more than 6 times higher in patients with a PREMISE score of ≥10 compared to patients with 0-4 points (OR: 6.21, 95% CI: 4.13-8.29). The PREMISE score showed excellent calibration (Hosmer-Lemeshow  $\chi^2$ : 0.01,  $p = 0.99$ ) and good discriminatory power (AUC 0.873, 95% CI: 0.844-0.901).

**Conclusions:** The present study confirms the prognostic accuracy of the PREMISE score in an independent cohort of patients with acute ischemic stroke treated in the stroke unit and supports its use in clinical practice and research.

**Trial registration number:** N/A

**AS17-041**

## **COMPARISON OF RISK SCORES FOR THE PREDICTION OF THE OVERALL CARDIOVASCULAR RISK IN PATIENTS WITH ISCHAEMIC STROKE: THE ATHENS STROKE REGISTRY**

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**Background and Aims:** Stratification of overall vascular risk in patients with ischemic stroke is important as it may guide management decisions. Currently available schemes have only modest prognostic accuracy. The TRA2°P score aids in vascular risk stratification in patients with previous myocardial infarction (MI). We investigated whether the prognostic performance of TRA2°P can be extended in patients with ischemic stroke and whether it can improve the risk stratification made by CHA<sub>2</sub>DS<sub>2</sub>-VASc and Essen-Stroke-Risk-Score (ESRS) scores.

**Methods:** We analyzed the Athens Stroke Registry using Kaplan-Meier survival and Cox-regression analyses to assess if TRA2°P (in different categorizations) predicts the composite endpoint of stroke recurrence, MI or cardiovascular death. We compared its incremental predictive value over CHA<sub>2</sub>DS<sub>2</sub>-VASc and ESRS and calculated continuous net reclassification indices (cNRI).

**Results:** In 2833 patients (followed for 9278 patient-years) and 776 events, there was decreased survival probability for TRA2°P-based high-risk patients compared to low-risk (log-rank-test  $p < 0.001$ ), but the discriminatory power for the occurrence of the composite endpoint was only modest (Harrell's-C: 0.566, 95% CI: 0.545-0.587). Combined with ESRS, TRA2°P conferred incremental discrimination (Harrell's-C: 0.544, 95% CI: 0.513-0.574 versus 0.574, 95% CI: 0.543-0.605 respectively,  $p = 0.049$ ) and reclassification value ( $cNRI = 9.8\%$ ,  $p = 0.02$ ). Combined with CHA<sub>2</sub>DS<sub>2</sub>-VASc, TRA2°P did not improve discrimination (Harrell's-C: 0.578, 95% CI: 0.547-0.608 versus 0.585, 95% CI: 0.554-0.616,  $p = 0.738$ ).

**Conclusions:** The currently available prognostic scores have generally low performance to predict the overall cardiovascular risk in ischemic stroke patients. Further research is needed to improve vascular risk stratification in ischemic stroke patients.

**Trial registration number:** N/A

**AS17-064**

## **HEART RATE VARIABILITY POTENTIAL PROGNOSTIC IMPACT IN EMBOLIC STROKE OF UNDETERMINED SOURCE**

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Portugal; <sup>4</sup>NOVA Medical School – Universidade Nova de Lisboa, Internal Medicine, Lisboa, Portugal

**Background and Aims:** Heart rate variability (HRV) is a non-invasive measure of autonomic nervous system function. Autonomic dysfunction has been linked to stroke prognosis, although this has not yet been studied in the subset of ESUS.

We aimed to study whether time domain measures of HRV can predict functional outcome in patients with ESUS.

**Methods:** We retrospectively reviewed 384 consecutive patients admitted to a tertiary hospital's stroke unit within two years, selecting ESUS cases according to established criteria. Additional criteria included 24-h Holter monitoring availability and first ever ischemic stroke. Data related to vascular comorbidities, baseline/72h NIHSS, and three months mRS was collected. Normal sinus RR intervals standard deviation (SDNN) and successive normal sinus RR intervals >50 ms percentage (pNN50) were calculated from 24-h Holter recordings.

Patients were divided according to functional outcome, defining poor outcome as mRS > 2 at three months. Co-variable differences between groups were assessed using Chi-Square or Mann-Whitney tests, as appropriate. A logistic regression model was subsequently created.

**Results:** Sixty-eight patients were included, 31 female (45.6%), mean age 67 years ( $\pm 13.2$ ) with mean baseline NIHSS of 8 ( $\pm 9.0$ ). Seventeen patients (25%) had poor functional outcome. Age ( $p = 0.011$ ), diabetes ( $p = 0.002$ ) and baseline NIHSS ( $p = 0.012$ ) were significantly different between groups. Both 72h NIHSS ( $p = 0.009$ ) and mRS at follow-up ( $p = 0.023$ ) showed significant inverse correlations with pNN50 values. Logistic regression model with significantly different co-variables showed non-significant pNN50 prognostic impact (OR 0.923; 95% CI 0.85-1.00;  $p = 0.06$ ).

**Conclusions:** We observed a trend towards pNN50 value prognostic significance, possibly linked to diminished parasympathetic output in the acute stroke setting

**Trial registration number:** N/A

**AS17-050**

## **CHARACTERISTICS AFFECTING THE OUTCOMES OF PATIENTS WITH HEMORRHAGIC STROKE**

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**Background and Aims:** Intracerebral hemorrhage remains the deadliest and most disabling form of stroke. Our study aimed to investigate characteristics affecting patients' outcome (discharge disposition) after hemorrhagic stroke (HS).

**Methods:** We retrospectively reviewed 1963 stroke code activations. 956 vascular events were identified from September of 2012 to September of 2016. Clinical data were compared between patients with hemorrhagic (HS) and ischemic strokes (IS). Outcome predictors were identified in patients with HS.

**Results:** 78.12% of strokes were acute IS and 21.88% were HS. Patients with HS, were younger (median 61 vs. 66,  $p < 0.01$ ) and had higher NIHSS score on admission (median, 15.5 vs. 7,  $p < 0.01$ ). The IS (74.47%) had significant better outcomes than the HS (42.41%) ( $\chi^2 (1) = 57.8$ ,  $p < 0.001$ ). In patients with HS, age (OR 0.96, 95% CI 0.94-0.98), location (OR 0.2, 95% CI 0.077-0.51), NIHSS on admission (OR 0.94, 95% CI 0.91-0.97), decreased level of consciousness (OR 0.36, 95% CI 0.17-0.78),  $\text{PaO}_2/\text{FiO}_2 < 300$  (OR 0.068, 95% CI 0.0084-0.54) and < 200 with respiratory support (OR 0.28, 95% CI 0.086-0.55); GCS equal to 6.9 (OR 0.16, 95% CI 0.050-0.53); or < 6 (OR 0.09, 95%

CI 0.03-0.28), and ventilatory support requirement (OR 0.19, 95% CI 0.097-0.40) were associated with poor outcome.

**Conclusions:** These are preliminary results of a prospective study to identify outcome predictors for HS stroke. As expected we showed that factors such as age, NIHSS, GCS, location, requirement of ventilatory supports are correlated with poor outcome, however more studies are needed to identify modifiable predictors aiming to improve outcomes after hemorrhagic stroke.

**Trial registration number:** N/A

## AS17-127

### ADDING VALUE TO CICAT REGISTRY DATA: CENTRALISED, POST-DISCHARGE FOLLOW-UP OF STROKE PATIENTS. THE 3-YEAR EXPERIENCE OF THE STROKE PROGRAMME OF CATALUNIA

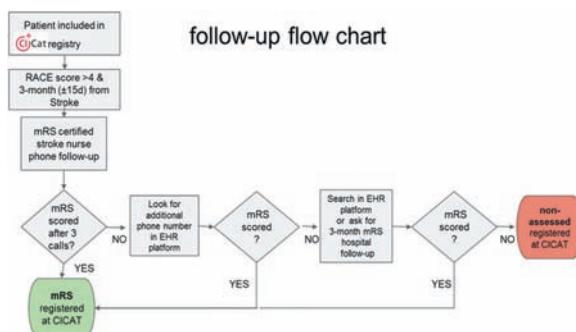
**M. Salvat-Plana<sup>1</sup>, V. Hidalgo<sup>1</sup>, J. Ros<sup>1</sup>, S. Álvarez<sup>1</sup>, R.M. Vivanco-Hidalgo<sup>1</sup>, G. Gallofré-Ribera<sup>1</sup>, M. Ayesta<sup>1</sup> and S. Abilleira<sup>1</sup>**

<sup>1</sup>Agency for Health Quality and Assessment of Catalonia, CICAT registry, Barcelona, Spain

**Background and Aims:** One of the goals of the European Stroke Action Plan is to collect post-discharge patient-reported outcome measures (PROMs). In 2016, the Stroke Programme of Catalonia launched a quality improvement initiative focused on registry data of stroke patients including 3-month outcomes.

**Objective:** To describe our 3-year experience obtaining centralised 3-month mRS scores based on structured phone interviews.

**Methods:** In 2016, the Stroke Programme of Catalonia launched the CICat registry; a population-based, government-mandated registry of all acute strokes entering the Code Stroke circuit. Besides, we established a Technical Monitoring Office (TMO) consisting of three mRS certified stroke nurses (TMO assessors), and a TMO coordinator. Based on CICat information, the TMO coordinator identifies the list of patients and confirms their vital status via consultation of the central Electronic Health Records (EHR) platform. After excluding patients known dead within 3 months, TMO assessors make up to three calls per patient/proxy to undergo a structured interview and assign the corresponding mRS score. TMO assessors do not have access to patients' health data.



**Results:** In 2016 only patients treated were monitored, and in 2017 the sample was expanded progressively. Out of 9,003 acute Code Stroke patients, 4,374 patients have been called, and mRS scores obtained in 93%. Among non-assessed cases, 116 (2.6%) were alive. 2735 (62.5%) answers were obtained at first call.

**Conclusions:** Centralised monitoring of health outcomes is feasible and should be part of any quality improvement strategy. Next step is to go from usual outcomes to PROMs.

**Trial registration number:** N/A

## AS17-096

### GREATER EFFICACY OF INTRAVENOUS THROMBOLYSIS WITH ALTEPLASE IN CARDIOEMBOLIC STROKE COMPARED TO THROMBOEMBOLIC STROKE IN SARDINIAN PATIENTS: A THREE YEARS RETROSPECTIVE STUDY

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**Background and Aims:** Among patients with ischemic stroke, a significant proportion is represented by those with cardioembolic stroke; among whom the prevalent share is represented by patients with atrial fibrillation. The relationship between acute ischemic cardioembolic stroke associated with atrial fibrillation and intravenous thrombolysis appear still unclear. Our study aims to evaluate the relationship between the post-thrombolysis clinical course and the factors that may influence this course, with particular attention to the difference between stroke patients with a cardioembolic and non-cardioembolic etiology.

**Methods:** The present work is a monocentric retrospective study that evaluates a population of 311 consecutive patients afferent to the Stroke Unit of Sassari from January 2014 to December 2017 with acute ischemic stroke undergoing intravenous thrombolysis. Patients were classified with respect to the etiology of ischemic stroke in atherosclerosis of large vessels, cardioembolism, lacunar and other causes. All patients received an NIHSS evaluation at the time of fibrinolysis and after 2 hours, 24 hours, 7 days after fibrinolysis, and at discharge.

**Results:** We found that the basal NIHSS is higher in the group of patients with cardioembolic stroke, following the group of atherothrombotic strokes and finally of the lacunars; despite of this finding, patients with cardioembolic stroke show a better response to intravenous thrombolytic treatment with a greater reduction of NSAHSS at 7 days and discharge compared to the other two groups.

**Conclusions:** The data from our study seem to show a greater reduction of NIHSS in patients with cardioembolic stroke undergoing thrombolysis, although a higher baseline NIHSS than the other groups.

**Trial registration number:** N/A

## AS17-018

### HIGH-SENSITIVITY CARDIAC TROPONIN LEVELS IN PATIENTS WITH FIRST-EVER ISCHEMIC STROKE AND RISK FOR RECURRENT VASCULAR EVENTS-RESULTS FROM THE 'PROSPECTIVE COHORT WITH INCIDENT STROKE'

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**Background and Aims:** Cardiac troponin is a sensitive biomarker of myocardial injury and linked to embolic stroke in patients with atrial fibrillation. We aimed to assess whether cardiac troponin levels are associated with recurrent vascular events in patients with mild-to-moderate first-ever ischemic stroke.

**Methods:** Between February 2010 and May 2013, 627 patients with first-ever stroke were enrolled in the 'Prospective Cohort with Incident Stroke' (PROSCIS, NCT01363856). Patients were categorized according to quartiles of hs-cTnTas measured with a high-sensitivity assay (hs-cTnT,

Roche Elecsys®). Outcomes of interest were the occurrence of recurrent ischemic stroke or TIA during a 3-year follow-up, and a composite of ischemic stroke, TIA, myocardial infarction (MI) or death. Patients without hs-cTnT measurements, recent MI, and impaired kidney function ( $\text{GFR} < 30 \text{ mL/min}/1.73\text{m}^2$ ) were excluded from analysis. Unadjusted and adjusted Cox proportional hazards regression was used to explore the association between hs-cTnT and the respective endpoint.

**Results:** A total of 562 patients (mean age  $66 \pm 13$  years, 61% male, median NIHSS 2 [IQR 1–4]) were analyzed. During a median follow-up of 3.0 years, recurrent ischemic stroke/TIA occurred in 8.9% ( $n = 40$  with ischemic stroke,  $n = 10$  with TIA), and the combined endpoint in 17.6% of patients (additional  $n = 4$  with MI,  $n = 45$  with death). Compared with the lowest hs-cTnT quartile, hs-cTnT levels in the highest quartile were associated with recurrent ischemic stroke or TIA (unadjusted HR 3.2, 95% CI 1.2–8.2, adjusted HR 3.1, 95% CI 1.1–9.4), and the composite endpoint (unadjusted HR 6.7, 95% CI 3.2–14.2, adjusted HR 5.0, 95% CI 2.2–11.5).

**Conclusions:** In patients with mild-to-moderate first ever stroke, higher hs-cTnT levels are associated with an increased risk of recurrent vascular events. Further studies should explore the utility of hs-cTnT for individual risk stratification.

**Trial registration number:** NCT01363856

## AS17-174

### SELF-RATED HEALTH QUALITY IN YOUNG ESTONIAN STROKE PATIENTS

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**Background and Aims:** The most common aspects in determining the burden of stroke have usually been mortality and disability. Yet self-rated quality of health adds valuable information about stroke survivors' quality of life. We aimed to assess the quality of life in young ischemic stroke patient cohort and compare it to the Estonian general population.

**Methods:** We conducted a postal questionnaire survey in 2014 among ischemic stroke survivors who were treated in Tartu University Hospital and North Estonia Medical Centre from January 2003 to December 2012 and were 18–54 years old at the time of stroke. The questionnaire comprised among other items the 3-level version of EQ-5D. We compared these data to the results of *Health Behavior among Estonian Adult Population* study conducted in 2012 that also comprised the EQ-5D questionnaire.

**Results:** Three hundred and eighty patients and 2776 controls were included in the analysis. Response rate among stroke survivors was 70.2%. After adjusting to age and sex the study population rated their health quality worse in all domains, except pain/discomfort. The largest differences were in the overall health state (OR 6.27; 95% CI 4.80–8.17) and physical domains (usual activities (OR 5.58; 95% CI 4.4–7.13), self care (OR 6.24 95% CI 4.75 – 8.19), mobility (OR 3.84; 95% CI 3.0–4.91)) and to a lesser extent in anxiety/depression.

**Conclusions:** Self-rated health assessment is negatively altered across multiple domains. Although motor recovery rightly receives the greatest emphasis in stroke rehabilitation, other domains are also important and call for the development of effective interventions.

**Trial registration number:** N/A

## AS17-143

### EVALUATION OF BRAIN STEM SIGNS IN POSTERIOR CIRCULATION STROKE AND THEIR CLINICAL RELEVANCE

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#### Background and Aims:

**Background:** Posterior circulation strokes have distinct clinical features, treatment options, and outcome. NIH Stroke Scale (NIHSS) scale is commonly used in clinical trials to objectively quantify the neurological impairment, especially in the anterior circulation strokes. However, in the NIHSS the brainstem signs are mostly neglected.

**Aim:** To assess and quantify the occurrence of brain stem signs and their correlation with clinical outcome in posterior circulation stroke patients.

**Methods:** A Retrospective monocentric study evaluating patients with brain imaging proven posterior circulation stroke. Evaluated brain stem signs were gait ataxia, diplopia, nystagmus, internuclear ophthalmoplegia, skew deviation, vertical and horizontal gaze paresis, Horner syndrome, palatal and tongue paresis, dysphonia, hypoacusis, and vertigo.

**Results:** 154 patients with posterior circulation stroke were included, 70.8% of patients had at least one brainstem signs, 22.1% of patients had  $>3$  brainstem signs. The most common were vertigo (48.1%), ataxia (34.4%), and diplopia (9.1%). Good outcome in 90 days (mRS 0–2)/poor outcome (mRS 3–6) had 110/44 patients respectively; mean age was 63.05/73.7 ( $p < 0.001$ ) years; 35.5/38.6% ( $p = 0.71$ ) underwent recanalisation; mean of onset NIHSS was 3.65/12.05 ( $p < 0.001$ ) points, and mean total of brainstem signs was 1.89/1.41 ( $p = 0.053$ ).

**Conclusions:** There were no significant differences in the presence of brain stem signs between patients with good and poor clinical outcome. The only significant difference was admission NIHSS and age. A larger prospective study is needed to assess the influence of brain stem signs on more inconspicuous disability outcomes of posterior strokes.

**Trial registration number:** N/A

## AS17-026

### LONG TERM QUALITY OF LIFE AND DISABILITY AFTER EARLY INSTITUTIONAL REHABILITATION OF SEVERE STROKE

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<sup>1</sup>Asklepios Klinik Nord- Heidberg, Neurologie und Neurologische Frührehabilitation, Hamburg, Germany; <sup>2</sup>Asklepios Klinik Hamburg-Harburg, Sektion Frührehabilitation, Hamburg, Germany; <sup>3</sup>Asklepios Klinik St. Georg, Fachübergreifende Frührehabilitation und Physikalische Medizin, Hamburg, Germany; <sup>4</sup>ASKLEPIOS proresearch, ASKLEPIOS proresearch, Hamburg, Germany; <sup>5</sup>Asklepios Kliniken Hamburg GmbH, Konzernbereich Qualität, Hamburg, Germany

**Background and Aims:** There is limited information on long term effects on quality of life after severe stroke followed by early institutional rehabilitation.

**Methods:** Analysis of the Asklepios Hamburg multicenter early stroke rehabilitation registry. Early rehabilitation Barthel index (ERBI), 12-Item Short Form Health Survey (SF-12) and further treatment and complications were recorded three and twelve months after discharge by phone interviews. We used descriptive statistics as well as t-test, Kendalls method and an ordinal logistic model.

**Results:** 270 stroke patients were enrolled between 10/2015 and 11/2017 and contacted until 02/2018. 200 and 151 patients could be

followed up after 3 and 12 months, respectively. 70 and 12 patients were lost in follow-up, 14 and 28 patients died after 3 and 12 months, respectively. There was a significant improvement ( $p < 0.001$ ) in the median ERBI (151 survivors at 12 months: admission in early rehabilitation: -10, discharge +30, 3 months: +45, 12 months: +55). Factors influencing a higher mRS at 12 month were female sex (OR 0.486 [0.247, 0.958];  $p = 0.04$ ) and age (OR of a 10 years older person 1.495 [1.094, 2.023];  $p = 0.01$ ). Quality of life (QOL, SF12) did not change significantly (3 vs. 12 months). Mental QOL showed no difference compared to a historical low-handicapped collective (Lingnau and Hesse 2004), physical QOL was expected to be significantly lower ( $p < 0.001$ ).

**Conclusions:** Surviving severe stroke patients recover significantly up to 12 months after discharge. The mental QOL surprisingly does not differ from a historical stroke collective despite lower physical QOL.

The study is sponsored by Asklepios Kliniken Hamburg.

**Trial registration number:** N/A

#### AS17-098

#### LONG-TERM OUTCOME AFTER STROKE IN RELATION TO COMORBIDITY – AN OBSERVATIONAL STUDY FROM THE SWEDISH STROKE REGISTER (RIKSSTROKE)

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**Background and Aims:** Comorbidity in stroke is common, but comprehensive reports on how comorbidity affects long-term mortality and functional outcome are sparse. We describe both survival and functional outcome in relation to comorbidity level in a large unselected stroke cohort.

**Methods:** We used data from a long-term follow-up survey conducted in 2016 in the Swedish Stroke Register (Riksstroke) on patients with stroke three and five years earlier. We included 13 496 pre-stroke functionally independent patients with first-ever stroke followed up at three months, 12 months, three years (2013 cohort only) and five years (2011 cohort only). Data on 16 pre-stroke chronic conditions were obtained from the Swedish National Patient Register (not including primary care) and the Riksstroke register. Individuals were grouped according to comorbidity burden (number of conditions): none (0), low (1), moderate (2–3) or high (4 or more). Functional outcome was estimated using the modified Rankin Scale and functional dependency was defined as mRS 3 or higher.

**Results:** The proportion of patients without comorbidity was 25.9%, 31.4% had low comorbidity, 32.6% moderate comorbidity and 10% had high comorbidity. At 12 months, the proportion of poor outcome (dead or functionally dependent) was 29% (no comorbidity), 37% (low), 47% (moderate) and 61% (high). At five years these proportions were 40%, 52%, 66%, and 82% respectively. This increasingly poor prognosis was largely driven by mortality rates.

**Conclusions:** A high comorbidity burden more than doubled the risk of poor outcome in the mid- and long term after stroke. The importance of comorbidities in stroke warrants further attention.

**Trial registration number:** N/A

#### AS17-196

#### S100B SERUM ELEVATION PREDICTS INHOSPITAL MORTALITY AFTER BRAIN ARTERIOVENOUS MALFORMATION RUPTURE

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**Background and Aims:** Clinical, demographic and imaging prognostic markers after brain arteriovenous malformation (BAVM) rupture have been repeatedly reported. The purpose of this study is to determine whether elevation of S100B is associated with increased inhospital mortality after BAVM rupture.

**Methods:** This is a retrospective study of patients admitted for BAVM rupture in a tertiary-care center between 2003 and 2018. Demographic, clinical, imaging and biological data was analyzed. Association between S100B protein serum level and inhospital mortality was studied. The study population was divided into derivation and validation cohorts. Univariate followed by multivariate logistic regression analysis was used to determine whether elevation of S100B serum levels above 0.5 µg/L during the first 48 hours after admission was associated with inhospital mortality.

**Results:** Two hundred and three BAVM rupture events met inclusion criteria. Twenty three hemorrhages led to inhospital mortality (11%). The mean highest S100B serum concentration within the first 48 hours after admission ( $S100B_{max48}$ ) was  $0.49 \pm 0.62 \mu\text{g/L}$ . In the derivation cohort, multivariate stepwise logistic regression found only initial Glasgow coma scale  $\leq 8$  (OR 21, 95% CI [2-216],  $P = 0.001$ ) and an  $S100B_{max48}$  value  $> 0.5 \mu\text{g/L}$  (OR 19, 95% CI [2-188],  $P = 0.001$ ) to be independently and significantly associated with inhospital mortality. When applied to the validation cohort, this same model found only  $S100B_{max48}$  value  $> 0.5 \mu\text{g/L}$  (OR 8, 95% CI [1.5-44],  $P = 0.01$ ) to be associated with inhospital mortality.

**Conclusions:** An elevated S100B protein serum level is strongly associated with inhospital mortality after BAVM rupture.

**Trial registration number:** N/A

#### AS17-045

#### DEHYDRATION IS ASSOCIATED WITH MORE SEVERE ISCHEMIC STROKE ON HOSPITAL ADMISSION

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**Background and Aims:** Dehydration in acute ischemic stroke may worsen neurological deficits due to the reduction of cerebral blood flow and extent of infarct volume. Although there is no gold standard for assessing dehydration, high plasma BUN (Blood Urea Nitrogen)/creatinine ratio is widely used as dehydration marker in clinical settings. This study investigates the association between dehydration and stroke ischemic severity on hospital admission.

**Methods:** This is a cross-sectional study, 48 acute ischemic stroke subjects who admitted at Dr. Sardjito Hospital Yogyakarta on April 2018 – September 2018 were eligible. BUN, creatinine level and stroke severity were measured at the time of admission. We defined dehydration if plasma BUN/creatinine ratio  $\geq 15$ . Stroke severity was assessed using NIHSS (National Institutes of Health Stroke Scale). Clinical data were analyzed using univariate and multivariate statistical analysis.

**Results:** Twenty three (47.9%) subjects were dehydrated and 25 (52.1%) subjects were non-dehydrated on hospital admission. Dehydrated subjects are associated with higher NIHSS score on admission than

non-dehydrated ( $9.39 \pm 1.8$  vs.  $2.96 \pm 0.34$ ,  $p = 0.001$ , 95% CI [2.4–10.4]). Multivariate linear regression showed that dehydration is independently associated with NIHSS score on admission ( $p = 0.041$ )

**Conclusions:** Dehydration is associated with more severe ischemic stroke on hospital admission

**Trial registration number:** N/A

## AS17-126

### BIOCHEMICAL ASPIRIN RESISTANCE: PREVALENCE AND CLINICAL OUTCOME IN INDIAN PATIENTS WITH ISCHEMIC STROKE

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#### Background and Aims:

**Background:** Aspirin is used in ischemic stroke therapy. However, some patients are not responsive to the antithrombotic action of aspirin.

**Aim:** The aim of this study was to estimate the prevalence of biochemical aspirin resistance among patients with ischemic stroke and evaluate its impact on clinical outcome.

**Methods:** Methodology: This is an interim analysis from an ongoing study. Patients with ischemic stroke receiving aspirin therapy alone for at least 7 days and within 30 days of the stroke event were enrolled in the study. Aspirin responsiveness was determined by light transmission aggregometry and was classified as aspirin resistance, aspirin semiresistance and aspirin sensitive using standard definitions. Clinical outcome was measured using modified Ranking Score at 3 months and one year

**Results:** Data of 184 patients is presented. There were 129(71%) males and 55(29%) females, mean age of patients is  $54 \pm 14.8$  years. 29 (15.7%) patients were resistant to aspirin; 42(22.8%) patients were semiresistant to aspirin; 113(61.4%) patients were sensitive to aspirin. Statistically, there was no significant difference in the patients with good outcome (mRS 0–2) and poor outcome (mRS 3–6) between the two group. The mortality rate was higher in the aspirin resistance group than aspirin sensitive group. Statistically significant difference was observed between both the groups ( $p = 0.01$ ). Recurrence of stroke was reported in 13 patients; 8 patients were aspirin resistant and 5 patients were sensitive to aspirin ( $p = 0.06$ )

**Conclusions:** Interim analysis suggests that biochemical aspirin resistance is not uncommon in acute ischemic stroke patients and is associated with short and long term mortality and recurrence of stroke in these patients.

**Trial registration number:** NA

## AS17-056

### RACE DIFFERENCES IN POST-STROKE DISABILITY AMONG LONG TERM STROKE SURVIVORS

L. Skolarus<sup>1</sup>, C. Feng<sup>1</sup> and J. Burke<sup>1</sup>

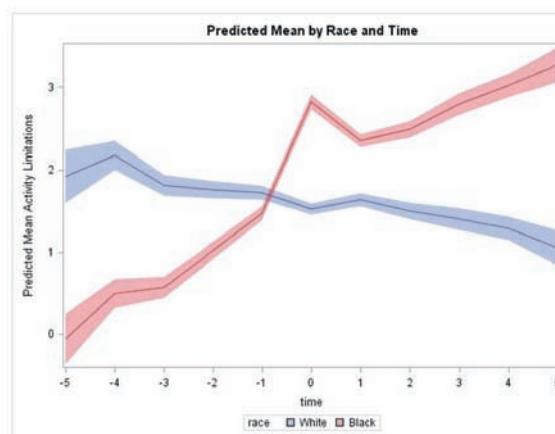
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**Background and Aims:** African Americans have greater disability and short term mortality after stroke than White Americans. Differential pre-stroke disability, long term mortality, post-stroke recovery and selection bias due to nursing home placement may contribute to racial differences. In longitudinal analyses, we assessed race differences in mortality, nursing

home placement and disability among older adult stroke survivors who survived at least 90 days post-stroke.

**Methods:** United States national data of stroke survivors from the National Health and Aging Trends Study (2009–2015) linked to Medicare were used. Stroke survivors were defined in Medicare using a claims-based definition of an ischemic stroke or intracerebral hemorrhage hospital admission. Disability was a count of self-care and mobility limitations (0–7). We used cox proportional hazards models to assess mortality and nursing home admission and multi-level linear regression models to assess disability adjusting for sociodemographics, co-morbidity, hospitalization factors, utilization and intensity of rehabilitation, and readmissions.

**Results:** There were 282 stroke survivors, representing about 775,000 stroke survivors, of which 12.6% were African American. There were no race differences in mortality (HR for Black = 1.16,  $P = 0.63$ ) or nursing home placement (HR for Black = 1.09,  $P = 0.75$ ). African Americans experienced greater post-stroke disability than white Americans most of which occurred in the first year after stroke (Figure).



**Conclusions:** Race differences in post-stroke disability emerge in the peri-stroke period and appear not to be strongly influenced by differential mortality after 90 days or nursing home placement. Further study on factors such as responsiveness to rehabilitation therapy and preferences for life sustaining procedures is warranted.

**Trial registration number:** N/A

## AS17-180

### ENDOVASCULAR TREATMENT IN BASILAR ARTERY OCCLUSION – RESULTS FROM THE AUSTRIAN ENDOSTROKE REGISTRY

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**Background and Aims:** There is limited evidence whether mechanical thrombectomy (TE) is beneficial for patients with basilar artery occlusion (BAO). Previous studies have shown that intraarterial lysis ± endovascular treatment may not be superior to intravenous thrombolysis (IVT). Our aim was to analyze rates of recanalization after TE in BAO and functional outcome after 3 months compared to proximal intracranial occlusion of the anterior circulation (ACS).

**Methods:** The Austrian Endostroke Registry is part of the Austrian Stroke Unit Registry. We analyzed data of all patients enrolled to the Austrian Endostroke Registry with acute ischemic stroke caused by occlusion of intracranial artery. Recanalization rates were classified

according to the Thrombolysis in Cerebral Infarction Scale (TICI) and the functional outcome measured by the modified Rankin Scale (mRS).

**Results:** From 2013- 2017 1876 patients underwent thrombectomy for ischemic stroke with proximal vessel occlusion. Of those, 206 were treated for BAO and 1651 for ACS. Overall, baseline characteristics were comparable in patients with BAO and ACS (ACS: median age = 73, median NIHSS 16, BAO: median age = 73, median NIHSS = 16). Recanalization rates were similar (BAO: TICI 2b-3 = 77.1%, ACS = 76%, respectively). Symptomatic intracranial bleedings rates were low in both groups (3.6% vs 6%). After 3 Months 36.4% of patients with BAO and 40% of patients with ACS were functional independent (mRS 0–2) and 28.1% respectively 28.7% had an excellent outcome (mRS 0–1). Mortality rates (mRS 6) were higher in BAO (BAO: 39.7%, ACS: 24.2%).

**Conclusions:** Functional outcome after mechanical thrombectomy was comparable in BAO and ACS; however, mortality was substantially higher in BAO.

**Trial registration number:** N/A

## AS17-179

### MEAN PLATELET VOLUME IS A PROGNOSTIC MARKER IN PATIENTS WITH ISCHAEMIC STROKE TREATED WITH rtPA

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**Background and Aims:** Previous studies suggest that mean platelet volume (MPV), platelet count (PC) and platelet distribution width (PDW) may be associated with the prognosis of ischemic stroke, but there is no data in patients treated with rtPA. We aimed to analyse the association between platelet parameters and prognosis of this group of patients.

**Methods:** Retrospective, observational study in adult ischemic stroke patients treated with rtPA between January 2015 and February 2017. We recorded demographic characteristics, vascular risk factors, stroke severity (NIHSS), aetiology (TOAST), platelet parameters (MPV, PC, PDW) within the first 72h of stroke, other reperfusion treatments, ECASSII classification, and functional outcome (mRS) at discharge. The association between platelet parameters and unfavourable prognosis (mRS>2) was tested using non-parametric tests and logistic regression analysis.

**Results:** 267 patients were included, 134 (50.2%) females, and the median (IQR) age was 74 years (64–82). The median admission NIHSS was 14 (8–19); 87 (32.6%) patients underwent endovascular therapy. The most frequent aetiology was cardioembolism ( $n=115$ , 43.1%). At discharge, 170 (63.7%) patients had mRS>2. MPV values were higher in patients with mRS>2 (median 8.2fL versus 7.8fL,  $p=0.013$ ). This association remained significant ( $OR=1.39$ , 95% CI 1.02–1.90,  $p=0.037$ ) after adjustment for variables associated with prognosis. There were no significant associations between other platelet parameters and prognosis.

**Conclusions:** High MPV values were associated with unfavourable prognosis in patients treated with rtPA. Future studies should confirm whether this biomarker adds predictive value in prognostic models of stroke patients treated with rtPA.

**Trial registration number:** N/A

## AS17-060

### ANTI-NMDA-RECEPTOR ANTIBODY SEROPOSITIVITY AND COGNITIVE FUNCTION OVER TIME IN FIRST-EVER STROKE PATIENTS (PROSCIS-B)

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**Background and Aims:** Anti-NMDA-receptor GluN1 antibodies (NMDAR-Abs) are prevalent in serum of healthy elderly people. We recently demonstrated that seropositivity is associated with unfavorable functional outcome and recurrent vascular risk after stroke (unpublished). Here, we aimed to estimate the impact of NMDAR-Abs on cognitive function over time after first-ever ischemic stroke.

**Methods:** Data were collected from 2010 to 2013 for the PROSpective Cohort with Incident Stroke Berlin study and NMDAR-Abs were measured from serum using cell-based assays. We assessed cognitive function annually up to three years after stroke using the Telephone Interview for Cognitive Status-modified (TICS-m). To estimate the effect of seropositivity on TICS-m over time, we performed adjusted linear mixed models on available observations. We further conducted a crude sub-group analysis comparing patients with low titers (1:10; 1:32; 1:100) and high titers (1:320; 1:1000) to seronegative patients.

**Results:** Out of 621 (NIHSS < 16) ischemic stroke patients (mean age: 67, 39% female, median NIHSS: 2 IQR: 1–4, median MMSE: 28 IQR: 26–30), 583 had an antibody measurement. Of those, 76 (13%) were seropositive (IgM:n = 49; IgA:n = 43; IgG:n = 2; Titer  $\geq 1:10$ ). Overall seropositivity was not associated with TICS-m scores over time (adjusted for: age, sex, education;  $\beta = 0.219$ , 95% CI: -1.041; 1.479). In a crude subanalysis, low titers were not associated with TICS-m over time ( $\beta = 1.590$ , 95% CI: 0.012; 3.192) and high titers with a 2.481 points (95% CI: -4.959; -0.004) decrease in TICS-m scores over time compared to seronegative patients.

**Conclusions:** Our study did not show an association of overall NMDAR-Abs seropositivity and cognitive function over time after mild-to-moderate first-ever ischemic stroke. Whether cognitive function declines in patients with high titers needs to be addressed in larger studies.

**Trial registration number:** (PROSCISB; NCT01363856)

## AS17-079

### ATTITUDES AND CURRENT PRACTICE OF END OF LIFE CARE IN STROKE PATIENTS: A QUESTIONNAIRE SERVICE EVALUATION

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**Background and Aims:**

**Background:** End of life care is a major aspect in the management of acute stroke, presenting challenges for both medical and nursing staff. The aim of this service evaluation was to investigate staff experiences of end of life care in acute stroke setting at a teaching hospital in South West Wales.

**Methods:** The study involved the use of a questionnaire, composed of 16 close-ended questions using a likert-scale for the staff responses. Participants were asked to complete the questionnaire before and after 'a tailored end of life care for stroke training session'. The data from the questionnaires were quantitatively analysed to identify staff attitudes, management practices, perceived barriers in end of life care and impact of targeted training.

**Results:** The respondents included 16 doctors, 18 nurses, 20 healthcare support workers (HCSV) based on the stroke ward. The biggest differences observed in the staff responses were in their readiness to support families and in decisions around appropriate medication management and nutrition/hydration. Out of all staff groups, Nurses appeared to be more confident in these areas. In other domains such as satisfaction with basic training and confidence in delivering end of life care, little differences were observed between doctors, nurses and HCSV.

**Conclusions:** Discussion The results of our study indicate that end of life care is not straightforward. The biggest impact of specific end of life training was observed in staff confidence in dealing with families and management of medication and nutrition during end of life care.

**Trial registration number:** N/A

**AS17-066**

## RECURRENT AND NON-RECURRENT STROKE HAD DIFFERENCES CARDIOVASCULAR RISK FACTORS: RESULTS FROM ONE ISCHEMIC STROKE REGISTRY IN A SOUTHEAST ASIA COUNTRY

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**Background and Aims:** Patients with a history of recurrent stroke had highest risk for developing new episode of recurrent. Possibility, they had multiplex cardiovascular disease (CVD) risk factors. Few studies in Southeast Asian examined CVD risk in recurrent stroke. We compared the prevalence and amount of CVD risk among ischemic stroke with a history of recurrent versus non-recurrent.

**Methods:** We included 3,135 ischemic strokes, who were admitted to a tertiary care hospital in Southern Thailand during October 2011 to February 2016. Approximately 11% (n=339) were recurrent. Five CVD risk were identified based on the Essen Stroke Risk Score included hypertension, diabetes, previous myocardial infarction (MI), peripheral arterial disease, and others CVD except MI and atrial fibrillation (AF). Other four were AF, hypercholesterolemia, smoking, and alcohol drinking.

**Results:** There were more elderly in recurrent group (OR 1.29, 95% CI 1.05-1.58), compared with non-recurrent. Recurrent group had higher rates of hypertension (OR 2.17, 95% CI 1.71-2.75), diabetes (OR 1.36, 95% CI 1.09-1.69), AF (OR 1.81, 95% CI 1.22-2.71), hypercholesterolemia (OR 2.14, 95% CI 1.75-2.62), and smoking (OR 1.30, 95% CI 1.06-1.59]. Non-recurrent had higher rates of MI (OR 1.12, 95% CI 1.11-1.13), and

others CVD (OR 1.12, 95% CI 1.11-1.13). Recurrent group had a greater number of CVD risk (mean  $\pm$  SD, 2.49  $\pm$  1.34 vs 1.94  $\pm$  1.22, t=7.24, p = 0.000), compared with non-recurrent group.

**Conclusions:** Multiplex CVD risk in recurrent stroke was found in our studied. Hypertension, diabetes, hypercholesterolemia, AF, and smoking were five among nine common CVD risk among recurrent stroke. Specific CVD risk reduction protocols are needed to implement in order to prevent stroke recurrent.

**Trial registration number:** N/A

**AS17-108**

## STROKE PATIENTS ON ANTICOAGULANTS: OUTCOMES OF A LEVEL A STROKE UNIT

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**Background and Aims:** Evaluate the differences of outcome and hemorrhagic complications between the two types of oral anticoagulants (OACs) in stroke patients.

**Methods:** A retrospective observational study was performed. Data of patients on OACs admitted in a level A Stroke Unit from 01/01/2016 to 31/08/2018 for ischemic and hemorrhagic stroke was collected. Only patients whose rationale for anticoagulation was atrial fibrillation were included. Statistical analysis was performed using SPSS Statistics 23®. Chi-square and Mann-Whitney tests were used for bivariate analyses and binary logistic regression for multivariate analyses (p < 0.05).

**Results:** Table 1: Descriptive analysis

	Ischemic (n = 174)	Hemorrhagic (n = 31)
Mean age	76.8 years ( $\pm$ 8.7)	77.8 ( $\pm$ 6.9)
Male	39.1%	40.0%
Direct-oral-anticoagulants	46.8%	44.0%
Mortality	8.7%	16.0%
mRankin>2	11.0%	24.0%
Cardiovascular-risk-factors>3	39.3%	28%
Previous cerebral-vascular-disease	41.0%	24.0%

In the ischemic group mortality was associated with hemorrhagic transformation (HT, p = 0.005) and with anticoagulant type (p = 0.019). In a multivariate model adjusted for age, CVRFs and reperfusion therapy, HT (OR 9.2, 95% CI 2.0-43.2, p = 0.005) and vitamin-K-antagonists (OR 9.3, 95% CI 1.1-80.4, p = 0.043) were predictors of mortality. HT was not associated with anticoagulant type. Reperfusion therapy (n = 75; 44% DOACs) was positively associated with HT (p = 0.013) and neurologic improvement (p < 0.001), but not with mortality. Reperfusion therapy was also a predictor of neurologic improvement (OR 12.8, 95% CI 5.1-32.0, p < 0.001) when adjusted for the previous confounders, but not of HT.

In the hemorrhagic group no association was found between anticoagulant type and mortality or neurologic improvement.

**Conclusions:** In this sample direct-oral-anticoagulants and reperfusion therapy were associated with better outcome.

**Trial registration number:** N/A

**AS17-198****RISK FACTORS FOR EARLY READMISSION OF ISCHEMIC STROKE PATIENTS IN A PERIPHERAL PORTUGUESE HOSPITAL****I. Taveira<sup>1</sup>, C. Vicente<sup>1</sup>, H. Nzwalo<sup>2</sup> and J. Sousa e Cosra<sup>1</sup>**<sup>1</sup>Stroke Unit- Litoral Alentejano Hospital, Internal Medicine Department, Santiago do Cacém, Portugal; <sup>2</sup>Stroke Unit- Litoral Alentejano Hospital, Neurology, Santiago do Cacém, Portugal

**Background and Aims:** Stroke mortality decreased over the last years due improved quality of acute care. The immediate post-discharge phase is complex and if not properly planned, medical complications can occur leading to Hospital Readmission (HR). Identification of these factors is important to prevent hospital readmissions and improve long-term prognosis.

**Methods:** Retrospective study of a population representative consecutive acute ischemic stroke (AIS) survivors (2012–2015) in Alentejo, Portugal. Logistic regression analysis was used to identify sociodemographic (age, residence, gender), clinical (Charlson Comorbidity Index, discharge mRS, Bamford type, etiology) and process of care (discharge destination) predictors of very early ( $\leq 7$  days) and early (7–30 days) HR. **Results:** Of the 780 patients discharged, 424 (54%) males, mean age 77, 1,9% (n=15) were very early readmitted, mostly due to infections (n=10) and 3,7% (n=29) early readmitted, mainly for non-infectious causes (n=16). Predictors of very early HR were discharge to nursing home (OR = 13.32, CI 2.59-68.44, p=02), particularly when only infections causes of HR were considered (OR = 16.47, CI 1.78-152.66, p = 14). Discharge to nursing home and specific AIS aetiologies – para-neoplastic (OR = 20.97, CI 3.00-146.79, p = 002), undetermined aetiology (OR = 6.41, CI 1.41-29.12, p = 016) increased the likelihood of early HR.

**Conclusions:** Our results suggest that the quality of care during the transition period and/or the persistence of unsolved medical problems may account for very early and early HR among AIS survivors.

**Trial registration number:** N/A

**AS17-049****RISK FACTORS FOR RECURRENT ISCHAEMIC STROKE AT LONG-TERM FOLLOW UP****G. Tekgol<sup>1</sup>, Y. Tehli<sup>1</sup> and N. Uzuner<sup>1</sup>**<sup>1</sup>Eskisehir Osmangazi University, Neurology, Eskisehir, Turkey

**Background and Aims:** The advanced age, diabetes mellitus, previous myocardial infarction, smoking, and atrial fibrillation are risk factors of ischaemic stroke recurrence. We aimed to find which risk factors are associated with the recurrent ischaemic stroke at long-term follow-up after the first-ever stroke.

**Methods:** We defined the ischaemic stroke patients in our stroke registry data bank, and the suitable patients were followed for recurrent ischaemic stroke beginning at 2008. Although our regular follow-up time is about nine months, this study consists of 264 patients who were followed over nine months after the first-ever stroke.

**Results:** Seventy patients (26.5%) had a recurrent ischaemic stroke after nine months after the first-ever ischaemic stroke. The mean time for late stroke recurrence was 28 months. There are no significant known risk factors for very late recurrence.

**Conclusions:** This study clearly showed that well management of the risk factors of the ischaemic stroke keeps from the late recurrence of the ischaemic stroke even they are under irregular follow-up.

**Trial registration number:** N/A

**AS17-015****MECHANICAL THROMBECTOMY IN THE ACUTE PHASE OF STROKE IN ELDERLY PATIENTS: EXPERIENCE AT OUR HOSPITAL****M. Altuna Azkargorta<sup>1</sup>, J. Timiraos Fernandez<sup>1</sup>,****A. Cruz Nuñez<sup>1</sup>, F.J. Maynar Moliner<sup>2</sup> and F. López Zarraga<sup>2</sup>**<sup>1</sup>Hospital Universitario Araba, Neurology, Vitoria-Gasteiz, Spain;<sup>2</sup>Hospital Universitario Araba, Interventional Radiology, Vitoria-Gasteiz, Spain

**Background and Aims:** Ischemic stroke with large artery occlusion frequently affects the elderly population. Advanced age is not an exclusion criterion for recanalizing treatment by mechanical thrombectomy.

**Aims:** To describe the experience of the first 3 years of performing mechanical thrombectomy in our hospital.

To analyze the possible differences in vital and functional prognosis that may exist in elderly patients.

**Methods:** Observational study based on prospective data. Ischemic strokes treated in our hospital with mechanical thrombectomy from March 2015 to September 2018 have been analyzed.

**Results:** Sample of 137 patients. 67 women and 70 men. Average age of 71.50 years (27–97): 46 patients older than 80, 19 older than 85 and 7 older than 90 years. At inclusion the average score of NIHSS was 15.41(2–29), no differences among patients under and over 80 and 85-years-old ( $p = 0.242$ ); and the average score of mRankin was 0.57(0–3), significantly higher in the elderly ( $p = 0.008$ ).

The mortality was 42/137(30.66%). No differences between patients over and under 80 and 85 years old ( $p = 0.953$ ). Most of the deaths occurred in the first month.

56.1% of the survivors at discharge had a mRankin 0–2, no differences among over and under 80 and 85 years old ( $p = 0.695$ ).

NIHSS $\geq 10$ ( $p = 0.05$ ) as well as mRankin $\geq 3$ ( $p = 0.001$ ) are predictors of mortality in all age groups. Treatment with oral anticoagulants at the time of stroke is associated with higher mortality ( $p = 0.032$ ) but not worse functional prognosis in all age groups.

**Conclusions:** Our results support that advanced age should not limit access to mechanical thrombectomy whenever indicated.

**Trial registration number:** N/A

**AS17-016****PREVALENCE AND REPERCUSSION OF COGNITIVE-BEHAVIORAL SYMPTOMS IN PATIENTS WITH ISCHEMIC STROKE TREATED WITH MECHANICAL THROMBECTOMY****M. Altuna Azkargorta<sup>1</sup>, J. Timiraos Fernandez<sup>1</sup>,****A. Cruz Nuñez<sup>1</sup>, F.J. Maynar Moliner<sup>2</sup> and F. López Zarraga<sup>2</sup>**<sup>1</sup>Hospital Universitario Araba, Neurology, Vitoria-Gasteiz, Spain;<sup>2</sup>Hospital Universitario Araba, Interventional Radiology, Vitoria-Gasteiz, Spain

**Background and Aims:** The cognitive-behavioral sequelae of ischemic stroke are underdiagnosed and incorrectly treated, having a great impact on the quality of life of the patients and their relatives.

**Aims:** To study the prevalence of cognitive-behavioral symptoms and its repercussion in patients with ischemic stroke treated with mechanical thrombectomy.

**Methods:** Observational study based on prospective data. Ischemic strokes treated in our hospital with mechanical thrombectomy from March 2015 to September 2018, with minimum follow-up at discharge of 3 months, have been analyzed.

**Results:** Sample of 137 patients. 67 women and 70 men. Average age of 71.50 years (27–97). At inclusion average mRankin was 0.57(0–3) and at discharge 56.1% had mRankin $\leq 2$ .

Before the stroke only 8% required a caregiver and after up to 38%. In up to 28% a relative had to readjust their job and the adaptation of the home was necessary in 22% of the cases.

50% suffered a change in their character or behavioral symptoms, most frequently sadness (38.5%), apathy (42%) and irritability (46.2%). 52% refer worsening of sleep quality, 50% fatigue and 32% neuropathic pain. Up to 44% renounce some of their hobbies and/or domestic responsibilities.

44% report cognitive worsening especially of executive functions.

**Conclusions:** Our study reveals the importance of non-motor symptoms, which are not assessed by mRankin scale.

Sadness, apathy and irritability as well as cognitive worsening after ischemic stroke are frequent symptoms, directly affecting patient's quality of life, diminishing their autonomy, and the lives of their relatives and/or caregivers. The correct and early identification of them can allow to start the best treatment and improve prognosis.

**Trial registration number:** N/A

## AS17-192

### THE CONTRIBUTION OF CHOLESTEROL LEVELS TO THE SHORT- AND LONG-TERM PROGNOSIS OF ISCHEMIC STROKE

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**Background and Aims:** We assessed the impact of total cholesterol levels (TChol) on the prognosis of patients with a first-ever ischemic stroke (FEIS).

**Methods:** Prospective population-based registry including all residents with a FEIS in 2011–2013 followed up to 2018. Values of TChol < 200 mg/dL were considered normal, regardless of statin treatment at stroke onset.

**Results:** Out of 919 patients with a FEIS, TChol was available in 759 (82.6%), and was normal in 511 (67.3%) and high in 248 (32.7%). Compared with those with high TChol, patients with normal values were older, had more severe strokes and higher proportion of atrial fibrillation leading to a higher proportion of cardioembolic strokes ( $P < 0.05$  for all comparisons). Besides, patients with normal TChol had worse 30-day ( $P = 0.001$ ), 1-year ( $P = 0.002$ ), and 5-year CFRs ( $P < 0.001$ ) and stroke recurrence probability at 30 days ( $P < 0.001$ ) and at 1-year ( $P < 0.001$ ) compared to those with high values. The Cox analysis showed that age (HR 1.03, 95% CI 1.01–1.05), atrial fibrillation (HR 1.39, 95% CI 1.07–1.80), and diabetes mellitus (HR 1.43, 95% CI 1.08–1.89), but not normal Chol were independent predictors of 5-year mortality. Notably, patients with normal TChol had worse 30-day (20.4% vs 6.9%), 1-year (30.9% vs 13.7%), and 5-year (47.5% vs 28.4%) CFRs than those under effective statin treatment ( $P < 0.05$  for all comparisons).

**Conclusions:** Our results suggest that normal Chol values are associated with a higher probability of stroke recurrences and of reduced survival after the FEIS, possibly depending on older age and higher rate of cardiac embolism.

**Trial registration number:** NA

## AS17-176

### RESCUED BY RES-Q. IMPROVEMENT IN QUALITY OF STROKE CARE IN ROMANIA FOLLOWING DATA ANALYSIS FROM RES-Q REGISTRY

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**Background and Aims:** Incidence of stroke is very high in Romania, with high mortality and a high level of disability in survivors

**Methods:** Registration of quality stroke care indicators in RES-Q Registry, regarding all types of stroke, every year in March, was performed in 10 centers in 2017 and 2018. Data are presented by comparison, first figure corresponding to 2017, the second to 2018

**Results:** Total number of patients was 1060/1590, figures considered country representative. Subarachnoid hemorrhage and cerebral venous thrombosis were also registered. Female represented 52/50,2%, median age was 70,3/72 years. More patients were hospitalized in 2018 in stroke units or monitored beds (26,82/30,94%), although with great variability between centers. Performing NIHSS score at admittance increased significantly 54,72/80,08% and also the dysphagia screening in the first 24 hours 1,99/47,87%. Intravenous thrombolysis is still insufficiently administered, but has increased from 2,24 to 5,19%. Median DTN time decreased from 67 to 58 min. There are still many things to improve, such as revascularization for carotid stenosis, but medical treatment is prescribed at discharge, according to the guidelines, in more than 80% of the patients. Evaluation for rehabilitation was performed during hospitalization in 35,16/38,36% but unfortunately discharge destination was at home for 70,3/78,6 %, because there are not enough facilities for neuro-rehabilitation. Mortality was not influenced significantly (15,09/14,59%)

**Conclusions:** Registering data for quality of stroke care is essential for identifying dysfunctional areas in hospital care for stroke patients. Certain depend on economic conditions but others can be improved by repetitive training and by implementing standardized procedures.

**Trial registration number:** N/A

## AS17-184

### COLLATERAL CIRCULATION EVALUATED WITH PATHS IN MCA STROKE: DOES MODIFIABLE FACTORS REALLY EXIST IN ACUTE PHASE?

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**Background and Aims:** The collateral circulation (CC) is paramount for stroke prognosis. However, which factors determine CC grade in acute ischemic stroke (AIS) is still a matter of discussion, with few large studies reporting controversial results. We aimed to identify the factors related to CC status in stroke, especially those that could be modifiable during AIS phase.

**Methods:** Retrospective study of patients with MCA stroke and M1/terminal carotid occlusion treated with thrombectomy in our center. Data were retrospectively recorded. For CC assessment we used PATHS scale, a new scale applied on CT perfusion source images, allowing a dynamic evaluation of CC in three critical regions. We analyzed the correlation of CC status with baseline characteristics, previous treatment, laboratory tests, clinical features and radiological data. 52 variables were studied.

**Results:** N:202. Mean age:72 years (59–80), women 57,4%. In univariate analysis worse CC status was associated with contralateral carotid

stenosis ( $p = 0,035$ ), previous stroke ( $p = 0,009$ ), baseline mRS > 1 ( $p = 0,013$ ), higher age ( $p = 0,034$ ), calcium-channel blockers intake ( $p = 0,037$ ), higher glycaemia ( $p = 0,009$ ) and creatinine ( $p = 0,038$ ) levels, lower albumin ( $p = .030$ ) levels, shorter evolution times ( $p = 0,010$ ), higher NIHSS ( $p < 0,001$ ), lower percentage of rt-PA treatment ( $p = 0,038$ ), terminal carotid occlusion ( $p = 0,002$ ), lower ASPECTS ( $p < 0,001$ ), larger CBV-core infarction ( $p < 0,001$ ) and larger white matter vasculopathy ( $p = 0,025$ ). We did not find association with blood pressure. In multivariate analysis just age, glycaemia, ASPECTS and CBV-core reached statistical significance.

**Conclusions:** In our study factors associated with previous cerebrovascular injury were related to CC function in AIS phase so they cannot be modified. Interestingly we identified a relationship between glycaemia levels and CC. More studies are warranted to define targets that could enlarge ischaemia tolerance through CC modification.

**Trial registration number:** N/A

### AS17-141

#### SYNERGISTIC EFFECTS OF ELEVATED LIPOPROTEIN(A) LEVELS AND RENAL IMPAIRMENT ON CARDIOVASCULAR RISK OR DEATH IN FIRST-EVER STROKE PATIENTS THE PROSPECTIVE COHORT WITH INCIDENT STROKE (PROSCIS)

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**Background and Aims:** Renal impairment (RI) predicts poor outcome after stroke. High levels of Lipoprotein (a) are also an established cardiovascular risk factor, and often found in patients with RI. It is however unknown to what extent these also exert additive or even synergistic effects on cardiovascular risk after stroke.

**Methods:** We analyzed data from the PROSpective Cohort with Incident Stroke-Berlin (PROSCISB; NCT01363856). RI was a priori defined as eGFR < 60ml/min and high levels of Lipoprotein (a) (high-Lp (a)) as  $\geq 50$ mg/dl. Main outcome was a combined endpoint (recurrent stroke, myocardial infarction, all-cause mortality) during three years of follow up, where we obtained hazard ratios and their corresponding 95% confidence intervals adjusted for age, sex, arterial hypertension, diabetes mellitus, atrial fibrillation, coronary heart disease, current smoking, and TOAST classification as measure of incidence ratios.

**Results:** In 583 of 616 patients eGFR and Lipoprotein (a) were measured (38.6% female, median NIHSS 2 [1-5]). Of those, 30 (5.2%) patients had both RI and high-Lp (a), 89 (15.3%) RI only, 120 (20.6%) high-Lp (a) only, and 344 (59.0%) none. Compared to patients without risk factor, neither patients with high-Lp (a) only, nor patients with RI only had a significant increase in risk (HR high-Lp (a) 1.3; 95% CI 0.8-2.2; HR RI 1.0; 95% CI 0.5-1.8). However, patients with both risk factors had a threefold increase in risk (HR 3.0; 95% CI 1.5-5.9).

**Conclusions:** In our data, stroke patients with RI and high-Lp (a) had a substantially higher risk for a cardiovascular event or death than can be expected based on their individual effects may indicating synergistic effects of RI and high-Lp (a).

**Trial registration number:** N/A

### AS17-188

#### NEUTROPHIL-TO-LYMPHOCYTE RATIO AS A FUNCTIONAL PREDICTOR IN ACUTE ISCHEMIC STROKE

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**Background and Aims:** NIHSS evaluated 24 hours after stroke onset has been widely used to predict functional outcome.

The aim of this study is to evaluate the relationship between Neutrophil-to-lymphocyte ratio (NLR) at admission and 24 hours with functional outcome at 3 months in acute ischemic stroke patients (AIS).

**Methods:** A total of 350 AIS patients were retrospectively included in our study from 2012 to 2018. We included patients attended in  $\leq 6$  hours after onset, baseline Modified Rankin Scale (mRS)  $\leq 2$ . We recorded demographic variables, NIHSS at admission, at 24 hours after onset and at discharge. NLR were obtained at admission and at 24 hours after AIS. All variables were tested with the Shapiro-Wilk (SW) test and the Anderson-Darling (AD) test for normalcy, and cross-tabulation tables were used to determine the relationship between variants. Quantitative comparisons were determined by Chi Square. Functional outcome was measured using 3-month mRS. Logistic regressions were performed to compare mRS with NIHSS and NLR at different time points.

**Results:** Variables Age, Hypertension, Diabetes Mellitus and Fibrinolysis significantly influenced 3-months mRS in our cohort, and were included as co-variants in the equation. NIHSS24h was the best AIS functional outcome predictor (OR = 3,9; Cox Snell R2 = 0,44; specificity: 95,8%; sensitivity: 69%;  $p < 0,0001$ ). The addition of NLR 24h to the model significantly improved the specificity (97,6%) and the sensitivity (75%) (OR = 4,1; Cox Snell R2 = 0,48;  $p < 0,0001$ ).

**Conclusions:** In our cohort the NLR combined with NIHSS at 24 hours after stroke onset may be a clinically useful tool for functional outcome prediction.

**Trial registration number:** N/A

### AS17-121

#### PREDICTORS OF ORAL FEEDING RESUMPTION AFTER STROKE IN A REHABILITATION HOSPITAL: PRELIMINARY DATA OF A PROSPECTIVE STUDY

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**Background and Aims:** The 20% of post-stroke patients requires exclusive enteral feeding because of dysphagia. Recovery of oral feeding is associated with increased quality of life, better functional outcomes and decreased mortality rates. However, evidence is heterogeneous and not conclusive on which factors are predictive of oral feeding recovery success for stroke patients. The aim was to investigate predictors of complete oral feeding recovery after stroke.

**Methods:** The study was conducted in an intensive inpatient rehabilitation hospital. Inclusion criteria were: post-stroke individuals with dysphagia and enteral feeding at the admission. Exclusion criteria were: minimally conscious state, discontinued rehabilitation period due to death or transfer.

Data on demographic, clinical, rehabilitation and swallowing factors were collected during the hospitalization period. Univariate analysis (chi-squared test or Mann-Whitney U test) was used to compare variables between oral feeding recovery group vs. enteral feeding group at discharge.

**Results:** 55 patients were recruited between June 2017 and January 2019. 41/55 (73%) patients resumed complete oral intake at discharge. There were statistically significant differences between the two groups in motor FIM score at admission ( $p = 0.040$ ), motor FIM gain ( $p < 0.001$ ), cognitive FIM gain ( $p = 0.001$ ), presence of memory impairment ( $\chi^2 = 4.853$ ,  $p = 0.028$ ), penetration-aspiration scale score at fiberoptic endoscopic evaluation of swallowing (FEES) with liquids ( $\chi^2 = 12.903$ ,  $p = 0.012$ ), semisolids ( $\chi^2 = 3.881$ ,  $p = 0.049$ ), and solids ( $\chi^2 = 4.966$ ,  $p = 0.026$ ), dysphagia outcome and severity score at FEES ( $\chi^2 = 15.201$ ,  $p = 0.010$ ), and type of swallowing rehabilitation ( $\chi^2 = 9.293$ ,  $p = 0.010$ ). **Conclusions:** Several clinical and swallowing characteristics predicted oral feeding recovery. Results are preliminary and need to be confirmed by a larger sample and a multivariate analysis.

**Trial registration number:** N/A

## AS17-145

### PREDICTIVE FACTORS OF FUNCIONAL RECOVERY OF PATIENTS WITH APHASIA AFTER STROKE: A LARGE RETROSPECTIVE COHORT STUDY

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**Background and Aims:** Aphasia affects 21–38% of acute stroke patients and is associated with low functional improvement after rehabilitation. Most studies investigate the presence/absence of aphasia without any analysis regarding different language impairments and their severity. The aim of the study is to assess the role of different linguistic deficits and their severity on the functional recovery of patients with aphasia due to stroke after intensive motor and speech rehabilitation.

**Methods:** 556 left-hemispheric stroke patients were consecutively admitted to our Neurorehabilitation Unit from 2010 to 2016. For this observational retrospective study we analyzed data for 254 patients who underwent at admission: functional (Functional Independence Measure, FIM) and language evaluation (Aachener Aphasic Test, AAT). 146 patients underwent occupational therapy too. The dependent variable is defined as the achievement of the Minimal Clinical Important Difference (MCID) between admission and discharge in the FIM.

**Results:** 129 patients (50.7%) reached the FIM MCID. The proportion of patients who reached the FIM MCID was higher in patients who were independent before stroke ( $p < 0.047$ ), were admitted within 42 days post-stroke ( $p < 0.03$ ) and underwent occupational therapy ( $p < 0.001$ ). Regarding language, it was higher in patients with better performances in AAT (i.e. repetition =  $p < 0.002$ , written-language =  $p < 0.006$ , naming =  $p < 0.003$ , comprehension =  $p < 0.007$ ) and lower severity of aphasia at admission ( $p < 0.002$ ). Logistic regression analysis showed that lower severity of aphasia at admission and additional occupational therapy increase the probability to achieve the FIM MCID.

**Conclusions:** Functional clinically meaningful recovery in post-stroke aphasic patients is predictable based on severity of aphasia and occupational therapy in addition to intensive motor and speech rehabilitation.

**Trial registration number:** N/A

## AS17-123

### REPERFUSION IN NON-RECANALIZING STROKE PATIENTS AS A SIGN OF COLLATERAL INVOLVEMENT USING DSC-MRI: A SUBSTUDY OF THE OBSERVATIONAL 1000PLUS STUDY

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**Background and Aims:** The aim of this study was to evaluate the use of dynamic susceptibility contrast MRI (DSC-MRI) in acute stroke patients as a method to quantify collateral involvement.

**Methods:** Retrospective analysis of 186 patients enrolled into the prospective observational 1000Plus study (clinicaltrials.org NCT00715533). Inclusion criteria were vessel occlusion on day1 MR-angiography, repeat imaging within 24 hours after stroke onset and follow-up DSC-MRI (3 Tesla). Reperfusion in non-recanalizers, hypoperfusion intensity ratio ( $HIR = T_{max} > 8s / T_{max} > 2s$ ) on day1 and the Higashida score using subtracted dynamic MR perfusion source images on day1 were used to quantify collateral flow. The influence of these variables on clinical and imaging outcome was assessed using robust linear regression.

**Results:** Sixty-seven patients (36%) showed persistent vessel occlusion on follow-up examination (30% of whom reperfused), 64 (34%) partial and 55 (30%) complete recanalization. There was a significant relationship between Higashida score and HIR ( $p < 0.0001$ ), however none between Higashida score and the interaction between recanalization and reperfusion (reperfused partial recanalizers:  $p = 0.607$ ; reperfused non-recanalizers:  $p = 0.704$ ). The interaction between recanalization and reperfusion was however associated with HIR ( $b = -0.18$ ,  $t = -2.45$ ,  $p = 0.016$ ). NIHSS on admission ( $p < 0.0001$ ) was associated with higher mRS day90 and thrombolysis ( $p = 0.002$ ) as well as Higashida scores 2, 3, 4 ( $b = -2.09$ ,  $T = -2.63$ ,  $p = 0.001$ ;  $b = -2.13$ ,  $t = -2.54$ ,  $p = 0.01$ ;  $b = -2.45$ ,  $t = -2.90$ ,  $p = 0.005$  respectively) were associated with lower mRS day90. There was no interaction between recanalization status and reperfusion on long-term outcome.

**Conclusions:** Patients with favorable Higashida scores have better clinical outcomes. The presence of reperfusion in non-recanalizers was not associated with clinical outcome, but was associated with HIR.

**Trial registration number:** clinicaltrials.org NCT00715533

## AS17-177

### PREDICTION OF FUNCTIONAL OUTCOME USING DRAGON SCORE IN PATIENTS WITH ACUTE ISCHEMIC STROKE IN ANTERIOR CIRCULATION TREATED WITH ENDOVASCULAR PROCEDURE

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**Background and Aims:** The DRAGON score has been used as a prediction tool of good functional outcome in patients treated with intravenous thrombolysis in acute ischemic stroke (AIS). Recent smaller studies have shown that DRAGON score can be used in assessment of a good functional outcome in patients who are treated for AIS with endovascular

procedures, also. Our aim was to assess utility of DRAGON score in predicting favorable neurological outcome (FNO) after 90 days.

**Methods:** We included patients treated for AIS with endovascular treatment, regardless of prior application of intravenous thrombolysis as "bridge" therapy, in period from December 2016 to November 2018. All patients underwent computed tomography angiography (CTA) with proven large vessel occlusion (LVO) in anterior circulation. Baseline DRAGON score, modified Rankin Score (mRS) on the hospital discharge and after 90 days were noted, next to other clinical and radiological characteristics. FNO was defined as mRS  $\leq 2$  after 90 days.

**Results:** Thirty-one patient was included with LVO. Median baseline DRAGON score was 5 (IQR 1). FNO was achieved by 39%. Patients with lower DRAGON score had lower mRS after 90 days ( $r = 0.49$ ,  $p < 0.01$ ). FNO was most frequent in patients with low DRAGON score (score 0–4), following those with intermediate (score 5–6) and high (score of 7 or higher) scores (58%, 33%, 8% respectively), which was significant ( $p = 0.016$ ).

**Conclusions:** The DRAGON score can be helpful tool for predicting functional neurological outcome following endovascular procedures for AIS.

**Trial registration number:** N/A

### AS17-103

#### STROKE IN WORKING AGE ADULTS: REHABILITATION SERVICE USE AND OUTCOMES IN AUSTRALASIA, UNITED KINGDOM AND SOUTH EAST ASIA (AVERT TRIAL)

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**Background and Aims:** People of working age ( $\leq 65$  years) often request information on recovery, mobility, quality of life (QOL), depression and return to work (RTW) after stroke. We describe post-acute rehabilitation pathways and 12 month outcomes by geographic regions (Australasia (AUS), United Kingdom (UK) and South East (SE) Asia) from the AVERT trial.

**Methods:** A post hoc exploratory descriptive summary (demographics; stroke characteristics; rehabilitation pathways; 12 month outcomes) for participants aged  $\leq 65$  years. We examined the distribution of participants, by region, into 4 rehabilitation pathways; inpatient rehabilitation (IR), home with community rehabilitation (CR), IR then CR and, home with no rehabilitation.

**Results:** The 668 participants  $\leq 65$  years had a median age 58 years, 70% male, median stroke severity (NIHSS) 6. Prior to stroke, 62% were working. At 12 months, 70% had an mRS 0–2, 44% were depressed, 28% rated QOL as poor or worse than death, and of those working prior to stroke, 57% had RTW. The proportion receiving IR was higher in AUS than other regions (AUS 52%; UK 25%; SE Asia 23%), whereas the UK had higher CR (UK 65%; AUS 61%; SE Asia 39%). The number who went home and received no rehabilitation (IR or CR) was unexpectedly high (Australasia 25%; UK 22%; SE Asia 40%).

**Conclusions:** We'll describe in detail the variation in post-acute rehabilitation pathways for young stroke across the regions. Over a quarter of participants did not receive rehabilitation services. There were high rates of depression and poor QOL, and low rates of RTW.

**Trial registration number:** AVERT Trial registration number: ACTRN12606000185561

### AS17-171

#### THE VALIDITY OF APPARENT DIFFUSION COEFFICIENT QUANTIFICATION FOR NEUROLOGIC PROGNOSIS AFTER CARDIAC ARREST

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**Background and Aims:** Magnetic resonance imaging (MRI) may help predict neurologic prognosis after resuscitation from cardiac arrest. We sought to validate previously described MRI apparent diffusion coefficient (ADC) quantification parameters for neurologic prognosis after cardiac arrest.

**Methods:** MRI data from patients resuscitated after cardiac arrest was retrospectively analyzed. Percentage of brain volume with ADC less than 650 or  $450 \times 10 - 6$  mm $^2$ /sec (ADC  $< 650$  or ADC  $< 450$ ), and dominant ADC cluster less than 650 or  $450 \times 10 - 6$  mm $^2$ /sec (ADCcluster  $< 650$  or ADCcluster  $< 450$ ) were correlated with awakening, cerebral performance category (CPC), cortical responses on somatosensory evoked potentials (SSEP), and cerebrospinal fluid creatinine kinase BB isoenzyme activity (CK-BB).

**Results:** 53 patients with MRI were included with a median 3.7 days (IQR 2.5–5.4) from resuscitation to MRI. ADC  $< 650$  and ADCcluster  $< 650$  were higher in patients who did not awaken by hospital discharge (15% vs 8%,  $p = 0.04$  and 1.9% vs 0.42%,  $p = 0.04$ , respectively). ADCcluster  $< 650$  was associated with worse discharge CPC ( $\rho = 0.29$ ,  $p = 0.03$ ). This finding was accentuated when only including patients with MRI obtained between 2 and 5 days post-resuscitation ( $\rho = 0.48$ ,  $p = 0.009$ ). MRI measures were higher in patients with bilaterally absent SSEPs ( $p < 0.05$  in 3 of 4 comparisons) and correlated with CK-BB ( $\rho = 0.79-0.86$ , all  $p < 0.05$ ). ADC  $< 450$  and ADCcluster  $< 450$  were not associated with awakening or CPC.

**Conclusions:** ADC  $< 650$  and ADCcluster  $< 650$  were associated with awakening by hospital discharge, and ADCcluster  $< 650$  with CPC at discharge. These findings support the validity of MRI ADC quantification parameters for prognostication after cardiac arrest and encourage further research.

**Trial registration number:** N/A

### WITHDRAWN

**AS17-028****HIGH LEVEL OF SERUM TISSUE KALLIKREIN IS ASSOCIATED WITH FAVORABLE OUTCOME IN ACUTE ISCHEMIC STROKE PATIENTS****F. Wu<sup>1</sup>, Y. Ling<sup>1</sup>, L. Yang<sup>1</sup>, X. Cheng<sup>1</sup>, Q. Dong<sup>1</sup> and W. Cao<sup>1</sup>**<sup>1</sup>Huashan Hospital affiliated to Fudan University, Department of Neurology, Shanghai, China

**Background and Aims:** We sought to assess the association between serum tissue kallikrein (TK) level and 90 days outcome in acute ischemic stroke (AIS) patients who received acute reperfusion therapy.

**Methods:** Consecutive AIS patients within 6 hours after stroke onset between December 2015 and August 2017 were prospectively recruited. Blood samples were collected before acute reperfusion therapy for serum TK measurement. Outcome was modified Rankin scale (mRS) score at 90 days after stroke onset. Binary logistic regression was performed to analyze the association between baseline TK level and clinical outcome.

**Results:** Between December 2015 and August 2017, 75 patients (age range from 33 to 91 years, 72.0% male) were recruited in this study. Higher baseline TK was independently associated with favorable functional outcome (mRS 0–2) [odds ratio 1.01, 95% confidence interval (CI) 1.00–1.02,  $p = 0.047$ ] and low mortality rate (odds ratio 0.98, 95% CI 0.96–1.00,  $p = 0.049$ ) at 90 days. Increased TK level was associated with 90d-mRS(0–2) with area under curve of 0.719 (95% CI 0.596–0.842;  $p = 0.002$ ).

**AS17-021****'IT WAS AS IF THE DOTS HADN'T BEEN JOINED UP': BEREAVED FAMILIES' EXPERIENCES OF END OF LIFE CARE IN ACUTE STROKE WARDS: A QUALITATIVE INVESTIGATION**

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**Background and Aims:** Despite significant improvements in survival, severe stroke remains a major cause of mortality. Acute stroke settings have a key role at the end of people's lives following a severe stroke. Ensuring appropriate, timely, high quality, person-centred, safe and effective end-of-life care in these settings is a professional priority. This study aimed to illuminate bereaved family members' experiences of end-of-life care in an acute stroke setting following implementation of an end-of-life care training intervention.

**Methods:** A qualitative exploratory study using in-depth, semi-structured, face to face, digitally recorded interviews was conducted. Nine bereaved (> three months) family members, all women, participated. Interviews were fully transcribed and analysed using thematic analysis.

**Results:** The analysis identified three major themes: *the variable nature and quality of interaction with healthcare staff; doing care at the end of life and toward the realisation of a certain manner of good death*. Findings illuminated some positive end-of-life care practices following a severe stroke in terms of recognising dying and family members' support, care and engagement in decision-making. However, a pressing need for improved, timely, proactive and regular interaction with family members of people dying imminently in the acute stroke care setting was identified.

**Conclusions:** End-of-life stroke care in the busy, noisy, fast paced acute hospital environments is not without challenge for many reasons. Furthermore, interacting with the family members of imminently dying people is delicate, difficult territory. Yet these are places where people die and the manner of a person's dying casts an indelible mark on those who live on.

**Trial registration number:** N/A

Table 2 Binary logistic regression analysis

Predictors	OR	95% CI	P value
<i>Favorable functional outcome (90-day mRS 0–2)</i>			
Age	0.87	0.79–0.96	0.004
Baseline NIHSS	0.87	0.76–0.99	0.037
Baseline TK	1.01	1.00–1.02	0.047
AF	3.18	0.52–19.44	0.210
DM	0.33	0.08–1.42	0.136
Previous stroke	0.35	0.07–1.79	0.205
EVT	0.31	0.06–1.67	0.177
<i>90-day mortality</i>			
Age	1.16	0.95–1.40	0.137
Baseline NIHSS	1.05	0.94–1.17	0.371
Baseline TK	0.98	0.96–1.00	0.049
AF	3.44	0.36–32.77	0.283
HBP	1.465E+9		0.998
DM	15.78	0.95–261.1	0.054
Previous stroke	6.42	0.59–69.42	0.126

Abbreviations: OR, odds ratio; CI, confidence interval; NIHSS, National Institutes of Health Stroke Scale; TK, tissue kallikrein; AF, atrial fibrillation; DM, diabetes mellitus; EVT, endovascular therapy; HBP, hypertension.

**Conclusions:** Serum TK can be a promising predictor of clinical outcome in AIS patients who received acute reperfusion therapy.

**Trial registration number:** N/A

**AS17-112****THERAPEUTIC GAP IN LIPID-LOWERING THERAPY AND OUTCOMES AFTER STROKE: A STUDY OF 10,231 CHINESE STROKE PATIENTS****B. Yan<sup>1</sup>, C.K.Y. Chan<sup>1</sup>, W.H.S. Lai<sup>1</sup> and O.T.L. To<sup>1</sup>**<sup>1</sup>The Chinese University of Hong Kong, Department of Medicine and Therapeutics, Hong Kong, Hong Kong S.A.R.

**Background and Aims:** Guidelines recommend intensive low-density lipoprotein cholesterol (LDL-C) lowering after ischemic stroke (IS). We evaluated “real-world” temporal trend in lipid-lowering treatment (LLT) and outcomes after IS in a Chinese population.

**Methods:** We retrospectively evaluated consecutive patients admitted with IS or transient ischemic attack (TIA) between January 2005 and September 2017 to an academic institution. Temporal trends in lipid profile, LLT and 12-month major adverse cardiovascular and cerebrovascular events (MACCE, including cardiovascular death, myocardial infarction and stroke) were compared between 2005–2008, 2009–2012 and 2013–2017. Multivariate analysis was performed to identify independent outcome predictors.

**Results:** Of 10,231 patients, 95% ( $n=9,719$ ; mean age  $72.1 \pm 12.8$  years; 52.3% male) survived to hospital discharge ( $n=3,172$  [2005–2008];  $n=3,135$  [2009–2012];  $n=3,412$  [2013–2017]). From baseline to month 12, mean LDL-C reduced from  $3.0 \pm 1.0$  to  $2.2 \pm 0.8$  (2005–2008 and 2009–2012) and  $2.7 \pm 1$  to  $2.0 \pm 0.7$  (2013–2017) ( $p < 0.01$ ). Statin therapy on discharge increased over time from 52.1% to 70.7% and 78.3% ( $p < 0.01$ ). Use of high-intensity statin therapy (1.5%) and proportion of patients who achieved target LDL-C  $< 1.8\text{mmol/L}$  (12.7%) was low. Rates of 12-month IS/TIA decreased over time from 7.7% to 7.1% and 6.2% ( $p = 0.05$ ) and MACCE from 12.5% to 10.9% and 9.3% ( $p < 0.01$ ). Initiation of statin in patients with baseline LDL-C  $> 2.6\text{mmol/L}$  was an independent predictor of lower 12-month MACCE (OR 0.71, 95% CI 0.59–0.85,  $p < 0.01$ ).

**Conclusions:** LLT use after stroke improved over time but remained sub-optimal with significant number of patients not prescribed statins. Use of high-intensity statin and proportion of patients who reached LDL-C goal was very low.

**Trial registration number:** N/A**AS17-014****USE OF DWI-ASPECTS AND CORE VOLUME TO DETERMINE THE MALIGNANT PROFILE IN ACUTE ISCHEMIC STROKE****T. Yoshimoto<sup>1</sup>, M. Inoue<sup>2</sup>, H. Yamagami<sup>3</sup>, K. Fujita<sup>2</sup>, K. Tanaka<sup>3</sup>, D. Ando<sup>2</sup>, K. Sonoda<sup>3</sup>, N. Kamogawa<sup>2</sup>, M. Koga<sup>2</sup>, M. Ihara<sup>1</sup> and K. Toyoda<sup>2</sup>**

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**Background and Aims:** To clarify the correlation between the diffusion-weighted imaging (DWI)-Alberta Stroke Program Early CT Score (ASPECTS) and DWI lesion ischemic core volume ( $\text{Vol}_{\text{DWI}}$ ) in acute ischemic stroke (AIS) due to large vessel occlusion and determine the thresholds for the malignant profile.

**Methods:** DWI-ASPECTS and  $\text{Vol}_{\text{DWI}}$  were measured in consecutive AIS patients with anterior LVO.  $\text{Vol}_{\text{DWI}}$  was assessed with automated software. Favorable/unfavorable outcome were defined as modified Rankin Scale score 0–2 and 5–6 at 3 months. Malignant profile was defined as DWI-ASPECTS/ $\text{Vol}_{\text{DWI}}$  which predicted the unfavorable outcome.

**Results:** Of the total, 198 patients (111 men,  $77 \pm 13$  years old) were enrolled. The median baseline National Institutes of Health Stroke Scale score was 21 (interquartile range 14–17), the median DWI-ASPECTS was 7 (5–9), and the median  $\text{Vol}_{\text{DWI}}$  was 55 (6–134) mL. In all, 72 (36%) patients underwent reperfusion therapy [39 (20%) intravenous thrombolysis, 54 (27%) endovascular treatment, and 21 (11%) combination therapy]. The favorable outcomes were observed in 48 (24%) patients, with the unfavorable outcomes in 83 (42%). There was a significant correlation between DWI-ASPECTS and  $\text{Vol}_{\text{DWI}}$  ( $\rho = -0.90$ ,  $p < 0.01$ ). The threshold values for the malignant profile on receiver operating characteristic curve analysis for DWI-ASPECTS and  $\text{Vol}_{\text{DWI}}$  were 4 [area under the curve (AUC) 0.78,  $p < 0.01$ ; sensitivity 0.71, specificity 0.75] and 71 mL (AUC 0.80,  $p < 0.01$ ; sensitivity 0.76, specificity 0.77), respectively.

**Conclusions:** A significant correlation was found between DWI-ASPECTS and  $\text{Vol}_{\text{DWI}}$ . The cut-off values for the malignant profile were DWI-ASPECTS 4 and  $\text{Vol}_{\text{DWI}}$  71 mL.

**Trial registration number:** N/A**AS17-009****PROGNOSTIC SIGNIFICANCE OF HOMOCYSTEINE IN ACUTE ISCHEMIC STROKE****S. You<sup>1</sup>, C. Zhong<sup>2</sup>, H. Du<sup>3</sup>, X. Wang<sup>4</sup>, H. Liu<sup>1</sup>, Y. Cao<sup>1</sup> and C.F. Liu<sup>1</sup>**

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**Background and Aims:** We investigated the association between homocysteine upon hospital admission and short-term outcomes of acute ischemic stroke (AIS) patients.

**Methods:** A total of 2,084 AIS patients enrolled from December 2013 to May 2014 across 22 hospitals in Suzhou city were included in the present study. We divided patients into 4 groups according to their level of admission homocysteine: Q1 ( $< 9.70 \text{ umol/L}$ ), Q2 (9.70–12.3  $\text{umol/L}$ ), Q3 (12.3–16.9  $\text{umol/L}$ ) and Q4 ( $\geq 16.9 \text{ umol/L}$ ). Logistic regression models were used to estimate the effect of homocysteine on all cause in-hospital mortality and discharge poor outcome (modified Rankin Scale score  $\geq 3$ ) in AIS patients.

**Results:** During hospitalization, 57 patients (2.7%) died from all causes and 784 (37.6%) patients experienced poor functional outcome at discharge. Multivariable model adjusted for age, sex, baseline NIHSS score, and other potential covariates, showed the highest serum homocysteine level (Q4) was associated with a 3.63-fold increase in the risk of in-hospital mortality in comparison to lowest (Q1) (odds ratio [OR] 3.63; 95% confidence interval [CI], 1.24–10.65; P-trend = 0.009). The highest serum homocysteine level was also associated with poor functional outcome at discharge in comparison to Q1 (OR 1.58; 95% CI, 1.12–2.23; P-trend = 0.018) after adjusted for potential confounders. Subgroup analyses further confirmed a significant association between higher homocysteine levels and a high risk of in-hospital mortality as well as poor outcome at discharge.

**Conclusions:** Increased serum homocysteine levels at admission were independently associated with in-hospital mortality and poor functional outcome in AIS patients.

**Trial registration number:** N/A

## AS17-072

## TEMPORAL TRENDS IN MECHANICAL THROMBECTOMY OUTCOMES IN THE UNITED STATES NATIONAL INPATIENT SAMPLE

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**Background and Aims:** Multiple large trials have demonstrated efficacy of mechanical thrombectomy for acute ischemic stroke (IS) since 2014; clinical practice has changed accordingly. We analyzed the period between 2014–2016 for temporal trends in outcomes during this transition.

**Methods:** The National Inpatient Sample, a 20% sample of all US hospital discharges, was analyzed for discharges with mechanical thrombectomy. Data was analysed in two sections (Jan 2014-Oct 2015 and Oct 2015-Dec 2016) due to transition of US hospitals from ICD version 9 to 10 in Oct 2015. Multi-variable logistic regression was used to study effect of time (in 3 month periods), patient age and sex, concurrent thrombolysis, insurance status, hospital teaching status and hospital thrombectomy case volume on odds of death and discharge home.

**Results:** During both time periods, the proportions of IS patients receiving thrombectomy increased markedly (Table 1 and 2). A temporal trend towards fewer patients being discharged home was seen over the last 15 months studied (Table 3, Figure 1). Older age and lower thrombectomy case volume were associated with increased odds of death and decreased odds of discharge home during both time periods (Table 3).

Table 1-Patient characteristics and outcomes during ICD 9 period

	2014Q1	2014Q2	2014Q3	2014Q4	2015Q1	2015Q2	2015Q3
Sample size (total estimated for US)	333 (1665)	324 (1620)	337 (1685)	408 (2040)	466 (2330)	620 (3100)	623 (3115)
Mean Age in years (SE)	67.4 (0.79)	66.8 (0.85)	66.3 (0.94)	68.0 (0.77)	67.9 (0.68)	67.8 (0.64)	67.6 (0.57)
Female (%)	161 (48%)	163 (50%)	179 (53%)	195 (48%)	246 (53%)	297 (48%)	273 (44%)
Received IV tPA (%)	183 (55%)	177 (55%)	174 (52%)	218 (53%)	235 (50%)	289 (47%)	321 (52%)
At hospital with <1 case per quarter (%)	84 (25%)	92 (28%)	73 (22%)	103 (25%)	81 (17%)	132 (21%)	132 (21%)
At teaching hospital (%)	299 (90%)	292 (90%)	304 (90%)	365 (90%)	422 (91%)	544 (88%)	561 (90%)
Died	46 (13.8%)	41 (12.7%)	48 (14.2%)	68 (16.7%)	82 (17.6%)	74 (11.9%)	100 (16.1%)
Discharged home	59 (17.7%)	58 (17.9%)	62 (18.4%)	74 (18.1%)	82 (17.6%)	118 (19.1%)	130 (20.8%)

Table 2- Patient characteristics and outcomes during ICD 10 period

	2015Q4	2016Q1	2016Q2	2016Q3	2016Q4
Cases in sample (population size)	687 (3435)	773 (3865)	784 (3920)	769 (3845)	797 (3965)
Mean Age (SE)	67.6 (0.55)	68.1 (0.54)	69.4 (0.57)	68.2 (0.54)	68.9 (0.56)
Female (%)	349 (51%)	396 (51%)	398 (51%)	386 (50%)	417 (52%)
Received IV tPA (%)	266 (39%)	317 (41%)	319 (41%)	308 (40%)	321 (40%)
At a Hospital with <4 cases per year (%)	396 (58%)	72 (9.3%)	61 (7.8%)	84 (11%)	83 (10%)
At teaching hospital (%)	76 (11%)	90 (12%)	96 (12%)	92 (12%)	83 (10%)
Died	99 (13.0%)	112 (14.5%)	120 (13.3%)	104 (13.5%)	114 (14.3%)
Discharged home	157 (22.9%)	164 (21.2%)	149 (19.0%)	148 (19.3%)	135 (17.0%)

Table 3-Logistic regression outcomes

	Death ICD 9	Death ICD 10	Discharge Home ICD 9	Discharge Home ICD 10
Time (by discharge quarter)	OR 1.005 (95% CI 0.955-1.057, p=0.854)	OR 1.034 (95% CI 0.967-1.106, p=0.324)	OR 1.041 (95% CI 0.991-1.094, p=0.113)	OR 0.894 (95% CI 0.835-0.957, p=0.001)
Age	OR 1.027 (95% CI 1.017-1.038, p<0.001)	OR 1.013 (95% CI 1.003-1.022, p=0.012)	OR 0.969 (95% CI 0.961-0.977, p<0.001)	OR 0.969 (95% CI 0.962-0.976, p<0.001)
Female Sex	OR 0.588 (95% CI 0.588-0.884, p=0.002)	OR 0.805 (95% CI 0.754-1.124, p=0.637)	OR 0.921 (95% CI 0.900-1.143, p=0.589)	OR 1.340 (95% CI 1.117-1.609, p=0.002)
Insurance				
Medicaid (Reference Medicare)	OR 1.365 (95% CI 0.890-2.094, p=0.153)	OR 1.008 (95% CI 0.664-1.530, p=0.970)	OR 1.036 (95% CI 0.731-1.467, p=0.843)	OR 1.257 (95% CI 0.911-1.734, p=0.164)
Insurance, Private (Reference Medicare)	OR 0.918 (95% CI 0.673-1.252, p=0.588)	OR 0.750 (95% CI 0.559-1.008, p=0.056)	OR 1.356 (95% CI 1.022-1.798, p=0.035)	OR 1.851 (95% CI 1.445-2.370, p<0.001)
Insurance, Other (Reference Medicare)	OR 1.783 (95% CI 1.119-2.841, p=0.015)	OR 1.195 (95% CI 0.785-1.817, p=0.406)	OR 2.192 (95% CI 1.525-3.150, P<0.001)	OR 2.271 (95% CI 1.538-3.355, p=0.001)
Treatment at a Teaching Hospital	OR 1.135 (95% CI 0.932-1.620, p=0.494)	OR 1.270 (95% CI 0.933-1.730, p=0.129)	OR 1.003 (95% CI 0.730-1.379, p=0.983)	OR 0.703 (95% CI 0.530-0.934, p=0.015)
Hospital Thrombectomy Volume	OR 0.985 (95% CI 0.974-0.995, p=0.005)	OR 0.987 (95% CI 0.979-0.994, p=0.001)	OR 1.019 (95% CI 1.010-1.029, p<0.001)	OR 1.012 (95% CI 1.002-1.023, p=0.020)

Figure 1-Thrombectomy Outcomes Jan 2014- Dec 2016



**Conclusions:** The recent decreasing trend in proportion of patients being discharged to home after thrombectomy may reflect less selective and more aggressive therapy of IS and warrants further study.

**Trial registration number:** N/A

## WITHDRAWN

while there was a tendency for simvastatin to have a protective effect (Table 3).

**Table 1:** Characteristics of patients with and without dementia prior to first ischemic stroke before

	DEMENTIA (n=1410)	NON- DEMENTIA (n=7150)	p-value
Age at stroke, mean (SD)	83 (7)	82 (7)	<b>0.043</b>
Female sex, n (%)	795 (56.4)	4054 (56.7)	0.827
Charlson comorbidity index, median (IQR)	2 (2)	1 (3)	<b>&lt;0.001</b>
Antiplatelets, n (%)	674 (47.8)	2641 (36.9)	<b>&lt;0.001</b>
Anticoagulants in patients with AF, n (%)	60 (12.6)	398 (20.2)	<b>&lt;0.001</b>
Blood pressure lowering medication, n (%)	930 (66.0)	4792 (67.0)	0.438
Statins, n (%)	259 (18.4)	1436 (20.1)	0.140
Antipsychotics, n (%)	106 (7.5)	102 (1.4)	<b>&lt;0.001</b>
Antidepressants, n (%)	440 (31.2)	761 (10.6)	<b>&lt;0.001</b>

In variables where n (%) are reported, p-values were obtained by chi-square, whereas in variables where median (IQR) are reported, p-values were obtained by Mann-Whitney test.

**Table 2:** Cox regression models for survival: impact of pre-existing dementia on mortality after stroke

Basic model	Dementia	0.97 (0.91-1.05)
	Age	1.03 (1.02-1.03)
Adjusted model	Sex	1.04 (0.98-1.11)
	Dementia	1.03 (0.93-1.15)
	Age	1.03 (1.03-1.04)***
	Sex	1.02 (0.93-1.12)
	Nursing home placement after stroke	1.02 (0.93-1.12)
	Total number of medication	1.02 (1.01-1.03)***
	Charlson comorbidity index	1.05 (1.03-1.07)***

Results are presented as hazard ratios (HRs) with 95% CI.

\*p<0.05

\*\*p<0.01

\*\*\*p<0.001

**Table 3:** Cox regression models for survival: impact of medication prior to stroke on mortality after an ischemic stroke

	Model 1	Model 2	Model 3
Antipsychotics	1.29 (1.10-1.52)*	1.23 (1.05-1.45)*	1.51 (1.18-1.93)***
Antidepressants	1.10 (1.01-1.20)*	1.02 (0.93-1.11)	1.08 (1.00-1.18)
Lipid agents	1.01 (0.94-1.10)	0.92 (0.85-1.00)	0.96 (0.89-1.04)
only simvastatin	0.98 (0.91-1.07)	0.90 (0.82-0.98)*	0.94 (0.87-1.02)
Antithrombotic agents	1.03 (0.97-1.10)	0.95 (0.89-1.01)	0.99 (0.93-1.06)
Antiplatelets	1.02 (0.96-1.09)	0.95 (0.89-1.01)	0.99 (0.93-1.05)
Anticoagulants	1.00 (0.88-1.14)	0.96 (0.84-1.09)	0.99 (0.87-1.13)
Blood pressure lowering medication	1.09 (1.02-1.16)*	0.98 (0.90-1.06)	1.04 (0.97-1.11)

Results are presented as hazard ratios (HRs) with 95% CI.

Model 1 is adjusted for dementia age, sex. Model 2 is adjusted for dementia, age, sex, nursing home placement after stroke and number of all medication. Model 3 is adjusted for dementia, age, sex, nursing home placement after stroke and Charlson comorbidity index.

Warfarin – only in patients with diagnosis of AF anytime in medical records.

\*p<0.05

\*\*p<0.01

\*\*\*p<0.001

**Conclusions:** In our study, dementia was not an independent predictor of death after stroke. Antipsychotic medication taken before stroke was the strongest predictor of mortality after stroke.

**Trial registration number:** N/A

## AS17-163

### PREDICTORS OF DEATH AFTER FIRST ISCHEMIC STROKE

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**Background and Aims:** Patients with dementia have increased mortality after stroke, however, causes have not been explored. Diagnosis of dementia may preclude these patients from receiving stroke prevention medication, which could be due poor compliance or comorbidities. Antipsychotic medication are known to increase the risk for stroke and death in dementia patients. The aim of this study was to determine whether pre-existing dementia is an independent predictor of death after first ischemic stroke (IS) and whether medication taken prior to stroke affects survival.

**Methods:** Prospectively collected data from the Swedish national dementia registry (SveDem) and the Swedish national stroke registry (Riksstroke) between 2007 and 2014 were retrospectively analysed. Patients registered with dementia who suffered an IS (n = 1410) were compared with matched non-dementia IS patients (n = 7150). We analysed whether dementia impacts mortality after stroke and whether treatment with antiplatelet, anticoagulation, blood-pressure lowering, statin, antidepressant, and/or antipsychotic medication prior to stroke affects survival after stroke.

**Results:** Characteristics of patients before an IS are described in Table 1. After 3 years, 1058 (75.0%) dementia and 4531 (63.4%) of non-dementia patients died. In none of the models was pre-existing dementia a significant predictor of death after stroke (Table 2). Among the medication, antipsychotics taken prior to stroke had a deleterious effect on survival,

## Rare Causes, Stroke in the Young

**AS23-018**

### PEDIATRIC ISCHEMIC STROKE WITH RENAL DISEASE: A CASE REPORT

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**Background and Aims:** Pediatric ischemic stroke often presents with unique risk factors. Risk factors management are crucial points to reach positive outcome. This case report aims to report ischemic stroke management with renal disease as risk factor in pediatric patient.

**Methods:** We report a case of 11-year-old boy with acute headache, followed by projectile vomiting, general tonic clonic seizure, and coma. Physical examination found GCS was 5, hypertensive emergency, increased of temperature, NIHSS was 29, and positive Babinsky's sign in both feet. From laboratory examination, there were leukocytosis and increase in BUN creatinin level. Further investigation through head CT-scan, MRI-MRA and DSA showed bihemispheric infarction caused by total stenotic in right a. cerebri media pars proximal MI, and severe stenotic in left a. cerebri media pars media M2. The result of USG ren were bilateral chronic parenchymal renal disease.

Clopidrogel, phenytoin, and meropenem were administered for preventing further plaque formation, epilepsy, and infection. For the hypertension, patient got titration of nicardipine and was switched with oral amlodipine, propranolol, furosemide, and lisinopril. After 2 months of treatment, patient was discharged in stable condition with bihemiparesis, global aphasia, myoclonic seizure, and his NIHSS was 17.

**Results:** Unlike adult stroke, degenerative vascular and chronic degenerative diseases have very little role in pediatric stroke's genesis. Renal disease is the one of most commonly risk factors for pediatric ischemic stroke.

**Conclusions:** This case highlights renal disease as pediatric ischemic stroke risk factor. The outcomes stroke with renal disease are bad, and improving these outcomes should be subject of future clinical trial.

**Trial registration number:** N/A

**AS23-074**

### ISCHAEMIC STROKE SECONDARY TO CAROTID ARTERY DISSECTION IN TURNER'S SYNDROME

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**Background and Aims:** Turners syndrome (45 XO) is a chromosomal abnormality characterised by a defect or absence of the X chromosome. Cardiovascular abnormalities are common in patients with turners, these include hypertension, co-arctation of the aorta, aortic root dilatation, bicuspid aortic valve, atrial and ventricular septal defects. Importantly, the cardiovascular abnormalities contribute to an increased risk of aortic dissection, a potential lethal complication.

There is a dearth of literature on Cases of Turners syndrome with carotid dissection leading to stroke. The case stresses the importance of patient education, disease monitoring and management of risk factors to help prevent a potentially avoidable life-changing event.

**Methods:** In this case, we document a young patient aged 28 years old with Turner's syndrome who was leading an active life with work and regular exercise. The patient presented with headache and seizures and dense hemiplegia after strenuous exercise at the gym. Subsequent CT angiography demonstrated internal carotid artery dissection leading to a large middle cerebral artery thrombus.

**Results:** This case highlights the importance of patient education. Given the fact that cardiovascular abnormalities are prevalent in patients with Turners, an educational discussion regarding modifiable risk factors should have taken place.

**Conclusions:** Patients with Turners are at an increased risk of aortic dissection due to underlying risk factors, some of which can be modified and controlled with education. Consideration of periodic cardiac evaluation and screening of these patients may be warranted to allow early recognition and treatment of this potentially lethal complication.

**Trial registration number:** n/a

## WITHDRAWN

**AS23-044**

### EPIDEMIOLOGICAL EVOLUTION IN JUVENILE STROKE FROM 2000 TO 2015 IN A TERTIARY HOSPITAL

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**Background and Aims:** A worrisome increase in young stroke incidence is being reported in the last years. To confirm this information in a

local environment, a study was conducted in a tertiary hospital to check this evolution along 15 years, analyzing several clinics characteristics.

**Methods:** Retrospective study recruiting 159 stroke  $\leq 45$  year-old patients, admitted in 2000, 2005, 2010 and 2015. Traditional and specific of young stroke risk factors were evaluated, as well as clinical features, treatments, etiology and prognosis.

**Results:** There were 73.6% ischemic stroke (IS) (24.8% TIA). Both IS and hemorrhagic stroke (HS) were more frequent in men and 31–45 year-old. Between IS the etiology was cryptogenetic in 35%, infrequent etiology 32% (46% arterial dissection), < 10% each of the rest of etiologies. There were a high increased in hyperhomocysteine and patent foramen ovale. The follow-up showed a decrease in cryptogenetic in favour of infrequent etiology. The first HS etiology was vascular malformation (35%). Acute reperfusion therapies experienced a huge increased, with a 50% reduction of mortality (both IS and HS).

**Conclusions:** The HS is more frequent between young population than the general stroke population. Along the 15 years increased incidence in young stroke could not be confirmed, but diagnosis ability has improved and mortality fell in half.

**Trial registration number:** N/A

## AS23-014

### DRUG ADDICTION. REPETITIVE INJECTIONS INTO CAROTID ARTERIES. A RARE CASE OF STROKE IN YOUNG ADULTS

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**Background and Aims:** The causes of stroke in young adults are significantly different from those which are present in olders. In many cases, it is not possible to identify a risk factor, at other times unusual, rare states are revealed. We report the medical history of our ischemic stroke patient who had the occlusion of carotid and medial cerebral arteries caused by an extremely rare pathology.

**Methods:** The 45-year-old male patient had a history of repetitive intra-arterial drug injection into the carotid artery. Pseudoaneurysm of the left sided common carotid artery was developed, because of its resection and AFS homograft interposition of common and internal carotid arteries was performed. 2 months later the patient was admitted to vessel surgery because of dyspnoea, pulsation in the territory of the neck, dizziness and fever. On the next day right sided faciobrachial paresis and aphasia appeared.

**Results:** The CT scan showed an extended ischemic lesion in the territory of the left medial cerebral artery. Occlusion was seen from the pseudoaneurysm to the syphon. The broken needles damaged during the repetitive self-punctures were visible in the arteries by the CT-angiography. The closing of the common carotid artery was carried out. After it he was transferred to the neurology department. Withdrawal symptoms were not observed. Thrombophilia, autoimmun disease were not proved. After speech therapy and complex rehabilitation his state improved remarkable.

**Conclusions:** The history of the patient is rare. The broken needles in the carotid artery caused multiple vascular risks: toxic effect, source of embolism, inflammation. The pseudoaneurysm changed the circulation.

**Trial registration number:** N/A

## AS23-035

### USE OF ANTIDEPRESSANTS IN YOUNG PATIENTS WITH ISCHEMIC STROKE

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**Background and Aims:** Depression after stroke potentially worsens outcome and affects quality of life. We aimed to investigate the use of antidepressants within first year after ischemic stroke in young patients and assess which characteristics are associated with post-stroke antidepressant (PSAD) use.

**Methods:** The Helsinki Young Stoke Registry (HYSR) includes 1008 consecutive patients with first-ever ischemic stroke aged 15–49 years. We obtained data from the nationwide Drug Prescription Register and Care Register for Health Care (prior psychiatric hospitalizations). Filled prescription (i.e. purchase) for antidepressant medication within 1 year from stroke was considered as PSAD use. Multivariable logistic regression analysis allowed assessing baseline factors associated with PSAD use, adjusting for age, sex and factors with  $P < 0.2$  in univariate comparison.

**Results:** A total of 889 patients were included (63.5% male, median age 44 years, IQR 37–47), of which 207 (23.3%) had PSAD use within 1 year from stroke. Compared to patients without PSAD use, PSAD user were less often blue-collar workers (33.8% vs. 44.9%), more often cigarette smokers (48.8% vs. 41.9%), and they had more severe strokes (median NIHSS score 5 vs. 2). They also tended to have more often a history of psychiatric hospitalization (7.7% vs. 4.7%) and hypertension (44.4% vs. 38.9%). In multivariable analysis, smoking (odds ratio 1.60; 95% confidence interval 1.14–2.27), NIHSS score (1.13 per point; 1.10–1.16), and blue-collar socioeconomic status (0.59; 0.38–0.93) were associated with PSAD use.

**Conclusions:** More severe symptoms, cigarette smoking, and socioeconomic status were associated with antidepressant use within 1 year after ischemic stroke in young adults.

**Trial registration number:** N/A

## AS23-017

### STROKE AND DELAYED THROMBOTIC THROMBOCYTOPENIC PURPURA IN A YOUNG WOMAN

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**Background and Aims:** Thrombotic thrombocytopenic purpura (TTP) is a thrombotic microangiopathy caused by reduced activity of von Willebrand factor-cleaving metalloprotease (ADAMTS13). It is characterized by platelet aggregation, which causes microangiopathic haemolytic anaemia and thrombocytopenia. Clinically, there is a variety of symptoms. TTP is a rare cause of stroke. Untreated it has a mortality up to 90%.

**Methods:** A 29-year-old woman presented with a numb feeling and paresis of the right arm and hand. Initial laboratory findings were unremarkable except for high D-dimer (1721 ug/L). CT-brain showed small subarachnoid haemorrhage in the left frontal lobe. Brain-MRI showed multiple areas of recent ischemia and suggestion of subarachnoid blood in the left central sulcus. With working hypothesis cortical vein thrombosis, she was treated with fraxiparin and advised to quit smoking and using oral contraceptives.

Six weeks later she developed new stroke symptoms, extreme fatigue, disorientation and headache. Physical examination showed petechiae. Laboratory testing showed thrombocytopenia ( $5 \times 10^9/L$ ), microangiopathic haemolytic anaemia (Hb 3.4 mmol/l, reticulocytes 323) and light renal failure. Clotting factors were unremarkable. Activity of ADAMTS13 was < 5%. She was diagnosed with TTP and treated with plasma exchange (PEX).

**Results:** After treatment with PEX her neurological deficits improved and laboratory findings returned to normal.

**Conclusions:** Thrombotic thrombocytopenic purpura is a rare cause of neurologic symptoms. In this case typical laboratory findings were found after a delay of a few weeks after first presentation with stroke. TTP has to be considered a potential diagnosis in young patients presenting with stroke, even if initial laboratory findings are normal.

**Trial registration number:** n/a

## AS23-056

### TRANSCRANIAL DOPPLER SCREENING PROGRAMME IN CHILDREN AND ADOLESCENTS WITH SICKLE CELL DISEASE: EXPERIENCE IN A DISTRICT GENERAL HOSPITAL IN THE UK

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**Background and Aims:** Surveillance programs through annual transcranial Doppler (TCD) to prevent stroke in children and adolescents with Sickle Cell Disease (SCD) are a standard of care. However, across the world, screening is inadequate, with rates between 22–44% of eligible children in the United States; there are no European data on feasibility or adherence to the screening program.

We aimed to investigate the feasibility of TCD screening program according to the Stroke Prevention Trial in Sickle Cell Anaemia (STOP) criteria, and screening rates in a district general hospital (DGH) in the UK.

**Methods:** Eligible children underwent local TCD screening as a tertiary paediatric support program from Oxford University Hospital. A dedicated specialist nurse liaised with children and families through home and school visits, facilitating attendance. Patients' clinical details, TCD time-averaged mean of the maximum velocity (TAMMV) and screening outcomes were recorded at each visit.

**Results:** All 44 eligible SCD children attended the screening program (100% rate) between 2016 and 2018; they were classified as per Table 1, and treated accordingly.

Table 1

	NORMAL TAMMV <170cm/s	CONDITIONAL TAMMV 170–199cm/s	HIGH RISK TAMMV >200cm/s
PATIENTS (%)	29 (66)	12 (27)	3 (7)
MEAN AGE (SD)	8.3 (5.1)	6.7 (3.5)	5.3 (2.1)
MEAN TAMMV (SD)	106.9 (26.5)	175.6 (5.2)	201 (1.7)

**Conclusions:** TCD screening for SCD is feasible at a UK DGH, with risk stratification close to the STOP trial recommendations. Specialist nurses

working in the community have a critical role in promoting compliance to the program.

**Trial registration number:** N/A

## AS23-075

### ISCHEMIC STROKE AMONG YOUNG ADULTS IN BRAZIL

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**Background and Aims:** Recent evidence suggests that ischemic stroke (IS) incidence in young adults is increasing worldwide. However, this increase has been associated to a growing prevalence of some traditional vascular risk factors. Unfortunately, there is a lack of data about IS among young adults in Brazil. The aims of this study were (1) to investigate risk factors and etiology of stroke in Brazilian young adults, and (2) to assess predictors of functional outcome at 3 months after stroke.

**Methods:** Consecutive IS patients aged 18–55 years were retrospectively selected from a hospital-based prospective registry from 2014 to 2018. Baseline demographic, risk factors, stroke severity (NIHSS) and etiology were obtained and related to a long-term functional outcome (modified Rankin scale, mRS).

**Results:** Among 2172 patients admitted with acute stroke, 362 (16.7%) were young (54% male). Median age was 48 (IQR 41–52) years and median NIHSS on admission 8 (IQR 4–17). At least one of traditional modifiable vascular risk factors was found in 84% of cases. The other risk factors included illicit drug use (8%) and oral contraceptives (4%). Stroke etiology was cardioembolism in 32%, and large-artery atherosclerosis in 28%. Other determined etiologies were artery dissection (6%); pro-thrombotic state (2%) and vasculitis (1%). Outcome at 3 months was favorable (mRS 0–1) in 51% and fatal in 5%. Stroke severity ( $p < 0.001$ ) and large-artery atherosclerosis etiology ( $p = 0.001$ ) predicted unfavorable outcome.

**Conclusions:** Most Brazilian young IS adults had modifiable vascular risk factors. Moreover, unfavorable outcome was associated with atherosclerosis etiology. Therefore, the prevention strategies are also important in young adults.

**Trial registration number:** N/A

## AS23-039

### “PATENT FORAMEN OVALE(PFO) ASSOCIATED WITH CHIARI NETWORK: AN INFREQUENT CAUSE OF PARADOXICAL EMBOLISM”

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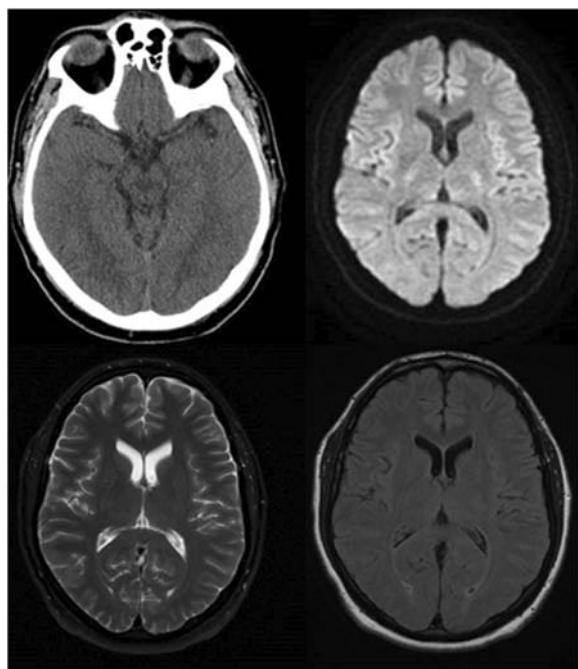
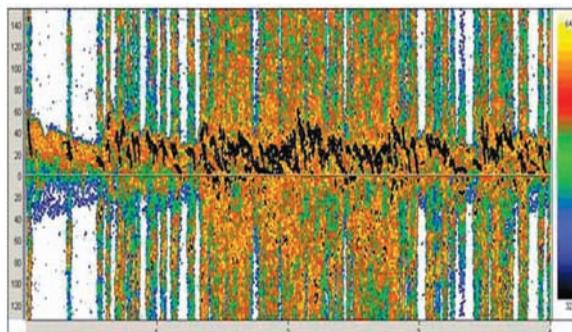
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**Background and Aims:** Chiari Network (QN) is a vestige of the valve of the right venous sinus. It occurs in approximately 2% of the population and is associated up to 80% with PFO. It can be complicated by paradoxical embolism (PE) as stroke and be accompanied by other cardiac manifestations as such as arrhythmias, infectious endocarditis, obstruction to flow, formation of thrombi and cardiac tumors.

**Methods:** A 47-year-old man was admitted to neurology for a transitory episode of sudden onset with decreased verbal fluency accompanied by

hemiparesis in the right side of the body. This clinic was repeated 3 times in the last week.

**Results:** Complete blood analyses, Doppler TSA, 24 h Holter, Neuroimaging with brain MR and intracranial angiography were normal. Ecocardiogram transthoracic visualization detected network Chiari and Transcranial Doppler with bubbles showed a pattern of curtain preconscious compatible with shunt right-left intracardiac. An ecocardiogram transesophageal visualized PFO tuneliforme with passage of bubbles through a network associated with Chiari. Anticoagulation was decided for avoiding new strokes, doing weeks later a successful percutaneous closure of PFO with resection of network Chiari.



**Conclusions:** Present a rare case of recurrent TIAs in a young patient secondary to PE due to PFO associated QN with a successful result after cardiac intervention. The characteristics of the QN explains the pathophysiology of a PE, since it facilitates blood stasis and thrombosis. Its inverted cone morphology also contributes the mobilization of the thrombus to the fenestrated area and the proximity between this area and the PFO explains the embolism, especially during Valsalva maneuvers.

**Trial registration number:** N/A

## AS23-051

### AN UNCOMMON CAUSE FOR ESUS WHICH SHOULD NOT BE FORGOTTEN: PULMONARY AVM IN HEREDITARY HAEMORRHAGIC TELANGIECTASIA WITH PARADOXICAL EMBOLISM

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**Background and Aims:** Embolic strokes of undetermined source (ESUS) may recur if no source is found. Paradoxical embolism through a pulmonary arterio-venous fistula (PAVM) in hereditary haemorrhagic telangiectasia (HHT) is uncommon but should be considered and sought.

**Methods:** review of all stroke/TIA admissions during 2018: case studies of 3 with HHT/PAVM

**Results:** 3 (0.4%) of 821 admissions suffered HHT, 2% of the 137 classified as ESUS A 24y old male presented 4 days after developing a hemianopia he attributed to migraine: CT showed an occipital infarct and CXR a recurrence of a PAVM ablated 4 years earlier. He remained free of recurrence on aspirin, though suffering frequent epistaxis and underwent a second ablation, with regular follow-up. His father, also HHT positive, had had unexplained epistaxis for years. A 72y old female presented with a cerebellar infarct. Petechiae were noted on her tongue; this sign had been overlooked during investigations for iron deficiency anaemia 2y earlier and for TIA 6 months earlier. She was intermittently hypoxic (asymptomatic) – CXR showed a large PAVM. No CXR had been performed during previous assessments. A 64y old female presented with a basal ganglia infarct after stopping warfarin following a GI bleed. She had suffered a septic embolism and cerebral abscess 13 years earlier through a PAVM. Antiplatelets were resumed in place of warfarin.

**Conclusions:** in cases of ESUS HHT and PAVM should be sought. Ask about personal or familial history of epistaxis and anaemia, look for telangiectasia and hypoxia, and check the CXR. TCD, angiography, genetic analysis can confirm diagnosis

**Trial registration number:** N/A

**WITHDRAWN**

infection. Possibility of Xylometazoline associated cerebral vasoconstriction leading to stroke was considered. He was treated with dual anti-platelets and statins and advised to stop xylometazoline. A review of literature shows 5 cases of ischemic stroke reported in association with xylometazoline use out of which 2 were in the posterior circulation territory and 3 were in the middle cerebral artery distribution.

**Conclusions:** Xylometazoline use can rarely lead to stroke. It should not be available as over the counter drug to limit such vascular events.

**Trial registration number:** N/A

## AS23-037

### A RETROSPECTIVE STUDY OF STROKE IN YOUNG ADULTS FROM A SINGLE TERTIARY CARE HOSPITAL FROM EASTERN INDIA

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**Background and Aims:** Strokes in young adults are reported as being uncommon, comprising 10%–15% of all stroke patients. Recently sharp rise in young stroke observed with more prevalence of traditional risk factors than previously suggested. We aimed to look the incidence and different etiology of stroke in young.

**Methods:** We retrospectively surveyed consecutive patients admitted in our stroke centre over the last 6 yrs. We identified the young patients (15–49 yrs) admitted with acute stroke. Baseline and discharge NIHSS, vascular risk factors, medical & imaging records and patient demographics were recorded.

**Results:** Out of 1304 patients, 194(14.87%) belonged to young stroke. Among them 113(58.24%) were male while 81 (41.75%) were female. Among 194 patients, 128(65.97%) had ischemic while 66(34.02%) had hemorrhagic stroke. Out of 194, 42(21.64%) had large vessel disease, 37(19.07%) small vessel disease, 32(16.49%) cardio-embolic and 48 (24.74%) had undetermined etiology while 35(18.04%) patients had other determined etiology. The commonest vascular risk factors were hypertension followed by smoking, diabetes and dyslipidemia. Out of 194, 41(21.13%) patients had no known vascular risk factors. Among 32 patients with cardio-embolic stroke, 17(53.12%) patients had rheumatic heart disease. Out of 35 patients with other determined etiology, 13 (37.14%) had cervical dissection. Commonest location of hemorrhage was basal ganglia followed by thalamus, brain stem, cerebellum and lobar with hypertension being the commonest cause.

**Conclusions:** In our study, major mechanism of stroke in young remained undetermined followed by large vessel disease. Hypertension was commonest vascular risk factor followed by smoking. Rheumatic heart disease accounted for the majority of cardio embolic stroke.

**Trial registration number:** N/A

## AS23-079

### YOUNG CRYPTOGENIC ISCHEMIC STROKE PATIENTS: A DESCRIPTIVE ANALYSIS OF BASIC CLINICAL AND LABORATORY OUTCOMES

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**Background and Aims:** Approximately one-fourth of ischemic stroke occur in young adults. Despite an extensive work-up the cause of ischemic stroke (IS) remains often unclear (cryptogenic). Our aim was to assess clinical and laboratory parameters and determine their relationship to clinical outcome in young cryptogenic IS patients.

**Methods:** The study set consisted of acute IS or TIA patients < 50 years enrolled in the prospective HISTORY (Heart and Ischemic STrOke Relationship studY) study registered on ClinicalTrials.gov (NCT01541163). We perform extensive diagnostic work-up to determine etiology of IS. Based on follow-up visits clinical outcome and stroke recurrence was recorded.

**Results:** Out of 279 young patients enrolled in to HISTORY study, 200 (71.6%, 122 males, mean age  $41.5 \pm 7.3$ ) were identified as cryptogenic. PFO was detected in 57 (28.5%) patients and was more frequent in patients with IS in posterior circulation. D-dimer level  $>500\text{ng/l}$  was detected in 30% patients and NT-pro BNP was elevated in 17.5% patients. Recurrence IS occurred in 7 (3.5%) patients in  $24.2 \pm 22$  months of follow-up. Patients with stroke recurrence were older (mean age 47.4 years) and had higher prevalence of hypertension, hyperlipidemia and smoking. Patients with hyperglycemia in admission had good 3 months clinical outcome (mRS 0–2) in 73% compared with 88% with normoglycemia.

**Conclusions:** In our study we found hyperglycemia as a negative prognostic factor for clinical outcome. PFO, high D-dimer level and elevated NT-pro BNP was not associated with higher risk of stroke recurrence.

**Trial registration number:** HISTORY (Heart and Ischemic STrOke Relationship studY) study registered on ClinicalTrials.gov (NCT01541163)

## AS23-011

### TRUNCATED EPITHELIAL SODIUM CHANNEL B SUBUNIT RESPONSIBLE FOR LIDDLE SYNDROME IN A CHINESE FAMILY

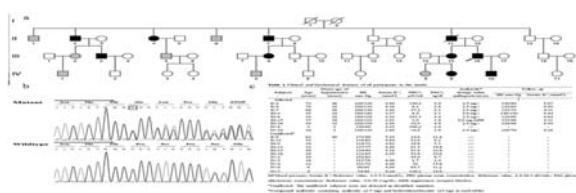
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**Background and Aims:** Liddle syndrome is a rare autosomal dominant disease caused by mutations in genes coding for epithelial sodium channel (ENaC) subunits. The aim of this study was to identify the mutation responsible for the Liddle syndrome in an extended Chinese family.

**Methods:** DNA samples from the proband with early-onset, treatment-resistant hypertension and hypokalemia and 19 additional relatives were all sequenced for mutations in exon 13 of the  $\beta$ -ENaC and  $\gamma$ -ENaC genes, using amplification by polymerase chain reaction and direct DNA sequencing.

**Results:** Genetic testing of exon 13 of SCNN1B revealed duplication of guanine into a string of three guanines located at codon 602. This frame-shift mutation is predicted to generate a premature stop codon at position 607, resulting in truncated  $\beta$ -ENaC lacking the remaining 34 amino acids, including the crucial PY motif. Among a total of nine participants with the identical mutation, different phenotypes were identified. Tailored treatment with amiloride was safe and effective in alleviating Liddle syndrome. No mutation of SCNN1G was identified in any of the examined participants.



**Conclusions:** We report here a family affected by Liddle syndrome harboring a frameshift mutation (c.1806dupG) with a premature stop codon deleting the PY motif of  $\beta$ -ENaC. Our study demonstrates that the earlier Liddle syndrome patients are diagnosed by genetic testing and treated with tailored medication, the greater the likelihood of preventing or minimizing complications, such as stroke, cardiac diseases, and other target organ disorders.

**Trial registration number:** N/A

### AS23-073

#### ONE SIDE DIRECT BYPASS SURGERY IN SUSPECTED MOYAMOYA DISEASE: A CASE REPORT

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**Background and Aims:** Moyamoya disease (MMD) is a rare idiopathic condition caused by progressive steno-occlusion of the cerebral arteries. Hemodynamic impairment of blood flow and repeated ischemic symptoms are the main indications for surgical treatment. However, despite the consensus on the efficacy of revascularizing surgery in Asia, the indications in caucasian patients are still controversial. Moreover perioperative and long-term complications are rare, but must be carefully assessed.

**Methods:** CASE DESCRIPTION: a caucasian 45-years-old woman referred to our Stroke Unit, presenting sudden onset of aphasia due to multiple bilateral hemispheric ischemic lesions. The transcranial Doppler ultrasound and MRI study showed multiple intracranial vessels stenoses of terminal portion of left internal carotid artery and proximal tract of bilateral middle and anterior cerebral arteries. Cerebral angiography confirmed the intracranial arteries narrowing and the lack of collateral circulation provided mainly from the leptomeningeal vessels, suggestive for vasculitis or MMD. Cerebrospinal fluid analysis showed normal parameters. High level intravenous steroid therapy did not show efficacy. Dual antiplatelet therapy was administered before surgical revascularization. Afterwards left superficial temporary artery-middle cerebral artery bypass was performed without any complication.

**Results:** At six months the transcranial Doppler showed good cerebral reperfusion and neuropsychological tests showed a persistent impairment of language, visuo-spatial and praxis functions.

**Conclusions:** This case provided further evidence that bypass surgery is an effective and safe treatment to re-establish cerebral blood flow and may be considered like first-line therapy also in caucasian patients and in asymptomatic cases.

**Trial registration number:** N/A

### AS23-016

#### A RARE CAUSE OF EMBOLIC STROKE IN A PATIENT WITH B-THALASSAEMIA

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**Background and Aims:** Left ventricular noncompaction (LVNC) is a rare cardiomyopathy. It is most commonly congenital, however acquired forms have been described. It results in multiple and excessive trabeculations with deep intertrabecular recesses which communicate with the left ventricle (LV) and a thickened ventricular myocardium with two distinct layers, compacted and noncompacted. It varies in presentation, from severe prenatal manifestations to asymptomatic cardiomyopathy or even heart failure and systemic embolisation, secondary to mural thrombi formation. It has been reported to be more prevalent in individuals with  $\beta$ -thalassaemia, though the causative relationship has not to date been established.

**Methods:** Case report

**Results:** A 36-year-old male with  $\beta$ -thalassaemia intermedia presented with confusion and visual loss. He had splenectomy in childhood resulting in chronic moderate thrombocythaemia but was not transfusion-dependent with no hospitalisations as an adult. Fundoscopy demonstrated retinal emboli. There were no clinical signs of congestive heart failure. Brain magnetic resonance imaging (MRI) showed multi-territorial shower emboli. An echocardiogram showed restrictive LV filling pattern and calcification of the LV outlet. Cardiac MRI demonstrated features consistent with LVNC but ruled out significant cardiac siderosis. Other causes for calcification were ruled out. He was anticoagulated with warfarin but had recurrent, symptomatic retinal ischaemia. He has had no further events after the addition of clopidogrel.

**Conclusions:** The co-existence of splenectomy-related thrombocythaemia with the deep intertrabecular recesses of LVNC may explain the recurrent embolism in this case, who did not have severe cardiac siderosis. Further research is needed to understand the link between LVNC and thalassaemia.

**Trial registration number:** N/A

### AS23-019

#### EXPERIENCE WITH THE INCORPORATION OF A TRANSCRANIAL DOPPLER PROTOCOL FOR THE MONITORING OF SICKLE CELL ANEMIA IN A STROKE CENTER

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**Background and Aims:** Current guidelines recommend Transcranial Doppler (TCD) monitoring for sickle cell disease (SCD) patients to identify those at high risk of stroke and to guide treatments. However, low rates of TCD screening have been reported, suggesting physicians' lack of knowledge of the role of TCD in SCD. Our aim is to describe the results of TCD monitoring in patients with SCD after its incorporation into the neurosonology portfolio of the Neurology Department in a Stroke Center with the collaboration of the pediatric haemato-oncology unit.

**Methods:** Retrospective study of patients with SCD between January 2014 and December 2017. Age, sex, risk factors, neurological manifestations, DTC-Time Averaged Maximum Mean (TAMM), brain MRI findings and treatment decisions were analyzed.

**Results:** Of a total of 16 patients with SCD, 12 (75%) were studied. The majority were HbSS homozygotes (58.3%). Seven were males and average age was 12 years (SD 5.5). Ten patients (83.3%) presented normal values of TAMM, none of them suffered a stroke and did not show alterations in MRI. In one case (8.3%) a conditional TAMM (170–199 cm/s) was found, so more frequent controls were scheduled and hydroxyurea was restarted. Another patient (8.3%) not attending DTC controls had a cerebral infarction and had a pathological TAMM so was programmed for hypertransfusion

**Conclusions:** The incorporation of a TCD monitoring protocol in patients with SCD has made it possible to guarantee follow-up in primary stroke prevention and guide the treatment of this disease without the occurrence of symptomatic strokes in the patients evaluated.

**Trial registration number:** N/A

## AS23-025

### PAEDIATRIC STROKE CODE. FREQUENCY, CLINICAL FEATURES AND FINAL DIAGNOSIS

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**Background and Aims:** Our aim is to analyse the frequency, clinical features and final diagnosis of stroke code at paediatric age (from 1 month to 16 years-old) in a stroke centre with a multidisciplinary paediatric stroke management protocol.

**Methods:** Retrospective analysis from the emergency calls to the neurology service selecting those activating the paediatric stroke code between January 2014 to March 2018. In-hospital strokes were excluded.

**Results:** We analysed 204 emergency calls from the Paediatric Hospital, which 22 (10.7%) were activated as stroke codes (6 cases per year on average). The diagnosis of stroke was confirmed in 7 (31.8%), with 2 brain haemorrhages (29 %) and 5 cerebral infarctions (71 %). The median door-to-neuroimaging time was 177 minutes (IQR 88, 355) and the median NIHSS was 11 (IQR 3, 13). Two out of 5 ischemic stroke patients were treated with recanalization therapies: 1 patient with intravenous thrombolysis plus mechanical thrombectomy and other with primary mechanical thrombectomy. Fifteen patients were diagnosed with stroke mimics (72.7%), being migraine the most frequent diagnosis with 7 patients (46 %) followed by 2 patients with convulsive disorders (13%), 1 patient with epileptic seizure (7%), 1 patient with a brain tumour (7%) and 4 patients with other diagnosis (27%).

**Conclusions:** Paediatric stroke code is an uncommon neurological emergency even in a Stroke Center and only one third of them are actually strokes, being the migraine the main stroke mimics. A paediatric stroke code allows the indication of recanalization treatments for properly selected children suffering ischemic stroke.

**Trial registration number:** N/A

## AS23-065

### CAROTID WEBS ASSOCIATED WITH CRYPTOGENIC ISCHEMIC STROKES : A MONOCENTRIC RETROSPECTIVE STUDY FROM A CONTINENTAL FRENCH COMPREHENSIVE STROKE CENTER TERTIARY STROKE UNIT

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**Background and Aims:** Carotid webs (CW) may be an under-recognized source of anterior circulation cryptogenic ischemic stroke or TIA (ACS). Its frequency is unknown in European continental patients with ACS.

To evaluate the frequency of CW associated with ACS in a cohort of consecutive patients from a French Comprehensive stroke center.

**Methods:** We conducted a monocentric cohort study in consecutive patients ≤ 65 years old admitted with ACS, after excluding patients with probable causes according to ASCOD phenotyping, in the Stroke Unit of University Hospital of Montpellier, France. Multiplanar CTA were reviewed in search of a CW, according to ad-Hoc criteria, by 2 couples of residents/seniors from Neurology and Neuroradiology departments.

**Results:** From 01/01/2015 to 31/12/2017, among 661 patients with anterior circulation stroke, 361 were excluded according to ASCOD phenotyping (including 53 dissections) resulting in 300 ACS patients. 190 ACS patients (mean age 51, men 61%) with CTA were finally included. Among these 190 ACS patients, a CW was unmasked or confirmed in 12 patients (mean age 52, 7 women, 11 Caucasian). Ipsilateral to stroke in 10 patients, bilateral in 1, contralateral in 1. The frequency of CW associated with ipsilateral ACS was 5.8% (95% CI: 3.1-10.4%).

**Conclusions:** CW ipsilateral to ACS in patients ≤ 65 years was found in a substantial portion of our population, although about 7 times less frequent compared to Afro-Caribbean population. CW may account for about 6% of ACS in continental European young patients. Given assumed high recurrence rate of stroke associated with CW and specific management, its recognition is crucial.

**Trial registration number:** N/A

## AS23-033

### A RARE CAUSE OF CARDIOEMBOLIC STROKE IN A YOUNG PATIENT

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**Background and Aims:** The young stroke (below the ages of 45 years) occurs in 10–15% of people. Atrial myomas are the commonest primary cardiac tumours found on echocardiogram, and it is found in 75/100000 autopsy studies. Overall prevalence of cardiac tumours is 0.02%. We highlight the importance of performing thorough cardiac review on young stroke patients as rare and treatable causes may be missed.

**Methods:** A 35 year old male presented with right quadrantanopia with odd rude behaviour which was unusual for him as per partner. The MRI showed a cardio-embolic stroke in both hemispheres. He had CT angiogram, 24 hour Holter monitor and echocardiogram. He also had a normal

retroviral screen, autoimmune screen and lupus anticoagulant testing. We decided to perform a transthoracic echo (TOE) which showed a mobile echogenic mass, measuring 0.8X0.6cm, attached at level of A1/P1 mitral valve scallops. He was listed for mitral valve surgery and was anticoagulated until then.

**Results:** Patient underwent surgery and the tumour was a Papillary Fibroelastoma (PFE), with an incidence of 0.0002-0.33%. They have about 5% risk of embolization.

**Conclusions:** We present a classic cryptogenic case of cardio embolic stroke in a young patient. His routine tests were all negative and therefore we arranged a TOE, which showed the mitral valve tumour. We believe that this PFE was the cause of his stroke and operated on the valve. We would like to use this case to highlight the importance of vigilance in true cryptogenic strokes in the young, and consider TOE examination early in such cases.

**Trial registration number:** N/A

## WITHDRAWN

### AS23-013

#### THE ROLE OF D-DIMER VALUES AND A NEW CLINICAL SCORE FOR THE PREDICTION OF CEREBRAL VENOUS THROMBOSIS IN ISOLATED HEADACHE

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**Background and Aims:** Predictive value of D-dimer values for prediction of cerebral venous thrombosis (CVT) in isolated headache at the emergency department is uncertain and a clinical score would be helpful.

**Methods:** This prospective multicenter study, included 88 consecutive adults (09/2009-02/2016) with isolated headache presenting at two university hospital emergency departments. On admission, patients underwent clinical neurological examination, blood-sampling for D-dimers-measuring (ELISA-test) and MR-/CT-venography. For CVT predictive value of D-dimer values alone was analysed. Moreover, a clinical score consisting of D-dimer values  $\geq 500\mu\text{g/l}$  and of for CVT most predictive clinical variables was established by multivariate logistic regression and weighing of score subitems according to their regression coefficients.

**Results:** CVT was confirmed in 12 (13.6%) patients by neuroimaging. D-dimer values showed an AUC 0.774. Predictive value of D-dimer values at the cut-off of  $\geq 500\mu\text{g/l}$  was: Sensitivity 91.7%/Specificity 72.4%/PPV 54.1%/NPV 96.1%/ACC 77.5%. The for CVT most predictive new clinical score consisted of the following variables: known thrombophilia (4 points), oral contraception (2 points), duration of symptoms  $>6$  days (2 points), worst headache ever (1 point) and D-dimer values  $\geq 500\mu\text{g/l}$  (3 points) (AUC 0.892). At the cut-off  $\geq 8$  CVT prediction was as follows: Sensitivity 33.3%/Specificity 100%/PPV 100%/NPV 90.5%/ACC 90.9%, at the cut-off  $\geq 3$ : Sensitivity 100%/Specificity 51.3%/PPV 24.5%/NPV 100%/ACC 58%.

**Conclusions:** Our study shows that D-Dimer values alone and the proposed new clinical score may be helpful for the prediction of CVT in isolated headache. None of our CVT patients showed very low clinical score values and none of our patients showed high clinical score values but no CVT.

**Trial registration number:** N/A

### AS23-055

#### FAMILIAL CLUSTERING OF EMBOLIC STROKE OF UNDETERMINED SIGNIFICANCE

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**Background and Aims:**

**Background:** Embolic stroke of undetermined source (ESUS) is not known to be associated specifically with any monogenic condition and is probably related to a sum of different etiologies. We studied 3 families with familial clustering of stroke where the proband was younger than 56 years and experienced ESUS.

**Objective:** To analyze the possibility of monogenic causes underlying stroke in young patients with ESUS and history of stroke heredity.

**Methods:** Clinical data of 14 affected members and 10 healthy family members were compiled. Whole exome sequencing (WES) of all the probands was performed on Ion Proton (Life Technologies), using base and variant calling by Torrent Suite. Ion Reporter Libraries were generated with Ion AmpliSeq Exome RDY kit. We only considered exonic or splice-site variants with a minimum allele frequency < 1%. A previously established comprehensive stroke gene panel was used to detect possible known monogenic causes for stroke. An autosomal dominant (AD) model of inheritance of the underlying disease was assumed.

**Results:** Clinical traits are presented in the Table. Specific additional characteristics that might cause ESUS were identified for each individual family. However, no specific known monogenic forms of stroke was detected on WES of the 3 families.

**Conclusions:** ESUS in families with clustering of stroke may be associated with specific clinical characteristics including prothrombotic/cardio-logical findings. This suggests that ESUS may sometimes be related to different monogenic diseases.

**Trial registration number:** N/A

**AS23-069**

### DESPERATE MEASURES – ALTERNATIVE MEDICAL TREATMENT LEADING TO POSTERIOR REVERSIBLE ENCEPHALOPATHY AND STROKE

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**Background and Aims:** Posterior Reversible Encephalopathy Syndrome is a rare and potentially dangerous condition associated with a number of known triggers. We present a case suggesting a novel trigger for PRES leading to secondary ischemic stroke.

**Methods:** A 57 year old woman with surgically treated breast cancer two years earlier and known pulmonary metastases with ongoing chemotherapy was brought to our emergency department because during the first session of a self-prescribed alternative medical treatment with intravenous ozone therapy she presented the new-onset of a generalized tonic-clonic seizure with clinical and imaging features suggesting PRES with secondary stroke.

**Results:** Neurological examination revealed complete bilateral blindness and acute confusional state associated with an aphasic disorder and no significant motor deficit. In the following 24–48 hours there was clinical improvement with only a subtle aphasic disorder and subtle visual metamorphopsias. 72 hours after onset the patient presented a complete recovery with no lasting symptoms. MRI examination unfortunately undertaken after complete remission of symptoms revealed a subtle right occipital paraventricular T2 hyperintensity suggestive for possible vasogenic edema in remission and a small subacute right cerebellar infarction (presumed secondary to severe posterior endothelial dysfunction/vasoconstriction) which fortunately led to no lasting deficit at follow-up.

**Conclusions:** Acute onset of symptoms during a complementary and alternative medical treatment with intravenous ozone therapy with clinical and imaging features suggesting the diagnosis of PRES leading to a secondary ischemic stroke outlines the potential danger of these

procedures and the need for further study of these treatments and the pathogenic mechanisms of PRES.

**Trial registration number:** N/A

**AS23-048**

### SYSTEM-INTEGRATIVE PSYCHOPHYSIOLOGICAL APPROACH IN THE DIAGNOSIS OF ACUTE CEREBRAL STROKE IN YOUNG PEOPLE

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**Background and Aims:** The goal – to summarize the results of system-integrative psychophysiological approach in diagnosis of cerebral stroke with transient-ischemic attacks (TIA) in anamnesis and outcome of disease.

**Methods:** Materials/methods.

In study included 130 patients: divided into 4 groups:

1. 75 with arterial hypertension
2. 22 with chronic cerebral ischemia
3. 18 with obesity
4. 15 with diabetes

Data obtained were subjected to matrix-based factor analysis using 3 blocks of approach:

1. Psychological
2. Neurophysiological
3. Psychophysiological

**Results:** In 74 patients with transient ischemic attacks in the anamnesis the stroke occurred in period from 10 months to 3.8 years, in 28 patients up to 6 months, at 18 cases – from 6 months to 1 year, at 23 cases – from 3–5 years, in 10 – from 5–10 years. Stroke in carotid pool developed in 85 patients, in vertebro-basilar – in 45 cases. When circulation in carotid pool was disturbed, the cerebral stroke developed not only more often, but also earlier than stroke caused by insufficiency in vertebrobasilar basin. Among 59 patients with hemorrhagic stroke – 37 had no TIA anamnesis. 71 patients with ischemic stroke didn't have TIA. In prognostic evaluation, it's necessary to take into account the nature of TIA (local, cerebral, mixed). If TIA is manifested by local symptoms, prognosis is worse. The analysis made possible to evaluate the prognostic value of TIA in relation to possibility of recurrent stroke – its time, lesion localization, outcome.

**Conclusions:** The proposed approach provides good results in diagnosis and prevention of cerebral stroke determining the perspectives for further implementation to neurological practice.

**Trial registration number:** N/A

**AS23-077**

### INTRACEREBRAL HEMORRHAGES IN THE LATE PERIOD OF THE INTERNAL CAROTID ARTERY DISSECTION

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**Background and Aims:** Cervical artery dissection (CeAD) is a common cause of an ischemic stroke (IS) in young adults. The development of the intracerebral hemorrhages (ICH) in patients who survived CeAD and do not have arterial hypertension, cerebral artery aneurysms has not been yet described in the literature.

**The aim** is to describe ICH in patients survived internal carotid artery dissection (ICAD).

**Methods:** We describe three male patients who at the age of 53.25 and 35 years underwent ICAD with arterial occlusion and in one patient – subsequent recanalization. Dissection was verified by MRI and/or CT. Clinically ICAD was manifested by IS with mild or severe residual neurological deficit: mRS equal to 1 (1 patient) and 3 (2 patients).

**Results:** In 3.5 months, 13.5 years and 3 years respectively, these patients developed ICH, which were not related with arterial hypertension, cerebral aneurysms and anticoagulants intake. ICH were verified by MRI and located in the brain hemisphere on the dissection side (2 patients) and bilaterally (1 patient). Clinical ICH manifestations included unilateral persistent hyperkinesis (1 patient) and epileptic seizures (1 patient). In the third patient ICH was located in the area of cerebral infarction and was asymptomatic. MR-spectroscopy performed in one patient on 40 and 48 days after ICH revealed a high lactate peak.

**Conclusions:** This case series allow us to propose that mitochondrial disorder which may underlie arterial wall dysplasia in CeAD [1] may also involve small intracerebral arteries leading to mitochondrial angiopathy. We hypothesize that the latter may be the cause of ICH after CeAD.

**Trial registration number:** N/A

## AS23-024

### FABRY DISEASE DIAGNOSIS IN A MIDDLE-AGED TRANSIENT ISCHEMIC ATTACK PATIENT: A CASE REPORT

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**Background and Aims:** Fabry disease (FD) is a rare, tends to be underdiagnosed, cause of cerebrovascular accidents in young and middle-aged patients.

**Methods:** The 48 year-old male presents with divergent strabismus due to the left eye, right hemihypesthesia, right hyperreflexia. Symptoms regressed in several hours.. Physical examination revealed no angiokeratomas. Renal function was normal.

He had a history of progressive hearing loss, transient arthralgia, an attack of fever of unknown origin at the age of 47.

Neurovisualization: cerebral CT angiography revealed calcium deposits in the both vertebral arteries walls (VA) and right VA proximal stenosis up to 50%; MRI brain scan revealed cystic parenchymal lesions within the subcortical white matter and basal ganglia, contrast enhancing in T1 Fat-Sat scan in the walls of the both vertebral and the initial segment of the basilar arteries. These findings could probably reflect inflammatory changes in the vessels walls.

The cerebrospinal fluid analysis revealed mild lymphocytic pleocytosis.

Transthoracic echocardiography: asymmetric left ventricular hypertrophy.

**Results:** Subsequently performed biochemical and genetic tests confirmed suspected FD.

**Conclusions:** Young and middle-aged patients with cerebrovascular accidents have to be examined to exclude FD.

First described by our study team T1 Fat-Sat scans MRI contrast uptake in cerebral vessels walls in FD should be taken into consideration as the method for pathology mechanisms investigation in patients with FD

**Trial registration number:** N/A

## WITHDRAWN

## AS23-066

### PATHOLOGICAL TORTUOSITY OF THE INTERNAL CAROTID ARTERY AS A RISK FACTOR OF STROKE IN PATIENTS YOUNG AND MIDDLE AGE

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**Background and Aims:** One of the leading causes of cerebral blood flow extracranial origin is pathological tortuosity of the internal carotid artery (PT ICA). Children and young people with symptoms of cerebral insufficiency, this pathology is found in 14–30%.

The aim – the study of symptomatic cases of PT ICA in patients young and middle age

**Methods:** Surgical specimens investigated 79 patients for 45 years, operated with symptomatic PT ICA. The diagnosis of PT ICA installed at duplex ultrasound scanning CA. The main method of surgery was resection with redressation and reimplantation ICA. Pathological study was conducted of all cases.

**Results:** Among patients women dominated – 55 (70%), there were 24 men (30%) The youngest patient was 18 years old. Among the clinical manifestations in half of operated patients, TIA was observed with neurological symptoms of varying degrees of severity from a few seconds to days. Postponed stroke is detected in one third of patients. Violation of

the visual function, headaches and vertigo was detected in 74 (19.6%) patients. Four patients were admitted to a clinic with acute stroke. The most common type of software was coiling – 43 cases (54.4%), rarely observed C- and S-shaped curves – 18 (22.7%) and kinking – 14 (17.7%). In pathological study of PT ICA revealed intimal hyperplasia; irreversible changes of elastic fibers, fibrosis and degeneration of collagen fibers of the media; sclerosis of adventitia.

**Conclusions:** Clinically PT ICA manifest transient ischemic attack and dyscirculatory disorders encephalopathy. A typical type of PT in young is coiling.

**Trial registration number:** N/A

## AS23-067

### CEREBRAL VENOUS-SINUS THROMBOSIS: EVALUATION OF RISK FACTORS AND POOR OUTCOME PREDICTORS

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**Background and Aims:** Cerebral venous-sinus thrombosis (CVST) is an uncommon cause of stroke, accounting for 0.5-1% of all stroke cases. The aim of our study is to assess poor outcome predictors in CVST.

**Methods:** Consecutive CVST patients admitted to a single centre were included in a retrospective observational study from 2009–2018. Demographic, clinical, radiological, and laboratory data were collected. Logistic regression was done to detect poor outcome, defined as recurrence, death or modified Rankin Scale (mRS) score  $\geq 3$  at 90 days.

**Results:** Among 69 CVST patients were included (median age 42, IQ 33–56, 62.3% female). Median follow-up time was 250 days (IQ 176–368). The most frequent clinical manifestations were intracranial hypertension syndrome (59.4%) and focal signs (37.7%). Encephalopathy or altered mental status (AMS) occurred in 14 patients (20.3%). Transverse sinus was the most involved venous sinus (26.1%). Cerebral haemorrhage and venous infarction occurred in 26 (37.7%) and 27 (39.1%) patients, respectively. Intracranial hypertension (21.4% vs 1.8%;  $p < 0.005$ ) and elevated D-dimer ( $>500\text{mcg/L}$ ) (14.3% vs 0%;  $p = 0.007$ ) were associated with more recurrence rates. AMS, pathological D-dimer and older age were related to poor functional outcome at 90 days ( $\text{mRS} \geq 3$ ) (35.7% vs 10.9%;  $p = 0.038$ ), (14.3% vs 0%;  $p = 0.029$ ), and (56 years old vs 39 years old;  $p = 0.005$ ), respectively. AMS was identified as independent predictor of death (OR 7.085, 95% confidence interval [CI] 1.59–31.54;  $p = 0.01$ ) and disability/independence at 90 days (OR 4.53, 95% CI 1.13–18.09;  $p = 0.032$ ).

**Conclusions:** Intracranial hypertension and elevated D-dimer are related to CVST recurrence. In our series, AMS at admission have been identified as a relevant predictor of disability and death in CVST patients.

**Trial registration number:** N/A

## AS23-022

### CLINICAL MANIFESTATIONS OF PRIMARY ANGIITIS OF THE CENTRAL NERVOUS SYSTEM INVOLVING THE INTERNAL CAROTID AND VERTEBRAL ARTERIES

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**Background and Aims:** Primary angiitis of the central nervous system (PACNS) is one of the less studied causes of ischemic stroke (IS). High-resolution vessel-wall imaging (HRVWI) has improved the diagnosis of PACNS of the internal carotid (ICA) and vertebral arteries (VA).

**Aims:** To study clinical presentation of PACNS of ICA and VA.

**Methods:** 30 patients (mean age  $36.8 \pm 11.8$  years, 22 men (73%) with PACNS of ICA and VA diagnosed with HRVWI were clinically examined.

**Results:** ICA was affected in 23 patients (77%), VA – in 5 (17%), both – in 2 (6%). The lesion was usually presented by prolonged artery stenosis (43%), total occlusion of the artery (40%), or their combination (17%). Clinical manifestation of PACNS of ICA and VA in 28 patients (93%) was presented with IS, in 17% of cases it combined with transient ischemic attack (TIA). In 38% of cases IS repeated over a period from 2 weeks to 2 years (mean 10 months). Diffuse headache shortly before or concurrently with IS was presented in 31% of cases. In some patients IS was preceded by fatigue for several weeks/months (21%). According to the medical history of patients, there were frequent (2–3 times a year) herpetic rashes on the lips, rarely on the skin (44%), chickenpox in 20–28 years (7%), and psoriasis (7%).

**Conclusions:** The presence of the steno-occlusive arterial lesion in the young requires HRVWI. The leading clinical presentation of PACNS of ICA and VA was IS with or without prior TIA. In some cases, IS was preceded by diffuse headache and fatigue.

**Trial registration number:** n/a

## AS23-072

### MOYAMOYA SYNDROME ASSOCIATED TO PSORIATIC ARTHRITIS: A CASE REPORT

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**Background and Aims:** Moyamoya syndrome (MMS) is an isolated chronic, usually bilateral, vasculopathy of undetermined etiology characterized by progressive narrowing of the terminal intracranial portion of the internal carotid artery and circle of Willis. In the background of MMS are often present autoimmune disorders, like type-I-diabetes, autoimmune thyroiditis, systemic lupus erythematosus, scleroderma, antiphospholipid antibody syndrome, autoimmune polyendocrine syndrome.

**Methods:** We present a case of 45-years-old man with MMS associated with psoriatic arthritis.

**Results:** The patient was admitted to our Stroke Unit because of multiple episodes of transient right hand hyposthenia within the last 18 months. Past medical history was remarkable only for psoriatic arthritis treated with methotrexate since three years, dyslipidemia and smoking habit. Magnetic resonance (MR) imaging showed multiple ischemic lesions and moderate atrophy in the left hemisphere. MR angiography evidenced bilateral carotid siphon narrowing, involving also the origin of middle and anterior cerebral arteries, more evident in the left anterior circulation, where the classical “puff of smoke” was present and MR perfusion proved severe hypoperfusion. This pathological findings was confirmed by cerebral angiography, staging the disease at Suzuki grade 3. Transcranial Doppler documented reduced cerebrovascular reserve also in the right hemisphere. Extensive laboratory testing demonstrated only hypertriglyceridemia. EEG showed bilateral slow waves. Neuropsychological evaluation revealed impaired processing speed. While surgical treatment was planned, he started 100mg/q.d.-aspirin therapy.

**Conclusions:** Unless unilateral MMD may be more associated with autoimmune disease, we present -to our knowledge- the first case of

bilateral MMS and psoriatic arthritis, pointing towards autoimmune association in partially explained etiology of the disease.

**Trial registration number:** N/A

## AS23-021

### ACUTE SYMPTOMATIC SEIZURES IN CEREBRAL VENOUS THROMBOSIS

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**Background and Aims:** Acute symptomatic seizures (ASS) are common among patients with cerebral venous thrombosis (CVT). We studied the characteristics of and factors associated with ASS in CVT.

**Methods:** Consecutive adult patients with CVT were included retrospectively from seven academic hospitals. Patients with previously diagnosed epilepsy were excluded ( $n=18$ ). We defined ASS as seizure at presentation or within 7 days after diagnosis.

**Results:** Of 961 patients (median 42 years, 68% female), 349 (36%) had ASS, of whom 273 (78%) at presentation and 76 (22%) within 7 days after diagnosis. 62 patients (18%) developed status epilepticus. Patients with ASS more often were female (73% vs. 65%), more often had a female-specific risk factor (40% vs. 29%), more often had focal neurological deficit (78% vs. 49%), more often were comatose at admission (10% vs. 4%), and more often had hemorrhagic lesion (52% vs. 24%), non-hemorrhagic lesion (45% vs. 23%), subarachnoid hemorrhage (17% vs. 8%), and thrombosis of the superficial venous system (97% vs. 91%, superior sagittal sinus-, cortical vein- or lateral sinus thrombosis) at baseline imaging (all  $p < 0.01$ ). In multivariate analyses, coma at admission ( $OR = 1.9$ , 95% CI = 1.03-3.53), female-specific risk factor ( $OR = 1.59$ , 95% CI = 1.10-2.29), hemorrhagic lesion ( $OR = 3.63$ , 95% CI = 2.65-4.97), non-hemorrhagic lesion ( $OR = 3.23$ , 95% CI = 2.36-4.43) and superficial venous system thrombosis ( $OR = 2.34$ , 95% CI = 1.14-4.78) remained independent predictors for ASS.

**Conclusions:** ASS occur in one-third of adult CVT patients. Of the neuroimaging findings, superficial venous system thrombosis, hemorrhagic lesions and non-hemorrhagic lesions appeared independent predictors for ASS.

**Trial registration number:** N/A

## AS23-027

### LARGE THROMBOSED SUBCLAVIAN ARTERY ANEURYSM DUE TO EXTRACRANIAL AUTOIMMUNE VASCULITIS: AN UNUSUAL AETIOLOGY OF YOUNG STROKE

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**Background and Aims:** Systemic vasculitis affecting cerebral vessels, resulting in stroke, is well known. However there is a paucity of literature on various mechanisms causing cerebral infarction due to autoimmune vasculitic process. One of the rare mechanisms will be discussed here in our case report.

**Methods:** We report the case of a 48 year old female who was seen in the Acute Stroke Unit of a general hospital in Singapore. She presented with a large posterior inferior cerebellar artery (PICA) territory infarct secondary to left vertebral artery occlusion, and a large palpable left supraclavicular mass.

**Results:** Imaging of the left supraclavicular mass revealed a thrombosed 5.3 x 3.3 x 2.7 cm fusiform aneurysm in the proximal left subclavian artery. Young stroke workup yielded positive antinuclear antibody (ANA) and cytoplasmic antineutrophil cytoplasmic antibodies (c-ANCA). Aneurysmal superior mesenteric and bilateral common iliac arteries, together with renal, splenic infarcts, and femoral arterial emboli strengthened the possibility of autoimmune vasculitis being the underlying cause of stroke. The patient underwent immunosuppressive therapy, anticoagulation for stroke prevention and was offered surgical ligation of the large subclavian artery aneurysm. She recovered well after a short stay of rehabilitation.

**Conclusions:** This case emphasizes on autoimmune vasculitic process resulting in aneurysmal dilatation, causing artery-to-artery thromboembolic infarct. It highlights different treatment modalities such as immuno-modulators, anticoagulation and surgical ligation for large aneurysm, for comprehensive management of the stroke and its underlying cause.

**Trial registration number:** N/A

## AS23-040

### A CASE OF ISCHAEMIC STROKE IN A PATIENT WITH SEVERE ANAEMIA

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**Background and Aims:** We present the case of a 59 year old female, previously independent with a background of type-two diabetes and a repaired retinal detachment. She presented with breathlessness and confusion later found to have multiple infarcts on MRI.

**Methods:** Initial blood results showed a severe normocytic anaemia in this patient with a haemoglobin count of 36 g/l. Initial CT head showed low areas of density in the white matter querying inflammation or infarction. MRI confirmed these to be areas of infarction. The patient was investigated thoroughly for a cause to these infarcts: ECG, CT CAP, vasculitis screen all of which came back negative. Alongside this she was investigated for causes of her anaemia which was eventually confirmed to be autoimmune red aplasia.

**Results:** Whilst there are some cases of stroke with severe anaemia, almost all of these relate to iron deficient anaemia and particularly in children. This makes our case unique in that this related to a pure red cell aplasia, which resulted in a hypovolaemic state with the patient hypotensive on presentation. Given this and the watershed distribution of infarcts

low blood pressure is much more likely as the cause of stroke as opposed to a thrombotic cause.

**Conclusions:** Whilst most cases reported tell of iron deficiency anaemia causing a prothrombotic state and formation of carotid thrombus this case is rather more unique. This case shows a stroke caused by hypovolaemia secondary to an acquired anaemia, which does not appear to have been described before.

**Trial registration number:** N/A

## AS23-078

### EXPERIENCE OF REVERSIBLE CEREBRAL VASOCONSTRICITION SYNDROME AT A TERTIARY NEUROLOGY AND NEUROSURGERY CENTRE IN THE UK

J. Mayer<sup>1</sup>, J. Williamson<sup>1</sup> and A. Sekhar<sup>1</sup>

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**Background and Aims:** Reversible cerebral vasoconstriction syndrome (RCVS) is a condition that typically presents with recurrent thunderclap headache with or without ischaemic or haemorrhagic stroke, subarachnoid haemorrhage (SAH) and seizures.

**Methods:** We performed a retrospective case review of patients diagnosed with RCVS who were referred to a tertiary neurological and neurosurgery centre from 2017–2018. Details including the imaging, presenting features, probable triggers and outcome were recorded

**Results:** Twelve patients were identified. 92% patients were female; mean age at onset was 54 years. All patients presented with thunderclap headache; seven patients had SAH at presentation, with a history of preceding headaches identified in four of these cases; 2 patients had ischaemic stroke at presentation. Eight patients were identified as having triggers; SSRI's (3); phenylephrine (2); doxycycline in combination with nortriptyline; combination of cannabis and amphetamine use with citalopram; and cannabis use alone. Three patients developed symptoms less than two weeks since starting medications. Two patients were identified as having aneurysms which were determined to be incidental and one patient had left internal carotid dissection. All patients were managed conservatively. All had a good outcome with only minor disability.

**Conclusions:** Similar to previous cohort studies, the majority of our patients were middle aged, female and 66% were related to vasoactive substances. Three patients had additional incidental vascular findings posing diagnostic difficulty. Use of antidepressants and cannabis is increasing in the UK therefore acute physicians should be aware of this relationship with RCVS in patients presenting with severe headache.

**Trial registration number:** N/A

## AS23-029

### A FATAL CASE OF FULMINANT POSTPARTUM POSTERIOR REVERSIBLE ENCEPHALOPATHY SYNDROME

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<sup>1</sup>National center for Neurosurgery, Department of Vascular and functional Neurosurgery, Astana, Kazakhstan

#### Background and Aims:

**Background:** Posterior reversible encephalopathy syndrome (PRES) rare and pathophysiologically poorly described pathology. PRES can occur within 30 days after uncomplicated pregnancy and labor.

#### Methods:

**CASE:** 32-year-old woman gravida 1, parity 1. Patient had polyhydramnios, big fetus. The pregnancy was uneventful. History for recent illicit drug use was negative, non-smoking.

There was urgent delivery of a live, full-term female baby. On the 3<sup>rd</sup> day, after childbirth, patient started to complain of neck pain, headache more in the occipital region, BP 150/90 mm Hg. On MRI (A) and MRI angiography (B) no pathology. No signs of brain vessel anomalies. **Fig.1.**

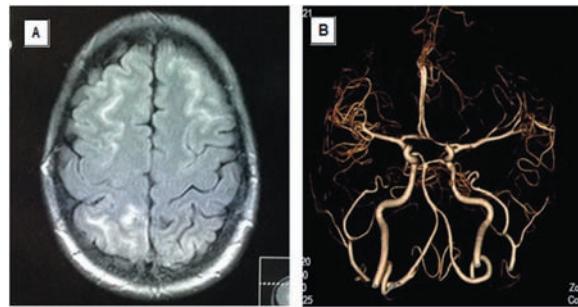


Figure 1.

On 4th day postpartum, patient's condition worsened, developed psychomotor agitation, right-sided hemiparesis, consciousness deterioration, GCS -7.

CT revealed parenchymal hemorrhage in the left hemisphere and basal nuclei region with blood in the ventricular system and subarachnoid space, ventricular system hemotamponade. **Fig.2.**

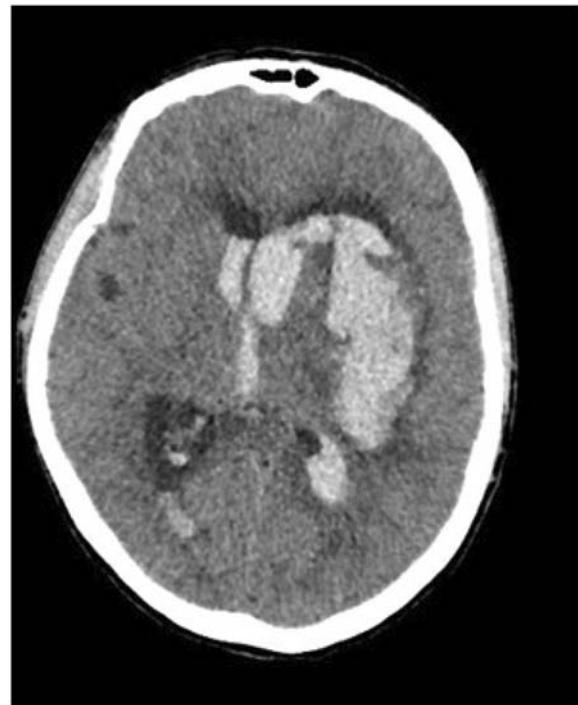


Figure 2.

According to emergency indications, an operation of decompressive craniotomy was performed with restrictive dura mater covering and local fibrinolysis, plus external ventricular drainage.

The patient's condition remained extremely difficult, in dynamics with a deterioration of neurological status due to swelling and secondary ischemia of the brain tissue. **Fig.3.**

Unfortunately, patient was declared brain dead, 18 days postpartum, 15 days after the initial onset of symptoms.

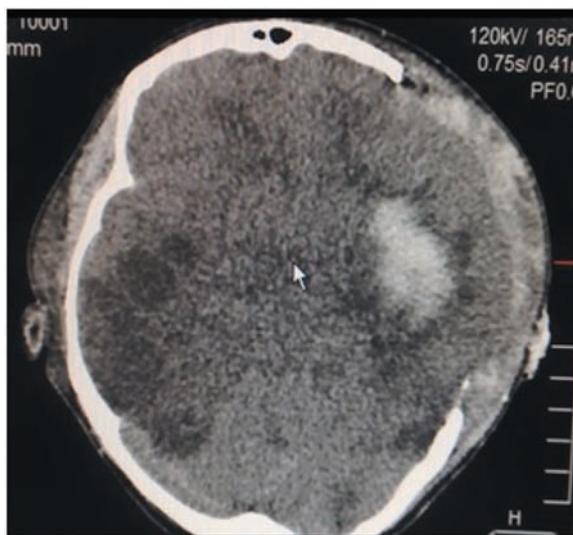


Figure 3.

**Results:**

**DISCUSSION:** Pregnant women with eclampsia in more than 95% also develop PRES. The incidence of hemorrhagic stroke in patients with PRES, according to some estimates, ranges from 10 to 15%. A quick diagnosis of PRES during and after pregnancy remains a problem.

**Conclusions:**

Trial registration number:

**AS23-004****PREVALENCE OF ANTIPHOSPHOLIPID ANTIBODIES IN YOUNG ADULTS WITH ISCHEMIC STROKE**

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**Background and Aims:** In about one third of ischemic stroke the causes aren't well known: in patients with antiphospholipid antibodies syndrome (APS) stroke is the first thrombotic event in about 15% of cases.

Aims of the project were the evaluation of the prevalence of antiphospholipid antibodies (aPL) in young adults with stroke, the investigation of the prevalence of conventional risk factors and the definition of the radiological characteristics of the ischemic lesion.

**Methods:** Inclusion criteria were: age between 18 and 55 years, informed consent and clinical and radiological diagnosis of stroke.

Patients data were collected at the diagnosis and, if an aPL positivity was found, 30 days after the stroke patient was referred to the hematologists.

For each patients were collected demographic features, conventional risk factors and neuroradiological data: aPL profile was determined at diagnosis and if positive was repeated after 12 weeks according with Sapporo Criteria.

**Results:** From January 2017 to December 2018 were enrolled 40 patients out of 600 ischemic stroke.

In our population the prevalence of any APS positivity was 17,5%. Stroke was a relapse of systemic ischemic disease in 35% of patients.

We didn't find any correlations between aPL antibodies and radiological pattern of MRI scan.

**Conclusions:** In young patients with ischemic stroke the prevalence of aPL is not negligible: most of the APS patients relapsed in the same site of previous episode.

Trial registration number: N/A

**AS23-034****CEREBRAL HEMODYNAMICS IN TAKAYASU ARTERITIS: A DOPPLER SPECTRAL ANALYSIS**

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**Background and Aims:** Central nervous system disease is an important expression of vascular injury in Takayasu Arteritis (TA). Most of the patients develop diverse neurological complications during their disease. Neurosonological aspects of the intracranial circulation in TA are not known. Our aim is to evaluate cerebral hemodynamics by means of transcranial Doppler (TCD) in subjects with Takayasu Arteritis.

**Methods:** Monophasic, observational, transverse, prospective study. We studied 35 consecutive patients, who met the ACR criteria classification for TA. We obtained medical history, clinical manifestations, imagine studies and recorded the intracranial basal arteries by TCD. We compared the patients according to their hemodynamic pattern normal/high-pulsatility/low-pulsatility (Fig.1).

**Results:** We found abnormalities in cerebral hemodynamics (high/low pulsatility) in 72.3% of the patients. When comparing patterns we found an increased frequency of ischemic retinopathy, syncope, visual disturbances, amaurosis, epilepsy, transient ischemic attacks and cerebral infarction in the low-pulsatility group (Table). There seems to be a trend towards more disability in the low-pulsatility group (Fig.2).

**Conclusions:** Cerebral hemodynamics abnormalities by TCD are frequent in TA. The intracranial low-pulsatility pattern is strongly associated to clinical symptoms, ischemic retinopathy and stroke.

Trial registration number: N/A

**AS23-036****ENDOVASCULAR TREATMENT OF ACUTE ISCHEMIC STROKE IN THE PEDIATRIC POPULATION – A SINGLE-CENTER EXPERIENCE**

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**Background and Aims:** Pediatric ischemic stroke is an under-recognized condition, frequently leading to delayed diagnosis and mainly caused by arteriopathy or cardioembolism. Despite strong evidence for endovascular therapy in adults with acute ischemic stroke, limited data exist in children and adolescents. We aimed to review our center experience with mechanical thrombectomy (MT) in the pediatric population.

**Methods:** Retrospective review of all cases of MT for acute ischemic stroke in the pediatric population at our center between 2011–2018.

**Results:** Seven patients (ages between 2–17) with acute ischemic stroke underwent MT for large vessel occlusion (LVO). Most (71%) were female. Cardiac disease was known in 5 (71%) patients – 2 under external cardiac

assistance, I had Varicella zoster virus vasculopathy (diagnosed *a posteriori*) and I had unknown etiology. The median pedNIHSS at admission was 14 (3–24). All patients had an ASPECTS score >8, except for one with ASPECTS score of 2. Six patients had LVO of the anterior circulation and I had a basilar artery occlusion. The median time since onset of symptoms until imaging was 12h30 (1h15min–21h). Aspiration was used in 3 cases (43%); stent retriever in 3 cases (43%) and a combined technique in one case. Complete recanalization (TICI 2C/3) was achieved in 57% of the cases. At 90 days, 2 patients (29%) died and 4 (57%) had a mRS <2.

**Conclusions:** Mechanical thrombectomy seems safe and feasible in the pediatric population. Multidisciplinary selection of pediatric patients with LVO is warranted. Larger prospective studies are needed to validate these conclusions.

**Trial registration number:** N/A

## WITHDRAWN

## AS23-060

### CEREBROVASCULAR MANIFESTATIONS IN ERDHEIM-CHESTER DISEASE

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**Background and Aims:** Erdheim-Chester disease (ECD) is a rare, non-Langerhans form of histiocytosis of unknown origin, which was first described by Jakob Erdheim and William Chester in 1930. This multi-systemic disease is currently considered as an inflammatory myeloid neoplasia. Central nervous system (CNS) involvement is present in up to 50% of ECD cases and represents a strong prognostic factor and an independent predictor of death in patients with ECD. Central nervous system manifestations of ECD are usually related to infiltration of the brain parenchyma by abnormal cells, with a predominance of lesions occurring in the posterior fossa. Stroke is an exceptional manifestation of this disease.

We aimed to describe cerebrovascular diseases in patients with ECD.

**Methods:** We report the case of 71-year-old woman with aortic and renal involvement who was hospitalized for recurrent TIAs and a vertebrobasilar stroke secondary to infiltration and severe stenosis of the

basilar artery as well as infiltration of other intracranial and extracranial arteries. She stabilized after cobimetinib and steroid treatment. We also report the case of a 59-year-old woman who presented with a vertebrobasilar stroke secondary to infiltration and severe stenosis of the basilar artery, who clinically improved after interferon-alpha therapy. We performed a review of the relevant literature and reported the few other cases described.

**Results:** Including our patients, we have found only 9 cases of cerebrovascular disorder in ECD. Most of them had supraortic artery involvement.

**Conclusions:** Acute ischemic stroke and TIA are rare complications of ECD, which are mainly due to infiltration and stenosis of the cerebral arteries.

**Trial registration number:** N/A

## AS23-031

### ATYPICAL IMMUNE THROMBOTIC THROMBOCYTOPENIC PURPURA: FREQUENCY IN SINGLE COHORT OF YOUNG-ADULTS WITH STROKE

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**Background and Aims:** Thrombotic-thrombocytopenic purpura (TTP) is a rare blood disorder characterized by haematologic abnormalities, neurologic involvement, renal failure, and fever. However the full spectrum is present only in less than 10% of patients, and the haematological involvement may not be present at the onset. The incidence in young people has not yet been defined. We report clinical characteristics of the patients with atypical immune-TTP included in our young-adult stroke registry.

**Methods:** Our registry includes data of consecutive stroke patients, aged 18 to 50 years, admitted from January 2015 to October 2018. We analyzed clinical, radiological and biological data. All suspected cases of immune-TTP underwent to the evaluation of ADAMTS13 activity (normal value >50%) and the detection of anti-ADAMTS13 antibodies.

**Results:** In the period indicated above 120 young-adults with stroke were admitted in our Stroke Unit. 4 patients (3,4 %) had an ischemic stroke related to immune-TTP. 1 was categorized as classic-TTP and 3 patients (2,5 %) had no haematological criteria. These three patients had large cerebral lesions. One patient had proximal occlusion of middle cerebral artery. In our cohort atypical immune-TTP was found in 2.5% of young-adult stroke patients and, according to TOAST criteria, in 15% of patients with "other causes" of stroke.

**Conclusions:** Atypical immune-TTP is a rare, but treatable, cause of ischemic stroke in young-adults. The occlusion of large arteries and massive cerebral infarction can represent the first manifestation of the disease. Prompt identification of this rare blood disorder, even in absence of haematologic abnormalities, is crucial to avoid potentially lifethreatening and disabling events.

**Trial registration number:** N/A

## AS23-080

### VASCULITIS OF THE CENTRAL NERVOUS SYSTEM: AN INFREQUENT CAUSE OF STROKE. REPORT OF 16 CASES IN A UNIVERSITY HOSPITAL OF COLOMBIA BETWEEN 2014 – 2018

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**Background and Aims:** There is not enough information about the frequency of cases of primary (PACNS) or secondary (SACNS) vasculitis of the central nervous system in Colombia, this research article seeks to know the frequency of its presentation in a reference hospital in the city of Bogotá (Colombia).

**Methods:** Observational study of case series, from 2014 to 2018.

The search through electronic medical records of the diagnosis of PACNS, according to the criteria of Calabrese and Mallek that were seen in emergency room. The search for SACNS was performed with autoimmune disease and evidence of cerebrospinal fluid (CSF), magnetic resonance imaging (MRI), angiography or pathology abnormalities.

**Results:** We found 16 cases, 5 (31.2%) PACNS and 11 (68.8%) SACNS; female 87.5%; with  $42 \pm 15$  years old. The most common symptoms were: headache (56.2%), cognitive (31.2%) and motor deficit (31.2%). The most frequent etiology was systemic lupus erythematosus (73.5%) of SACNS. The most frequent finding was: multiple subcortical ischemic lesions in different arterial territories (56.2%) and haemorrhagic stroke (31.2%), with a predominance of convexity subarachnoid hemorrhage (25%) in the IRM. In the angiographic changes were bilateral (55.5%) and multisegmental (44.4%). The presence of hyperproteinorraxia (66.7%) in the CSF. All patients received induction treatment with steroids, other combined immunosuppressive therapies: cyclophosphamide (37.5%), Azathioprine (31.2%), Rituximab (18.8%), etc. Mortality was 18.8%

**Conclusions:** In our study, CNS vasculitis predominated in females and we observed higher mortality, which is different from that reported in other series. The clinical presentation and the findings in CSF and MRI were similar in appearance to other publications.

**Trial registration number:**

## AS23-07I

### MOYAMOYA IN ARGENTINA

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**Background and Aims:** Moyamoya disease (MMD) and Moyamoya syndrome (MMS) are uncommon in Western countries. We report a cases series of MMD and MMS from our center during the last 20 years.

**Methods:** Review of medical records between January 1998 and July 2018. We assessed clinical features, imaging and outcomes dichotomized by age ( $\leq 18$  vs  $> 18$  years), treatment (medical vs surgical) and condition (MMD vs MMS). Fisher's exact test was used to compare categorical variables and Mann-Whitney U test for continuous variables. Differences were considered statistically significant when p values were  $< 0.05$ .

**Results:** We included 37 patients (2 asians, 40% children, 70% women). MMD was present in 49% and MMS in 51%. The most frequent clinical presentation was ischemic stroke (68%), followed by seizures (41%) and headache (24%). The angiographic pattern was generally bilateral (92%), with involvement of the proximal middle cerebral artery in 81% and the distal internal carotid in 72%. MMD subjects had a higher rate of intracranial hemorrhage (61% vs 16%,  $p < 0.05$ ) but lower mRS at follow up ( $1 \pm 1.6$  vs  $3 \pm 2.4$ ,  $p < 0.001$ ) than MMS patients. Twenty patients underwent surgical treatment. The pediatric population was more frequently treated with synangiosis (82% vs 11%,  $p < 0.005$ ) and adult tended to received combined treatments (synangiosis plus bypass, 78% vs 18%,  $p < 0.05$ ).

**Conclusions:** We present the largest Latin American series of patients with MMS/MMD. Our population, largely non-asian, has clinical and imaging characteristics similar to those previously described for other Western populations.

**Trial registration number:** N/A

## AS23-007

### SYMPTOMATIC DEVELOPMENTAL VENOUS ANOMALY THROMBOSIS : CAN ANTICOAGULANTS BE GIVEN ?

M. Saini<sup>1</sup>

<sup>1</sup>Changi general Hospital, Neurology, Singapore, Singapore

**Background and Aims:**

**Background:** Developmental venous anomalies (DVA) are brain vascular malformations – autopsy incidence ~ 2.6%; magnetic resonance imaging (MRI) detection rate 0.48–0.7%. Symptomatic DVAs are rare; < 35 patients with spontaneous DVA thrombosis (DVAT) have been reported till date, several of whom had associated parenchymal hemorrhage.

**Aim:** To describe a rare case of symptomatic, spontaneous DVAT managed with anticoagulation.

**Methods:** Case Description

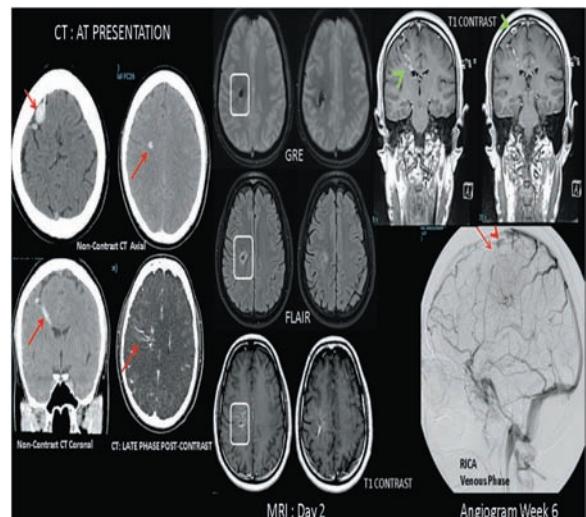
**Results:** 35 year male presented with one day of left upper limb (LUL) weakness, headache.

Neurological exam showed LUL monoparesis. Brain Imaging in Emergency department showed right, partially thrombosed (saccular component) frontal DVA with drainage into deep ependymal vein and superior sagittal sinus (Fig I; Left panel). No associated bleed or venous infarct noted. Therapeutic dose Clexane was initiated.

He had 3 episodes generalized seizures; subsequent MRI showed thrombosis progression and localized FLAIR hyperintensity surrounding the thrombosed DVA (Fig; Middle Panel). Epilim was given, Laboratory tests for inherited and acquired procoagulant states were negative; Clexane was continued.

4Vessel angiogram, 6 weeks later, showed partial recanalization only.

Neurosurgeons opined conservative management. Clexane was continued.



Evaluation at 12 weeks showed no focal deficits. There were no hemorrhagic complications. Switch to oral anticoagulation was planned but patient was subsequently lost to follow-up.

**Conclusions:** Symptomatic, spontaneous DVAT is very rare. There are no guidelines regarding management. DVA resection is avoided so as to prevent catastrophic venous infarction. Anticoagulation appears safe, but duration is debatable in absence of known procoagulant states.

**Trial registration number:** N/A

**AS23-046****CLINICAL FEATURES OF ONE HUNDRED CONSECUTIVE PATIENTS WITH CERVICAL AND INTRACRANIAL ARTERY DISSECTIONS TREATED IN A UNIVERSITY HOSPITAL****P. Mellado<sup>1</sup>, B. Soler<sup>1,2</sup>, A. Queirolo<sup>1</sup>, P. Sandoval<sup>1</sup>****and H. Miranda<sup>1</sup>**<sup>1</sup>Hospital Clinico Pontificia Universidad Catolica de Chile, Departamento de Neurologia, Santiago, Chile; <sup>2</sup>Hospital Dr. Sotero del Rio, Servicio de Neurologia, Santiago, Chile

**Background and Aims:** Cervical and intracranial artery dissection (CIAD) represents about 2% of acute ischemic strokes (AIS) and 25% in people younger than 45 years old. Recent trauma is reported in 25% of the cases. Case fatality ratio ranges from 3 to 7% and in 70 to 80% of the cases there is a good clinical outcome. Objective: To describe demographic and clinical features and outcomes of CIAD patients treated in a university hospital in Chile.

**Methods:** Prospective registry between January 2009 and October 2017 of all consecutive patients diagnosed of CIAD admitted in the neurology service at the Clinical Hospital of P. Catholic University of Chile.

**Results:** 100 patients; 53% were men. Mean age 41 years old. Recent trauma was reported in 39% of the patients. Location: 38% of the CIAD were located in anterior circulation and 62% in posterior circulation. 11 % of the CIAD were intracranial, most of them in posterior circulation (1% vs 10%). 17% were mixed extra-intracranial. Clinical features: AIS (71%), headache (80%), Claude Bernard–Horner syndrome (37%), cranial nerve palsy (3%), subarachnoid hemorrhage (7%). All the patients were admitted in a stroke unit, but only 4% were treated with intravenous thrombolysis, and 3% with endovascular treatment, in most of the cases because of late arrival. Antithrombotic treatment: antiplatelets (41%) and anticoagulants (52%). Outcomes: mRankin 0–1 at discharge, 3 months and 6 months were 65%, 72% and 77%, respectively.

**Conclusions:** This is the first prospective registry of CIAD in Chile, outcomes were similar than international multicentric studies.

**Trial registration number:** N/A

**AS23-047****CLINICAL FEATURES OF ONE HUNDRED CONSECUTIVES PATIENTS WITH CEREBRAL VENOUS THROMBOSIS TREATED IN A UNIVERSITY HOSPITAL****P. Mellado<sup>1</sup>, B. Soler<sup>1,2</sup>, P. Sandoval<sup>1</sup>, A. Queirolo<sup>1</sup>****and H. Miranda<sup>1</sup>**<sup>1</sup>Hospital Clinico Pontificia Universidad Catolica de Chile, Departamento de Neurologia, Santiago, Chile; <sup>2</sup>Hospital Dr. Sotero del Rio, Servicio de Neurologia, Santiago, Chile

**Background and Aims:** Cerebral venous thrombosis (CVT) represents about 1% of all types of strokes. Its clinical picture is pleomorphic and early diagnosis allows proper treatment and good prognosis. Objective: To describe demographic and clinical features and outcomes of CVT patients treated in a university hospital in Chile.

**Methods:** Prospective registry between January 2009 and October 2018 of all consecutive patients diagnosed of CVT admitted in the neurology service at the Clinical Hospital of P. Catholic University of Chile.

**Results:** 74% were women, mean age was 38 years old (range 16–88). Most common consultation symptoms were headache (66%), disorder of consciousness (31%), seizures (35%) and isolated focal deficit (1%). The most common cerebral sinus and veins involved were lateral sinus (48%), multiple (25%), sagittal superior sinus (13%), cortical veins (10%) and cavernous sinus (3%). In women, the most common etiology was

contraceptive pills use (54%), and in 50% of them, there was another factor associated. From the whole cohort, in 46% a thrombophilia was diagnosed (10% was G20210A prothrombin gene mutation). All the patients were treated with anticoagulants, 8% required endovascular treatment and 4% decompressive craniectomy. Outcome: mRankin 0–1 and 5–6 at 3 months, and mRankin 0–1 and 5–6 at 12 months, were 71%, 7%, 90% and 5%, respectively.

**Conclusions:** This is the first prospective registry of CVT in Chile, outcomes were similar than international multicentric studies.

**Trial registration number:** N/A

**AS23-058****SPONTANEOUS CEREBRAL HEMORRHAGE AS CADASIL ONSET****A. Sanna<sup>1</sup>, S. Parcaroli<sup>1</sup>, G. Fresu<sup>1</sup>, C. Mongili<sup>1</sup>, L. Parish<sup>1</sup> and A. Manca<sup>1</sup>**<sup>1</sup>Azienda Ospedaliera Universitaria di Sassari, Stroke Unit, Sassari, Italy

**Background and Aims:** CADASIL is the most common genetic cause of adult stroke and dementia. It results from a mutation on Notch 3 gene on chromosome 19; this gene encodes a transmembrane receptor expressed in arterial smooth muscle cells. Most common clinical manifestation are transient recurrent cerebral ischemic attack, cognitive impairment and a history of migraine with aura. Seizures, intracerebral hemorrhage and mood disturbance are also reported. Intracerebral hemorrhage is not a common presentation in CADASIL, it is rare as first manifestation.

**Methods:** We describe a case of CADASIL first manifested with cerebral frontal lobe hemorrhage in a young woman with a history of migraine and hypertension. No antiplatelet therapy taken before the event. The patient showed a classic MRI pattern with subcortical leucoencephalopathy and a single microbleed and was found carrying a not previously described mutation on NOTCH 3 gene.

**Results:** The genetic test showed a mutation in heterozygosity on NOTCH3 gene, exon 17. This mutation was not previously described: Y916C A/G (TAC-TGC Tyr916Cys) OMIM 125310. This mutation modify content of cysteine residues in the EGFr repeats from 6 to 7 resulting in multimerization of mutated protein and accumulation inside the vascular cell wall. For this reason the mutation is related with the clinical condition of CADASIL.

**Conclusions:** CADASIL is a diagnosis to be considered in spontaneous cerebral hemorrhage in young patient especially with risk factor such as hypertension. This is the first report of mutation Tyr916Cys in exon 17 of the NOTCH3 gene on chromosome 19 in CADASIL, furthermore manifested as intracerebral hemorrhage.

**Trial registration number:** N/A

**WITHDRAWN**

**Background and Aims:** Floating aortic thrombus is a rare phenomenon with the potential to cause multiple systemic emboli downstream from the primary thrombus. There is currently limited guidance on the management of patients with this finding due to the scarcity of the condition. Interventions vary depending upon location and resources. However, surgical intervention has previously shown to have favourable outcomes despite the high risk of mortality and morbidity. We discuss the case of a 50 year old gentleman who presented with dense right hemiparesis, expressive dysphasia and chest pain 1 hour preceding presentation to the emergency department. Immediate CT brain showed a left middle cerebral artery thrombus (dense MCA sign). CT angiogram, performed to rule out dissection in view of his cardiac chest pain, showed a floating thrombus in the proximal aortic arch. He was successfully treated with thrombolysis and subsequent thrombectomy to the left middle cerebral artery. Subsequent MRI brain showed multiple embolic infarcts within the left frontal and parietal lobes and basal ganglia.

**Methods:** Case report

**Results:** Following multidisciplinary discussion, he was commenced on a direct oral anticoagulant to prevent further clot formation. At three month follow up, his neurological symptoms had resolved. Repeat CT angiogram showed complete dissolution of his aortic arch thrombus.

**Conclusions:** This rare case demonstrates successful thrombolysis and thrombectomy of a cerebral thrombus with aortic arch thrombus in situ. We also highlight a potential role for NOAC therapy in long term management of floating aortic thrombi. We hope this case allows for further research and consensus on subsequent management.

**Trial registration number:** N/A

## AS23-068

### ESTONIAN YOUNG STROKE REGISTRY: HIGH BURDEN OF TRADITIONAL RISK FACTORS AND UNDETERMINED ETIOLOGY

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**Background and Aims:** Young adults comprise about 10–15% of all stroke patients. Earlier retrospective study from Estonia has shown high proportion of traditional risk factors among young adult stroke patients. The main aim of this study was to evaluate the etiology of ischemic stroke in a prospective young cohort.

**Methods:** This prospective two-centre study was carried out over the period of 5 years (2013 – 2017) in two largest hospitals in Estonia. All consecutive patients aged 18 – 54 years were included and were thoroughly examined for ischemic stroke etiology. Etiological subtype of stroke was classified using both CCS and TOAST classification.

**Results:** 290 patients were included, men (61%) outnumbered women (39%). The most common risk factors were smoking (46%) and hypertension (46%), followed by hyperlipidaemia (22%) and obesity (18%). 21% of patients had no classical risk factors. According to both classifications about 20% of the strokes were attributed to large artery atherosclerosis, and another 20% to cardioembolism. Small vessel occlusion was diagnosed in less than 10% of the patients. The exact cause of stroke could not be determined in more than 40%. Other determined causes were identified in 6% (CCS criteria) and 8% (TOAST criteria) of the patients.

**Conclusions:** Despite the high prevalence of classical risk factors, there was a significant percentage of patients with no risk factors. Arterial dissections are surprisingly rare in our cohort, although thorough diagnostic workup was carried out.

**Trial registration number:** N/A

## AS23-042

### FLOATING AORTIC ARCH THROMBUS: A RARE CAUSE OF CEREBRAL INFARCT

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## AS23-043

### ACUTE INFARCT FOLLOWING EPIDURAL BLOOD PATCH

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**Background and Aims:** The risk of acute stroke is known to rise significantly in the peripartum period. There are case reports documenting how an epidural blood patch, a procedure often utilised to help patients with symptoms of a post-dural puncture headache, may augment the risk of stroke further for women in puerperium. Here we discuss the case of an acute infarct following a therapeutic epidural blood patch.

A 29 year old primigravida with no past medical history presented in labour at 41 + 1 weeks. Following five failed epidural attempts, she was transferred to theatre for a lower segment caesarean section under general anaesthetic. Within 48 hours, she developed a severe fronto-occipital headache. Despite conventional analgesia, the headache persisted and as such an epidural blood patch for presumed post-dural puncture headache was performed. Within two hours, she developed right hemiparesis and right facial droop and had two witnessed tonic clonic seizures.

**Methods:** Case report

**Results:** Initial CT brain and intracranial venogram showed no acute abnormality and no venous sinus thrombosis. Subsequent MRI brain revealed restricted diffusion in the left fronto-parietal region. Magnetic resonance venography showed patent dural venous sinuses. She was commenced on dual antiplatelets for ischaemic stroke. Her neurological deficit swiftly improved and she was discharged soon after.

**Conclusions:** This case demonstrates a possible causal relationship between epidural blood patch and stroke. We advise that a national register be implemented for all epidural blood patch procedures, to enable us to review and analyse any temporal relationship between the procedure and stroke

**Trial registration number:** N/A

**AS23-032****HYPERTENSIVE DISORDERS OF PREGNANCY DO NOT INCREASE RISK OF SMALL VESSEL DISEASE AFTER STROKE AT A YOUNG AGE: THE FUTURE-STUDY**

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**Background and Aims:** Patients with a stroke at a young age are for largely unknown reasons at an increased risk of small vessel disease (SVD). Hypertensive disorders of pregnancy (HDP) are associated with SVD in the general population. We aimed to investigate whether patients with young stroke/TIA and a history of HDP have higher risk of SVD when compared to controls and patients without HDP.

**Methods:** Prospective cohort study (1980–2010) with 132 female young stroke/TIA patients (18–50years) and 28 controls with at least one pregnancy. 36 Patients suffered from HDP and 96 did not. All underwent MRI and assessment of HDP (preeclampsia, gestational hypertension, HELLP-syndrome) at follow-up 2009–2012. White matter hyperintensity (WMH)-severity (Fazekas scale), WMH-volume, lacunes and microbleeds were assessed according to STRIVE criteria. Logistic and linear regression was used to compare SVD-markers between groups, adjusted for known risk factors for SVD (age, hypertension, smoking).

**Results:** Mean age at MRI was 50.1yrs (SD 9.3); mean follow-up 9.9yrs (SD 8.2). Patients with HDP had more severe WMH (Fazekas  $\geq 1$ ; OR 5.9 (95% CI 1.2–28.8)  $p < 0.05$ ) and higher median WMH-volumes than controls (1.70ml [IQR 0.54–3.93] versus 0.61ml [0.01–2.50]  $p < 0.05$ ). There was no significant difference for microbleeds and lacunes. There were no significant differences in SVD severity between patients with or without HDP.

**Conclusions:** Patients have more SVD compared to controls, but a history of HDP does not further modify this observation. As we adjusted for known risk factors for SVD within the young stroke patients, the young stroke itself is the main risk factor for SVD in these patients.

**Trial registration number:** N/A

**AS23-045****CADASIL: A RARE CASE IN AN AFRICAN MALE WITH TWO HETEROZYGOUS NOTCH 3 MUTATIONS**

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**Background and Aims:** Cerebral autosomal dominant arteriopathy with subcortical infarcts and leukoencephalopathy (CADASIL) is a hereditary angiopathy characterized by recurrent strokes, migraines, cognitive deficits, and progressive dementia. The causative mutation lies in the NOTCH 3 gene on Chromosome 19. It is described mostly in Caucasians with only two published case reports in Africans until date. Characteristic neuroimaging findings include anterior temporal lobe hyperintensities, lacunar infarcts, and cerebral microhaemorrhages.

**Methods:** We report a case of CADASIL in a 47-year-old Nigerian male who presented with acute onset right side weakness and difficulty speaking. Neurological examination showed apathy, right hemiparesis, right facial weakness, truncal ataxia, global aphasia, and dysphagia. He had a history of chronic severe bilateral sensorineural hearing loss but no significant family history. MRI brain revealed multiple acute embolic infarcts in both cerebral hemispheres. In addition, old lacunar infarcts, microhaemorrhages, white matter hyperintensities in periventricular region and corpus callosum were noted. However, the anterior temporal lobes were spared. A fundal fluorescein angiogram did not show branched retinal artery occlusion. Neurogenetic testing revealed heterozygous c.2149C>T variant in exon 14 and c.3296G>T variant in exon 20 of the NOTCH 3 gene, confirming the diagnosis.

**Results:**

**Conclusions:** CADASIL is seldom reported in Africans. A single mutation in the NOTCH 3 gene is often identified, making two heterozygous mutations rare. Even rarer are the sparing of anterior temporal lobes on neuroimaging. This case exemplifies the heterogeneity of clinical findings in CADASIL and emphasizes on considering this in every young-onset stroke patient, regardless of his or her ethnicity or unusual presentations.

**Trial registration number:****AS23-020****INCREASED E/A RATIO IN TRANSTHORACIC ECHOCARDIOGRAPHY IS ASSOCIATED WITH HIGH-RISK PATENT FORAMEN OVALE**

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**Background and Aims:** Patent foramen ovale (PFO) is associated with cryptogenic stroke. However, it is always challenging to determine whether an observed PFO is incidental or pathogenically related to ischemic stroke. We aimed to investigate transthoracic echocardiography (TTE) parameters, which were associated with high-risk PFO.

**Methods:** Ischemic stroke patients admitted in our hospital with positive contrast-enhanced transcranial Doppler between March 2015 and June 2018 were retrospectively reviewed. The Risk of Paradoxical embolism (RoPE) score was calculated for each individual. RoPE score higher than 6 was considered to be high-risk PFO. TTE parameters were compared between patients with RoPE score  $>6$  and patients with RoPE score  $\leq 6$ .

**Results:** A total of 79 patients were included. Patients with RoPE score  $>6$  had smaller diameter of aorta, left atrial internal diameter, end-diastolic interventricular septal thickness, end-diastolic left ventricular posterior wall thickness, increased peak E-wave velocity, peak A-wave velocity and E/A ratio. Binary logistic regression analysis showed that increased peak E-wave velocity (odds ratio [OR] 1.06, 95% confidence interval [CI] 1.01–1.11,  $p = 0.020$ ), peak A-wave velocity (OR 0.94, 95% CI 0.89–0.98,  $p = 0.008$ ) and E/A ratio (OR 40.82, 95% CI 3.57–466.4,  $p = 0.003$ ) were all independently associated with RoPE score  $>6$  with E/A ratio having the largest OR. Increased E/A ratio was associated with RoPE score  $>6$  with area under curve of 0.814 (95% 0.713–0.916,  $p < 0.001$ ).

Predictors	OR	95% CI	P value
<b>Model 1</b>			
Male	2.95	0.71-12.28	0.138
Diameter of aorta	1.05	0.87-1.25	0.620
LAID	0.80	0.67-0.96	0.017
IVST (ed)	0.92	0.45-1.88	0.813
LVPWT (ed)	1.01	0.38-2.63	0.992
Peak E-wave velocity (cm/s)	1.06	1.01-1.11	0.020
<b>Model 2</b>			
Male	2.72	0.62-12.0	0.186
Diameter of aorta	1.02	0.86-1.20	0.864
LAID	0.88	0.74-1.05	0.150
IVST (ed)	1.06	0.50-2.23	0.883
LVPWT (ed)	0.86	0.35-2.12	0.739
Peak A-wave velocity (cm/s)	0.94	0.89-0.98	0.008
<b>Model 3</b>			
Male	3.58	0.73-17.61	0.116
Diameter of aorta	1.11	0.92-1.34	0.290
LAID	0.85	0.71-1.02	0.077
IVST (ed)	1.17	0.55-2.52	0.683
LVPWT (ed)	0.90	0.34-2.32	0.821
E/A ratio	40.82	3.57-466.4	0.003
<b>Model 4</b>			
Male	2.43	0.62-9.46	0.202
Diameter of aorta	0.97	0.83-1.14	0.734
LAID	0.83	0.70-0.99	0.037
IVST (ed)	0.87	0.42-1.81	0.707
LVPWT (ed)	0.98	0.39-2.51	0.972
DT (ms)	0.99	0.98-1.00	0.108

Aberations: LAID, left atrial internal diameter; IVST (ed), interventricular septal thickness (end diastole); LVPWT (ed), left ventricular posterior wall thickness (end diastole); DT, deceleration time

**Conclusions:** Diastolic function impairment in TTE was common in patients with RoPE score>6. E/A ratio might be the most sensitive parameter in TTE, which was associated high-risk PFO.

**Trial registration number:** N/A

## WITHDRAWN

was reduced in the left foot. Then Leiden heterozygous mutation has been diagnosed- FVL-G 169 IA- G/AHeterozygotes. CBC showed thrombocytopenia. The serum HCY level, D – Dimer was high. Antiphospholipid syndrome (APS) were diagnosed. Evaluation of lupus anticoagulants were positive. Coagulation test showed prolonged APTT. TEE showed versus thrombus infection vegetation (tricuspid valve). Head MRI Showed ischemic stroke in the basin of the right MCA, left PCA

## AS23-052

### CAROTID WEB AND ISCHEMIC STROKE: A MORE FREQUENT ASSOCIATION THAN PREVIOUSLY THOUGHT?

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**Background and Aims:** Carotid web, a subtype of fibromuscular dysplasia, recently gained attention as rare but treatable cause of cryptogenic stroke. The main mechanism involved is artery-to-artery embolism, single antiplatelet does not effectively prevents a recurrent stroke and both endarterectomy and stenting of the affected artery were described as effective preventive tools.

**Methods:** Among ischemic stroke patients prospectively enrolled in a hospital-based registry subjects aged 18–45 years from 30 July 2015 to 30 July 2018 were selected. Clinical-demographic data and advanced neuro-imaging of head and neck (CTA, MRA, DSA) were examined, searching for carotid web in both carotid arteries irrespectively from the cause of stroke.

**Results:** 72 patients with ischemic stroke aged 19–45 years were identified and 6 among them were found to have a unilateral or bilateral carotid web. Female-to-Male ratio is 2:4 and the mean age is 38.5 years (range 29–45). 3/6 patients have a previous history of cryptogenic stroke in the same vascular territory, 3/6 patients have a bilateral carotid web and only in 1/6 patients carotid web was unrelated to the index stroke. All other causes were investigated and excluded in 5/6 patients and they were treated by carotid stenting on the symptomatic side. In 1/6 patients an incidental finding of early thrombosis superimposed on the carotid web strengthened the causal association with ischemic stroke.

**Conclusions:** If carefully searched, carotid web may be more frequent than previously known, mainly in young patients with stroke. This finding has a relevant implication in secondary prevention.

**Trial registration number:** N/A

## AS23-054

### THE GREAT IMITATOR STRIKES AGAIN: A CASE OF PERSISTENT LUETIC ARTERITIS WITH STROKE AND MOYAMOYA PHENOMENON

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**Background and Aims:** Syphilis is called "the great imitator" and it is a rare cause of stroke, mainly in immunocompromised subjects. Treponema pallidum infection has been also recognised as possible cause of Moya-Moya arteriopathy, (MA) although there are only few isolated reports.

Herein, we describe a patient affected by syphilis developing a unilateral MA.

**Methods:** A 59-y.o patient was admitted to Stroke Unit because of the sudden onset of left-sided hemiparesis and dysarthria. Neuroimaging (CT and MRI) with angiographic sequences showed a right fronto-parietal ischemia with a tight ipsilateral ICA terminus stenosis and circular contrast enhancement (CE) in the wall of the stenotic artery.

**Results:** VDRL in serum and CSF was positive at high titre and a diagnosis of luetic intracranial arteritis was made. After prolonged antibiotic treatment VDRL in CSF turned negative, but at neuroimaging follow-up the right ICA terminus stenosis increased with persistent CE and development of a moyamoya-like collateral circulation, well evident in digital subtraction angiography. Other typical sites of vascular luetic involvement were excluded (i.e. luetic aortitis). The negative autoimmunity tests as well as the lack of CSF oligoclonal band did not clearly support the diagnosis of primary vasculitis. Moreover, CE of ICA wall was poor responsive to steroid treatment.

**Conclusions:** Since a persistent large intracranial vessel arteritis has never been described at our knowledge, it can be reliable that Treponema infection may be associated with the development of MA. Thus, we suggest that diagnostic pathway of patients with symptomatic intracranial stenosis should include blood and CSF test for syphilis.

**Trial registration number:** N/A

### AS23-003

#### CAROTID DISEASE IN MYELOPROLIFERATIVE NEOPLASM – 3 CASES (IL BUONO, IL BRUTTO, IL CATTIVO)

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**Background and Aims:** Myeloproliferative neoplasms are associated with arterial thrombosis.

**Methods:**

**Case reports:**

**Results:** Case 1 – 35 years old woman with right-sided hemiparesis. CTA: occlusion of the left ICA, ECA and ACM. Thrombolysis and thromboendarterectomy with complete recanalization. A myeloproliferative neoplasm was suspected before the stroke, but not proven. We detected a mutation of the calreticulin-gene. Treatment with hydroxyurea and aspirine was initiated. At discharge the patient had only a mild paresis of the right hand.

Case 2 – 56 years old woman with left-sided hemiparesis. CTA: extensive occlusion of the right ICA and ACM. Thrombolysis was ineffective. We also found bilateral pulmonary embolisms and occlusion of the superior mesenteric artery. Since the patient had a thrombocytosis we performed sequencing of the jak2-gene with detection JAK2 V617F-mutation. Treatment with hydroxyurea and oral anticoagulant was initiated. At discharge the patient had a severe left-sided hemiparesis.

Case 3 – 70 years old woman with mild paresis of the right hand. CTA/ ultrasound: free-floating thrombus in the ICA. After thromboendarterectomy only small ischemic strokes in cerebral MRI. Because of marked thrombocytosis and mild polyglobulia we performed sequencing of jak2 and detected a JAK2- V617F-mutation. Treatment with Hydroxyurea and aspirine was started, but after two weeks severe right-sided hemiparesis occurred. CT-angiography and ultrasound demonstrated extensive

thrombus formation of the CCA. A second thromboendarterectomy was performed without benefit. Follow-up imaging showed a large stroke. Treatment with interferon alpha was started.

**Conclusions:** We present cases with carotid thrombosis, stroke and myeloproliferative neoplasm. we report the laboratory parameters, management and outcomes.

**Trial registration number:** N/A

### AS23-063

#### RECURRENT BRAINSTEM STROKE AND VASCULITIC ANGIOPATHY IN A YOUNG MAN – FINALLY TREATED WITH PENICILLINE

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**Background and Aims:** Diagnosis of infectious causes of recurrent stroke requires a high degree of suspicion. We present a case report of a young man with recurrent brainstem stroke caused by meningo-vascular syphilis.

**Methods:** case report

**Results:** A 45 years old male was admitted to our hospital with a left pontine stroke causing dysarthria and dyshagia, because after his transfer to a neurorehabilitation facility the neurologic deficits worsened and he developed fever. Initially he was treated in another hospital with this stroke, was diagnosed with an PFO and APC-resistance and started on phenprocoumon for suspected embolic stroke.

MRI showed an ischemic stroke in the left pons and new ischemic lesions in the right internal capsule, the MR-angiography demonstrated stenosis of the basilar artery and of the right ACM. Subtraction angiography confirmed these stenotic changes, which were deemed arteriosclerotic at this point. Echocardiography and lab excluded endocarditis, antiphospholipid-syndrome or vasculitis. Within a few days the patient developed an anarthria, he became stuporose. The follow-up MRI showed a new ischemic lesion involving the right pons. After correction of coagulation disorder (due to VKA) we performed a lumbar puncture. The CSF showed a pleocytosis with 93 cells/ $\mu$ l with elevated CSF-protein (1100 mg/l), without intrathecal immunoglobuline synthesis but with oligoclonal bands and elevated TPPA-titre (CSF 1:64, serum 1:10240). VDRL-titre was 1:128, FTA-Abs 1:1600, leading to the diagnosis of meningo-vascular syphilis and initiation of an antibiotic treatment with penicilline, which resulted in normalization of serologic markers.

**Conclusions:** Meningo-vascular syphilis is an easily missed, but treatable cause of recurrent stroke.

**Trial registration number:** N/A

### Rehabilitation – Excluding Clinical Trial Results

#### AS08-021

#### THE SAEBOGLOVE EVALUATION TRIAL

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**Background and Aims:** Impaired active finger extension is common after stroke. It hinders participation in functional rehabilitation and predicts poor recovery. The SaeboGlove assists finger extension and may help. We performed a single group open pilot feasibility trial of the SaeboGlove in people with recent stroke.

**Methods:** People with reduced active finger extension who were deemed able to participate in rehabilitation (+/-help of a carer) were enrolled during their index hospital admission. Participants received 4-weeks of repetitive functional-based SaeboGlove therapy involving goal setting, independent practice and weekly physiotherapy review plus usual

NHS care. We assessed self-reported adherence, adverse events, participant, carer and therapist views, durability of gloves in clinical use and five performance measures; upper limb function (ARAT), gross dexterity (BBT) and perceived functional upper limb use (quality, quantity and percentage of tasks executed) (Motor Activity Log).

**Results:** Twelve patients commenced therapy (mean age 62 (range 47–80), days post stroke 27 (range 4–80) and ARAT score of 15.9 (range 0–44)). All participants completed the trial performing therapy on 85% of available days (mean repetitions 81.2 per session). There were no related serious adverse events or adverse events. There was a significant improvement in all five performance measures. Feedback from patients, carers and therapists was positive. No obvious wear or tear was observed on a glove washed ten times.

**Conclusions:** Self-directed repetitive functional-based practice involving a SaeboGlove is feasible, safe, and acceptable to patients, carers and therapists early after stroke. Measures of motor performance improved but further controlled and randomised studies are required.

**Trial registration number:** NCT03036033

## AS08-017

### AUTOMATIC IDENTIFICATION OF MOTOR ANOMALIES IN STROKE PATIENTS WITH CUSTOMIZED COMPUTATIONAL MOVEMENT SYSTEM

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**Background and Aims:** Motion Capture Systems (MCS) are currently used in stroke rehabilitation, but its use in stroke diagnosis is still undeveloped. Our aim is to test a customized MCS' algorithm that automatically identify motor deficit in stroke patients.

**Methods:** Using Kinect camera (Microsoft) and customized software Akira (system friend Inc.) we registered 10 exercises divided in 3 workouts: the first one included trunk stability and walk, the second one included right upper limb exercises and the third one includes left upper limb exercises. We designed a case-control study, in which compared the performance of the exercises between stroke patients (cases) and healthy controls. The controls performance was registered and obtained normality movements values. Then, with a customized comparison algorithm (developed with MATLAB), we automatically compared the cases movement with controls and obtained a complete report of movement trajectories and their deviation.

**Results:** We analyzed 30 healthy controls and 14 stroke patients (median NIHSS 2, IQR 0–12): 6 with left hemisphere damage, 6 with right hemisphere damage, 1 with bilateral damage and 1 with cerebellar damage. All stroke patients had alterations in trunk stability (first workout): right hemisphere damage patients tend to imbalance forward, while left hemisphere damage patients tend to imbalance to the left. In the upper limb evaluation all stroke patients had right or left alteration according to brain damage, except in 2 right damage patients that showed alteration in both arms.

**Conclusions:** Our system was useful detecting movement alterations in stroke patients with higher precision than clinical exploration.

**Trial registration number:** N/A

## AS08-012

### THE NEED FOR NEUROPSYCHOLOGY AND PSYCHIATRY IN A COMMUNITY BED-BASED NEUROREHABILITATION SETTING

C. Annesley<sup>1</sup>, C. Walters<sup>2</sup>, H. Warwick<sup>2</sup>, D. Lally<sup>2</sup> and A. Chandraratheva<sup>3</sup>

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**Background and Aims:** Post stroke psychological support should be offered to all patients. We aimed to determine the burden of psychological and psychiatric needs in a community bed-based neurorehabilitation setting.

**Methods:** In St Pancras Neurorehabilitation unit London, 17 bed, level 3 community neurorehabilitation unit (no alternative level 2 unit), we performed a 6 month retrospective review of consecutive patients from October 2017. We recorded complexity, length of stay (LOS), Anxiety Scale Circles(ASC 1–4), Depression Intensity Scale Circles(DISCs 1–4), formal cognitive assessment, weekly multidisciplinary assessments of mood and functional cognition.

**Results:** Of 102, 89 neurology (60 stroke). Mean age 73(SD 15.6), mean LOS 36 days (SD 23.4), median PCAT 28(IQR 4,35% > 30). ASC median score 2. 35(39%), were reviewed for anxiety. 10(11%) required psychology review. 2(2%)diagnosed with severe anxiety, requiring treatment. Median DISCs score 2. 22(25%) were treated for depression. 8(8%) required psychology review and 12(12%) were commenced on new antidepressants. 4(4%) were suicidal. Median MOCA score 13, with 94% in cognitive impairment range. 11(11%) had a pre-existing dementia. 19 (21%) were treated for delirium. 4(4%) reviewed for challenging behaviour. 2 (2%) psychiatry reviews for uncontrolled schizophrenia, and suicidal ideation. Median total medical reviewsfor patients with anxiety was 16(3 per week), depression 15(2.9 per week), anxiety and depression 22 (4.2 per week), compared to those without anxiety/depression 10 (1.9 per week).

**Conclusions:** Approximately half of post stroke community neurorehabilitation patients had mood/anxiety symptoms. They required double the medical reviews. One fifth had delirium. Psychological interventions accounted for over a third of interventions, with formal psychiatry review required in 2%.

**Trial registration number:** N/A

## AS08-013

### UTILITY OF FRAILTY SCORES POST STROKE IN A COMMUNITY BED-BASED NEUROREHABILITATION UNIT

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**Background and Aims:** There are no stroke-specific frailty diagnostic tools. Existing frailty scoring systems have not been validated in stroke survivors.

**Methods:** St Pancras Neurorehabilitation unit London is a 17 bed, level 3 community neurorehabilitation unit (no alternative level 2 unit). We performed a retrospective review of consecutive patient records and drug charts from October 2017 for 6 months to reviewed length of stay

(LOS), comorbidities, patient complexity using patient categorisation tool (PCAT) and Barthel. We applied the Clinical Frailty Scale (CFS) 9 point scale, 1 = very fit to 9 = terminally ill.

**Results:** Of 60(58% female), mean age 75(SD 12.3), 9(15%) < 65yrs; 19 (32%) 65–74yrs, 32(53%) > 75yrs. Mean admission LOS 37 days (SD 16.46), median comorbidities 4(IQR 3), median PCAT 27(IQR 4). 35% had PCAT > 30. Median Barthel 35(IQR 41.3), and median admission medications 9 (IQR 4.3), median Clinical Frailty Scale 6(IQR 1) 5(8%) scored 5, 24(40%) scored 6, 31(52%) scored 7. Those with CFS 5 had median PCAT 27.5, CFS 6 had PCAT 28, CFS 7 had PCAT 29. CFS 5 had median LOS 30.8 days, CFS 6 LOS 32.7, CFS 7 LOS 40.9. Post stroke neuropsychiatric sequelae were common: depression 16(27%), anxiety 8 (13%), cognitive impairment 21(35%), delirium 9(15%).

**Conclusions:** Current frailty scores do not accurately reflect post stroke complexity with 100% scoring 5–7, not discriminating frailty between patients. There was a trend suggesting CFS score 7 was associated with increased LOS, number of comorbidities, polypharmacy, age, higher PCAT. Further scores should consider dysphagia, Barthel, cognition/neuropsychiatric sequelae, polypharmacy, comorbidities, particularly psychiatric comorbidities.

**Trial registration number:** N/A

## AS08-014

### COMPLEXITY AND MEDICAL INTERVENTIONS IN A COMMUNITY BED-BASED REHABILITATION SETTING

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**Background and Aims:** Medical provision in community bed-based neurorehabilitation is variable from consultant led to general practitioners. No clear guidance exists. We aimed to determine patient complexity, and medical interventions in this setting.

**Methods:** St Pancras Neurorehabilitation Unit is a 17 bedded, level 3 community unit. Medical cover is weekly consultant ward round/multi-disciplinary-team meeting, daily 0900–1700 junior doctors. 17:00–09:00 on-call General Practitioner. We retrospectively reviewed 6 months consecutive patients from October 2017, recording length of stay (LOS), comorbidities, patient categorisation assessment tool (PCAT: score > 30 considered level 1), Barthel and medical reviews.

**Results:** Of 102, 89 neurology (60 stroke). Mean age 73yrs (SD 15.6), mean LOS 37 days (SD 23.4), median comorbidities 4(IQR 3), median PCAT 28(IQR 4). 35% had PCAT > 30. Median Barthel 35(IQR 40), median medications 9(IQR 5).

Per patient per week mean 2.5 reviews and 4.3 interventions.

Of 2312 interventions :

- Neurological/stroke 178(8%): secondary prevention 87(4%), spasticity 34(2%);
- Cardiovascular/respiratory 69(3%): Cough/dyspnoea 43(2%), Chest pain 11(0.5%);
- Pharmacological 858(37%), 566 (25%): medication review (post clinical change), 137(6%) analgesia;
- Psychiatric/neuropsychology 374(16%): anxiety 205(9%), depression 56 (2.4%), delirium 34(2%), sleep disturbance 18(1%);
- Reviewing investigations/liasing with specialties 431(19%)

21(21%) referred to acute hospital (e.g. desaturation, sepsis, fracture). 13 (62%) returned for rehab, mean LOS at acute hospital 14 days. 5(24%) treated for pneumonia.

Only 23(1%) interventions for minor complaints (e.g. sore throat, reflux)

**Conclusions:** Appropriately skilled medical input is important in this setting. One third had PCAT > 30. Medical interventions were frequent (> 4 per person per week): one third pharmacological, one sixth psychiatric. Minor complaints only accounted for < 1%.

**Trial registration number:** N/A

## AS08-024

### RESEARCH AND CLINICAL PRACTICE: NEW DIRECTIONS FROM THE STROKE RECOVERY AND REHABILITATION ROUNDTABLE II MONTREAL 2018

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**Background and Aims:** The Stroke Recovery and Rehabilitation Roundtables (SRRR) bring together an international group of clinical researchers from a range of disciplines, pre-clinical scientists, statisticians and methodologists, funders and consumers working to help accelerate and facilitate the development of effective post-stroke treatments to enhance recovery and support best-evidence uptake in rehabilitation practice. SRRR I (2016) focused on four recommendation areas: (i) pre-clinical translation; (ii) recovery biomarkers; (iii) intervention development, monitoring and reporting standards and; (iv) standardised measurement in motor recovery trials. SRRR II was held in October 2018. This paper will outline core recommendations from each of the 2018 working groups.

**Methods:** At SRRR II (Montreal), we aimed to address gaps and targets identified following SRRR I. Once again we gathered an international group of experts, some previous and many new participants to address four challenging priority areas to move us closer to breakthrough treatments in stroke recovery and more effective care. The working groups focused on consensus recommendations in the follow areas: 1) cognitive impairment post stroke; 2) standardising measurement of movement quality; 3) improving development of recovery trials; 4) moving knowledge into practice.

**Results:** Core recommendations will be outlined.

**Conclusions:** Position papers from SRRR I are growing in impact, with uptake of recommendations emerging and funders exploring ways to incorporate recovery research targets and recommendations in funding rounds. This international consortium continues to work to build research methods and standards to accelerate discovery of game changing treatments for stroke recovery.

**Trial registration number:** N/A

**AS08-064****A REVIEW OF STROKE UNIT ADMISSIONS IN A REGIONAL ACUTE STROKE CENTRE**

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**Background and Aims:** Stroke unit care is associated with a lower risk of morbidity. American, European and UK guidelines recommend early stroke unit care. However, access to stroke-units is limited. The Irish National Stroke Audit in 2015 found only 29% of patients were admitted to a stroke unit. The aim of this retrospective review was to assess how many patients with acute ischemic stroke (AIS) were admitted to a four-bed capacity stroke-unit, in a regional acute stroke centre, during a one-year period.

**Methods:** Patients were selected from HIPE codes for AIS from June 2017–2018. IPIMS, the data manager, was utilised to assess admission times to the stroke-unit.

**Results:** Of the 105 patients with AIS, 9.52% were admitted to the stroke-unit on admission. 24.76% were admitted during admission. 11.42% were admitted to the ICU on admission. 45.71% were admitted to either the ICU or Stroke Unit during admission. 34% were admitted to a stroke-unit at any point, with 66% of patients with a diagnosis of AIS being managed outside of the stroke-unit. Of the 36 patients who were admitted to the stroke-unit, the median time from admission was 22hours and 34minutes.

**Conclusions:** A stroke-unit is fundamental for any hospital managing AIS. Access is a priority for all in-patients with stroke. This review highlights that access to the stroke-unit in a regional acute stroke centre remains limited and that the time to admission is not in keeping with recommended standards. It is critical that access is enhanced in order to expedite treatments, prevent complications and improve outcomes.

**Trial registration number:** N/A

**WITHDRAWN**

**WITHDRAWN**

**AS08-058****CEREBROLYSIN IN POST-STROKE SPASTICITY****N. Chemer<sup>1</sup>, A. Galusha<sup>2</sup> and K. Horobets<sup>3</sup>**

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**Background and Aims:**

**Background:** Cerebrolysin, a neurorecovery stimulating agent, has been reported to be efficacious in post-stroke spasticity in an Asian population. Treatment of post-stroke spasticity with botulinum toxin does not always have the desired and long-lasting effect, in addition, in Ukraine, botulinum toxin is not reimbursed. Affordable treatment options which are safe and efficacious and do not require repeated treatment courses could be beneficial for patients.

**Methods:** Eight chronic stroke patients (at least one year post stroke) suffering from severe spasticity were treated with 10ml Cerebrolysin intramuscularly for 30 consecutive days. The NIHSS was assessed on day 1 and 21, the Modified Ashworth Scale (MAS) and the Manual Muscle Test (MMT) were assessed on day 1, 21, 90 and 180.

**Results:** The improvement in MMT in average was 38% for the whole study population, MAS scores improved between 1–2 points. Improvements in NIHSS were not significant on day 21. The most pronounced effects in both, MAS and MMT were observed on day 180, especially in the highly motivated patients who continued recommended rehabilitation exercises – also at home – throughout the 180 day observation period. It is important to note that no follow-up treatment course was necessary for these long-lasting effects.

**Conclusions:** Cerebrolysin might be a valuable addition to neurologists' armamentarium treating post-stroke spasticity in chronic stroke patients, especially in botox non-responders and highly motivated patients who perform rehabilitation exercises at home on a regular base. Prospective randomized, controlled trials should be performed to assess longer-lasting treatment effects of Cerebrolysin in post-stroke spasticity.

**Trial registration number:** N/A

**AS08-009****COMBINED EFFECT OF VIRTUAL REALITY TECHNOLOGY AND MANUAL WORK TRAINING ON UPPER LIMB MOTOR FUNCTION IN STROKE PATIENTS****D. Chen<sup>1</sup>, R. Shi<sup>1</sup>, L. Ji<sup>1</sup> and Y. Cao<sup>1</sup>**

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**Background and Aims:** We evaluate the efficacy of virtual reality technology combined manual operation on the function of upper limb movement in stroke patients with hemiplegia.

**Methods:** A total of 40 stroke patients enrolled from January 2016 to August 2017. Patients were divided into virtual reality technology group (virtual reality technology combined manual operation, n = 20) and the control group (manual operation, n = 20) according to the digital table method. Fugl-Meyer scale, modified Barthel index (MBI), simple upper limb function scale (STEF) and National Institutes of Health Stroke Scale (NIHSS) score were used to estimate the efficacy before and after treatment in two groups and modified Rankin Scale score (mRS) were used to evaluate the functional outcome between the two groups.

**Results:** There were no significant difference in Fugl-Meyer scale, MBI, STEF and NIHSS between two groups in the baseline (all P > 0.05). After 3 weeks treatment, the score of Fugl-Meyer scale ( $49.27 \pm 3.54$  vs  $41.32 \pm 5.28$ , P < 0.001), MBI ( $72.04 \pm 7.52$  vs  $65.71 \pm 6.45$ , P < 0.001), STEF ( $67.23 \pm 7.16$  vs  $60.03 \pm 8.16$ , P = 0.003) were significant higher in virtual reality technology group compare to control group. The NIHSS score was lower in virtual reality technology group compare to control group ( $10.52 \pm 6.54$  vs  $11.05 \pm 7.23$ , P = 0.022). The mRS score in virtual reality technology group is significant lower than control group after 90 days follow-up ( $2.75 \pm 0.54$  vs  $3.17 \pm 0.63$ , P = 0.009).

**Conclusions:** Compared with the pure manual work training treatment, joint VR technology cans more effectively improvement the functional outcome in stroke patients with hemiplegia.

**Trial registration number:** N/A

**WITHDRAWN**

(N = 59). Observational data were analysed thematically. Interview data were analysed using the Framework Method.

**Results:** In stroke units, routine care and therapy practices increased the likelihood that stroke survivors would be sedentary for long periods. Restricted environments, together with staff perceptions of stroke survivors' physical and psychological capability to move safely and prioritising falls risk reduction meant breaking up sedentary behaviour was not normal practice. Inpatient experiences initially shaped stroke survivors' and caregivers' expectations and behaviour in community settings. However, community staffs' emphasis on enabling stroke survivors to regain functional movement and participate in meaningful activity highlighted opportunities to incorporate sedentary behaviour reduction in stroke survivors' routine activities, supported by caregivers.

**Conclusions:** Factors influencing sedentary behaviour after stroke have been identified. Interventions to address sedentariness should be commenced in inpatient settings as part of routine practice, and followed through, when stroke survivors return to the community, integrating sedentary behaviour reduction in functional activities and utilising support from caregivers and community-based staff.

**Trial registration number:** N/A

## AS08-031

### PREDICTIVE FACTORS AT HOSPITAL DISCHARGE FOR DEVELOPMENT OF LEARNED NON-USE IN STROKE

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**Background and Aims:** Approximately 55 to 85% of post-stroke individuals present upper-limb compromise. The aim was to evaluate the predictive factors in the acute phase of the patient after stroke for development of learned non-use of the affected upper limb.

**Methods:** This is a prospective cohort study with 38 patients with ischemic stroke diagnosis. At hospital discharge data were collected on clinical and sociodemographic aspects, risk factors, scales of severity and incapacity (NIHSS, mRs and Barthel), as well as neuromuscular (muscle tone and handgrip strength) and sensory evaluation. At 90 days after hospital discharge the Motor Activity Log Scale for detecting learned non-use was obtained, and quality of life by Euroqol. The individuals with and without learned non-use were compared by the t test, and generalized linear model was employed to find possible predictors. Significance level 5%.

**Results:** Comparing the 2 groups, significance was found to age ( $p = 0.008$ ), creatine ( $p = 0.006$ ), handgrip strength ( $p < 0.001$ ), tactile hypoesthesia ( $p < 0.001$ ), NIHSS at discharge ( $p < 0.001$ ), incapacity by mRs ( $p = 0.015$ ) and Barthel ( $p = 0.021$ ) at discharge and general perception of quality of life ( $p = 0.002$ ). These variables had lower mean values in the learned non-use group. In the generalized linear model, age ( $\beta = 0.003$ ,  $p = 0.006$ ), NIHSS at discharge ( $\beta = -0.230$ ,  $p = 0.036$ ), handgrip strength ( $\beta = 0.057$ ,  $p = 0.000$ ), altered sensitivity ( $\beta = 0.659$ ,  $p = 0.011$ ), mRs at discharge ( $\beta = 0.498$ ,  $p = 0.009$ ) and Barthel at discharge ( $\beta = 0.057$ ,  $p = 0.011$ ) were found to be associated with learned non-use evaluated by Motor Activity Log Scale.

## AS08-050

### UNDERSTANDING FACTORS INFLUENCING SEDENTARY BEHAVIOUR AFTER STROKE: DIFFERENT PRIORITIES IN DIFFERENT SETTINGS

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**Background and Aims:** Stroke survivors spend up to 80% of their day in prolonged sedentary behaviour (s) (sitting/lying/reclining). The association between sedentary behaviour and adverse health outcomes is well established. Understanding factors influencing sedentary behaviour in stroke survivors is necessary to develop tailored interventions to reduce sedentary time.

**Methods:** Non-participant observations of routine practice in two stroke services, each including a stroke unit and linked community service (133 hours). Interviews with stroke survivors at six or nine months post-stroke, their caregivers, and staff to explore capabilities, opportunities and motivations associated with reducing sedentary behaviours

**Conclusions:** Age, severity, incapacity, neuromuscular and sensory compromise are predictors of learned non-use in stroke chronic phase.

**Trial registration number:** N/A

## AS08-032

### ASSOCIATION BETWEEN TRUNK CONTROL AND FUNCTIONAL CAPACITY AFTER STROKE

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**Background and Aims:** Trunk control loss caused by hemiplegia after stroke can lead to functional disability and compromise balance and postural control during activities. The aim was to verify the association between trunk motor control and disability after stroke.

**Methods:** Prospective cohort with patients over 18 years old, until 1 year of stroke accompanied in rehabilitation center. The Trunk Impairment Scale (TIS) was used to assess trunk control and functional capacity was assessed by Tinetti Index (TI), Functional Independence Measure (FIM), modified Rankin scale (mRs), and Barthel's Index (BI). Continuous variables were analyzed by Student's t-test or Mann-Whitney test. Results expressed in mean  $\pm$  standard deviation or median and percentiles and in percentage. Multiple linear regressions were constructed by Stepwise. Level of significance 5%.

**Results:** Ten patients with mean age of 64 (43–74) years, 8.5 (1–26) initial NIHSS score, 8.5 (1–20) days of hospitalization. The TIS presented a negative correlation with mRs ( $\rho = -0.785$ ,  $p = 0.015$ ), and a positive correlation with BI ( $r = 0.762$ ,  $p = 0.010$ ), FIM ( $\rho = 0.783$ ,  $p = 0.007$ ) and TI ( $\rho = 0.742$ ,  $p = 0.014$ ). In linear regression there was a significant association between TIS and FIM ( $\beta = 0.103$ ;  $p = 0.016$ ) and Barthel ( $\beta = -0.057$ ;  $p = 0.04$ ).

**Conclusions:** We conclude that the better the motor trunk control, better functional capacity and dependence degree after stroke.

**Trial registration number:** N/A

## AS08-033

### LONG TERM ASSOCIATION BETWEEN CARDIOPULMONARY AND PERIPHERAL MUSCLE FUNCTION IN ACUTE STROKE PHASE AND SEVERITY AND FUNCTIONAL INCAPACITY

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**Background and Aims:** Stroke can lead to musculoskeletal and respiratory dysfunctions, chronic deconditioning and disability. The aim was to evaluate the association between cardiopulmonary and peripheral muscle

function in the acute phase of stroke and severity, dependence degree and functional capacity in long term.

**Methods:** Prospective study with 46 patients admitted to the stroke unit. Cardiopulmonary function was assessed by echocardiographic evaluation, respiratory muscle strength (MEP – maximal expiratory pressure) by manovacuometry and handgrip strength in the first 72 hours after stroke. Functional capacity was assessed by mRs, and Barthel's index, and stroke severity by the NIHSS at discharge and 90 days after hospital discharge. Statistical analysis: multiple linear regression to verify the correlation between cardiopulmonary and peripheral muscle function and outcomes adjusted by confounding variables (NIHSS at admission, age and sex). Significance level 5%.

**Results:** MEP showed a negative correlation with increase in NIHSS ( $\beta = -0.016$ ,  $p = 0.011$ ) at hospital discharge, handgrip strength on the unaffected side had a correlation with the better functional capacity assessed by mRs ( $\beta = -0.034$ ,  $p = 0.049$ ) and Barthel's index ( $\beta = 0.480$ ,  $p = 0.023$ ) at hospital discharge. The left ventricular mass corrected for body surface area had negative correlation with the increase in mRs ( $\beta = -0.010$ ,  $p = 0.027$ ) and NIHSS ( $\beta = -0.012$ ,  $p = 0.021$ ), and presented a positive correlation with Barthel's index ( $\beta = 0.051$ ,  $p = 0.048$ ) 90 days after hospital discharge adjusted for confounding variables.

**Conclusions:** In the acute phase of stroke, the worst cardiopulmonary and peripheral functions are related to the worst functional outcome 90 days after hospital discharge.

**Trial registration number:** N/A

## AS08-029

### PREVENTING PARTICIPATION RESTRICTIONS AFTER STROKE: INVESTIGATION OF COPING BEHAVIORS STRATEGIES USED BY PATIENTS AS DETERMINANTS OF PARTICIPATION AFTER MILD AND MODERATE/SEVERE STROKE

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**Background and Aims:** The WHO International Classification of Functioning, Disability and Health (ICF) defines participation restrictions as "problems individuals experience in involvement in life situations". Disabled individuals develop specific behaviors and actions to manage consequences of disabilities in daily life: this is called coping. As it was suggested that coping is a determinant of participation in some disabling conditions, we investigated coping strategies as determinants of participation in mild and moderate/severe stroke patients.

**Methods:** Self-administered questionnaires were sent at 6 months post-stroke to mild and moderate/severe stroke patients from the Stroke 69 cohort. Participation was measured with the Stroke Impact Scale (SIS.2.0) (0 to 100 (= excellent participation)), and coping strategies with the Brief Cope (4 dimensions: positive thinking, problem solving, avoidance, and seeking for social support). Univariate and multivariate linear regression analyses adjusted for potential confounders were performed.

**Results:** Among the 122 respondents, 83 had mild stroke (NIHSS  $\leq 6$ ) and 39 had a moderate/severe stroke. The two groups were similar regarding the significant association of positive thinking (acceptance, humor and positive reframing) and better participation ( $p < 0.05$ ). They

were different regarding problem solving (active coping and planning) associated with higher participation score ( $\beta = 2.9$ ,  $p < 0.05$ ) only in moderate/severe stroke group, and avoidance which was negatively associated with participation ( $\beta = -4.2$ ,  $p < 0.05$ ) only in mild stroke group.

**Conclusions:** We identified similar and different coping strategies associated with participation restrictions in mild vs moderate/severe stroke patients. This could help to design rehabilitation program and appropriate support which specifically address coping strategies improvement to prevent participation restrictions.

**Trial registration number:** N/A

## WITHDRAWN

consumer and public engagement in research. We present a successful model of a local Stroke Research Register that has boosted recruitment to trials and consumer engagement.

**Methods:** The Stroke Research Register was established in 2016. We employ two stroke survivor consumers and continually seek and respond to feedback from consumers, health professionals and researchers. We have a science communication strategy including social media and community forums. Research information is made accessible in simple multi-media and aphasia-friendly formats.

**Results:** We have 483 registrants. Registration rate increased by 60% in response to our science communication strategy. Hospital recruitment remains inefficient (25% of registrants) compared with other pathways (direct registration online / phone 49%, via Facebook 29%). We strengthened consumer and public engagement with community forums in 2018 ( $n = 285$  attended in person,  $n > 2700$  watched via social media). Importantly, this has translated to strong trial recruitment. In 2018, 147 participants across 7 trials were recruited via the Register with minimal time commitment from individual researchers. Register participants are currently involved in co-producing an exercise intervention.

**Conclusions:** Dedicating resources to a local Stroke Research Register boosts recruitment to trials. Community and consumer engagement are key drivers of success. We are exploring ways to increase efficiency of recruitment into trials, including video information statements and online recruitment. Future directions include research priority setting activities and ensuring consumers are embedded in all stages of research activities.

**Trial registration number:** n/a

## AS08-043

### A SYSTEMATIC REVIEW AND META-ANALYSIS OF INTERVENTIONS TO REDUCE TIME SPENT SEDENTARY OR BREAK UP PROLONGED SEDENTARY EVENTS IN ADULTS

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**Background and Aims:** Stroke survivors are more sedentary than other populations, and therefore have a higher risk of future cardiovascular events and other adverse sequelae. However, there is limited work identifying the intervention components that are effective for reducing sedentary behaviour in stroke survivors and other populations. This systematic review and meta-analysis examined the effectiveness of interventions and their components for reducing total time spent sedentary and breaking up prolonged sedentary events in adults.

**Methods:** Nine electronic databases and four additional sources were searched in October 2017 to identify randomised controlled trials (RCTs) in clinical and non-clinical adult populations that included an outcome measure of sedentary behaviour. Two reviewers conducted data extraction and quality assessments. Meta-analyses included data from the first and last available follow-up post-intervention.

## AS08-038

### STROKE RESEARCH REGISTER (HUNTER). INCREASING RECRUITMENT TO TRIALS AND CONSUMER INVOLVEMENT IN RESEARCH IN AN AUSTRALIAN REGIONAL SETTING

**C. English<sup>1,2</sup>, G. Mason<sup>1,2</sup>, M. Nilsson<sup>1,2</sup>, M. Pollack<sup>3</sup>, F. R. Walker<sup>1,2</sup>, M. Hourn<sup>3</sup>, M. Burke<sup>2</sup>, R. Peak<sup>2</sup> and N. Spratt<sup>1,2</sup>**

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<sup>2</sup>Hunter Medical Research Institute, Centre for Research Excellence in Stroke Rehabilitation and Brain Repair, Newcastle, Australia; <sup>3</sup>Hunter New England Local Health District, Hunter Stroke Service, Newcastle, Australia

**Background and Aims:** Recruitment to clinical trials of stroke recovery is challenging and there is increasing requirements to demonstrate

**Results:** Searches identified 24,184 records. Eighty-two studies were eligible, 68 of which were included in the meta-analyses. At post-intervention, total time spent in sedentary behaviour was reduced in interventions that incorporated the provision of information, education, or formal support, in conjunction with either motivational counselling ( $-38$  min/day; 95% CI:  $-64$  to  $-12$ ; n = 262) or a form of physical activity ( $-15$  min/day; 95% CI:  $-23$  to  $-0.07$ ; n = 2421). This positive effect was not maintained at last follow-up. No intervention was effective at breaking up prolonged sedentary events.

**Conclusions:** The review findings show that interventions may be effective in reducing time spent sedentary immediately post-intervention, and highlight potentially effective intervention components. Further research is required to address breaking up prolonged sedentary events.

**Trial registration number:** N/A

## AS08-065

### MANY HANDS MAKE LIGHT WORK: INTERACTIVE PHYSIOTHERAPY IS BETTER THAN SOLO THERAPY IN CERTAIN PATIENT TYPES

**C. Fernandes<sup>1</sup>, J. Ranchagoda<sup>1</sup>, A. Ali<sup>1</sup>, R. Gupta<sup>1</sup>, M. Mace<sup>2</sup>,  
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<sup>2</sup>Imperial College London, Engineering, London, United Kingdom

**Background and Aims:** Motor training that involves human-human interactions improves performance and learning, more than training alone. We recently demonstrated a convenient method by which stroke patients with arm disability can train collaboratively with other people, including relatives or other patients. Importantly, the performance advantage of human interaction is greater for more disabled patients. In the current study, we explore a broader set of patient factors accounting for performance advantages with interactive, versus solo, arm training.

**Methods:** Consecutive stroke patients with arm weakness were recruited and consented within a fortnight of onset; and underwent physical, cognitive, emotional, and personality tests, and brain MRI. Subjects played a motor-training digital game with their paretic arm, alternating between two conditions (interactive vs. solo). In both, subjects had to variably squeeze a digital handgrip ("Gripable"), so as to vary the height of one end of a balancing-beam according to a target sinusoidal path. In the interactive version, the opposite end of the beam was balanced by another human; whilst in the solo condition, this was set as horizontal by the computer.

**Results:** Interactive versus solo game play resulted in gaming performance improvement with a median improvement of 32%. Factors associated with a greater advantage for interaction were: baseline disability, hemi-somatosensory impairment, lesion of superior parietal cortex (or its connections), and extrovert personality (p < 0.05, corrected).

**Conclusions:** Rehabilitation involving human-human interaction is likely to be performed better by patients than solo training, but certain patient types, e.g. those with sensory impairments, benefit more so.

**Trial registration number:** N/A

## AS08-040

### A SYSTEMATIC REVIEW OF THE ASSESSMENT AND ASSOCIATION OF UNILATERAL NEGLECT AND PROPRIOCEPTION AFTER STROKE

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D.S. Kennedy<sup>1,2</sup>**

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**Background and Aims:** To determine if people with unilateral neglect (UN+) after stroke have more frequent or severe proprioceptive deficits than those without unilateral neglect (UN-) after stroke.

**Methods:** The MEDLINE, Embase, Scopus, CINAHL and Web of Science databases were searched from inception to December 2018 using an a priori search strategy. Two independent reviewers screened abstracts and full texts. Two reviewers then independently extracted data from each full text. A third reviewer resolved disagreements at each step. Risk of bias was assessed using the AXIS Quality Assessment tool for cross-sectional studies, and the Newcastle-Ottawa Scale for cohort studies. For full protocol see PROSPERO, registration number CRD42018086070.

**Results:** One-hundred and sixty-seven (n = 167) abstracts were identified, of which fifty-four (n = 54) were eligible for full text screening. A total of eighteen (n = 18) papers were included in the review. We found low to moderate quality (AXIS median 14, IQR 12–15) evidence that UN+ have more frequent and severe proprioceptive deficits than UN-. There were fifteen (n = 15) different reported UN assessments, and thirteen (n = 13) different measures of proprioception. Only two (n = 2) studies used an assessment capturing UN present in all possible domains.

**Conclusions:** The evidence is limited by the large heterogeneity of assessments and level of study quality. However, more severe proprioceptive impairment is implicated in UN. We found that neither UN nor proprioception are consistently and rigorously assessed and thus, this is likely also true in clinical practice. Future high-quality investigation of proprioception in UN is warranted to form the foundation for targeted treatment strategies.

**Trial registration number:** N/A

## AS08-023

### DEVELOPMENT OF A GROUP HEALTH EDUCATIONAL INTERVENTION FOR YOUNG STROKE PATIENTS AND THEIR RELATIVES TO IMPROVE QUALITY OF LIFE AFTER STROKE

**M.N. Folke<sup>1</sup>, H. Christensen Krarup<sup>1</sup>, C. Ovesen<sup>1</sup>, H.M. Rytter<sup>1</sup>,  
M. Forsling<sup>1</sup>, S. Rosenbaum<sup>1</sup> and A. Hansen<sup>1</sup>**

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**Background and Aims:** Stroke can bring about a sudden and unexpected change to patients' normal life, with functional impairments and emotional changes. While functional impairment is frequently measured in clinical outcome studies, emotional symptoms receive much less attention and targeted preventative interventions are missing. This pilot study aims to implement and evaluate a group health educational intervention for working-age stroke patients and their relatives to improve emotional empowerment and thereby quality of life after stroke.

**Methods:** This is an on-going, prospective, single-centre, open intervention pilot study evaluating the effect of group-based health educational intervention after transient ischemic attack (TIA) or minor stroke in adults of working-age (18–65 years) by using patient reported outcome measures before and after the intervention.

The one-day intervention program includes:

1. Stroke epidemiology, pathology, aetiology, clinical, treatment, and prevention (neurologist), 1 hour
2. Social law with focus on returning to work/education (social worker), 15 minutes
3. Emotional changes after stroke (neuropsychologist), 90 min
4. Group-based session patient and relatives separately (neuropsychologist), 90 min

The intervention is evaluated with Patient Health Questionnaire (PHQ-9), Fear Questionnaire (FQ) by Marks and Matthews, and quality of life (5Q-5D-5L).

**Results:** During the first 3 months we have recruited 21 patients of which 18 (86%) have completed questionnaires.

**Conclusions:** We will assess feasibility and patient satisfaction in relation to the intervention. Furthermore, we will explore if emotional distress is reduced after the intervention with the ultimate aim of testing a health educational intervention in a controlled design in a community setting.

**Trial registration number:** N/A

## AS08-020

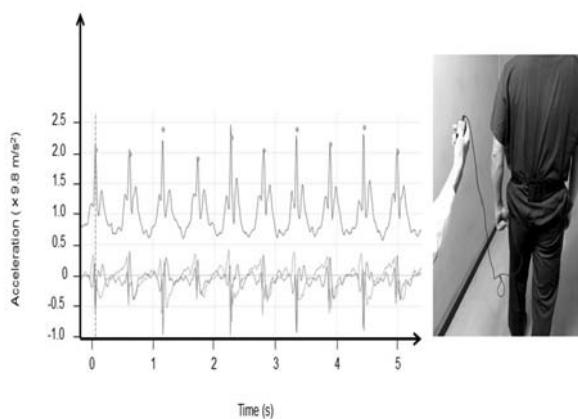
### RELIABILITY OF GAIT PARAMETERS OBTAINED BY A TRI-AXIAL ACCELEROMETER IN GAIT ASSESSMENTS

**S. Fujiwara<sup>1</sup>, S. Sato<sup>1</sup>, A. Sugawara<sup>1</sup>, Y. Nishikawa<sup>1</sup>, T. Koji<sup>1</sup> and K. Ogasawara<sup>1</sup>**

<sup>1</sup>Iwate Medical University, Department of Neurosurgery, Morioka, Japan

**Background and Aims:** Our purpose is to investigate whether the gait-related parameters obtained by a tri-axial accelerometer are reliable or not, in terms of their reproducibility, by using test-retest gait measurement in healthy subjects.

**Methods:** Each of 44 healthy subjects performed a 10-m walk six times with a tri-axial accelerometer fixed at the L3 level of the subject by a nylon belt. Both the first and second gait assessment were performed on the same straight 30-m walkway in our hospital. Nine gait-related parameters (assessment time, number of steps, stride time, cadence, ground force reaction, coefficients of variation of step time (CV), step time, velocity, and step length) were automatically calculated from each 10-m measurement wave dataset by the commercial software GaitView. Six values of repeated measurements in each gait assessment parameter were averaged. Differences in each gait parameter between the first and second assessments was statistically examined using a significance level of  $p < 0.05$  and the intraclass correlation coefficient (ICC) was also calculated for each gait parameter.



**Results:** Both the first and second evaluation (mean interval,  $49.6 \pm 7.6$  days) were successfully performed in 33 subjects (21 men, 15 women; mean age,  $35.7 \pm 9.9$  years). All parameters except CV showed no significant differences. Only the CV showed a significant difference between the first and second assessments ( $p = 0.0188$ ). The CV of step time showed the lowest ICC, being less than 0.50 (0.425) in all parameters.

**Conclusions:** In a test-retest gait assessment using a tri-axial accelerometer, sufficient reproducibility for clinical evaluation was observed in all parameters except the CV.

**Trial registration number:** N/A

## AS08-059

### CLASSIFYING STROKE BASED ON STROKE-RELATED IMPAIRMENTS: FINDINGS FROM THE SENTINEL STROKE AUDIT PROGRAMME INVESTIGATING THERAPY (SSNAPIEST) STUDY

**M. Gittins<sup>1</sup>, S. Tyson<sup>2</sup>, A. Vail<sup>3</sup>, A. Bowen<sup>4</sup>, D. Lug-Palacios<sup>5</sup>, B. Bray<sup>6</sup>, B. Gannon<sup>7</sup>, L. Paley<sup>8</sup>; The SSNAP team and participants**

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**Background and Aims:** Stroke causes many impairments and disabilities which require personalised care. Stroke professionals need ways to classify patients' problems to identify needs, inform treatment plans, predict outcome, and benchmark care. We have developed a simple, clinically meaningful and feasible, impairment-based stroke classification to enable this.

**Methods:** Stroke patients ( $n = 94,905$ ) were included if recorded by SSNAP to be admitted (July 2013–2015), survived 72hrs, and had complete National Institute of Health Stroke Scale (NIHSS) data at admission. The 15 NIHSS items were grouped into body systems as follows:

- Loss of Consciousness
- Cognition (including communication)
- Senses (vision +/- sensation)
- Motor system (limb weakness, ataxia +/- dysarthria)

Then geometric coding identified clusters of impairments in the body systems which formed the stroke impairment types. Descriptive summary described the demographics; stroke characteristics and length of in-patient of the stroke types

**Results:** Geometric coding revealed 31 different combinations of system impairments. These were consolidated into seven distinct stroke impairment categories based on literature and clinical expertise:

- Altered consciousness +/- another system impairments
- Motor + cognitive + senses
- Motor + cognitive impairments
- Motor+ senses
- Motor impairments only
- Non-motor stroke (cognitive +/- sensory impairments but not motor nor altered consciousness)
- No impairments

Further details of patient's demographics, stroke characteristics and outcomes in impairment categories will be presented.

**Conclusions:** A novel impairment based stroke classification system has been developed. Future research will investigate its usability in clinical practice and its potential value as a prognostic tool

**Trial registration number:** N/A

## AS08-061

### IDENTIFYING FACTORS ASSOCIATED WITH THE INTENSITY OF THERAPY RECEIVED BY STROKE SURVIVORS: THE SENTINEL STROKE NATIONAL AUDIT PROGRAMME: INVESTIGATING AND EVALUATING STROKE THERAPY (SSNAPIEST)

**M. Gittins<sup>1</sup>, S. Tyson<sup>2</sup>, A. Vail<sup>1</sup>, A. Bowen<sup>3</sup>, D. Lugo-Palacios<sup>4</sup>, B. Bray<sup>5</sup>, B. Gannon<sup>6</sup>, L. Paley<sup>7</sup>; The SSNAP collaborators and participants**

<sup>1</sup>University of Manchester, Centre for Biostatistics- Manchester Academic Health Science Centre MAHSC, Manchester, United Kingdom; <sup>2</sup>University of Manchester, Division of Nursing, Midwifery and Social Work- MAHSC, Manchester, United Kingdom; <sup>3</sup>University of Manchester, Division of Neuroscience & Experimental Psychology- MAHSC, Manchester, United Kingdom; <sup>4</sup>Imperial College London, Health Economics – Centre for Health Policy Institute of Global Health Innovation, London, United Kingdom; <sup>5</sup>University College London, Farr Institute of Health Informatics Research-, London, United Kingdom; <sup>6</sup>The University of Queensland, Centre for Business and Economics of Health-, Brisbane, Australia; <sup>7</sup>King's College London, School of Population Health & Environmental Sciences, London, United Kingdom

**Background and Aims:** One key factor in the clinical improvement of stroke patients is the amount of therapy they receive during rehabilitation, with patients observed to receive a wide variation in amount of therapy. Here we attempt to quantify the impact of patient and hospital characteristics on the amount of therapy received.

**Methods:** Data included all strokes in England and Wales (July 2013–2015) reported to the national Stroke Sentinel National Audit Programme (SSNAP) who survived three days. A robust multilevel mixed effects regression model measured the impact of patient and hospital factors identified *a priori* on the amount of stroke therapy received per day of stay. In addition to total therapy, the model was repeated separately for Physiotherapy, Occupational Therapy, Speech and Language Therapy, and Clinical Psychology.

**Results:** The amount of therapy received per day is influenced by patient stroke characteristics relating to severity, impairment categories, and pre-stroke independence. Patients with moderate strokes, motor impairments, or pre-morbid independence received more therapy. Additionally mild association was found with patient demographics gender, ethnicity, and social deprivation. Whilst more therapy was associated with higher staffing levels (numbers of qualified therapists and nurses). More therapy was also associated with patients assessed within 72 hours of arrival, a characteristic that may relate to the staff availability to undertake assessment.

**Conclusions:** After allowing for stroke characteristics that influence the amount of therapy received, there are organisational factors specifically staffing levels that remain associated with differences in provision. To confirm any association with organisational factors is present further research is required.

**Trial registration number:** N/A

## AS08-056

### POST-STROKE SHOULDER PAIN: THE USE OF PRESSURE ALGOMETRY IN QUANTIFYING PAIN

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**Background and Aims:** Post-stroke pain syndromes are difficult to rehabilitate in patients. In connection with the formation of speech, cognitive impairments, an objective assessment of pain in the post-stroke period is a certain problem. Pressure algometry is a method used for objectivization of pain syndrome in various studies.

**Aim of investigation:** to determine the correlation between the degree of pain syndrome (VAS) and the factor of the pain threshold under pressure (PPT) in patients in the post-stroke period.

**Methods:** 120 patients were enrolled (mean age: 68), 62 men and 58 women. Inclusion criteria: a history of stroke (from 1 to 6 months after acute stroke); degree of arm paresis (from 1 to 4 points according to MRCS); pain syndrome in the shoulder area; signed informed consent. To assess the effectiveness, visual-analogue scale (VAS) was used. The indicator PPT is determined by applying controlled pressure to the trigger painful point in the certain muscle.

**Results:** In accordance with VAS patients were divided into three groups: 30% (n=36) VAS under 4; 37,5% (n=45) VAS from 4 to 6; 32,5% (n=39) VAS above 6. The PPT indices in the groups were distributed as follows:  $3.04 \text{ kg/cm}^2 \pm 0.38$  in the first group,  $2.97 \text{ kg/cm}^2 \pm 0.27$  in the second,  $2.89 \text{ kg/cm}^2 \pm 0.24$  in the third. Spearman's rank correlation coefficient  $r = -0,71252$ .

**Conclusions:** The use of pressure algometry makes it possible to objectify the assessment of pain after a stroke, which is most relevant for patients with speech and cognitive impairment.

**Trial registration number:** N/A

## AS08-037

### THE FLOREO PROJECT: IN SEARCH OF THE BUILDING BLOCKS FOR ONLINE SUPPORTED SELF-MANAGEMENT FOR STROKE SURVIVORS

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<sup>1</sup>University of Antwerp, Nursing and Midwifery, Antwerp Wilrijk, Belgium; <sup>2</sup>Antwerp University Hospital, Neurovascular Reference Center – Department of Neurology, Antwerp Edegem, Belgium; <sup>3</sup>University of Antwerp, Research Group on Translational Neurosciences, Antwerp Wilrijk, Belgium; <sup>4</sup>University of Antwerp, Primary and Interdisciplinary Care Antwerp, Antwerp Wilrijk, Belgium

**Background and Aims:** Self-management programs for stroke patients can improve disability, confidence in recovery and quality of life. We evaluated the educational needs of patients and caregivers using an online self-management program in the outpatient setting, to identify opportunities for improvement. Additionally, patients and caregivers' experience when using this program was recorded.

**Methods:** In-depth semi-structured interviews were undertaken with acute and chronic stroke patients, using a descriptive, qualitative research design. Their experiences with a prototype self-management website containing rehabilitation video-exercises, e-learning modules and social support information was assessed, after 2 weeks of use.

**Results:** We recruited stroke survivors ( $n = 8$ ) and caregivers ( $n = 9$ ) with a mean age of 64 (range 36–82). Stroke survivors expressed their need for personal care when coping with the strong emotional burden of stroke, rather than telecare. However, personal care could be complemented with telecare. Narrative video-education was preferred to text-heavy or factual content. An easy-to-access digital user interface and a personalized content were preferred, as opposed to generic content. Self-management skills for dealing with the daily challenges of stroke were related to the capacity for emotional and cognitive self-regulation. Recovery of physical impairment was associated with the motivation for repeated exercise and the level of social support and stimuli.

**Conclusions:** When using online self-management programs for stroke patients in the outpatient setting, the information-architecture should offer an interactive, user-friendly and personalized content, focusing on biopsychosocial self-management and education. Telecare is seen as a complementary tool in follow-up.

**Trial registration number:** N/A

#### AS08-049

### STROKE IN YOUNG ADULTS: QUALITY OF LIFE AND REHABILITATION GOALS OF YOUNG ADULTS FOLLOWING STROKE

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<sup>1</sup>Manchester Metropolitan University, Research Centre for Musculoskeletal Science and Sports Medicine, Manchester, United Kingdom; <sup>2</sup>Betsi Cadwaladr University Health Board, Physiotherapy Department- Ysbyty Gwynedd, Bangor, United Kingdom; <sup>3</sup>Hywel Dda University Health Board, Neuro-Physiotherapy- South Pembrokeshire Hospital, Pembroke Dock, United Kingdom; <sup>4</sup>Powys Teaching Health Board, Community Neuro Service- Newtown Hospital, Newtown, United Kingdom; <sup>5</sup>Cardiff and Vale University Health Board, Stroke Rehabilitation Centre- University Hospital Llandough, Cardiff, United Kingdom; <sup>6</sup>Cwm Taf University Health Board, Neuro-Physiotherapy Department- Keir Hardie University Health Park, Merthyr Tydfil, United Kingdom; <sup>7</sup>Abertawe Bro Morgannwg University Health Board, Physiotherapy Department- Morriston Hospital, Swansea, United Kingdom

**Background and Aims:** Many young adults are at risk of social isolation as they are unable to return to employment or participate in social activities post-stroke. The effect a stroke has on the quality of life of young adults is relatively unexplored and no rehabilitation guidelines are tailored for them. The aim of this research study was to establish key themes of the difficulties faced by and rehabilitation goals of young adults who have had a stroke.

**Methods:** Participants who had experienced a stroke (18–40years:  $n = 6$ , 41–54years:  $n = 20$ , 55–65years:  $n = 15$ ) were recruited from six health boards in Wales, UK. Data were investigated using interpretative thematic analysis of feedback from participants who were asked to complete a questionnaire asking them to name three things they find difficult and three aims they have since they had a stroke.

**Results:** Two key themes of difficulties emerged: Independence and communication (Figure 1). Sub-themes of difficulties within independence included walking (walking fast, loss of endurance, walking outside and up/down stairs), and inability to complete activities of daily living (washing, dressing and cooking or preparing food). Sub-themes within communication included talking, writing and reduced concentration during a conversation. Regain independence and participate in social activities were key aims with sub-themes of these including return to work and to be able to “walk normally” (Figure 2).

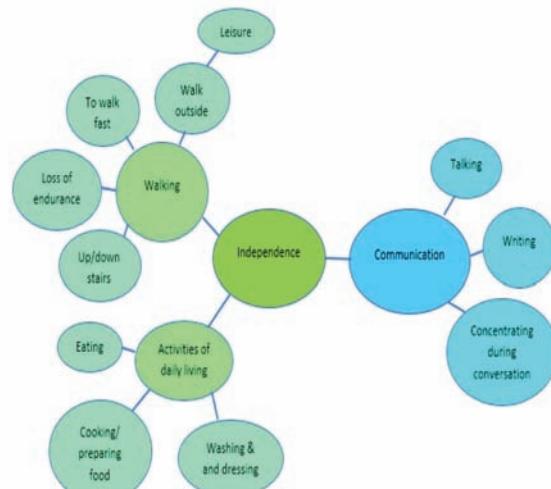


Figure 1: Key difficulties identified by young adults who have had a stroke.

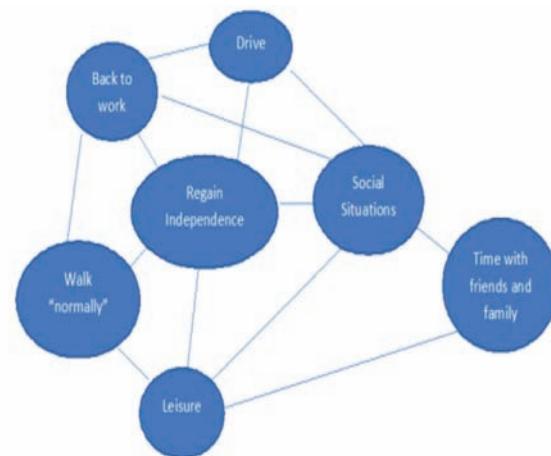


Figure 2: Key aims identified by young adults who have had a stroke

**Conclusions:** Understanding the effect of stroke on young adults' quality of life is critical to successful targeted rehabilitation and in enabling a greater proportion of individuals to return to work and participate in social activities.

**Trial registration number:** N/A

#### AS08-025

### THE EFFECTS OF GAIT TRAINING ON THE SANDY BEACH WITH SHALLOW WATER FOR PATIENTS WITH CHRONIC STROKE

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**Background and Aims:** To investigate the effects of gait training on the sandy beach with shallow water for patients with chronic stroke.

**Methods:** A total of 28 patients with chronic stroke were recruited for the study. They randomly assigned to beach group or urban group. Patients in the two groups received gait training twice a day for 5 days. We measured Motricity Index of lower extremity (MI-Lower), Functional Ambulatory Category (FAC), Self-Selected Velocity (10MWT-SSV) and Fast Velocity (10MWT-FV) of 10-meter Walk Test (10MWT), Berg Balance Scale (BBS), Timed Up and Go (TUG), spatiotemporal parameters for gait analysis using G-Walk before and after treatment.

**Results:** In the beach group, MI-Lower, 10MWT-SSV, 10MWT-FV, and BBS scores were significantly higher than baseline ( $p < 0.05$ ). In the urban group, scores of 10MWT-SSV, 10MWT FV were significantly higher than baseline after gait training program ( $p < 0.05$ ). MI-Lower and BBS scores were significantly improved in the beach group than those in the urban group after treatment ( $p < 0.05$ ). Furthermore, in spatiotemporal parameters such as cadence and speed, the beach group showed significant increased after treatment compared to before treatment ( $p < 0.05$ ). In the urban group, there were no significantly improved parameters after treatment. ( $p > 0.05$ ). In the beach group, cadence, speed, stride length were significantly increased compared to urban group after treatment ( $p < 0.05$ ).

**Conclusions:** Gait training on the sandy beach with shallow water is beneficial for improving lower extremity strength, walking ability, and balance for chronic stroke patients.

**Trial registration number:** N/A

## AS08-019

### CIMT IMPROVED MOTOR FUNCTION BY REGULATING NEUROPLASTICITY VIA DECREASING SEMA3A/VEGF165 CORECEPTOR NRPI IN MCAO RATS

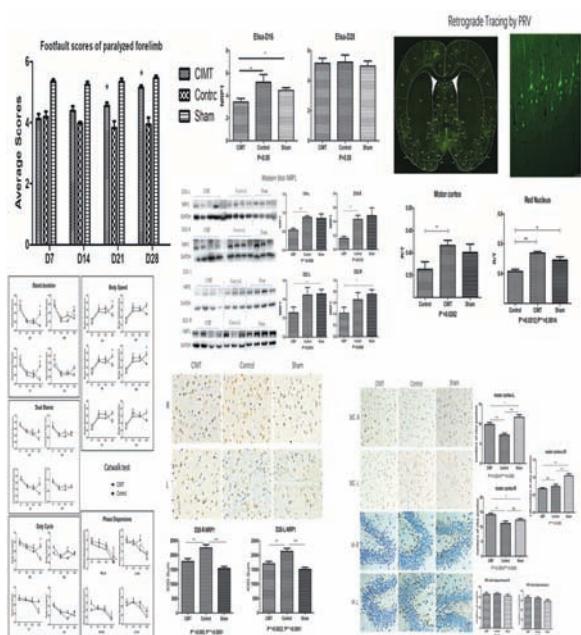
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**Background and Aims:** To explore the mechanisms underlying CIMT effectiveness in aspects of neuron activation, recruitment, and molecular mechanism.

**Methods:** In CIMT group, Rats received daily CIMT training for 2~3 weeks starting at the 8<sup>th</sup> after left Middle Cerebral Artery Occlusion (D8), while Sham and Control Groups underwent spontaneous recovery. Motor function were evaluated by "Foot fault" and Catwalk. Neurons in the efferent network innervating the paralyzed upper limb were labeled by infecting neurotropic PRV through brachial plexus. Eventually, "the percentage of right"(R/T) of PRV+ neurons was calculated for different brain area; Activated neurons during turning wheel training were labeled by c-fos IHC staining; NRPI were quantified in bilateral cortex (by western blotting and IHC) and serum (by Elisa) at different time points.

**Results:** CIMT significantly improved Motor function as shown by Foot-fault and Catwalk tests. For retrograde tracing, significantly ( $P < 0.05$ ) higher PORs were observed in CIMT group compared with Control group in motor cortex and locus ruber. Count of c-fos (+) cells ( $n = 6/group$ ) showed an significant increase both in the left and right MC in CIMT group. NRPI level was significantly down regulated in both right and left cortex and serum in CIMT group as shown in Western blotting, IHC and Elisa experiments.



**Conclusions:** CIMT promoted motor function recovery by down-regulating NRPI level in bilateral cortex and serum, further promoting neuroplasticity. This plasticity was bilateral, but with a contralesional side preference.

**Trial registration number:** N/A

## WITHDRAWN

of the obtained results in B and C groups were significant different after treatment. Obtained results QSO and QPM in C group were indistinguishable from A Group.

**Conclusions:** 1. AK in the treatment of MMD: improves QPM and effectively the standard therapy up to 43,3%; improves QSO and effectively the standard therapy by 81%.

2. The method of biomechanical analysis of the qualitative structure of cyclic step locomotion could be use in assessment of clinical results of ongoing treatment.

**Trial registration number:** N/A

## AS08-008

### STROKE, LIFE AND LEISURE RESEARCH SURVEY (STROLLERS)

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**Background and Aims:** Post-stroke impairments have a profound impact on quality of life, and around two thirds of stroke survivors report reduced participation in leisure activities. The aim of this study is to examine changes in leisure participation after stroke, and barriers and facilitators to returning to pre-stroke leisure activities.

**Methods:** People experiencing a new first or recurrent TIA or stroke, and with a pre-stroke modified Rankin Scale score of  $\leq 3$ , are being invited to take part whilst an in-patient, or at a first post-event TIA clinic appointment. Participants will complete two questionnaires (i) a baseline questionnaire to gather data on frequency of participation in leisure activities in the few weeks prior to their stroke and (ii) a six-month follow-up questionnaire to gather data on frequency of participation in leisure activities in the few weeks prior to completion of the questionnaire. The Shortened Nottingham Leisure Questionnaire is the primary measure for the study.

**Results:** The first study site opened on December 1st 2017. To date 2845 participants have been recruited from 21 sites. Of 1535 follow-up questionnaires which have been sent out, 814 have been returned giving a response rate of 53%. Study recruitment is due to close on the 1st of June 2019.

**Conclusions:** The findings will help to better understand factors that influence leisure participation after TIA/stroke and inform the development of tailored leisure interventions and services that can maximise participation for people after TIA/stroke.

**Trial registration number:** N/A

## AS08-062

### DEVELOPMENT OF A COMPLEX INTERVENTION FOR REHABILITATION OF POST-STROKE COGNITIVE IMPAIRMENT BASED ON MEDICAL RESEARCH COUNCIL GUIDELINES

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**Background and Aims:** Post-stroke cognitive impairment (PSCI) is a pervasive outcome of stroke, which reduces quality of life. Despite the prevalence of PSCI, the efficacy of existing interventions for the rehabilitation of PSCI has yet to be established. We aimed to develop a cognitive rehabilitation intervention for PSCI using an evidence-based approach in accordance with the framework recommended for developing and evaluating complex interventions by the Medical Research Council (MRC).

**Methods:** A mixed method study was conducted, comprising a systematic review of non-randomised interventions for PSCI and qualitative interviews with stroke survivors ( $n = 14$ ), carers ( $n = 11$ ), and healthcare professionals involved in providing stroke care ( $n = 19$ ) to inform the design of a cognitive rehabilitation intervention. Qualitative data were analysed thematically using the Template for Intervention Description and Replication (TIDieR) checklist as a structural framework.

**Results:** Limitations of the existing literature include a lack of high quality studies with low risk of bias. Qualitative findings address five themes relevant for the design of the intervention: i) intervention content; ii) when the intervention takes place; iii) intervention location; vi) intervention format; v) who the intervention should include. The resulting intervention consisted of a cognitive rehabilitation intervention tailored to patient-specified goals, incorporating both group and individualised activities.

**Conclusions:** We followed an evidence-based approach and the MRC guidelines for developing and evaluating complex interventions to design a cognitive rehabilitation intervention for PSCI. Qualitative work with stroke survivors, carers, and healthcare professionals supported intervention design. Ongoing work is examining the feasibility and effectiveness of the intervention to address PSCI.

**Trial registration number:** N/A

## AS08-034

### STROKE REHABILITATION EFFICIENCY AND EFFECTIVENESS IN LATVIA – A SINGLE CENTER STUDY

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**Background and Aims:** Rehabilitation is meaningful for improving mobility, performance in daily-living and activities in community, therefore we need to consider the effectiveness and efficiency of individual and health care organisation strategies and content of rehabilitation services. To determine the effectiveness and efficiency of inpatient post-stroke rehabilitation in Latvia.

**Methods:** A retrospective cohort study design – medical records of stroke patients were studied according to research protocol. Patients, who were admitted in subacute rehabilitation center from 01.01.2018.-31.12.2018. and with diagnosis ICD-10 I63.3 and I61.1, were included in study. The study was approved by the Ethics committee. Analyzed outcome measures: Functional Independence Measurement (FIM) efficacy – (admission-to-discharge FIM change), rehabilitation effectiveness (achieved percentage of potential gain), rehabilitation efficiency (FIM efficacy divided by length of stay).

**Results:** 296 patients were included in the study, aged from 27–90 years, median age 66 years. The average time from stroke diagnosis till subacute rehabilitation admission was 12,11 weeks and average length of stay in Rehabilitation centre was 13,11 days. Overall rehabilitation efficiency median 0,46, effectiveness 23,81% and FIM efficacy 6,00. Patients who waited longer from stroke diagnosis till admission in Rehabilitation centre tended to have lower rehabilitation effectiveness at the end of the rehabilitation ( $p < 0,01$ ). Patients with longer rehabilitation, had better rehabilitation efficacy ( $p < 0,01$ ).

**Conclusions:** Inpatient rehabilitation is regarded as relevant part for improving stroke patients' functional abilities. This is the first study about stroke rehabilitation effectiveness in Latvia and it is essentially to continue studies in this field to improve better outcome in multidisciplinary care.

**Trial registration number:** N/A

## AS08-051

### CO-PRODUCING A COMPLEX INTERVENTION TO REDUCE SEDENTARY BEHAVIOUR AFTER STROKE: CHALLENGES AND SOLUTIONS

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<sup>8</sup>Independent, Independent, London, United Kingdom; <sup>9</sup>University of Newcastle, School of Health Sciences, Newcastle, Australia

**Background and Aims:** Stroke survivors are highly sedentary; breaking up long uninterrupted bouts of sedentary behaviour could have substantial health benefit. However, intervention strategies tailored for this population are lacking. Co-production methods are highly valued in quality improvement work to enhance users' experiences and satisfaction with services but their use in complex intervention development is less commonly reported. We report on a co-production approach designed to develop an evidence informed intervention to reduce sedentary behaviour after stroke.

**Methods:** Co-production workshops with stroke survivors, their caregivers, health professionals, exercise professionals and researchers. Workshop processes were informed by the Behaviour Change Wheel framework for designing interventions, and incorporated systematic review and empirical evidence. Workshop interactions were recorded, analysis of outputs from each workshop informed subsequent workshops. Prototype intervention materials will be validated by workshop participants.

**Results:** Five workshops were conducted in parallel in two stroke services, one in England and one in Scotland. Across the two sets of workshops 14 stroke survivors, 7 carers, 17 professionals and 6 researchers participated in intervention development: specifying the target behaviour; barriers and facilitators; generation of solutions; review of intervention prototypes. Challenges included ensuring stroke survivors' and caregivers' views were heard and valued, avoiding overwhelming participants with research evidence and using time effectively. Solutions included effective facilitation, involving participants in all stages of decision making, and providing participants with structured feedback on intervention elements

**Conclusions:** A collaborative and iterative co-production approach has contributed to the development of a robust intervention with potential for integration into stroke care pathways

**Trial registration number:** N/A

## AS08-036

### HEMIPLEGIC SHOULDER PAIN AFTER RECENT STROKE (SPARS): IS CLINICAL FRAILTY RELATED TO PAIN OUTCOME? (NCT 02574000)

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**Background and Aims:** Shoulder weakness within 72 hours post-stroke significantly increases the risk of hemiplegic shoulder pain outcome at two months (Nadler 2017). Here we investigated whether patient frailty using the Clinical Frailty Score (CFS) was associated with pain outcome.

**Methods:** Retrospective analysis of consecutive, unselected stroke patients assessed within 72 hours and followed-up for shoulder pain (standardised pain questionnaire) and muscle power (MRC). Pre-admission CFS and Modified Rankin Score (mRS) were noted. Patients were classified as "Frail"; CFS  $\geq 3$  or "Not-frail"; CFS  $\leq 2$ . Pain outcome was dichotomised into "good" if there was never pain or any pain had resolved at follow-up or "poor" if pain developed/remained at two months.

**Results:** 121 patients had initial and follow-up data. 30/121 were Frail aged 76.1  $\pm$  11.6 years (score 3–6) and 91/121 were Not-frail aged 66.9  $\pm$  12.9 years. The Frail group was significantly older ( $p = 0.0006$  ANOVA). Pain outcome was not associated with frailty ( $p > 0.05$  Chi Squared test) nor age ( $p > 0.05$ ). Shoulder muscle weakness (MRC  $< 5$ ) was significantly associated with poor pain outcome for both, the Frail group ( $p = 0.009$ ) and Not-frail group ( $p = 0.03$  Chi-Sq). There was a significant correlation between CFS and MRS ( $r_s = 0.91$ ,  $p < 0.001$ ).

\* indicates significant

	Pain Outcome	Frail (3-8)	Not-frail (0-2)
<b>Number of subjects</b>	n=121	30/121	90/121
<b>Age</b>		76.1 $\pm$ 11.6 years	66.9 $\pm$ 12.9 years *
<b>Pain</b>	Good	57% (17/30)	56% (51/91)
	Poor	43% (13/30)	44% (40/91)
<b>Weakness present</b>	Good	46% (8/17)	35% (18/51)
	Poor	92% (12/13)*	58% (23/40) *

**Conclusions:** CFS highly correlates with and may complement mRS. However, poor shoulder-pain outcome was associated with muscle weakness but not frailty or age.

**Trial registration number:** N/A

## AS08-066

### PATIENT COMPLEXITY: THE IMPACT ON STROKE REHABILITATION CLINICIANS AND CLINICAL PRACTICE

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**Background and Aims:** Healthcare systems are experiencing strain as people age and develop more complex presentations. 'Patient complexity' reflects variations in individuals including not just their comorbid

conditions or frailty but also, psycho-social and health system issues. Given the increased complexity of patients, a better understanding of how individuals and teams respond to this complexity would be valuable. The purpose of this research project was: i) to better understand the influence of patient complexity on the clinical practice of stroke rehabilitation clinicians and ii) to situate the findings within the literature on patient complexity.

**Methods:** A qualitative descriptive study was conducted, collecting data from clinicians working on neurorehabilitation units within a mid-sized Canadian rehabilitation hospital. Twenty-three stroke rehabilitation clinicians participated in four focus groups and member checking interviews. Data were analyzed using qualitative content analysis techniques.

**Results:** Most stroke patients had complex care needs; requiring "more work and more time". The effects of complexity were noted within three nested levels: personal, professional and team. Clinicians reported experiencing increased personal strain, stress and burnout. Patient needs necessitated interdisciplinary work and role blurring. Teamwork was essential in dealing with complexity, fostering creative solutions to complex care problems, while providing a support network for clinicians.

**Conclusions:** The increasing complexity of patients' care needs has an effect on how clinicians work, both as individuals and as a team. Workforce wellbeing may affect the quality and safety of care, so developing strategies to support clinicians in managing the stress of managing this complexity, and the increased workload is essential.

**Trial registration number:** n/a

## AS08-010

### THE EFFECTS OF COMPUTER BASED COGNITIVE REHABILITATION IN STROKE PATIENTS WITH WORKING MEMORY IMPAIRMENT: A SYSTEMATIC REVIEW

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#### Background and Aims:

**Objectives:** To evaluate effects of computer based cognitive rehabilitation (CBCR) on working memory impairment after stroke.

**Methods:** Four electronic databases were systematically searched: Pubmed, Embase, Psycinfo and Cochrane Library. Authors of relevant studies were contacted to detect unpublished data or articles.

**Selection criteria:** Studies were eligible for inclusion in the systematic review if 1) they investigated effects of CBCR on working memory after acquired brain injury in a patient sample consisting of at least 50% stroke-patients, 2) it was possible to isolate effects of CBCR-training by comparison to control groups, and 3) the outcome assessment included a quantitative working memory outcome measure either isolated or as part of a general outcome measure. Retrieved studies were included into the meta-analysis if they were conducted as randomized controlled trials, they included only stroke patients, and the effects on working memory could be isolated.

**Results:** Literature is limited and reported effects of CBCR on working memory after stroke were heterogeneous. A meta-analysis could not be performed as all studies used different measures of working memory. An additional analysis was performed to estimate the difference between control and CBCR interventions. The analysis revealed no meaningful differences in increase on working memory measures between control and intervention conditions. However, this additional analysis should be interpreted with caution as it does not take heterogeneity of outcome measures or differences in sample sizes between studies into account.

**Conclusions:** There is insufficient evidence to conclude if CBCR is of benefit for patients with working memory deficits after stroke.

**Trial registration number:** N/A

## AS08-047

### MOTIVATION FOR PLAYING COMPETITIVE AND COLLABORATIVE GAMES IN PERSONS WITH STROKE

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**Background and Aims:** Recently ischemic stroke hits a greater part of population under 55 years according to the British Stroke Association. The older population is more reluctant to games and virtual reality, while the younger are motivated to perform regular physiotherapeutic tasks as exergames.

Aim of our case study was to explore motivation in collaborative and competitive exergaming.

**Methods:** We have developed two types of exergames for training in pairs; cooperative kitchen and competitive pong. Participants controlled the game by moving the affected upper extremity. The movement data were assessed by Bimeo device (Kinestika Ltd., Slovenia). 2 patients with stroke (hemorrhagic/ischemic CVI, M/F, 72/ 53 years, left side impaired, Box & Blocks test 44/ 37, respectively) participated in the 3 weeks (9 sessions of 15 min) study. Both chose to play kitchen 3 times and pong 6 times.

**Results:** The results demonstrated that the older participant decreased interest/enjoyment, but kept effort and importance at the same level, while the younger significantly increased all motivation (intrinsic motivation inventory) parameters, particularly interest/enjoyment and perceived competence. Both participants have slightly increased pressure/tension.

**Conclusions:** Further studies in a larger group of participants are needed to confirm results of our case study.

**Trial registration number:** N/A

## AS08-003

### RISK OF HOSPITAL READMISSION IN OLDER PERSONS WITH STROKE FOLLOWING INPATIENT REHABILITATION

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#### Background and Aims:

**Background:** Our goal was to examine factors associated with hospital readmission following inpatient rehabilitation in older persons with stroke.

**Methods:** A prospective cohort study of older persons with stroke (N = 674) who received inpatient rehabilitation at 11 facilities located in 8-states and the District of Columbia in the US. Measures included hospital readmission (within 3 months of rehabilitation discharge), length of in-patient stay, primary payment source, sociodemographic characteristics, comorbidities, stroke type, standardized assessments of cognitive and motor function, depressive symptoms, and social support.

**Results:** Mean age of the sample was 71.5 years (SD = 10.5). Eighteen percent of the sample (n = 122) was re-hospitalized within 3-months of rehabilitation discharge. Older persons re-hospitalized were significantly more likely ( $p < .05$ ) to be non-Hispanic white, married, demonstrate less functional independence at discharge, experience longer lengths of stay in rehabilitation, report more depressive symptoms and report lower social support. Multi-variable hierarchical generalized linear models showed motor functional status (OR = 0.98, 95% CI 0.96-0.99), depressive symptoms (OR = 1.80, 95% CI 1.06-3.05), and social support (OR = 2.28, 95%

CI 1.29-4.03) to be significantly associated with re-hospitalization risk. A minority-by-depressive symptoms interaction term also reached statistical significance.

**Conclusions:** Functional status, depressive symptoms, and social support were important predictors of hospital readmission following inpatient rehabilitation for stroke. These variables are not included in most administrative data sets, however. To develop useful risk-adjustment models for re-hospitalization following inpatient rehabilitation, future research should include diverse samples and explore practical sources for additional meaningful information.

**Trial registration number:** N/A

## WITHDRAWN

relevance in a clinical setting were rated. In round 2, those rated at least as "very relevant" and "very feasible" were prioritised through ranking within each ICF-domain, and assessment time points had to be indicated. In round 3, experts reviewed their answers in reference to overall results to reach final consensus.

**Results:** Fifty-nine out of 119 outcome measures had high ratings in round 1 and were prioritized in round 2. The recommended minimal set includes

[...to be finalized in late breaking period]

**Conclusions:** Agreement was found upon a set of XX outcome measures. Timing of measurements poststroke with xxxx time points were recommended. In a next step, the developed minimal outcome measure set should be implemented in clinical practice to improve transparency, comparability, and quality of stroke rehabilitation care in Europe.

[...to be finalized in late breaking period]

**Trial registration number:** Basec Nr. Req- 2018-00601

## AS08-068

### THE ROLE OF LEVODOPA IN IMPROVING PROCEDURAL MOTOR TRAINING FOR PATIENTS WITH CHRONIC STROKE

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**Background and Aims:** To test the hypothesis that administration of dopamine precursor levodopa improves procedural motor learning (defined as the ability to acquire novel movement patterns gradually through practice) in patients with residual motor deficits in the chronic phase after stroke (> or = 1 y after stroke).

**Methods:** Neurology department in a Tashkent Medical Academy. Eighteen patients with chronic motor dysfunction because of stroke (33 men, 25 women; age range, 53-78 y; mean time poststroke +/- SD, 3.3+/-2.1 y).

Patients received 3 doses of levodopa (100mg of levodopa plus 25mg of carbidopa) or placebo before 1 session of procedural motor learning. Procedural motor learning performed by using the paretic hand assessed by using a modified version of the serial reaction time task with a probabilistic sequence. The primary outcome measure was the difference in reaction times between random and sequential elements.

**Results:** Levodopa significantly improved our primary outcome measure, procedural motor learning, compared with placebo ( $P < .05$ ). Reaction times to random elements, analysis of error rates, psychophysical assessments, and performance in a simple motor task were comparable between conditions, indicating that better learning under levodopa was not caused by differences in response styles, arousal, mood, or motor reaction times but that levodopa modulated learning.

**Conclusions:** Our results show that levodopa may improve procedural motor learning in patients with chronic stroke, in line with our hypothesis. These findings suggest that this interventional strategy in combination with customary rehabilitative treatments could significantly improve the outcome of neurorehabilitation in the chronic stage after stroke.

**Trial registration number:** N/A

## WITHDRAWN

## AS08-030

### CEREBRAL HEMODYNAMIC CHANGES DURING A PASSIVE ROBOT-ASSISTED MOVEMENT OF THE LOWER LIMBS AND MOTOR IMAGERY

**M. Ridolfi<sup>1</sup>, P. Caruso<sup>1</sup>, G. Furlanis<sup>1</sup>, M. Ajcevic<sup>1</sup>, M. Naccarato<sup>1</sup> and P. Manganotti<sup>1</sup>**

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**Background and Aims:** Neurovascular Coupling is the cerebral mechanism responsible for linking neuronal activity, cerebral metabolism and regional cerebral blood flow (CBF). A direct relation between functional brain activity during active, passive and motor imagery paradigms and changes in CBF has been widely investigated using different techniques. However, CBF changes have not yet been investigated beat by beat during robot assisted passive movement (PM) and motor imagery (MI) of lower limb.

**Methods:** We investigated beat-to-beat hemodynamic changes in 8 healthy subjects using TCD during MI and robot-assisted PM of lower limb.

**Results:** The results showed that MI and PM induce a significant CBF<sub>v</sub> increase and that PM and MI lead to similar hemodynamic changes in healthy subjects.

**Conclusions:** The findings may be useful to better understand the variation of CBF<sub>v</sub> in brain pathology and to develop more specific and efficient rehabilitation therapy protocols in neurological diseases, such as stroke.

**Trial registration number:** N/A

## AS08-011

### A PORTRAIT OF DRIVING PRACTICE FOLLOWING A MILD STROKE: A SECONDARY ANALYSIS OF A CHART AUDIT

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**Background and Aims:** The objective of this study was to describe acute care practice related to driving among individuals with mild stroke, i.e. those whose discharge location is home.

**Methods:** This study consisted of a secondary analysis of data from a chart audit realized in the Province of Quebec, Canada. Data were retrieved from the charts by trained extractors. Evaluation practice was described according to whether the driving assessment was specific and non-specific to driving (cognitive, perceptual and visual functions). Descriptive statistics and analysis of variance (ANOVA) were conducted to describe the practice and investigate the presence of statistically significant relationships between the different variables under study.

**Results:** The sample consisted of 419 charts of individuals with a mean age of  $70.5 \pm 13.3$  years old. Mean length of hospital stay was  $10.3 \pm 13.3$  days. Driving was documented among 26/419 (6.2%) of the charts. Specific driving prerequisites were screened for seven of these 26, while 92/419 (22.0%) were considered as problematic for driving a vehicle. Individuals who had a documented cognitive, perceptual or visual deficit were more often referred ( $p < 0.05$ ) to outpatient rehabilitation or home care at discharge. Charts were characterized by several missing data relating to driving.

**Conclusions:** The proportion of charts documenting driving restriction post-stroke in acute care is very low, indicating a gap in actual practice and best practices relating to driving post-stroke.

**Trial registration number:** N/A

## AS08-016

### EARLY REHABILITATION FOR STROKE PATIENTS WITH INTRACRANIAL HYPERTENSION

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**Background and Aims:** Japanese guidelines for the management of stroke recommend early rehabilitation for the prevention of disuse syndrome. However, ROM exercise without contraction of muscle tends to be the main early rehabilitation, and it leads to muscle atrophy. Therefore we introduced Belt electrode-Skeletal muscle Electrical Stimulation (B-SES) as electrical muscle stimulation, which causes a muscle contraction, for patients with intracranial hypertension, and we assessed the safety of B-SES for the patients with intracranial hypertension.

**Methods:** We use AUTO Tens PRO Rehabili Unit made by HOMER ION LABORATORY CO., LTD, and selected LEG DISUSE MODE, and the duration of the stimulation is 20 minutes. Physical therapist determined the output level by palpation of triceps surae muscle of each patient, and the effective intensity was usually between 20V and 50V.

**Results:** Case1: A 43-year-old woman underwent coil embolization of the ruptured right VA-PICA aneurysm. We monitored her intracranial pressure (ICP) by external drainage, and her ICP kept 14.5–18.0 cmH<sub>2</sub>O during B-SES. Case2: A 66-year-old man underwent external drainage for the acute hydrocephalus due to left thalamic hemorrhage and intra ventricular hemorrhage. His ICP kept under 17.5–19.0 cmH<sub>2</sub>O during B-SES. Case3: A 41-year-old woman presented with subarachnoid hemorrhage underwent neckclipping of the left middle cerebral artery aneurysm. Her ICP kept 8–11 mmHg during B-SES.

**Conclusions:** Electrical muscle stimulation with B-SES, as can be seen from these three cases, never worsened intracranial hypertension. Therefore, early rehabilitation with B-SES is safe and worth introducing for the stroke patient with intracranial hypertension.

**Trial registration number:** N/A

## AS08-069

### CANADIAN PLATFORM FOR TRIALS IN NON-INVASIVE BRAIN STIMULATION (CANSTIM) CONSENSUS RECOMMENDATIONS FOR REPETITIVE TRANSCRANIAL MAGNETIC STIMULATION IN UPPER EXTREMITY MOTOR STROKE REHABILITATION TRIALS

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**Background and Aims:** Large scale clinical trials demonstrating the efficacy of repetitive transcranial magnetic stimulation (rTMS) for post-stroke functional motor recovery are lacking. Missing consensus regarding the optimal protocol for rTMS in stroke has been a challenge for trial

design. It was the aim of this consensus process to develop recommendations for the use of rTMS as an adjunct intervention for upper extremity motor recovery in stroke rehabilitation trials.

**Methods:** The multidisciplinary Consensus Working Group of clinicians and researchers from across Canada identified four consensus themes: 1) patient population; 2) stimulation parameters; 3) rehabilitation interventions; and 4) outcome measures. Comprehensive evidence reviews for each theme were conducted and a weighted dot-voting procedure was used to achieve consensus.

**Results:** The following consensus recommendations were reached: 1) recruit cortical and subcortical stroke patients between 2 and 12 weeks after stroke who have been identified to need upper extremity rehabilitation 2) randomization to receive 1800 pulses of 1Hz rTMS over contralesional M1 at 120% RMT or sham stimulation 3) followed by 60 minutes of a controlled treatment (GRASP), for a total of 15 sessions. 4) use of a suite of validated core primary outcome measures of impairment, function and ability as well as subjective patient-centered and real-world actigraphy secondary outcomes and MR imaging biomarkers and MEP parameters as exploratory outcomes.

**Conclusions:** Establishing the CanStim platform and developing these consensus recommendations for an rTMS protocol for clinical trials is a first step toward the translation of non-invasive brain stimulation technologies into the clinic to enhance stroke recovery.

**Trial registration number:** N/A

## AS08-001

### USE OF THE NON-MEDICATION ON THE TREATMENT OF THE POST-STROKE SPASTICITY

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**Background and Aims:** The effect of the non-medication (physiotherapy) complex (ultratonetherapy, low-frequent variable magnetic field and balneotherapy) on the patients having post-stroke spasticity was investigated.

**Methods:** 98 patients aged from 45 to 65 (41 males and 57 females) having post-stroke spasticity were observed. All patients suffered acute cerebrovascular accident in the form of brain stroke from 14 to 60 days ago. Spasticity is accounted for under the Ashworth Scale (2 – 3 points). The patients were divided into two groups. The first group (62 patients) received in addition their basic medication and physiotherapy with combination of ultratonetherapy – variable sinusoidal high-tension (4–5 kV) high-frequent (22 kHz) low-intensive current (power 1–10 Watt), and low-frequent variable magnetic field (frequency to 100 Hertz, magnetic induction 27 mTesla) treatment of upper and lower extremities, with taking turn each other, and balneotherapy. Every procedure exposure was 12–15 min. The complete course was 10–12 procedures. The second group (control, 36 patients) received only the basic medication.

**Results:** The spasticity and subjective sensation of constraint extremities of the patients in the first group was reduced after 25–30 days of treatment (77,4% patients) compared to the control group, where muscle constraint reduced after 32–42 days of treatment (58,3 % patients),  $p < 0,05$ .

**Conclusions:** The addition of the complex (ultratonetherapy, balneotherapy and the low-frequent variable magnetic field) to the treatment of post-stroke spasticity resulted in earlier reducing of subjective sensation of constraint extremities.

**Trial registration number:** N/A

## AS08-052

### DESIGN OF TECHNOLOGIES FOR REHABILITATION AFTER STROKE: AN USER CENTERED REVIEW

**F. Toso<sup>1</sup>**

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**Background and Aims:** The present paper suggests an analysis of technologies applied for rehabilitation after stroke in an user-centered approach. The researcher's background in product design allows to address the literature with an interdisciplinary point of view, focusing on humanities and user's interaction in consideration of the technological content of the different products.

**Methods:** The paper is based on a literature review of scientific papers.

**Results:** The result of the analysis consists in a collection of paper addressing the different technologies, enhancing the limits and the strengths of the use of commercial devices in comparison with specifically designed systems.

**Conclusions:** The paper allows to understand the state of art of the technologies under development and in use in the field of rehabilitation after stroke, aiming to sensitize on the necessary involvement on design research since early stages of product making.

**Trial registration number:** N/A

## AS08-053

### COMMERCIAL REHABILITATIVE ROBOTICS FOR LOWER LIMBS: A DESIGN REVIEW OF FOUR PRODUCT CATEGORIES

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**Background and Aims:** The paper presents an analysis of four products for the rehabilitation of lower limbs: System 4 Quick-SetTM by Biomed, G-EO SystemTM by Reha Technology, Hunova by Movendo Technology and TYMO® by Tyromotion.

**Methods:** Selected the four elements based on their taxonomy, they have been analysed in terms of user interaction and possible problems connected to their use in the early stages of hospitalization. No direct use of the devices has been made.

**Results:** The analysis shows how none of the devices can be considered feasible for an use with bedridden patients.

**Conclusions:** The analysis aims to show the lack of instruments that can be applied for the rehabilitation of lower limbs in bedridden patients.

**Trial registration number:** N/A

## AS08-015

### TELE-REHAB INTERVENTION TO IMPROVE UPPER LIMB RECOVERY AFTER STROKE: FEASIBILITY AND PATIENT SATISFACTION STUDY

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**Background and Aims:** Tele-rehabilitation for stroke survivors has emerged as a promising intervention for remotely supervised administration of physical, occupational and speech therapies aimed at improving neurological deficits from stroke. Until now, the 9Zest Stroke Application® has just been tested as an alternative for face-to-face

neurorehabilitation. However, we will focus on its potential as an add-on for the standard-of-care for outpatient rehabilitation.

**Methods:** We conducted a prospective, single arm, pre-post study involving 10 semi-recent stroke patients (< 12 months) recruited from a tertiary stroke center (Antwerp University Hospital) and a rehabilitation hospital (RevArte). They received an individualized, goal-targeted 5-days-a-week exercise program using the FDA-approved 9zest Stroke App® and to perform on top of the standard of care during 4 weeks. The program will be supervised and coached by a physiotherapist. Patient reported outcome measures will be assessed during workshops at the start and the end of the study, by user satisfaction (Likert-scale) and usability (System Usability Scale). And finally, patients will complete self-reported diaries on compliance.

**Results:** To date, we can only present the current study design and protocol. The intervention will be tested in 10 patients during the months January–February 2019 at the RevArte rehabilitation hospital, which gives our research team opportunity to complete the statistical analysis and data interpretation before the end of March 2019.

**Conclusions:** Our study will evaluate the feasibility to administer an m-health delivered physical therapy intervention (FDA-approved 9zest Stroke App®) on top-of the existing rehabilitation. Data-analysis and interpretation on potential benefits (satisfaction, usability and compliance) will be presented during ESOC2019.

**Trial registration number:** N/A

## AS08-018

### PATIENT SCREENING FOR EARLY STROKE REHABILITATION TRIALS

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**Background and Aims:** Stroke rehabilitation is suggested to take place early after symptom onset in order to optimize patient outcomes. Earlier timing of stroke rehabilitation trials affects designing studies, including a shorter timeframe for participant eligibility screening. This research aimed to investigate the participant enrollment rate for an early rehabilitation trial poststroke and estimate related costs.

**Methods:** A prospective observational trial started on 01/10/2017 at a university hospital. The main inclusion criteria were a first-ever unilateral ischemic stroke < 48 hours and a National Institutes of Health Stroke Scale (NIHSS) arm score  $\geq 1$ . Screening was performed by consulting the electronic health record system, attending morning rounds, and patient contact on the ward. Collected data included number of screened and enrolled patients, reasons for non-enrollment, and time needed for each patient identification method.

**Results:** Until 21/12/2018, 105 out of 831 identified stroke patients were screened on the ward and 29 (3.49%) were enrolled. Main reasons for exclusion were NIHSS arm score 0 (53.91%), >48 hours poststroke (29.00%), comorbidity (17.93%), unable to follow commands (17.33%), and recurrent stroke (17.21%). Daily screening time amounted 8.81 minutes for electronic health records, 14.23 minutes for morning rounds, and 4.54 minutes on the ward. To enroll one patient, 280.00 minutes had to be screened. With an hourly wage of €49.37, screening costed €214.50 per enrolled patient.

**Conclusions:** Patient recruitment for early rehabilitation trials is challenging. Only a low percentage of patients was eligible for this trial with wide inclusion criteria and eligibility screening is accompanied by high time investments with associated costs.

**Trial registration number:** N/A

## WITHDRAWN

## AS08-060

### DISTINGUISHING AND QUANTIFYING ACTIVITY TYPES IN STROKE IN-PATIENTS USING WEARABLE INERTIAL SENSORS

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**Background and Aims:** Behavioural assessment forms a critical part of monitoring stroke patients. A major challenge though lies in how behaviours can be recorded continuously and reliably, as compared with human observations. Our group have recently developed methods that quantify and distinguish behaviour types using standard wearable inertial sensors, in conjunction with high-order movement signature analysis. Here we tested the feasibility and validity of the approach in acute stroke, across a broad range of activity types.

**Methods:** Patients were recruited who had capacity, and could ambulate. Following consent, patients wore 4 inertial-movement-unit watches on their four limbs, with 100 Hertz real-time data-streaming. Subjects were asked to carry out a series of postural changes during a 30 minute test period, including: lying, sitting up in bed, sitting on chair or bed edge, standing, and walking. Activity timings and type were confirmed by video analysis. Models of activity class were built using quadratic discriminant

classifiers and neural nets. Leave 1-out validation tests were performed for each subject in turn.

**Results:** Twenty patients completed testing (median age in years: 70 (range: 30–91); median National Institutes of Health Stroke Scale: 3.5 (range: 0–8). Data collection occurred with a zero failure rate, and all patients found the sensor system unintrusive or minimally intrusive. Battery life was 6 hours. Activity classification accuracy across all 5 movement types averaged 84%.

**Conclusions:** Automated quantification of different, common activity types in stroke in-patients is both feasible and accurate. Ongoing studies are assessing more heterogeneous patients, more activity types, and unprompted protocols.

**Trial registration number:** N/A

## AS08-055

### THE IMMEDIATE TRAINING CAN MODIFY THE CHOICE REACTION TIME IN REACHING TASKS CROSSING OR NOT THE MIDLINE IN STROKE PATIENTS?

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<sup>1</sup>Federal University of Triângulo Mineiro UFTM, Department of Physical Therapy, Uberaba, Brazil; <sup>2</sup>Sao Paulo State University UNESP, Department of Internal Medicine, Botucatu, Brazil; <sup>3</sup>Sao Paulo State University UNESP, Department of Neurology- Psychology and Psychiatry, Botucatu, Brazil; <sup>4</sup>Federal University of Uberlândia UFU, Centre for Innovation and Technology Assessment in Health, Uberlândia, Brazil

**Background and Aims:** The Choice Reaction Time (CRT) is characterized ability to choose from two or more stimuli, and can be trained during upper limb tasks after stroke. The aim of this study was to investigate whether the CRT is modified after a single reaching training session while individuals crossing or not the midline.

**Methods:** This is a cross-sectional study in individuals after stroke. To evaluate the CRT, a monitor it was projected with the stimuli corresponding to each reaching task and the electromyographic signal of upper limb was collected simultaneously. The CRT was estimated verifying the response of stimuli in the channel marker, and the beginning of the electromyographic activity (Figure 1). The motor training of reaching was performed after CRT evaluation using six targets, with a randomized location into five blocks, totaling fifty repetitions in a single session. For statistical analysis was using a student's t-test and Cohen's D to compare pre- and post-intervention.

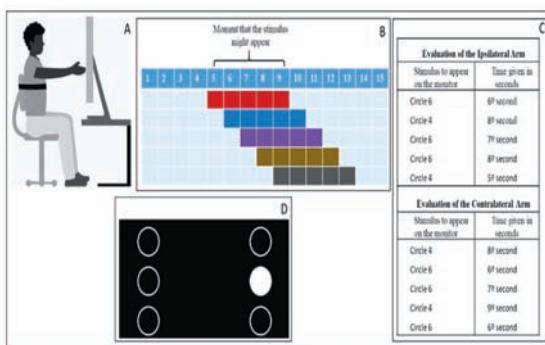


Figure 1. A. Illustration of the individual's positioning; B. Illustration of the possibilities for each block; C. Order of appearance of each stimulus, for each member evaluated; D. Form of presentation of the stimuli used in the training.

**Results:** Seven individuals were included (5 males,  $63.14 \pm$  years,  $23.71 \pm 5.17$  of Mini-mental state examination and Fugl-Meyer of  $21.14 \pm 8.04$ ). The CRT showed a no significant difference before and after training ( $p = 0.086$ ). When individuals crossed the midline (Figure 2) Cohen's d showed high clinical relevance ( $d = 1.31$ ) to the compromised limb after training. When participants crossed the midline (Figure 3) there was no significant difference for both limbs, shows a moderate clinical relevance ( $d = 0.6$ ) to the compromised limb.

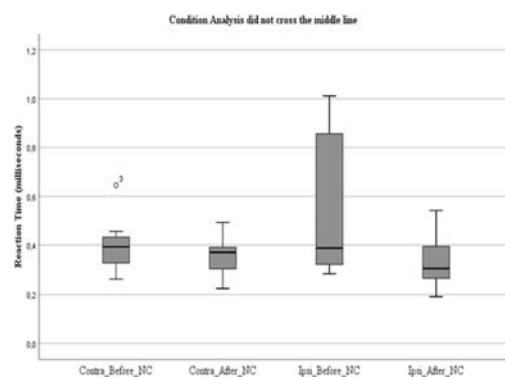


Figure 2. Box Plot of the CRT before and after training when individuals did not cross midline. Caption: Contra: contralateral limb to the lesion; Ipsi: Ipsilateral limb to the injury; NC: did not cross midline.

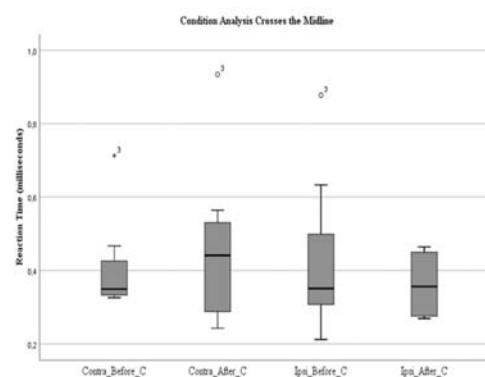


Figure 3. Box Plot of the CRT before and after training for the cross midline condition. Caption: Contra: contralateral limb to the lesion; Ipsi: Ipsilateral limb to the lesion; C: crossed the midline.

**Conclusions:** It was concluded the training proposed can decrease the reaching CRT of simpler tasks, that do not cross the midline.

**Trial registration number:** N/A

**AS08-005**

**IMPULSE – A PROSPECTIVE, MULTI-CENTER, RANDOMIZED, DOUBLE-BLIND STUDY ON THE STIMULATION OF BRAIN PLASTICITY TO IMPROVE UPPER LIMB RECOVERY AFTER STROKE**

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**Background and Aims:** Stroke is the number one cause of long term disability worldwide and a leading cause of chronic Motor disabilities. Conventional rehabilitation programmes have not yet solved the issues of residual motor dysfunctions in chronic stroke patients. About 70% of stroke survivors suffer from impaired hand motor function six months after the cerebrovascular incident even after participating in rehabilitative training programs.

Following stroke, the initial recovery process follows the resolution of reversible pathophysiological events and later on functional improvement occurs as the neural networks within the brain undergo changes in response to various stimuli. Up to 90% of functional improvement in patients with mild to moderate impairment is seen within the first 8–12 weeks after stroke. This decline of functional gain in the more subacute and chronic phase after stroke is attributed to an early but limited “sensitive period” post-stroke, which represents an environment of heightened plasticity. Animal studies suggest that both, recurrent stroke and pharmacological interventions can induce or extend this sensitive period, which correlates with the levels of the neurotrophin BDNF that has been implicated in the modulation of synaptic function and plasticity.

**Methods:** We hypothesize in this prospective, multi-center, randomized, double-blind study that the combination of the neuropeptide preparation Cerebrolysin and neurostimulation (atDCS) re-induces a milieu of heightened neuroplasticity in subacute and chronic stroke patients.

**Results:** The IMPULSE-Study will start in early 2019 in 6 Austrian stroke-centers.

**Conclusions:** This combination is expected to enhance the therapeutic benefit of a concomitant neurorehabilitation program on motor function recovery.

**Trial registration number:** N/A

**AS08-039**

**BIOMECHANICAL ANALYSIS OF SIT-TO-STAND TRANSFER REHABILITATION TRAINING IN DIFFERENT SEAT HEIGHTS**

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**Background and Aims:** To establish a biomechanical model of sit-to-stand transfer rehabilitation training for stroke patients, and guide stroke patients to conduct sit-to-stand transfer training more scientifically, the biomechanical analysis of sit-to-stand transfer process at different seat heights.

**Methods:** Biomechanical data of eight healthy adult women in sit-to-stand at different seat heights, which were 80%H, H, 120%H, seat height H is the distance from the lateral condyle of the femur to the ground when seated. The three-dimensional motion analysis system and the 3D force table were used. Repeated measurement anova was performed on the data of the dominant side (right) of subjects at different heights.

**Results:** (1) There was a significant difference in the total time of sit-to-stand at three heights ( $p = 0.014$ ), which gradually decreased with the increase of seat height. According to the analysis of sitting-metastasis movement stages (phasel-phasell-phaselll), there was a significant difference in the starting time of sitting-metastasis at three heights ( $p = 0.004$ ).

(2) There was a significant difference in the sagittal plane Angle peak of the right hip joint during sitting-to-stand transfer at three heights ( $p = 0.001$ ), which decreased with the increase of seat height. There were significant differences in ROM of right knee joint flexion and extension at three heights ( $p = 0.000$ ), significant differences in rotating ROM ( $p = 0.017$ ), and the range of motion decreased with the increase of seat height.

**Conclusions:** Different seat heights have a certain effect on the STS, and the effect on the knee joint is more obvious. For patients with stroke, early patients are recommended to focus on high-seat training, gradually reduce the height of the seat.

**Trial registration number:** ChiCTR1800020017

**Risk Factors for Stroke****AS22-037**

**AUDIT OF ADEQUATE USE OF ANTICOAGULATION IN KNOWN AND NEW ONSET ATRIAL FIBRILLATION PATIENTS PRESENTED TO HYPERACUTE STROKE UNIT AT SCUNTHORPE GENERAL HOSPITAL UK**

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**Background and Aims:** Atrial fibrillation (AF) is commonest arrhythmia. 20% of ischaemic stroke are related to AF. Stroke related morbidity and mortality can be reduced by appropriate anticoagulation of patients with AF.

NICE guidelines suggest that patients with AF should be offered anti-coagulation after assessment of stroke risk by CHA2DS2VASc and bleeding risk by HASBLED.

Audit is conducted to assess appropriate use of anticoagulation in AF patients presented to hyper acute stroke unit at Scunthorpe General Hospital United Kingdom.

**Methods:** Patients with known and newly diagnosed atrial fibrillation were identified using sentinel stroke national audit programme from 1<sup>st</sup> January to 31<sup>st</sup> December 2017. Patient's medical record reviewed. CHA2DS2VASc score was retrospectively performed for patients who were not on anticoagulation prior to admission.

**Results:** Total patients admitted to hyper acute stroke unit during the specified period were 621. 98 patients were known AF prior to admission and 36 were found to have new AF. 65 were on anticoagulation (66%) and 33 were not on anticoagulation prior to admission (34%). Twenty four patients were inappropriately not on anticoagulation. Anticoagulated group 58 patients had ischaemic stroke and 7 had haemorrhagic. 27 patients in ischaemic stroke group were on warfarin. 74 % of patients who were on warfarin had sub therapeutic INR on admission. 36 patients had new AF, 29 (81%) patients were discharged on anticoagulation, rest were not deemed suitable for anticoagulation

**Conclusions:** Audit result shared with primary care colleagues to improve anticoagulation management in AF patients.

Adequate AF management was done in Scunthorpe General Hospital Hyper-acute Stroke Unit.

**Trial registration number:** N/A

**AS22-048****ETIOLOGICAL FEATURES OF STROKE IN A YOUNG AGE**

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**Background and Aims:** Stroke is one of the main causes of death and disability among the population of developing countries. In recent decades there has been an increase of stroke incidences among young people. The aim of this research was to study the etiology and risk factors of stroke among young people.

**Methods:** The study was conducted in neurological departments of the Republican Clinical Hospital (Baku) of Azerbaijan. Within 3 years (2014–2016), 145 patients aged from 18 to 45 were examined. Patients were conducted by complete neurological, somatic, laboratory, ultrasonographic, neurovisual examination. 51% of patients were women, and 49% were men.

**Results:** The average age of patients was 35 years. Ischemic stroke (IS) was most common – 56%, less cases for intraparenchymal hemorrhage – 29%, subarachnoid hemorrhage – 9% and venous sinus thrombosis – 6%. According to TOAST classification atherosclerosis (41%) and lacunar syndrome (22%) were more common in men with IS, in women other known causes were more common (41%) – hypercoagulable states, anemia, hyperhomocysteinemia, CADASIL, and others. All patients with hemorrhagic stroke suffered from hypertension, along with this, 66% patients had arterial aneurysm, 33% arteriovenous malformation. The distribution of risk factors by gender showed that men are more likely to have hyperlipidemia (46%), smoking (76%), alcohol abuse (19%), women – anemia (90%), hypertension (88%), thrombophilia (7%).

**Conclusions:** The study showed that young people are more likely to have an IS. Among men, prevails hyperlipidemia, alcohol abuse and atherosclerotic etiology of stroke. Women are characterized by thrombophilia, various forms of anemia and hypertension.

**Trial registration number:** N/A

**AS22-063****TRAFFIC RELATED POLLUTION REDUCES THE LEVELS OF MATRIX METALLOPROTEINASES IN HIPPOCAMPUS AND STRIATUM AFTER CEREBRAL ISCHEMIA IN MICE**

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<sup>1</sup>Vall d'Hebron Institut de Recerca, Neurovascular, Barcelona, Spain; <sup>2</sup>Vall d'Hebron Institut de Recerca, Pneumology, Barcelona, Spain

**Background and Aims:** Air pollution contributes to 10% of global mortality and current data points at Diesel Exhaust Particles (DEP) component of the particulate matter (PM) as the main contributor to premature cardiovascular deaths. Our aim is to investigate the influence of DEP exposure in cerebral ischemia.

**Methods:** DEP particles (0.42um median diameter including 74% of PM<sub>10</sub>), where used for nasal instillations. Balb/c mice received 14 doses of either DEP or PBS and brains were obtained for matrix metalloproteinases (MMPs) and immune-histological analysis. Another group of mice received similar doses of DEP or PBS were subjected to distal permanent Middle Cerebral Artery occlusion after instillation, and infarct was evaluated by MRI at 24 hours together with MMP levels. All brains were

dissected in: olfactory bulb (OB), hippocampus (HC), striatum (ST) and cortex (CX).

**Results:** Non-ischemic animals did not show differences in CX and HC vessel density, but a significant reduction in migrating neuroblasts (DCX+) of the rostral migratory stream was observed in DEP-exposed-mice. However, these animals did not show significant changes in MMP-3, -8 and -9 in the analyzed areas. Ischemic mice exposed to DEP increased significantly MMP-3 and -8 levels in the OB and HC of both hemispheres compared to non-ischemic animals. Vehicle treatment significantly increased the levels of MMP-3, -8 and -9 in ipsilateral HC and ST areas, but this up-regulation was not observed in DEP-exposed brains. Infarct lesion was similar between groups at 24 hours.

**Conclusions:** We have shown how DEP exposure could alter MMPs and potential remodeling responses in ischemic brains.

**Trial registration number:** N/A

**AS22-015****THE CONCEPT OF PREVENTABLE STROKE AMONG VARIOUS ISCHEMIC STROKE SUBTYPES**

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**Background and Aims:** It is considered that 90% of strokes are preventable by vascular risk factor (RF) control. We analyzed the distribution of uncontrolled RF burden among various ischemic stroke subtypes and determined the contribution of anti-thrombotic therapy on this interplay.

**Methods:** Information about presence and optimal control of 7 major modifiable RFs (hypertension, diabetes, hyperlipidemia, smoking, obesity, diet, and physical activity) at the time of stroke onset was prospectively collected in three tertiary academic centers. Adequacy of RF control prior to stroke, as well as appropriateness of antithrombotic therapy with regard to stroke etiology, were determined per international guidelines.

**Results:** Among 787 patients, 50% needed further optimization of hypertension, 28% of diabetes and 71% of hyperlipidemia management. Furthermore, 22% were active smokers, 25% were obese, 81% had sedentary life-style and 85% had suboptimal dietary habits. Patients with small artery occlusion (SAO) constituted the subtype with the highest RF burden, with a median (IQR) of 4 (3–5) factors necessitating optimization. Patients with SAO (27%) or cryptogenic (30%) stroke, were more likely to use appropriate anti-thrombotic therapy prior to the incident event ( $p < 0.001$ ). In multivariate analyses, recurrent stroke ( $p = 0.019$ ), CHD ( $p < 0.001$ ), SAO ( $p = 0.007$ ) or cryptogenic ( $p = 0.012$ ) etiologies were associated with stroke in the setting of appropriate anti-thrombotic therapy and elevated RF burden.

**Conclusions:** Preventability of stroke, from the perspective of vascular RF control, differs among stroke subtypes. SAO, together with cryptogenic stroke patients, comprise special subgroups where more emphasis should be placed on RF control, as they more commonly experience these events despite appropriate anti-thrombotic regimens.

**Trial registration number:** NA

**AS22-009**

## EFFECT OF COEXISTING VASCULAR DISEASE ON LONG-TERM RISK OF RECURRENT ISCHAEMIC STROKE, CORONARY EVENTS AND MAJOR BLEEDING AFTER TIA OR ISCHAEMIC STROKE

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**Background and Aims:** To determine whether TIA or ischaemic stroke patients with co-existing cardiovascular disease (i.e. history of coronary or peripheral artery disease) might benefit from more intensive secondary prevention to reduce risk of recurrent ischaemic events.

**Methods:** In a population-based study in Oxfordshire, United Kingdom (Oxford Vascular Study), we studied consecutive patients with TIA or ischaemic stroke from 2002 to 2014. Patients were treated according to current secondary prevention guidelines and we determined risks of coronary events, recurrent ischaemic stroke, and major bleeding stratified by the presence of co-existing cardiovascular disease.

**Results:** Among 2555 patients (9148 patient-years of follow-up), those ( $n = 640$ ; 25.0%) with co-existing cardiovascular disease (449 coronary only; 103 peripheral only; 88 both) were at higher 10-year risk of coronary events than those without (22.8%; 95% CI 17.4-27.9; versus 7.1%, 5.3-8.8;  $p < 0.001$ , age-and sex-adjusted HR = 3.07, 2.24-4.21) and of recurrent ischaemic stroke (31.5%, 25.1-37.4; versus 23.4%, 20.5-26.2;  $p = 0.0049$ , age-and sex-adjusted HR = 1.23, 0.99-1.53), despite similar rates of use of anti-thrombotic and lipid-lowering medication. However, in patients with non-cardioembolic TIA/stroke, risk of extracranial bleeds was also higher in those with co-existing cardiovascular disease, particularly in patients aged  $< 75$  years (8.1%, 2.8-13.0 vs 3.4%, 1.6-5.3;  $p = 0.0050$ ; age-and sex-adjusted HR = 2.71, 1.16-6.30), although risk of intracerebral haemorrhage was not increased (age- and sex-adjusted HR = 0.36, 0.04-2.99).

**Conclusions:** TIA/ischaemic stroke patients with co-existing cardiovascular disease have a high risk of recurrent ischaemic events on current management. More intensive lipid-lowering might therefore be justified, but benefit from increased anti-thrombotic treatment might be offset by the higher risk of extracranial bleeding.

**Trial registration number:** N/A

**AS22-029**

## METABOLIC SYNDROME AS A COMMON RISK FOR STROKE IN NORMAL WEIGHT HYPERTENSION: A MULTI-SITE SURVEY FROM 11 PRIMARY CARE SETTINGS IN THAILAND

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**Background and Aims:** Metabolic syndrome (MetS) is a multi-complex risk of stroke and cardiovascular disease. Hypertension with MetS had at least three-folds higher risk for developed stroke. Most of the previous studies examined MetS in obese, few studies in none-obese, but not in a population of hypertension. We determined the prevalence of MetS and metabolic components in normal weight ( $BMI < 23.0 \text{ kg/m}^2$ ) hypertension.

**Methods:** Among 1,461 hypertensions attended 11 rural health care units in southern Thailand, 571 (39%) were normal weight. Data were obtained by structure interview, medical records, and by measurements of anthropometric, blood pressure, fasting plasma glucose, and lipid profiles. MetS was defined according to NCEP-ATP III criteria. Weight circumference was defined based on NCEP-APC criteria, a cut-off points of 80 cm in women and 90 cm in men indicated abdominal obesity.

**Results:** Prevalence of MetS was 54.8% in normal weight hypertension. Components of MetS were hypertension co-existed with hypertriglyceridemia (47.8%), HDL (47.3%), hyperglycemia (42.6%), and abdominal obesity (33.6%). All of these components were significantly attributed of MetS. Based on logistic Wald values, MetS was strongly attributed by low HDL (Wald 190.52, RR 27.99, 95% CI 17.44-44.94), hypertriglyceridemia (Wald 183.81, RR 22.41, 95% CI 14.30-35.14), abdominal obesity (Wald 70.18, RR 4.81, 95% CI 3.33-6.95), and hyperglycemia (Wald 70.81, RR 4.81, 95% CI 3.33-6.95), respectively.

**Conclusions:** Over a half of normal weight hypertension had MetS. Common co-existed components were low HDL, hypertriglyceridemia, and hyperglycemia. This finding warrants further research explored cardiovascular event in this patient group, and clinical practice to prevent MetS in normal weight person.

**Trial registration number:** N/A

**AS22-061**

## PARTICULATE MATTER AND THE ASSOCIATION WITH DISEASE INCIDENCE IN DUBLIN, IRELAND

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**Background and Aims:** Particulate matter under  $2.5\mu\text{m}$  in size ( $\text{PM}_{2.5}$ ) has been increasingly linked with disease incidence including respiratory disease, cardiovascular disease and stroke. This study aimed to explore if there was a relationship between short-term exposure to  $\text{PM}_{2.5}$  and hospital admissions due to haemorrhagic and ischaemic stroke in Dublin City and County between 2013 and 2017.

**Methods:** This study used an ecological time series design utilising routine hospitalisation data collected from the Health Service Executive (Hospital In-Patient Enquiry (HIPE)). Incidence of hospitalisation for each disease was identified by county of residence. Mean daily  $\text{PM}_{2.5}$  levels for Dublin were calculated using monitoring data from the Environmental Protection Agency's four monitoring sites in Dublin City and County. Disease incidence was organised by mean  $\text{PM}_{2.5}$  levels into five categories and significance values were calculated using independent two-tailed Student's t-tests.

**Results:** When  $\text{PM}_{2.5}$  levels were over  $50\mu\text{g}/\text{m}^3$  compared to levels below  $10\mu\text{g}/\text{m}^3$  at a lag of one day there was a rise in the mean incidence of stroke (7.75 v 5.87,  $p = 0.05$ ), AF (33.25 v 26.93,  $p = 0.05$ ), and COPD (34.00 v 24.77,  $p = 0.002$ ). There was no significant difference seen in the mean incidence of T2DM (60.25 v 47.81,  $p = 0.08$ ), hypertension (62.23 v 52.20,  $p = 0.13$ ), MI (5.13 v 4.84,  $p = 0.69$ ), heart failure (16.50 v 13.44,  $p = 0.08$ ), and asthma (12.88 v 10.44,  $p = 0.21$ ).

**Conclusions:** This study suggests that at high levels of  $\text{PM}_{2.5}$  pollution there is a short-term risk of increased hospital admissions for stroke and AF.

**Trial registration number:** N/A

**AS22-034****STROKE MODIFIED RISK FACTORS IN THE MULTINETNIC POPULATION OF YAKUTIA**

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**Background and Aims:** The stroke risk factor's study in different racial-ethnic groups living in identical climatic, geographical and socio-economic conditions is actual for understanding of stroke pathogenesis. The aim of this study was to estimate the stroke modifiable risk factor's prevalence in various racial groups of Yakutia.

**Methods:** The method of population-based stroke register (National Stroke Association, Russia) was used in this study. The study ( $n = 2171$ ) included all residents of Yakutsk city aged 25 and older with an acute stroke registered in 2015–2017. Patients of the two most common racial groups of Yakutia (Caucasians ( $n = 1031$ ; 47.5%) and indigenous Asian ethnic groups of Yakutia ( $n = 1140$ ; 52.5%)) were included in the study.

**Results:** The most frequent risk factor was arterial hypertension (99% in Caucasians vs. 98.1% in Asians;  $p = 0.085$ ). There were other studied risk factors: smoking (32.7% vs. 26.3%;  $p = 0.002$ ; OR = 1.360; 95% CI: 1.119–1.652); heart diseases (72.6% vs. 64.9%;  $p < 0.0001$ ; OR = 1.430; 95% CI: 1.184–1.727); atrial fibrillation (28.5% vs. 22.7%;  $p = 0.002$ ; OR = 1.352; 95% CI: 1.107–1.650); history of myocardial infarction (24.4% vs. 14.5%;  $p < 0.0001$ ; OR = 1.901; 95% CI: 1.518–2.382); dyslipidemia (54.6% vs. 50.6%;  $p = 0.084$ ); diabetes mellitus (18.3% vs. 17.3%;  $p = 0.560$ ); stress (3.7% vs. 3.5%;  $p = 0.881$ ), respectively.

**Conclusions:** The prevalence of such modifiable stroke risk factors as smoking, heart disease, atrial fibrillation and history of myocardial infarction are significantly higher among Caucasian stroke patients compared to the indigenous Asian ethnic group's stroke patients in Yakutia. The established data reflect the probably existing stroke pathogenesis features in different racial groups.

**Trial registration number:** N/A

**WITHDRAWN****AS22-050****RISK FACTORS THAT PREDICT TRANSIENT VS. PERMANENT VISUAL LOSS IN RETINAL ISCHEMIA PATIENTS AND THEIR CORRELATION WITH CAROTID STENOSIS**

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**Background and Aims:** Retinal ischaemic events are often perceived as lower risk compared with cerebral TIA. We aimed to determine the prevalence of vascular risk factors (RFs) in patients with transient and permanent ischaemic visual loss (TVL, PVL).

**Methods:** We reviewed records for consecutive patients from June 2013–September 2018 in the daily TIA clinic at UCLH, a regional referral centre for north central London and Moorfields Eye Hospital. We recorded number RFs (No.RFs) and presence of carotid stenosis (CS).

**Results:** Of 485 patients, 201(41%) female, mean age 64 years (SD = 14.9), 298(61%) TVL and 187(39%) PVL. RFs: hypertension 246 (51%), hypercholesterolaemia 179(37%), diabetes mellitus (DM) 68 (14%), previous retinal ischaemia (PRI) 58(12%), ischaemic heart disease (IHD) 51(11%), atrial fibrillation 37(8%), previous stroke 29(6%) and transient ischaemic attack 28(6%). 315(65%) never smoked, 99(21%) were ex- and 69(14%) were current smokers.

Mean No.RFs was 1.5 for TVL and 1.9 for PVL( $p = 0.02$ ). Independent RFs were hypertension (OR 1.8, 95% CI 1.2–2.7,  $p = 0.000$ ) and IHD(OR 2.6, 95% CI 1.3–5.0,  $p = 0.001$ ). 47% of TVL vs. 53% of PVL had >3 RFs ( $p = 0.026$ ).

Rates of CS>50% were 11% for TVL and 20% for PVL( $p = 0.002$ ). No.RFs was the same for CS>50% vs. CS<50% (1.4 vs. 1.6,  $p = 0.3$ ).

The PVL cohort had similar No.RFs as TVL(1.7 vs. 1.6,  $p = 0.6$ ). DM was an independent RF for PVL (OR 2.2, 95% CI 1.02–4.8,  $p = 0.04$ ).

**Conclusions:** Retinal ischaemic events represent an excellent opportunity for aggressive secondary prevention. 49% had >3 vascular risk factors, with hypertension, IHD and CS>50% more likely to be associated with PVL.

**Trial registration number:** N/A

**AS22-051****GENDER DIFFERENCES IN RISK FACTORS OF STROKE**

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**Background and Aims:** Stroke is a leading cause of severe disability and mortality. Although the advancements in primary prevention of stroke, data concerning gender differences in stroke risk factors are still contradictory.

The objective of our study was to assess gender differences in risk factors in patients with stroke.

**Methods:** We studied retrospectively 612 patients with stroke, admitted to the Neurology Clinic since January till the end of December 2018. Their demographic data, risk factor profile, clinical characteristics, neuroimaging and clinical outcome were evaluated twice – on admission and at discharge. The statistical analysis was performed with the Statistical Package for Social Sciences version 13.0.

**Results:** Of the 612 patients 336 (55%) were males and 276 (45%) were females. Only 49 patients (8.01%) had hemorrhagic stroke. No significant gender differences in the risk profile of the patients with hemorrhagic stroke were found. Arterial hypertension was statistically significant risk factor in males with ischemic stroke ( $p < 0.0001$ ), while diabetes mellitus ( $p < 0.0001$ ) and atrial fibrillation ( $p < 0.01$ ) were statistically significant risk factors in females with ischemic stroke. There were no significant differences by sex in smoking, dyslipidemia and stroke outcome.

**Conclusions:** Information on gender differences concerning risk factors in patients with stroke may provide additional therapeutic options for more effective primary and secondary prophylaxis. Our results confirm the existence of gender differences in the risk factors of stroke, but future research is necessary for better assessment of their impact on long-term clinical outcome of stroke.

Trial registration number: NA

## AS22-016

### A COMPARISON OF BEAT-TO-BEAT WITH OTHER MEASUREMENT METHODS ESTIMATING BLOOD PRESSURE VARIABILITY IN PATIENTS WITH CEREBROVASCULAR DISEASE

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**Background and Aims:** Beat-to-beat blood pressure (BP) variability (BPV) is increased in acute ischaemic stroke, and is associated with adverse outcomes and recurrent stroke. However, it is not routinely assessed in practice. This study investigated relationships between beat-to-beat BPV and short-term BPV from more established BP measurement methods.

**Methods:** Adults with a recent ischaemic stroke or TIA ( $N = 133$ ) underwent clinic BP measurement, ambulatory BP monitoring (ABPM), and 10 minutes beat-to-beat BP monitoring. Mean systolic and diastolic BP and BPV as standard deviation (SD) and coefficient of variation (CV) were calculated for each method. ABPM provided daytime and within-hour variability. Beat-to-beat mean and variability values were compared with each other method using Pearson's/Spearman's correlations respectively. Positive correlations were further investigated using Bland-Altman plots.

**Results:** Beat-to-beat systolic BPV was not correlated with within-visit clinic BPV, but was positively correlated with daytime (SD  $rs = 0.26$  [ $p < 0.01$ ], CV  $rs = 0.23$  [ $p < 0.01$ ]) and within-hour ABPM (SD  $rs = 0.20$  [ $p < 0.05$ ], CV  $rs = 0.20$  [ $p < 0.05$ ]). Bland-Altman analysis of the latter demonstrated minor bias (SD  $-11.6\%$  [95% CI  $-19.0$  to  $-4.2\%$ ], CV  $-9.1\%$  [95% CI  $-16.3$  to  $-1.9\%$ ]), but wide limits of agreement (SD  $-96.6\%$  to  $73.4\%$ , CV  $-91.5\%$  to  $73.3\%$ ). Daytime ABPM had greater bias (SD  $-78.2\%$  [95% CI  $-84.3$  to  $-72.0\%$ ], CV  $-77.9\%$  [95% CI  $-83.7$  to  $-72.1\%$ ]) and limits of agreement (SD  $-148.4$  to  $-7.9\%$ , CV  $-143.4$  to  $-12.5\%$ ). Results were similar for diastolic BPV.

**Conclusions:** Beat-to-beat BPV was not closely related to short-term variability assessed by other measurement methods. It is unlikely that other methods could act as a surrogate for beat-to-beat BPV.

Trial registration number: N/A

## WITHDRAWN

## AS22-043

### DETAILED PHENOTYPING OF POSTERIOR CIRCULATION STROKE VS. ANTERIOR CIRCULATION STROKE: A MULTI-CENTER MRI STUDY

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**Background and Aims:** Posterior circulation ischemic stroke (PCiS) constitutes 20–30% of ischemic stroke, but information about possible differences between PCiS and anterior circulation ischemic stroke (ACiS) is lacking. We assessed risk factors and stroke subtype according to the Causative Classification of Stroke (CCS) system in verified PCiS vs. ACiS, and lesion distribution in PCiS.

**Methods:** Of 3300 acute MRIs from 12 centers in the National Institute of Neurological Disorders and Stroke (NINDS) Stroke Genetics Network (SiGN), we included 2381 cases with acute DWI lesions. Cases were defined as ACiS or PCiS based on lesion location. The groups were compared using chi-square and logistic regression.

**Results:** PCiS occurred in 718 (30%) patients and ACiS in 1663 (70%). Diabetes and male sex were more common in PCiS vs. ACiS (diabetes 27% vs. 23%,  $p < .05$ ; male sex 68% vs. 58%,  $p < .001$ ). Both were independently associated with PCiS (diabetes, OR = 1.293; 95% CI, 1.041–1.607; male sex, OR = 1.465; 95% CI, 1.208–1.776). Large artery atherosclerosis and cardioembolism were significantly more common subtypes in ACiS (25%, 17%) than in PCiS (20%, 11%) ( $p < .01$ ,  $p < .001$ ). Small artery occlusion was significantly more common in PCiS vs. ACiS (20% vs. 14%,  $p < .001$ ). Atherosclerotic and cardiac embolism were seen in 33% of cerebellar and 38% of posterior supratentorial infarctions. Small artery occlusion accounted for 44% of isolated brainstem infarctions.

**Conclusions:** Diabetes and male gender have a stronger association with PCiS vs. ACiS. The prevalence of CCS subtypes differs between the two territories. MRI lesion location and distribution may aid etiological investigation in PCiS.

**Trial registration number:** N/A

## WITHDRAWN

## AS22-073

### SECONDARY RISK FACTOR MANAGEMENT 5-YEARS POST ISCHAEMIC STROKE: THE ASPIRE-S2 STUDY

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**Background and Aims:**

**Background:** Numerous guidelines have been published outlining evidence-based best practice in secondary stroke prevention, including optimal target control of risk factors. Despite these guidelines failure to achieve these recommendations in clinical practice is common. Aims: The primary aim of this study was to prospectively assess secondary prevention profiles of Irish ischaemic stroke patients at 5-years and compare them to that measured at 6-months.

**Methods:** The original ASPIRE S-1 study analysed 256 patients for secondary risk factors at 6-months post ischemic stroke. This study, ASPIRE S2, followed this cohort of patients five years on. Secondary risk factors were measured included clinic blood pressure, 24 hour ambulatory blood pressure measurements and fasting bloods (lipids, glucose, HbA1c in diabetic patients).

**Results:** 108 patients were followed-up at 5-years post-ischaemic stroke. The 5-year mortality rate was 24.6% (n = 63). Comparative analysis of risk factors between the two time-points (6-months and 5-years post-stroke) showed an increase in the prevalence of cardiovascular risk factors (atrial fibrillation, hypertension, hypercholesterolaemia). Only 34% (n = 36) of patients achieved a clinic SBP of < 140/90 mmHg, while 63% achieved a blood pressure target on 24-hour ABPM. 86% (n = 84) achieved an LDL of < 2.6 and 91% achieved target fasting glucose. There was no statistically significant improvement in secondary risk factor control between 6 months and 5 years.

**Conclusions:** secondary risk factors control remain sub-optimal in long term follow up of post stroke patients.

**Trial registration number:** N/A

**AS22-030****CARDIOVASCULAR RISK AND  
ATHEROSCLEROSIS PROGRESSION IN  
HYPERTENSIVE PARTICIPANTS TREATED TO  
BLOOD PRESSURE TARGETS**

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**Background and Aims:** Arterial hypertension promotes atherosclerosis and cardiovascular events. In the population-based Heinz Nixdorf Recall, we evaluated how cardiovascular risk and atherosclerosis progression are associated with blood pressure, antihypertensive treatment, and treatment efficacy.

**Methods:** In 3373 participants without previous cardiovascular disease, we evaluated the association of baseline antihypertensive treatment efficacy (normotension without treatment, treatment to normotension, untreated hypertension, hypertension despite treatment, based on 140/90 mmHg cutoffs) with incident coronary artery calcification (CAC) and CAC progression during 5-year-follow-up and with incident cardiovascular events during median 13.5-year-follow-up. We further evaluated the association of incident arterial hypertension and efficacy of new antihypertensive treatment at the 5-year-follow-up with subsequent cardiovascular events.

**Results:** At baseline, 1636 participants had normotension without treatment, 528 hypertension treated to normotension, 739 untreated hypertension, and 470 hypertension despite treatment. 647 participants experienced rapid CAC progression; 107, 132, and 249 experienced incident stroke, coronary, and cardiovascular events, respectively. Compared with normotensive participants without treatment, participants treated to normotension had an elevated risk of stroke (hazard ratio 2.33, 95% confidence interval 1.19–4.55), coronary (2.04, 1.20–3.45) and cardiovascular events (2.23, 1.48–3.36), but not rapid CAC progression (1.19, 0.91–1.48). Participants without hypertension at baseline, who were newly hypertensive but treated to normotension at the 5-year-follow-up, again exhibited an elevated stroke (4.80, 1.38–16.70) and cardiovascular event risk (2.99, 1.25–7.16), whereas the effect for coronary events did not reach statistical significance (2.24, 0.70–7.18).

**Conclusions:** Cardiovascular risk is elevated in participants treated to normotension despite modest CAC progression.

**Trial registration number:** N/A

**AS22-040****OBESITY AS A RISK FACTOR FOR STROKE IN  
THE RURAL POPULATION OF THE REPUBLIC  
OF MOLDOVA**

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**Background and Aims:** Obesity is a risk factor for different cardiovascular diseases, including stroke that can be efficiently prevented. Several studies have evidenced abdominal obesity as an independent risk factor for stroke, being a stronger predictor of stroke than body mass index. We aimed to study the relationship between obesity and other stroke risk factors in the population of the Republic of Moldova.

**Methods:** In November 2015, we initiated an epidemiological study in rural area of the country. Our study protocol included: questionnaire, clinical examination, electrocardiography, laboratory examinations and Doppler/Duplex ultrasound of the carotid arteries.

**Results:** In the study were included 1274 subjects, 757 (59%) women and 517 (41%) men (mean age  $47.9 \pm 13.6$  years). The most common identified risk factors were abdominal obesity in 938 (74%), dyslipidemia in 758 (59%) and general obesity of different degrees in 508 (40%) subjects. Abdominal circumference significantly correlated with systolic ( $r = 0.44$ ,  $p < 0.001$ ) and diastolic ( $r = 0.46$ ,  $p < 0.001$ ) blood pressure, body mass index ( $r = 0.84$ ,  $p < 0.001$ ), uric acid ( $r = 0.42$ ,  $p < 0.001$ ). Body mass index as well significantly correlated with systolic ( $r = 0.41$ ,  $p < 0.001$ ) and diastolic ( $r = 0.39$ ,  $p < 0.001$ ) blood pressure, abdominal circumference ( $r = 0.84$ ,  $p < 0.001$ ) and uric acid ( $r = 0.33$ ,  $p < 0.001$ ).

**Conclusions:** Stroke is a major health and social problem. Dyslipidemia, abdominal and general obesity were the most commonly identified modifiable risk factors. Abdominal and general obesity were significantly associated with other stroke risk factors. Prevention of obesity and weight reduction need a greater emphasis in stroke prevention programs.

**Trial registration number:** N/A

**WITHDRAWN**

**AS22-071**

**THE RISK OF SILENT STROKES IN PATIENTS UNDERGOING ELECTRICAL CARDIOVERSION FOR ATRIAL FIBRILLATION. THE NORWEGIAN ATRIAL FIBRILLATION AND STROKE TRIAL (THE NOR-FIB STUDY II)**

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**Background and Aims:** Patients with a persistent atrial fibrillation (AF) needs a strategy for rhythm control, symptom relief and restoring sinus rhythm. Electrical cardioversion is widely used and associated with a non-negligible risk of peri-procedural stroke or systemic embolism. Prior anticoagulation of 3 to 4 weeks before and after cardioversion reduces the risk of clinical embolism to less than 1%. However, it is not known if this procedure causes cerebral micro-embolization and small silent brain infarcts.

The aim of the NOR-FIB II Study is to find the risk of new small cerebral infarcts detected with diffusion-weighted MRI after direct-current cardioversion of persistent AF and assess the impact of inflammation and fibrosis measured by biomarkers in blood and cardiac <sup>18</sup>F-FDG-PET. We will also assess cognitive and cerebral structural and metabolic changes after direct-current cardioversion for AF using cognitive tests and cerebral and cardiac <sup>18</sup>F-FDG-PET before and 12 months after treatment.

**Methods:** This study is an ongoing prospective single-center observational study in patients with persistent AF who are scheduled for non-urgent direct-cardioversion taking a cerebral DWMRI before and one to two weeks after direct-current cardioversion. Follow-up with cardiological and neurological assessments, blood samples, cerebral DWMRI, cardiac and cerebral <sup>18</sup>F-FDG examinations is after 12 months.

**Results:** The preliminary results of the study will be presented.

**Conclusions:** The study will increase the knowledge regarding the risk of new cerebral infarcts when persistent AF is treated with electrical cardioversion and the risk of reduced cognitive function and new cerebral infarcts after 12 months follow-up.

**Trial registration number:** N/A

**AS22-014**

**CLINICAL FEATURES OF SUPER-OLD ISCHEMIC STROKE PATIENTS**

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**Background and Aims:** Recently the proportion of very elderly stroke patients has been increasing explosively. So it is meaningful to clarify the clinical features of super-old ( $\geq 90$  years-old) ischemic stroke patients.

**Methods:** Twenty-five Saiseikai hospitals in Japan prospectively registered acute stroke patients within 7 days of onset in the Saiseikai Stroke Database from April 2014 to September 2018. The clinical backgrounds and outcomes of 753 super-old ischemic stroke patients were compared with those of 3720 old (75–89 years old) ischemic stroke patients.

**Results:** In the super-old group, the comorbidities of dyslipidemia (25.0 vs 36.2%), diabetes mellitus (17.0 vs 29.5%) and current smoking (1.7 vs 11.6%) were significantly lower and female gender (71.6 vs 46.1%), atrial fibrillation (36.5 vs 27.0%), congestive heart failure (20.6 vs 11.0%) and chronic kidney disease (20.3 vs 17.4%) were significantly more prevalent. The rates of hypertension (73.7 vs 76.0%) and tPA thrombolysis at admission (5.2 vs 4.9%) did not differ between the groups. The proportion with cardioembolism diagnosed at discharge (40.0 vs 27.9%) and the rate of mortality during admission (9.5 vs 4.5%) were significantly higher.

**Conclusions:** Super-old ischemic stroke patients had a lower prevalence of atherosclerotic risk factors, a higher prevalence of cardioembolism due to atrial fibrillation and higher mortality compared with old ischemic stroke patients.

**Trial registration number:** N/A

**AS22-026**

**APPLICATION OF GEOGRAPHICAL INFORMATION SYSTEM IN STROKE RISK HOTSPOTS MAPPING IN UHUNMWONDE LOCAL GOVERNMENT AREA, EDO STATE, NIGERIA**

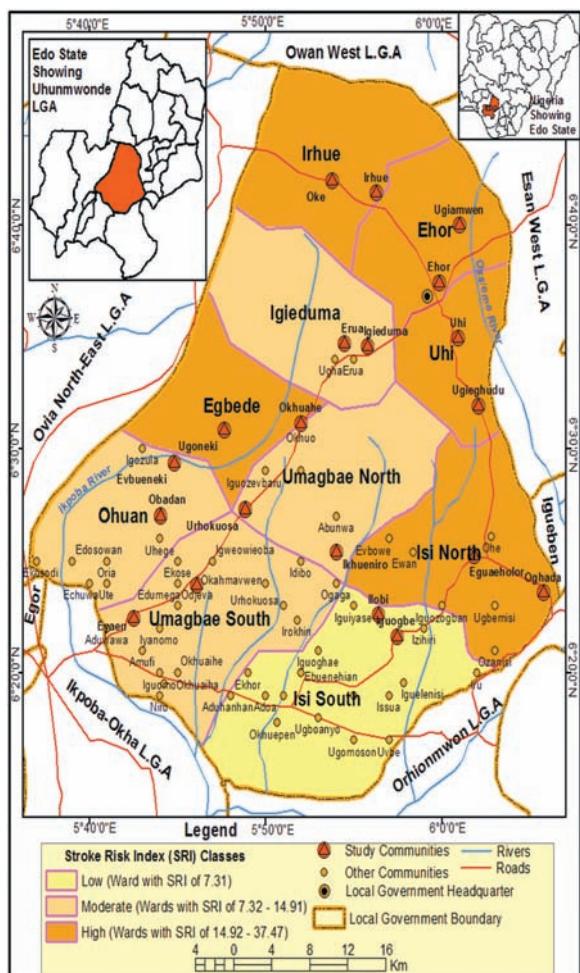
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**Background and Aims:** Globally, stakeholders across various domains require spatially explicit information regarding stroke risk hot-spots (SRHs) at the local scale. The aim of the study was to apply geographical information system (GIS) to map SRHs in Uhunmwonde Local Government Area (LGA), Edo State, Nigeria to support policy.

**Methods:** Multistage sampling technique was deployed to choose 400 respondents from twenty communities in ten electoral wards (EWs) in the LGA between August-December 2018. Nine modifiable risk factors (MRFs) were investigated using standard procedures and well-structured questionnaires. A blood pressure of  $\geq 140/90$ mmHg was classified hypertensive,  $\geq 3$ mmol/L low-density lipoprotein as high cholesterol, after meals blood sugar  $\geq 140$ mg/dl as diabetic and  $\geq 25$ kg/m<sup>2</sup> body mass index as overweight. Statistical analysis was done using SPSS 22. The resulted MRFs were exported to ArcGIS 10.1 software where map algebraic-based multi-criteria analysis through raster calculator in spatial analyst extension was executed according to specified weights generated from principal component analysis.

**Results:** A total of 358 (194 male, 164 female) voluntarily participated in the study. Hypertensive (44.4%), 43.6% diabetic, 73.5% high cholesterol and 40% overweight. Also, smoking (19.3%), heart disease (17.6%), alcohol consumption (68.4%), physical inactivity (80.2%) and drug abuse (64.5%). The SRH map showed that one, four and five EWs with stroke risk index (SRI) of 7.31, 7.32 – 14.91 and 14.92 – 37.47 were classified as Low, Moderate and High SRHs respectively.



**Conclusions:** Massive sensitization, lifestyle change including routine health check-ups were recommended to reduce stroke risk. GIS has proven a viable decision support tool in stroke risk mitigation.

**Trial registration number:** N/A

## AS22-062

### SUSCEPTIBILITY OF LOW-DENSITY LIPOPROTEIN (LDL) TO AGGREGATION IS LOWER WITH ALIROCUMAB TREATMENT THAN WITH STATINS IN PATIENTS WITH ISCHEMIC STROKE

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**Background and Aims:** PCSK9 inhibitors diminish plasma LDL cholesterol levels. However, the effect of PCSK9 inhibitors on LDL qualitative properties is rather unknown. In this pilot study, we aimed to evaluate the effect of the PCSK9 inhibitor Alirocumab versus statins on lipoprotein composition and LDL modifications in patients who suffered an ischemic stroke.

**Methods:** Plasma was obtained from healthy controls ( $n=6$ ) and patients with past medical history of ischemic stroke receiving statins ( $n=6$ ) or Alirocumab ( $n=6$ ). Lipoproteins were isolated from plasma by sequential ultracentrifugation. Lipid profile and lipoproteins composition were evaluated in an autoanalyzer Cobas 501. Susceptibility to aggregation of LDL was analyzed by gel filtration chromatography after sphingomyelinase treatment. Electronegative LDL (LDL(-)), an atherogenic LDL subfraction found in the circulation, was quantified as % LDL(-) of total LDL by anion-exchange chromatography.

**Results:** No statistically significant differences were found in lipoprotein composition between patients treated with Alirocumab or with statins. Compared to controls, LDL from patients showed higher triglyceride content ( $p=0.0442$ ), and lower phospholipid ( $p=0.0496$ ) and total cholesterol content ( $p=0.0139$ ). A statistically non-significant decrease of % LDL(-) was observed in Alirocumab subjects compared to statin subjects (7.46% vs 9.20%), and controls had the lowest % (4.53%). The most important difference in LDL properties induced by Alirocumab treatment was that LDL was almost two times less prone to aggregation than LDL from control and statin subjects ( $p=0.0442$ ).

**Conclusions:** Alirocumab decreased LDL susceptibility to aggregation compared to statins, thereby suggesting less modification and an improvement in the properties of LDL.

**Trial registration number:** N/A

## AS22-024

### THE RELATIONSHIP BETWEEN CEREBRAL MICROBLEEDS AND PATENT FORAMEN OVALE IN JUVENILE PATIENTS WITH ISCHEMIC STROKE: A SINGLE HOSPITAL RETROSPECTIVE OBSERVATIONAL STUDY

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**Background and Aims:** Cerebral microbleeds (CMBs) on magnetic resonance imaging is considered a surrogate marker of hemorrhagic stroke. However, emerging evidence has shown an association of CMBs with ischemic stroke. In this study, we aimed to investigate the relationship between CMBs and patent foramen ovale (PFO) in juvenile-onset ischemic stroke patients to assess underlying mechanisms of CMBs.

**Methods:** In our single hospital-based retrospective study, we collected juvenile-onset (30–65 years old) stroke patients who underwent transesophageal echocardiography from April 2015 to March 2018. CMBs were detected using T2\*-weighted imaging. Presence of 6 or more CMBs was labeled multiple. The odds ratio (OR) and 95% confidence interval (CI) of multiple deep (basal ganglia, capsule, or thalamus) or lobar (cortical or subcortical) CMBs were analyzed and adjusted with age, sex, and known vascular risk factors (hypertension, dyslipidemia, diabetes mellitus, and chronic kidney disease).

**Results:** Of 1191 subjects who underwent transesophageal echocardiography, 205 cases ( $54 \pm 8.8$  y; 68% male) met the age-of-onset criteria, among whom 43 had CMBs. Compared to the non-PFO group ( $n=107$ ), the PFO group ( $n=98$ ) had a higher frequency of deep vein thrombosis [OR (95% CI) = 4.7 (1.0-23);  $p=0.04$ ]. The frequency of multiple lobar CMBs was significantly greater in the PFO group (9 in 98) compared with the non-PFO group (2 in 107) [OR (95% CI) = 5.3 (1.1-25);  $p=0.02$ ]. Adjustment did not affect the association [OR (95% CI) = 4.7 (1.1-32);  $p=0.03$ ].

**Conclusions:** PFO together with deep vein thrombosis may contribute to lobar CMBs in juvenile-onset stroke patients although further investigation is required to determine the mechanism.

**Trial registration number:** N/A

**WITHDRAWN**

higher D-dimer level than patients who did not receive a diagnosis of stroke (Hazard ratio = 1.245;  $P < 0.001$ ).

**Conclusions:** It is widely known that in-hospital stroke occurs commonly in surgical or cardiology patients. However, cancer is also a powerful risk factor and high D-dimer level is its independent determinant.

**Trial registration number:** N/A

**AS22-008****QUANTITATIVE ASSESSMENT OF CEREBROVASCULAR REACTIVITY USING BRAIN SPECT**

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**Background and Aims:** The study aimed to develop the quantitative cerebrovascular reactivity (CVR) assessment tool using acetazolamide (ACZ) single photon emission computed tomography (SPECT), helping in the treatment and/or prevention of cerebrovascular diseases and playing a role as a useful tool for communication between doctors as well as patients.

**Methods:** The quantitative CVR (qCVR) is measured with the ratio of ‘Base-SPECT’ and ‘ACZ-SPECT’ data. Automated preprocessing steps for creating CVR map. Here, CVR values were calculated with two approaches, “ROI-based” and “Voxel-based”. The qCVR was further calculated to remove individual difference in reactivity, basal blood flow and blood vessel perfusion, ranging from 0 to 1, called as the featured qCVR. The calculated qCVR values in all ROI regions were also ranked for further analysis. Furthermore, the nuclear medical specialists assessed the severity of patients with and without the calculated CVR values.

**Results:** Distribution of qCVR values in all regions of a representative subject was shown in Fig. 1 in which only “Voxel-based” CVR provided the CVR distribution.

**AS22-053****RISK FACTORS AND STROKE MECHANISMS IN IN-HOSPITAL STROKE: CANCER IS A POWERFUL RISK FACTOR AND HIGH D-DIMER LEVEL IS ITS INDEPENDENT DETERMINANT**

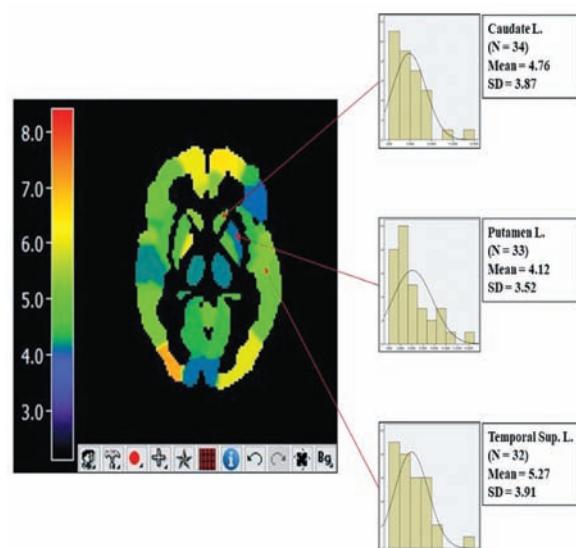
**E. Lee<sup>1</sup>, H.Y. Jeong<sup>1</sup>, C.H. Lee<sup>1</sup>, T.J. Kim<sup>1</sup>, H. Mo<sup>1</sup>, K. Min-kyoung<sup>1</sup>, S.B. Ko<sup>1</sup> and B.W. Yoon<sup>1</sup>**

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**Background and Aims:** A significant proportion of strokes occur in patients already in hospital. Even though there is an advantage that quick managements could be taken, however, delays in recognition and assessment are common. Therefore, we aimed at hospital-based evaluation to assess possible factors related to in-hospital stroke.

**Methods:** We retrospectively assessed 109 patients who initially suspected to have suffered a stroke at Seoul National University Hospital between May 21, 2015 and April 28, 2017. Patient characteristics, comorbid illnesses, medications, stroke mechanisms, and outcomes were analyzed for a patients who have a final diagnosis of stroke or transient ischemic attack (TIA). We also investigated a patients who have a diagnosis of non-stroke.

**Results:** A total of 109 patients were included in the analysis. 56 patients had cerebral ischemia and 8 had hemorrhagic stroke. 10 had a TIA. All patients developed symptoms in the hospital and were admitted for other medical or surgical disorders. We classified these patients according to the TOAST classification. Patients in the cardioembolism subgroup (37.5%) and stroke of other determined etiology subgroup (37.5%) were the most frequent. Most of the patients (90.4%) belonging to the OD etiology subgroup suffered from cancer and they had significantly



**Conclusions:** The developed qCVR program provided not only quantitative assessment, but also improved user's convenience by configuring software program with GUI. When the distribution of "Voxel-based" CVR values is analyzed, the range of normal subjects would be determined statistically and it would be utilized as a quantitative analysis technique to predict the risk factor related with the reduced range of CVR values in patients.

**Trial registration number:** N/A

## AS22-013

### DO ATRIAL FIBRILLATION AFFECTED PATIENTS REALLY REACT DIFFERENTLY TO STROKE SYMPTOMS?

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<sup>1</sup>C. H. La Mancha Centro, Neurology, Alcazar de san juan, Spain

**Background and Aims:** Atrial fibrillation (AF) is the risk factor most frequently associated with early admission (EA) in stroke patients. However not all studies agree on this point and there is no data on how it affects the different components of stroke response. Our study aims to analyse this relation.

**Methods:** We conducted an observational, analytical, prospective study in consecutive patients diagnosed with stroke at our hospital between November 2013 and April 2015, of which we collected all sorts of variables. We established as EA when patients were admitted within 3 hours of stroke onset, immediate reaction (IR) as seeking medical attention within the first 15 minutes, and correct decision (CD) as decision to contact 112 (C-112) within the first 15 minutes. We analysed the probability of EA, IR, DC and C-112 in relation to a history of AF.

**Results:** Of the 382 patients entered, 60 (15,71%) had a history of AF. Although having a history of AF was independently related to a higher probability of EA (OR 2,278;IC95% 1.001-5,180;p = 0,005), there were no significant differences in the probability of IR (33,33 vs 25,16%;ns), C-112 (21,67 vs 17,70%;ns) nor CD (15,00 vs 11,18%;ns) in the bivariate and multivariate analysis.

**Conclusions:** A history of AF was independently associated with EA, but not with a higher probability of having an IR, C-112 or CD in our study. Although a larger sample could reveal different results, confounding factors such as symptoms severity, usually worse in AF patients, should be considered.

**Trial registration number:** N/A

## AS22-068

### CONSTITUTION (PRAKRITI) AS DEFINED BY TRADITIONAL INDIAN MEDICINE IS A RISK FACTOR FOR STROKE

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**Background and Aims:** Ayurveda (traditional Indian medicine) describes the *prakriti* (constitution) of an individual in terms of three factors, called *vata*, *pitta* and *kapha*. *Prakriti* has recently been found to

correlate with genomic variations, enzymatic polymorphisms, and severity of disease manifestation. It is also believed to influence disease susceptibility. We performed a Case-control study to investigate whether *prakriti* is associated with risk for stroke.

**Methods:** Adult subjects diagnosed with an ischaemic stroke (n = 91) and their caregivers/bystanders (n = 127) in the hospital without a history of stroke, were enrolled and administered a 62-item yes/no questionnaire for *prakriti* analysis. We then built a two-stage Support Vector Machine (SVM) model to predict stroke versus control status of subjects. Age, gender, hypertension, diabetes, hyperlipidemia, smoking and alcohol abuse were used as predictor variables in the first stage. The three *prakriti* scores were added in at the second stage. For each stage, data from 146 randomly selected subjects was used to train the SVM and the predictive accuracy of the model was tested on the remaining 72 subjects.

**Results:** Stroke patients had significantly lower *kapha* scores compared to controls ( $P < 0.01$ ). The first stage SVM model yielded a predictive accuracy of 71.11%. Addition of the *prakriti* scores into the model improved the predictive accuracy in the second stage to 76.39%.

**Conclusions:** *Prakriti* appears to be an independent predictor of stroke risk in addition to known vascular risk factors. Specifically, a low *kapha* score appears to be associated with risk for stroke. Further epidemiological study of *prakriti* in stroke is warranted.

**Trial registration number:** N/A

## AS22-066

### ETHNIC DIFFERENCES IN ISCHEMIC STROKE IN KYRGYZSTAN: A RETROSPECTIVE COHORT STUDY

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**Background and Aims:** Kyrgyzstan has population of Asian and Non-Asian people and the highest mortality for ischemic stroke (IS) in the European Region. The aim of the study was to determine the ethical difference in risk factors screening for ischemic stroke (IS) in Kyrgyzstan.

**Methods:** Patients with IS were interviewed with the unique questionnaire regarding stroke risk-factors. Among sample (n = 181), Asians (Kyrgyz) were 74%, Non-Asians – 26 %. According TOAST criteria, large artery atherosclerosis was a target of surveillance and prevailed (56,9%).

**Results:** The proportion of large artery atherosclerosis (LAA) was significantly higher in Kyrgyz population (66,7% vs 34%), while lacunar strokes were prevalent in Non-Asians (14.9% versus 4.5%). OR for LAA for Asians was 3.2 ([CI], 3.0-4.11) for extracranial and 4.6 (CI, 2.04 to 11.7) for intracranial atherosclerosis. The RRs of total stroke for each 10mm Hg rise in systolic blood pressure in Non-Asian group (2.3 and 1.9, respectively) were higher than in Asians (1.8 to 1.6 and 1.6 to 1.8, respectively). Kyrgyz patients were more overweight, physically inactive, had more diabetes, metabolic syndrome preferred animal fat in daily diet ( $p = 0.001$ ) and were more from high social status. Prevalence of large infarction on MRI was higher in Kyrgyz population (17.2% vs 14.9%).

**Conclusions:** There were significantly more atherosclerosis and LAA in Asians population, while in Non-Asian arterial hypertension was the first significant factor. Non-Asians tend to have an alcohol as a risk factor and non-adherence to anticoagulation. Asian population prefers traditional animal fatty food and is less physically active with BMI 25.

**Trial registration number:** n/a

**AS22-010****ASSOCIATION BETWEEN EARLY-ONSET CRYPTOGENIC ISCHEMIC STROKE AND MIGRAINE SUBTYPES IN THE SECRETO STUDY**

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**Background and Aims:** Approximately one third of ischemic strokes in the young remain cryptogenic after an extensive diagnostic work-up. Migraine is a frequent feature in these early-onset cryptogenic ischemic strokes (CIS) yet its association has not been consistently shown specifically in this patient group. We assessed the association between migraine and its subtypes and early-onset CIS, with subgroup analyses stratified by sex.

**Methods:** We prospectively enrolled 213 patients aged 18–49 with imaging-positive acute CIS and 213 age- and sex-matched healthy controls in the ongoing international multicenter SECRETO study (NCT01934725). Screening and characterization of any migraine and migraine with and without aura (MA and MO, respectively) were performed using a novel validated questionnaire including 17 questions. To study the associations, we used conditional logistic regression adjusting for variables with  $P < 0.2$  in bivariate comparison between patients and controls (waist-to-hip ratio, tobacco smoking, use of combined oral contraceptives, physical inactivity, and excessive alcohol use).

**Results:** Compared to controls, patients more frequently had migraine (46% vs. 24%), MA (40% vs. 14%), but not MO (6% vs. 10%). Adjusted conditional logistic regression showed that MA was associated with early-onset CIS (OR 6.4, 95% CI 3.3–12.5). MO did not show an association (OR 0.7, 95% CI 0.3–1.7). In women, the association between MA and early-onset CIS was even stronger (OR 9.2, 95% CI 3.1–27.2) than in men (OR 4.9, 95% CI 2.0–12.3).

**Conclusions:** MA may emerge as one of the key contributors for CIS among the young, particularly in women.

**Trial registration number:** N/A

**AS22-038****RISK FACTORS FOR STROKE IN PATIENTS WITH CERVICAL ARTERY DISSECTION IN A CHILEAN COHORT**

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**Background and Aims:** Spontaneous cervical artery dissection (CeAD) broad clinical spectrum includes none or minor local signs to severe stroke. Men predominance has been described, with most information coming from European and US tertiary academic centers.

**Aim:** Characterize CeAD patients with and without central nervous system manifestations, and describe risk factors for stroke in a CeAD Chilean prospective cohort.

**Methods:** consecutive patients between 2011 and 2018 with CeAD neuroimaging confirmation were included. Uni and multivariate logistic regression was performed. P value  $\leq 0.05$  was considered significant.

**Results:** in 168 patients, mean age was 41 (SD 9.2) years, 67 (39.9%) were men and mean follow-up time was 256 days. Stroke occurred in 49 (29.2%). Four (2%) patients died, all of whom had a stroke, and ten (6%) presented CeAD recurrence. In univariate analysis, men (odds ratio [OR] 3.97, 95% confidence interval [CI] 1.97–8.00,  $P < 0.001$ ), internal carotid artery CeAD (OR 2.82, 95% CI 1.38–5.78,  $P = 0.005$ ) and vessel occlusion (OR 4.45, 95% CI 1.38–14.38,  $P = 0.035$ ) increased stroke risk. Conversely, vertebral artery dissection (OR 0.35, 95% CI 0.16–0.74,  $P = 0.006$ ) and symptoms onset to admission (O-A) time (OR 0.79, 95% CI 0.70–0.90,  $P < 0.001$ ) reduced stroke risk. After multivariate analysis, men (OR 2.88, 95% CI 1.32–6.27,  $P < 0.001$ ) and O-A time (OR 0.80, 95% CI 0.69–0.92,  $P = 0.002$ ) remained independently associated with stroke.

**Conclusions:** CeAD presented commonly as a non-stroke entity, with favorable prognosis. Albeit to a higher frequency of CeAD in women, stroke occurred predominantly in men, early after symptom onset. In this population the gender distribution warrants further research.

**Trial registration number:** N/A

**AS22-055**

## **COMPARISON OF CLINICAL RISK FACTORS AND LIPID PROFILE BETWEEN ISCHEMIC STROKE AND INTRACEREBRAL HEMORRHAGE STROKE OF A TERTIARY CARE HOSPITAL IN NORTH INDIA**

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### **Background and Aims:**

**Background:** Stroke is one of the leading causes of mortality and morbidity and the pathogenesis and clinical risk factor profile for the two types of stroke is completely different.

**Aims:** To study and compare the clinical risk factors and lipid abnormality between ischemic stroke (IS) and intracerebral hemorrhage (ICH) stroke patients.

**Methods:** An ongoing cross-sectional study being conducted at the Department of Neurology, All India Institute of Medical Sciences, New Delhi, India since December 2017. To determine the stroke subtype, clinical examination followed by NCCT brain was done. The lipid profile examination was done using enzymatic calorimetric method. All the statistical analysis was conducted in STATA version 13.0 software.

**Results:** A total of 228 IS and 157 ICH cases were enrolled with a mean age of  $54.44 \pm 1.04$  for IS and  $56.01 \pm 0.95$  for ICH. There was a significant difference in the mean levels of HDL between IS and ICH cases ( $36.54 \pm 0.76$  vs.  $39.94 \pm 1.04$ ,  $p = 0.01$ ). Low serum HDL levels were more prevalent in IS (69.23%) as compared to ICH (53.26%). Abnormal serum cholesterol, triglyceride, LDL and VLDL values were distributed similarly between IS and ICH. The prevalence of hypertension and diabetes in our study was 56.89% & 26.79% for IS and 70.27% & 19.31% for ICH respectively. Low education, less exercise & tobacco smoking were the emerging risk factors for overall stroke.

**Conclusions:** IS patients had a higher prevalence of diabetes and significantly lower HDL-cholesterol levels as compared to ICH cases while the prevalence of hypertension was higher in ICH cases.

**Trial registration number:** N/A

**AS22-027**

## **STENOTIC CHANGES OF THE POSTERIOR CEREBRAL ARTERY ARE A MAJOR CONTRIBUTING FACTOR FOR CEREBRAL INFARCTION IN MOYAMOYA DISEASE**

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**Background and Aims:** Some patients with moyamoya disease (MMD) show broad infarction with moderate internal carotid artery (ICA) stenosis, whereas others with complete ICA occlusion show no infarction. This suggests that other factors contribute to the occurrence of infarction. Contributing factors predictive of cerebral infarcts must be identified for the prevention of infarction and the consequent neurological deficits.

**Methods:** We examined data from 93 patients with confirmed MMD for the presence of infarction ( $n = 72$ ), transient ischemic attack (TIA,

$n = 41$ ), asymptomatic presentation ( $n = 51$ ), or hemorrhage ( $n = 22$ ) in 186 bilateral cerebral hemispheres. We analyzed the relationship between the occurrence of infarction and several clinical factors, such as steno-occlusive status or the site of the ICA and posterior cerebral artery (PCA).

**Results:** The incidence of PCA steno-occlusive lesions was significantly higher in infarcted (77.8%) than in non-infarcted hemispheres (TIA, 14.6%; asymptomatic, 9.8%; hemorrhagic 9.1%;  $P < 0.01$ ). The steno-occlusive site of ICA was also a significant factor ( $P < 0.05$ ). There was no significant correlation between the occurrence of infarction and the steno-occlusive status of the ICA or grade of the moyamoya vessels. Multivariate statistical analysis demonstrated that the PCA steno-occlusive changes were an important contributing factor for infarction ( $P < 0.0001$ ).

**Conclusions:** This is the multivariate statistical analysis study identifying PCA steno-occlusive lesions as the most important independent factor that is predictive to cerebral infarction in moyamoya patients. The prediction and inhibition of PCA steno-occlusive changes may help to prevent cerebral infarction.

**Trial registration number:** N/A

**WITHDRAWN****AS22-052**

## **THE EPIDEMIOLOGY OF OCCULT CANCER IN SURVIVORS OF ISCHEMIC STROKE**

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**Background and Aims:** The risk of occult cancer in stroke survivors is incompletely understood. Especially, it's uncertain how long to perform diagnostic evaluations of occult cancer in patients with cryptogenic ischemic stroke.

**Methods:** Using the National Health Insurance Services and a prospective multicenter stroke registry linked database, we investigated the incidence of occult cancer up to 5 years after index ischemic stroke. Patients were categorized into two groups according to the stroke etiology: unidentified stroke etiology (USE) and evident stroke etiology (ESE). The cumulative incidence was estimated by the Kaplan-Meier method. Poisson regression was used to compare the risk of occult cancer between USE and ESE during 6-month periods in 5 years.

**Results:** Among a total of 9,759 patients, 89.8% were ESE and 10.2% of USE. The cumulative incidence of occult cancer was 1.7% at 6 months and 6.4% at 5 years. USE(hazard ratio 1.35; 95% confidence interval, 1.06 to 1.74), age by a 10-year increment (1.74; 1.01 to 2.80), and male (1.83; 1.45 to 2.31) were independent predictors of occult cancer. Up to the 3.5 years, the interval 6-month risks of occult cancer were higher in USE versus ESE with peaking risk during the 6-months after index stroke: 4.28 % incident cancer rate per 1,000 person-month (95% CI, 2.77-6.32) in USE versus 2.71%(2.28-3.20) in ESE( $P < 0.0001$ )

**Conclusions:** The cumulative incidence of occult cancer was about 6.4% at 5 years after ischemic stroke in Korea. The risk of occult cancer remains to increase the 3.5 years and peaks in the 6 months after index stroke in patients with unidentified stroke etiology.

**Trial registration number:** N/A

## WITHDRAWN

## WITHDRAWN

## AS22-042

### COMPREHENSIVE ASSESSMENT OF THE ADOLESCENT LIPOPROTEIN SUBCLASS PROFILE

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**Background and Aims:** Atherosclerosis begins in early life. Assessment of comprehensive lipoprotein subclass profiles in adolescents

may elucidate the emergence of dyslipidemia, explain sex differences in atherosclerosis and inform early vascular prevention.

**Methods:** Content of lipids (cholesterol, free cholesterol, triglycerides, phospholipids) and apolipoproteins (apoB-100, apoA1, apoA2) by lipoprotein subclass (from largest to smallest: VLDL1-6, IDL, LDL1-6, HDL1-4) was measured in plasma of n=1776 14- to 19-year olds (56.6% female) by nuclear magnetic resonance. Absolute levels were compared by Wilcoxon test and age trends were investigated by linear regression. **Results:** Male compared to female youngsters had higher very large VLDL1 (FDR q<0.001), similar VLDL2, LDL5, and HDL4, and lower levels of all other lipoproteins with the largest sex-difference observed for large HDL1 (q<0.05). Regarding changes in lipoproteins by age, we found a continuous increase in the triglyceride content of most LDL and HDL subclasses in females (4.9-8.8% increase per year, FDR q<0.001). Constituents of HDL1 decreased in males (-5.0 to -8.4% per year, FDR q<0.05) but increased in females. Constituents of smaller HDL2-HDL4 increased with age in females and constituents of HDL4 also increased in males (2.8-6.2% per year, FDR q<0.05).

**Conclusions:** Male adolescents had higher levels of very large VLDL and showed a decline in large HDL with age. In females, constituents of all HDL subclasses increased as did the triglyceride content of LDL and HDL subclasses. The unfavourable dynamic of the male lipid profile may partly account for the sex difference in atherosclerosis and hint at opportunities for prevention.

**Trial registration number:** N/A

## AS22-033

### LEISURE-TIME PHYSICAL ACTIVITY LEVELS AND RISK OF STROKE. CONTRIBUTION OF THE COHORT HERMEX

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**Background and Aims:** Physical activity is an important component of primary prevention for cardiovascular disease. Leisure-time physical activity (LTPA) has been established as strongly protective against atherosclerotic coronary heart disease, whereas it is a less well-established modifiable risk factor for stroke. We sought to examine whether physical activity, as measured by intensity of exercise and energy expended, is protective against ischemic stroke.

**Methods:** Cohort study. Representative population sample of a health area of Extremadura (Spain). 2833 individuals, from 25 to 79 years old, randomly selected and recruited between 2007 and 2009. The relation of self-selected LTPA to first stroke event was studied in 2669 participating in the HERMEX cohort. LPTA was assessed by a validated questionnaire (Minnesota Leisure Time Physical Activity Questionnaire) and our primary exposure was physical activity (PA). Participants were followed during 6.9 years for incident stroke. We fit Cox-proportional hazard models to calculate hazard ratios and 95% confidence intervals (HR 95% CI) for the association of PA.

**Results:** The mean age was  $50.5 \pm 14.5$  years and 1458 (54.6%) were women. 1085 (40.7%) participants were classified as physically active (minimum recommendations of physical activity at least 500 MET per week). We found 53 strokes (45 ischemic, 8 hemorrhagic). In stratified

models, PA versus any activity (adjusted HR 0.36, 95% CI 0.15–0.85) was associated with a protective factor of stroke.

**Conclusions:** We conclude that minimal levels of physical activity (vs none) are associated with reduced risk of stroke. This result need to be viewed with caution and physical activity need to be explored in future studies.

**Trial registration number:** N/A

## AS22-041

### LONG-TERM RISK OF STROKE AFTER TRANSIENT GLOBAL AMNESIA: PROSPECTIVE COHORT STUDIES

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**Background and Aims:** Transient global amnesia (TGA) is known as a benign syndrome, but recent data from neuroradiological studies suggest an ischaemic aetiology in some cases, which might imply an increased susceptibility to cerebrovascular events. We determined the long-term risk of stroke after a first TGA in two independent prospective cohorts.

**Methods:** In two independent prospective cohorts of patients with TGA (Oxford Vascular Study – OXVASC, population-based; Northern Umbria cohort (NU), TGA registry), cardiovascular risk factors and long-term outcomes including stroke and major cardiovascular events were collected and compared to available population-based data. Cardiovascular risk factors were treated according to primary prevention guidelines. In OxVasc, the age/sex-adjusted risk of stroke during follow-up was compared with that expected from the rate in the underlying study population.

**Results:** Among 518 patients with TGA (425 NU, 93 OXVASC), mean (SD) age was 65.1 (9.5) years and 42.7% male. Hypertension (58.3%), dyslipidemia (40.5%) and smoking (28.5%) were the most frequent cardiovascular risk factors. The risk of stroke was similar in the two cohorts, with a pooled annual risk of 0.6% (95% CI 0.4–0.9) and a 5-year cumulative risk of 2.7% (1.1–4.3). Moreover, the stroke risk in OXVASC cases was no greater than that expected in the general population in OxVasc (adjusted-RR = 0.73, 0.12–4.54, p = 0.74).

**Conclusions:** TGA does not carry an increased risk of stroke, at least when any coincidental cardiovascular risk factors are treated.

**Trial registration number:** N/A

## AS22-072

### THE RISK OF ISCHEMIC STROKE IN YOUNG WOMEN WITH MIGRAINE USING LOW-ESTROGEN COMBINED HORMONAL CONTRACEPTIVES

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**Background and Aims:** We aimed to quantitatively estimate the relative and absolute risks of ischemic stroke (IS) in women with migraine using low-estrogen (< 50 µg ethynodiol dihydrogen acetone) combined hormonal contraceptives (CHCs) compared with those without migraine not using CHCs.

**Methods:** We ran a random-effect meta-analysis of observational studies reporting the effect sizes of IS in women with migraine using low-estrogen CHCs compared with those without migraine not using CHCs. The absolute risks of IS were estimated from a previously reported incidence rate of 21.4 per 100,000 person-years.

**Results:** Four case-control studies were included in the meta-analysis; only one of them stratified the results for migraine with and without aura. We found an odds ratio of IS of 4.05 (95% CI, 1.86-8.82;  $P = 0.0004$ ) in women with migraine using CHCs compared with those without migraine not using CHCs. The corresponding absolute risks in low-estrogen CHC users were 86.7 per 100,000 person-years among women with any migraine, 37.9 among migraine without aura, and 130.1 among migraine with aura. The number needed to harm of low-estrogen CHCs was 1,532 in women with any migraine, 6,069 in women with migraine without aura and 920 in women with migraine with aura.

**Conclusions:** Although based on low numbers, our quantitative data, suggesting a strong cumulative effect of migraine with aura and low-estrogen CHC use on the risk of IS in women, allow a clear discussion of the benefits and risks of CHC use in women with migraine.

**Trial registration number:** N/A

## AS22-032

### DO SEX DIFFERENCES IN CARDIOVASCULAR RISK FACTORS AMONG WOMEN AND MEN WITH ISCHEMIC STROKE? RESULTS FROM A HOSPITAL-BASED REGISTRY OF A DEVELOPING COUNTRY

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**Background and Aims:** Sex differences in cardiovascular disease (CVD) and stroke has long been explored globally, but less in developing countries. Although post-stroke women were at high risk for developing recurrent as similar to men, they were less likely received appropriate secondary prevention regimens. We examined whether women and men with acute ischemic stroke had differences type of major CVD risk factors.

**Methods:** We obtained data from the stroke registry of a tertiary care hospital in Southern Thailand. Among 3,135 acute ischemic strokes admitted during October 2011 to February 2016, they were 1,260 (40.28%) women, and 1,875(59.8%) men. A total of ten CVD risk factors

were defined. Six were based on the Essen Stroke Risk Score included hypertension, diabetes, previous myocardial infarction (MI), peripheral arterial disease (PAD), other cardiovascular diseases (CVD) except MI and atrial fibrillation (AF), and previous stroke/TIA. Other four were AF, hypercholesterolemia, smoking, and alcohol drinking.

**Results:** Women were five years older than men ( $p = 0.000$ ). There was a higher number of older adult women than men ( $p = 0.000$ ), with an odds ratio of 1.47 (95% CI 1.35-1.61). Women were more likely had hypertension (OR 1.29, 95% CI 1.18-1.42), diabetes (OR 1.36, 95% CI 1.25-1.49), MI (OR 1.87, 95% CI 1.06-3.29), and hypercholesterolemia (OR 1.33, 95% CI 1.22-1.45). Less smoker (OR 0.12, 95% CI 0.09-0.14), and alcohol drinker (OR 0.07, 95% CI 0.05-0.09) were found in women than did men.

**Conclusions:** Women and men had six differences CVD risk factors. Prevention recurrent stroke in women would be focused on blood pressure control, clinical management of diabetes and MI, and lipid lowering.

**Trial registration number:** N/A

## AS22-006

### ASSOCIATION OF LIPID METABOLISM GENES POLYMORPHISM IN THE FIRST ISCHEMIC STROKE

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**Background and Aims:** The study of the relationship between various of lipid metabolism gene polymorphism and the development of the first ischemic stroke.

**Methods:** 201 patients who underwent the first ischemic stroke and 109 people who did not suffer a stroke, corresponding to age, place of residence and nationality to a group of patients, were examined.

Genotyping of single nucleotide polymorphisms of genes: APO5, APOC2, ApoD, Apo H, Apo E using ready-made TaqMan probes was carried out.

**Results:** For polymorphisms ApoD (rs7659) and ApoA5 (rs619054) there was significant difference between groups in the variety of minor alleles and genotypes.

**Conclusions:** There is significant relation of mononucleotide polymorphisms of the genes ApoD (rs7659) and ApoA5 (rs619054) with the development of the first ischemic stroke In the studied groups.

**Trial registration number:** N/A

## AS22-007

### ASSOCIATION OF ANGIOPOIETIN AND APOLIPOPROTEIN CONCENTRATIONS WITH THE FIRST ISCHEMIC STROKE

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**Background and Aims:** The study of the relationship between different parameters: the concentration of Apo H, Apo E, Apo C2, Apo D, angiopoietin 1, angiopoietin 2, angiopoietin-4 and the development of the first ischemic stroke

**Methods:** A total of 109 patients who had the first ischemic stroke, and 40 people who did not suffer a stroke corresponding to the age, place of residence and nationality of the patient group were examined. The serum

concentrations of the following parameters were evaluated: Apo H, Apo E, Apo C2, Aro D, angiopoietin-1, angiopoietin-2 and angiopoietin-4.

**Results:** Based on the results of the correlation analysis, the following parameters were statistically significant with the first ischemic stroke: Apo D, Apo C2, angiopoietin-2.

**Conclusions:** There is significant association of concentration of Apo D, Apo C2 and angiopoietin-2 with the development of the first ischemic stroke in the studied groups.

**Trial registration number:** N/A

## AS22-046

### BLOOD LIPIDS ALTERATION AS RISK FACTORS IN ISCHEMIC STROKE HYPERTENSIVE PATIENTS OF PRIOR EXPOSURE TO COLD WEATHER DURING WINTER

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**Background and Aims:** To explore the relationships among low ambient temperature, hypertensive ischemic stroke and blood lipids.

**Methods:** We collected meteorological data of Guangzhou, China from 2014 to 2017. We retrospectively included ischemic stroke patients with hypertension admitted in each winter (12.01-03.01) from 2014 to 2017 and simultaneously collected hypertensive inpatients without stroke history as control. The demographics and clinical data as well as blood lipids measurement were evaluated. The 10<sup>th</sup> percentile of the daily minimum temperature of each winter was used as the cut point to distinguish the low temperature. The cold exposure subgroup was defined as experiencing low temperature 14 or less days prior to symptoms onset.

**Results:** One hundred and eighteen stroke patients and 364 control patients were. The systolic blood pressure on admission, diastolic blood pressure on admission, LDL-c, Apo-B, Lp- $\alpha$  was higher in the stroke group than the control group. Apo-A1 was lower than the control group. Eight three stroke and 279 control patients were included in cold exposure analysis. The frequencies of male, stroke history, diabetes mellitus, smoking history and alcohol abuse history were higher than in stroke group and the control group. Systolic blood pressure, diastolic blood pressure, blood cholesterol, LDL-c and Apo-B were higher in stroke group than the control group.

**Conclusions:** Increased blood pressure on admission, LDL-c, Apo-A1, Apo-B, and Lp- $\alpha$  were associated factors for ischemic stroke in hypertensive patients in winter. Cholesterol, LDL-c, and Apo-B are characterized to be associated with stroke onset in cold exposure during winter.

**Trial registration number:** N/A

## AS22-018

### SLEEP-DISORDERED BREATHING IN ACUTE ISCHEMIC STROKE PATIENTS WITH HEART FAILURE

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**Background and Aims:** Both, sleep-disordered breathing (SDB) and heart failure (HF) increase the risk of stroke. Although SDB is frequently observed in both stroke patients and HF patients, the prevalence in

patients with comorbidity of acute ischemic stroke and HF is unknown. The aim of the study was to explore the frequency and type of SDB in population of acute ischemic stroke patients with comorbidity of left ventricular systolic dysfunction (LVSD) or left ventricular diastolic dysfunction (LVDD).

**Methods:** We prospectively enrolled 120 patients with acute ischemic stroke. SDB was assessed using standard polysomnography within 7 days after stroke onset. Transthoracic echocardiography was used to assess LVSD and LVDD.

**Results:** SDB was present in 71 patients (59.2%). LVSD was present in 14 patients (11.7%) and LVDD in 90 patients (75.0%). SDB was significantly more frequent in patients with LVSD compared to the rest of the population (85.7% vs. 55.7%, p = 0.032). Similarly, SDB was significantly more frequent in population with LVDD compared to the rest of the patients (66.7% vs. 36.7%, p = 0.004). Frequency of central sleep apnea in LVSD was non-significantly higher than in the rest of the population (33.3% vs. 13.6%, p = 0.096). Contrary, frequency of obstructive sleep apnea in LVDD was non-significantly higher than in the rest of the population (85.0% vs. 72.7%, p = 0.318).

**Conclusions:** Prevalence of SDB in stroke patients with both LVSD and LVDD was significantly higher compared to the population without such dysfunction. Screening for SDB and consecutive treatment could be beneficial in this high-risk population.

Supported by APVV-15-0228 Grant.

**Trial registration number:** N/A

## AS22-054

### ETIOLOGICAL ASPECTS OF ISCHEMIC STROKE IN CHILDREN

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**Background and Aims:** Pediatric stroke occurs as a result of many triggering factors and often leads to significant morbidity and mortality. To study the causality of pediatric ischemic stroke (PIS) in the purpose of prophylaxis of morbidity and mortality among children.

**Methods:** During the period 2010–2018 we studied the structure and the profile of stroke risk factors of PIS in a group of 94 children aged from 1 month to 15 years old. The study was conducted in the Republic of Moldova.

**Results:** The following results were estimated: PIS predominated in males – 62 cases (66%), compared to females – 32 cases (34%). Among PIS causes in the investigated children have to be mentioned: CNS infections – 7 cases (7.4%, 95 CI 4.69-10.11), congenital heart malformations – 12 cases (12.8%, 95 CI 9.36 -16.24), severe dehydration – 3 cases (3.2%, 95 CI 1.39-5.01), sickle cell anemia – 3 cases (3.2%, 95 CI 1.39-5.01), inflammatory vasculopathy – 9 cases (9.6%, 95 CI 6.57-12.63), prothrombotic conditions – 6 cases (6.4%, 95 CI 3.88-8.92), arteriopathy – 14 cases (14.9%, 95 CI 11.23-18.57), metabolic diseases – 7 cases (7.4%, 95 CI 4.69-10.11), genetic syndromes – 3 cases (3.2%, 95 CI 1.39-5.01), CNS lupus – 2 cases (2.1%, 95 CI 0.61-3.59), Moyamoya syndrome – 1 case (1.1%, 95 CI 0.04-2.16), unidentified factors – 27 cases (28.7%; 95 CI 24.03-33.37).

**Conclusions:** PIS is predominant in male children. The risk factors responsible for PIS in children are multiple and varied, some of them remain unknown.

**Trial registration number:** I7.00418.80.IIA

**AS22-025**
**STROKE RISK AFTER A LATE-ONSET MIGRAINE-LIKE TRANSIENT NEUROLOGICAL ATTACK (TNA): POPULATION-BASED COHORT STUDY**

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**Background and Aims:** New-onset migraine-like TNAs in older adults can be due to migraine aura or TIA. Clinical distinction can be difficult after a first attack, particularly in older patients with vascular risk factors. In the absence of previous population-based studies, we determined the long-term risk of stroke in patients with new migraine-like TNAs.

**Methods:** In a population-based study of all TNAs, TIAs and strokes (Oxford Vascular Study; 2002–2018), we ascertained all patients with a first migraine-like TNA at age  $\geq 50$  in whom the study neurologist was not confident that the event was either a definite migraine aura or a definite TIA. Risk of stroke was determined by face-to-face follow-up to 15 years and was compared with the risk in study patients with definite TIA and also with the risk expected on the basis of age-sex specific stroke incidence in the underlying population.

**Results:** Among 264 consecutive patients with migraine-like TNAs (61% women; median age = 61.6 years) with 1895 patient-years of follow-up, the 90-day risk of stroke (8 events, 3.0%) was lower ( $p = 0.006$ ) than that in 984 patients with definite TIA (86 events; 7.8%). However, the post-90 day risk of stroke (19 events; 1.1/100 patient-years) was similar ( $p = 0.29$ ) to that after definite TIA (69 events; 1.1/100 patient-years). The long-term risk of stroke (27 events) was also greater than expected based on background population incidence ( $RR = 3.76$ , 95% CI: 1.65–8.56,  $p = 0.002$ ).

**Conclusions:** Patients with a late-onset migraine-like TNA have a substantially increased long-term risk of stroke which is comparable to that after definite TIA.

**Trial registration number:** N/A

**AS22-020**
**RISK FACTORS FOR EARLY RECURRENCE OF ISCHAEMIC STROKE**

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**Background and Aims:** Previous studies have shown that the advanced age, diabetes mellitus, previous myocardial infarction, smoking, and atrial fibrillation are risk factors of ischaemic stroke recurrence. We investigated the recurrent ischaemic stroke regarding risk factors within three months after the first-ever stroke.

**Methods:** We scanned the ischaemic stroke patients in our stroke registry data bank. The eligible patients were followed for recurrent ischaemic stroke beginning at 2008. This study included 525 patients who were followed only about three months after the first-ever stroke.

**Results:** Seventy-two (14%) patients had a recurrent ischaemic stroke within three months after the first-ever ischaemic stroke. The mean time for early stroke recurrence was 21 days. Significant risk factors of early recurrence were coronary artery disease (43%,  $p < 0.018$ ) and congestive heart disease (38%,  $p < 0.018$ ). The age, gender, atrial fibrillation, hypertension, diabetes mellitus, hyperlipidemia, smoking, alcohol usage were not significantly associated with stroke recurrence.

**Conclusions:** Despite the appropriate treatments patients with coronary heart disease and congestive heart disease have a higher rate of

recurrence risk for ischaemic stroke within three months after the first-ever ischaemic stroke.

**Trial registration number:** N/A

**AS22-012**
**HYPERTENSION AND STROKE SYMPTOMS RESPONSE: WHERE DO WE STAND?**

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**Background and Aims:** Hypertension is the most prevalent risk factor in stroke patients, nevertheless it is not generally associated with a higher probability of early admission (EA) after suffering a stroke. The aim of this study is to determine whether hypertensive patients present a better and faster response to stroke symptoms.

**Methods:** We conducted an observational, analytical, prospective study in consecutive patients diagnosed with a stroke at our hospital between November 2013 and April 2015, of which we collected all sorts of variables. We established as EA when patients were admitted within 3 hours of stroke onset, immediate reaction (IR) as seeking medical attention within the first 15 minutes, and correct decision (CD) as decision to contact 112 (C-112) within the first 15 minutes. We analysed the probability of EA, IR, DC and C-112 in relation to history of hypertension.

**Results:** Of the 382 patients entered, 285 (74,61%) had a history of hypertension. No differences were detected between hypertensive and non-hypertensive patients in terms of having an IR (26,67 vs 25,77%;ns), C-112 (17,89 vs 19,59%;ns) nor CD (11,23 vs 13,40%;ns). Although EA was slightly more common among hypertensive patients (50,18 vs 44,33%;ns), hypertension was not an independent predictor for EA.

**Conclusions:** While up to 75–80% of stroke patients have a history of hypertension, there are no differences in their response to stroke compared to non-hypertensive patients. This supports previous findings of poor stroke risk perception in this subset of patients and makes them a suitable target for stroke education in order to reduce prehospital delays.

**Trial registration number:** N/A

**AS22-036**
**ASSOCIATION OF RESIDENTIAL AIR POLLUTION, NOISE, AND NEIGHBOURHOOD GREEN SPACE WITH INITIAL STROKE SEVERITY**

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**Background and Aims:** Few studies have evaluated the influence of the residential environment on stroke severity.

We assessed the association of residential ambient fine particulate matter air pollution (PM2.5), noise, and surrounding greenspace with initial stroke severity.

**Methods:** We obtained data on patients hospitalized with acute ischemic stroke from a hospital-based prospective stroke register (2005–2014) in Barcelona. Assessment of spatiotemporal exposure to PM2.5 was based on a land use regression model developed in the European Study of

Cohorts for Air Pollution Effects. Residential surrounding greenspace was estimated as the average of satellite-based Normalized Difference Vegetation Index (NDVI) within a 300 m buffer of the residence. We abstracted daily, evening, night and average noise level at the street nearest to the residential address, using strategic noise map of Barcelona. Stroke severity was assessed using the NIHSS (dichotomous and continuous). We used binomial and logistic regression models to evaluate the associations of noise, greenspace and PM2.5, with stroke severity adjusting for patient demographics and traditional cardiovascular risk factors.

**Results:** 2761 cases were included. Higher residential surrounding greenspace was associated with lower risk of severe stroke (OR for NIHSS>5, 0.72; 95% CI: 0.62-0.85). Conversely, living in areas with higher evening noise had a higher risk of severe stroke (OR, 1.20; 95% CI: 1.02-1.41). PM2.5 was not associated with initial stroke severity.

**Conclusions:** In an urban setting, neighborhood greenspace and traffic noise are associated with initial stroke severity, suggesting an important influence of the built environment on the global burden of stroke.

**Trial registration number:** N/A

## AS22-017

### PERIODONTAL DISEASE DETERIORATES THE ISCHEMIC STROKE INJURY

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**Background and Aims:** Periodontal disease is a common chronic inflammatory disease of the tissue surrounding the teeth infected with bacteria. So far most of the studies have focused on the risk of stroke in periodontal patients, but no study to examine whether periodontal disease affects the severity of stroke. Therefore, we aimed to investigate whether periodontal disease exacerbates the degree of cerebral ischemia injury and its underlying mechanisms in mice.

**Methods:** Mice were orally infected with *Porphyromonas gingivalis* (*P. gingivalis*), the major oral pathogen associated with periodontal disease, and ligated right middle cerebral artery to cause focal cerebral ischemic stroke.

**Results:** We found that infected with *P. gingivalis* significantly increased cerebral infarction and neurological deficits in mice subjected to focal cerebral ischemic stroke compared with non-infected one. In addition, we also found that infected with *P. gingivalis* aggravated the vascular damage and blood-brain barrier leakage in mice after focal cerebral ischemic stroke.

**Conclusions:** We suggest that the increase of vascular damage and blood-brain barrier leakage, thereby worsening the cerebral infarction and neurological deficits induced by the focal cerebral ischemic stroke in the *P. gingivalis*-infected mice.

**Trial registration number:** N/A

## AS22-056

### RISK FACTOR RELATIONSHIP OF CORONARY ATHEROSCLEROSIS AND CEREBROVASCULAR HEMORRHAGE (RISK FACTORS OF SPONTANEOUS INTRACEREBRAL HEMORRHAGE AND SPONTANEOUS SUBARACHNOID HEMORRHAGE)

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**Background and Aims:** This study was to investigate whether arteriosclerotic factors are involved in the induction of two groups of ICH and SAH in patients with cerebral hemorrhage

**Methods:** Patients (n = 1,103) were hospitalized from January, 2015 to December, 2017 in department of neurosurgery at Gil Hospital if they fulfilled the following criteria:(1) ICH(n = 606) and SAH(n = 497) (2) no motor vehicle accident (3) no known congenital cerebral arterial malformation. Carotid IMT, Pulse wave velocity (PWV), Ankle brachial index (ABI) waist circumference, blood pressure, triglyceride, LDL-c and age were all satisfactory in 66 patients with ICH and 88 patients with SAH.

**Results:** There was a correlation between age and C-IMT and baPWA. There was a positive correlation between SAH, diastolic BP and C-IMT and a negative correlation with cholesterol. The baPWV values were negatively correlated with diastolic blood pressure in ICH patient. In SAH patients, there was a negative correlation with BMI and a positive correlation with systolic blood pressure. In all age and gender groups with ICH and SAH, the value of baPWV was higher than that of the normal population. In the ICH group, there was no mean C-IMT and baPWV between the sexes after adjusting for age, BMI, waist circumference, systolic blood pressure, and LDL cholesterol levels. In SAH patients, BMI, waist circumference, Mean C-IMT values after blood pressure and LDL cholesterol correction were significantly higher in males and there was no significant difference in baPWV between genders before and after correction.

**Conclusions:** There is a correlation between SAH and atherosclerosis related interest, but not with ICH.

**Trial registration number:** N/S

## WITHDRAWN

**AS28-009****ENDOVASCULAR TREATMENT OF RUPTURED TINY CEREBRAL ANEURYSMS, IN LOW FLOW CENTERS, FEASIBILITY AND COST EFFECTIVE STUDY IN LOW INCOME COUNTRY****M. Abbas<sup>1</sup>, O.Y. Mansour<sup>1</sup>, R.A. El Kabany<sup>2</sup> and M.S. Melake<sup>2</sup>**<sup>1</sup>Alexandria university, Neurology department, Alexandria, Egypt;<sup>2</sup>Menoufia University, Neurology department, Menoufia, Egypt

**Background and Aims:** Surgical clipping (SC) and endovascular coiling (EC) techniques are established treatment modalities for ruptured cerebral aneurysm. Tiny aneurysm ( $\leq 3$  mm.) remains challenging to treatment due to the high risk of IOR.

We aimed to investigate the outcomes of using SC versus EC in treating tiny cerebral aneurysm.

**Methods:** Prospectively, Between April 2014 and March 2018, 25 consecutive cases with subarachnoid hemorrhage due to ruptured tiny cerebral aneurysms were analyzed.

**Results:** Twenty-five patients were included; Patients' mean age (47.7 years). 20 patients had EC, and 5 patients had SC. Mean Length of stay for the coiled group (mean = 2.35 days) and (mean = 4.25 days) consequently. For the clipping group was (mean = 13 days) and (mean = 10.20 days) consequently. Occlusion rate (Meyers Occlusion grading scale) of the aneurysms for the 20 patients treated with EC was grade 2 in (n = 16 – 80%) and grade 3 in (n = 4 – 20%). At Follow up period, Occlusion rate was ameliorated from grade 2 to 3 in (n = 6 – 60%). While in clipped aneurysms, occlusion rate was grade 2 in (n = 2 – 20%) and grade 3 in (n = 3 – 30%). At Follow up, Occlusion rate was regressed to grade 2 in (n = 3 – 30%). In the coiling group, total cost was ranging from (23,000 to 87,500 EP – Mean 48,750). In comparison to the clipping group, total cost was ranging from (82,500 to 116,000 EP – Mean 104,800).

**Conclusions:** in low flow centers, EC for tiny cerebral aneurysms might be feasible, durable and more cost effective than surgical clipping.

Trial registration number: N/A

**SAH, Aneurysms and Vascular Malformations****AS28-006****PREDICTORS OF VASOSPASM RELATED CEREBRAL INFARCTION AFTER SURGICAL TREATMENT OF BLISTER-LIKE ANEURYSMS IN THE NON-BRANCHING SITE OF PARACLINOID INTERNAL CAROTID ARTERY****J.S. Ahn<sup>1</sup>, J.C. Park<sup>1</sup>, W. Park<sup>1</sup> and J.W. Jung<sup>1</sup>**<sup>1</sup>Asan Medical Center, Department of Neurosurgery, Seoul, Republic of Korea

**Background and Aims:** Vasospasm (VSP) related ischemic complication is associated with poor outcome in patients with subarachnoid

hemorrhage due to ruptured blister-like aneurysms in the paracclinoid internal carotid artery. The purpose of this study was to investigate the incidence of and factors related to VSP related cerebral infarction (VSP-CI) in patients with surgically treated blister-like aneurysms of the paracclinoid ICA.

**Methods:** Data from 25 consecutive patients with surgically treated blister-like aneurysm in the paracclinoid ICA were reviewed regarding preoperative angiographic findings, surgical method, development of postoperative VSP-CI and the patients' outcome.

**Results:** Of 25 patients, 10 had EC-IC bypass with trapping and 15 underwent clipping surgery. Postoperative VSP was observed in 18 patients (7 in EC-IC bypass with trapping and 12 in clipping groups). Among patients with postoperative VSP, VSP-CI in the ipsilateral side to the ruptured aneurysm was identified in 4 among EC-IC bypass with trapping and 6 in clipping groups. Positive findings of carotid test compression did not affect the occurrence of VSP-CI in the group of EC-IC bypass and trapping. The occurrence of VSP-CI was significantly higher in the group of ipsilateral dominant ACA on the preoperative angiography ( $P = 0.023$ ) with the hazard ratio of 14.14 (95% CI 1.57-127.68).

**Conclusions:** ACA dominance ipsilateral to the ruptured aneurysm can be used as the predictive factor for VSP-CI in both groups of EC-IC bypass with trapping and clipping to cope with postoperative VSP. Therefore, aggressive management of VSP could be necessary for the patients with ACA dominance in the ipsilateral side to the ruptured aneurysm.

Trial registration number: N/A

**SAH, Aneurysms and Vascular Malformations****AS28-044****CONCOMITANT AORTIC AND MIDDLE CEREBRAL ARTERY ANEURYSM: TREATMENT STRATEGY AND LITERATURE REVIEW****M. Campello<sup>1</sup>, O. Gervasio<sup>1</sup>, C. Zacccone<sup>1</sup>, R. Devotini<sup>2</sup>, P. Fratto<sup>2</sup>; neurosurgeons collaborators**<sup>1</sup>Grande Ospedale Metropolitano, Neurosurgery, Reggio Calabria, Italy;<sup>2</sup>Grande Ospedale Metropolitano, Heart Surgery, Reggio Calabria, Italy

**Background and Aims:** The prevalence of associated intracranial aneurysms (IAs) in patients with aortic aneurysms (AAs) is high, with a global prevalence of 11.8%, about 4 times higher than that in the general population. A potential explanation for the concomitant presence is that aorta and the intracranial arteries originate from the neural crest cells and a neurocristopathy could explain the susceptibility for both AA and IA. Nonetheless, a standardized priority of treatment in this concomitant pathology is not yet established.

**Methods:** Among seven patients harboring brain vascular malformations and cardiovascular pathologies, we analyse here two cases with middle cerebral arteries (MCA) aneurysms and thoracic AAs with need for valve replacement. Features involved in decision-making process were: size and site of the cerebral aneurysm, length and complexity of cardiac surgery, need for prolonged antiplatelet or anticoagulant therapies after cardiac surgery, overall patients performances. Both times we choose a "brain first" policy and clipping for MCA aneurysms was the preferred option.

**Results:** Both patients were treated successfully; we obtained a complete aneurysms exclusion through a pterional craniotomy; after a couple of weeks cardiac surgeons made their own procedures; at 6 and 3 months follow-up patients are doing well without neurological problems and stable cardiac performances.

**Conclusions:** These preliminary data seem orientate surgeons to resolve the intracranial condition first. This choice appears preferable than the opposite ("heart first") to guarantee a safe two-step treatment. Finally, the role of IA screening in patients with AAs is of major concern, especially in presurgical planning period.

Trial registration number: N/A

## **SAH, Aneurysms and Vascular Malformations**

### **AS28-003**

#### **TREATMENT OF CAROTID-CAVERNOUS FISTULA PRESENTING WITH CONTRALATERAL EXOPHTHALMOS ; SEVERAL EXPERIENCES OF GRAFT STENT**

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**Background and Aims:** Sporadic treatment of CCFs with graft stent is recently proving an excellent result not only in treatment of fistula but also preserving patency of parent artery. In this study, we experienced CCF of patient with contralateral exophthalmos in addition to 5 CCF with ipsilateral symptoms treated by graft stent.

**Methods:** A 64-year old female presenting with Lt decreased vision and exophthalmos was found with Rt CCF. In addition, we experienced 6 CCFs underwent graft stent alone during 4 years. Two were direct and 4 indirect with diplopia or exophthalmos. All patients had periodic clinical follow-up (0–29 months) and angiographic follow-up (0–15 months).

**Results:** Covered stent placement was successful in all 6 patients. Immediate complete exclusion was achieved in 3 and near complete with small endo-leak observed in 3. ICA patency was preserved in all. Symptoms regressed within 14 days in all without thromboembolic events. Follow-up angiography showed complete exclusion in all near complete with previous small endo-leak. However, one with complete immediately recur the filling during follow-up. This patient treated with re-dilation of the stent using balloon. Final follow-up angiography showed complete exclusion of all CCFs and revealed good stent patency without intra-stent stenosis.

**Conclusions:** Graft-stents should be considered as an alternative option of treating CCFs and preserving the parent artery especially for fistula that cannot be successfully occluded with detachable balloons or coils. Although a larger sample and expanded follow-up are needed, our series shows that covered stents can be used in the treatment of CCFs with symptomatic relief as experience.

**Trial registration number:** NA

### **AS28-013**

#### **INTRACRANIAL DURAL ARTERIOVENOUS FISTULAS. EXPERIENCE AT OUR CENTER**

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**Background and Aims:** Dural arteriovenous fistulas (DAVF) are a rare type of vascular malformation consisting of pathological shunts between dural arteries and veins or venous sinuses. Clinical presentation and severity depend on drainage type and location.

**Methods:** We performed a retrospective, descriptive study including patients admitted to our center throughout 10 years. DAVF were classified using Cognard scale. Epidemiology, location, drainage, clinical presentation, treatment and prognosis were analyzed.

**Results:** 34 patients were diagnosed with DAVF during this period. Median age was 61 years old and most of them were male (73.5%). Etiology was unknown in 23 patients (67.6%). Clinical presentation was severe (hemorrhage, seizures, focal deficit) in 24 patients (70.7%), the remaining patients had minor symptoms as thrill or headache or were asymptomatic. 6 patients (17.6%) first contact was as a stroke code. 23 of

the 24 patients presenting with severe symptoms were Cognard >/= IIb. 24 patients (70.6%) received treatment, surgical in 16 (66.7%). Complete obliteration of DAVF was achieved in 17 (70.8%). After discharge, 7 patients (20.6%) presented mRankin >2, all of them had severe clinical presentation and Cognard >/= IIb.

**Conclusions:** Worse prognosis was seen in patients who have direct cortical venous drainage and/or aggressive clinical presentation. Surgical treatment was the most frequently used in our centre, achieving good results in a majority of patients.

**Trial registration number:** N/A

### **WITHDRAWN**

### **AS28-001**

#### **SAFETY AND CLINICAL OUTCOME OF GOOD-GRADE ANEURYSMAL SUBARACHNOID HEMORRHAGE IN NON-INTENSIVE CARE UNITS**

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**Background and Aims:** Patients with good-grade aneurysmal subarachnoid hemorrhage (aSAH) defined as Hunt and Hess I-II achieve favorable outcomes. The early recognition and rapid intervention of complications justify the recommendation for intensive care unit (ICU) admission. The objective of this study is to compare the safety and clinical outcome of good-grade aSAH admitted in ICU and non-ICU.

**Methods:** We reviewed 242 records of patients with good-grade aSAH admitted in our hospital over the past five years. Three classifications were used for analyses based on the duration of admission: Group A (ICU days>non-ICU), Group B (non-ICU days>ICU days) and Group C (non-ICU only). Primary outcome measures were mortality and functional outcome at discharge. Secondary outcome measures included complication rates and total length of hospital stay. The medical and surgical interventions were also compared.

**Results:** There were no significant differences in the mortality rate, functional outcome and medical and surgical interventions between three groups. Delayed cerebral ischemia and nosocomial infections were significantly higher in the ICU compared to the non-ICU (91.67% vs.8.33%, p < 0.001 and 76.47%vs.23.53%, p < 0.001, respectively). On the other hand, rebleeding was significantly higher in the non-ICU (75%, p = 0.02). Patients who developed complications had a significantly longer total hospital stay compared to those who did not develop complications across all three groups (p < 0.05).

**Conclusions:** Admission of good-grade aSAH in a non-ICU maybe safe and may decrease the likelihood of developing nosocomial infection. Rebleeding is more frequent in the non-ICU. The development of complications is a predictor of unfavorable outcome and mortality, and is consequently associated with longer hospital stay.

Trial registration number: N/A

## AS28-023

### LONG-TERM OUTCOME AFTER MULTIPLE ANEURISMAL SUBARACHNOID HEMORRHAGE

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**Background and Aims:** The aim of our study was to describe long-term outcome after aneurismal subarachnoid hemorrhage (aSAH) according to the presence of multiple aneurysms (MA).

**Methods:** Prospective observational registry of patients admitted to our tertiary stroke center from to January 2005 to January 2017 with diagnostic SAH and followed to June 2018. Poor outcome was defined as punctuation in modified Rankin scale $\geq 2$ . Kaplan-Meier curve and Multivariable COX analysis were performed in order to determine if the presence of MA was associated with outcome. We also analyzed age, sex, hypertension, initial Glasgow and Fisher scale.

**Results:** Of a total of 398 patients with SAH we exclude 77 due to no aneurysm detection and 2 due to lost follow-up after hospital discharge. Finally 319 patients with a mean follow-up of  $40.9 \pm 40.5$  months were included in the analysis. MA was detected in 80 patients (25.1%). In Univariate analysis only sex was associated with MA (female 30.1% vs. male 15.9%, p = 0.05). Poor outcome was registered in 138 patients (43.3%). Of them 32/80 (40%) had MA compared with 106/239 (44.4%)

with a single aneurysm; p = 0.473. Variables associated with poor outcome in Multivariable Cox regression analysis were age and initial Glasgow while MA was not associated [HR:0.86(95% CI:0.571.29)]. Further subgroup analyses regarding sex or categorized Initial Glasgow (< 7.8-13,>13) did not show any association between outcome and MA.

**Conclusions:** MA was detected in 25% of patients with aSAH, with a higher incidence in women. MA detection did not have prognostic implications.

Trial registration number: N/A

## AS28-029

### IMPACT OF A MULTIDISCIPLINARY PROTOCOL FOR THE ACUTE MANAGEMENT OF SPONTANEOUS SAH

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**Background and Aims:** Spontaneous subarachnoid haemorrhage (sSAH) is one of the least common but more devastating stroke subtypes. Part of its mortality and morbidity lies on the associated complications (rebleeding, vasospasm and hydrocephalus). The aim of this study is to evaluate the impact of a multidisciplinary protocol for acute management of sSAH.

**Methods:** Retrospective study of patients admitted with sSAH between march 2012 and march 2018. The protocol was implemented in july 2016; and consisted in early assessment by ICU; followed by stroke unit care in all cases. We compared pre-protocol (Pre\_P) with post-protocol (Post\_P) periods. Main outcome: dichotomized day 90 mRS; secondary outcomes: rates of rebleeding/vasospasm/hydrocephalus; time between emergency room (ER) arrival-first arteriography and death rates.

**Results:** We analyzed 68 cases of sSAH (44Pre\_P and 24 Post\_P). There are no differences in basal clinical or SAH-specific characteristics between groups. At day 90: "mRS 0-2" was 55%vs77% p 0.12. Rebleeding:6.8%vs4.2% p 0.65; vasospasm:13.6%vs12.5% p 0.89; hydrocephalus:29.5%vs37.5% p 0.5. Comparisons of time between ER-arrival and first arteriography (in minutes) were  $2142 \pm 2168$  vs  $1798 \pm 920$  p 0.49. In-hospital mortality: 29%vs 8% p 0.04; 90-day mortality: 29%vs14% p 0.18.

**Conclusions:** Following the successful implementation of a protocol for spontaneous subarachnoid haemorrhage management including stroke unit care, we observed a significant drop in in-hospital mortality as well as trends for a better functional outcome and mortality at 90 days.

Trial registration number: N/A

**AS28-016****EFFECT OF NITRITE ON THE NEURAL ACTIVITY IN THE HEALTHY BRAIN****E. Franko<sup>1</sup>, M. Ezra<sup>1</sup>, D. Crockett<sup>1</sup>, O. Joly<sup>2</sup> and K. Pattinson<sup>1</sup>**<sup>1</sup>University of Oxford, Nuffield Department of Clinical Neurosciences, Oxford, United Kingdom; <sup>2</sup>Brainomix Ltd., Research and Development, Oxford, United Kingdom

**Background and Aims:** Sodium nitrite is a major intravascular storage for nitric oxide. The conversion of nitrite to the active nitric oxide occurs mainly under hypoxic conditions to increase blood flow where it is needed the most. The use of nitrite is, therefore, being evaluated more and more widely to reduce the damage in conditions resulting in cerebral hypoxia, such as cardiac arrest, ischaemic stroke or subarachnoid haemorrhage (SAH). Nitrite increases the brain activity of certain patients with SAH. However, the effects of the nitrite on the brain of healthy individuals who presumably do not have cerebral hypoxia are still unknown. Here we performed a double-blind placebo-controlled crossover study to investigate the effects of nitrite on the healthy brain.

**Methods:** Twenty-one healthy volunteers were recruited into the study. All participants received a continuous infusion of sodium nitrite (0.6mg/kg/h) on one occasion and placebo (sodium chloride) on another occasion. Electroencephalogram (EEG) was recorded before the start and during the infusion. We analysed the difference in the alpha-delta ratio of the EEG power spectrum during the nitrite and placebo infusions.

**Results:** When comparing the alpha-delta ratio during sodium nitrite and placebo infusions, we did not find any significant difference.

**Conclusions:** This lack of change in alpha-delta ratio emphasises the specificity of the brain's response to nitrite after SAH. This difference could be because the sodium nitrite is converted to vasoactive nitric oxide in areas of hypoxia, and in the healthy brain there is no significant amount of conversion due to lack of hypoxia.

**Trial registration number:** N/A

**AS28-015****ANEURYSNECTOMY AND END TO END ANASTOMOSIS FOR THE GIANT INTERNAL CAROTID ARTERY ANEURYSM AT NECK: TWO CASES REPORTS AND REVIEW OF LITERATURES****K. Furuta<sup>1</sup>, K. sugi<sup>1</sup>, A. hashimoto<sup>1</sup>, J. kikuchi<sup>1</sup>, N. tetsuya<sup>1</sup>, M. yoshitomi<sup>1</sup>, T. aoki<sup>1</sup>, Y. sugita<sup>2</sup> and M. morioka<sup>1</sup>**<sup>1</sup>Kurume University Hospital, Neurosurgery, Kurume, Japan; <sup>2</sup>Kurume University Hospital, Pathology, Kurume, Japan

**Background and Aims:** Extracranial carotid artery aneurysm is rare but the aneurysm often caused the cervical mass effect or the cerebral embolism. Although the symptomatic aneurysm needs surgical intervention, the surgical strategy is debatable.

**Methods:** Case1, 70-years-old woman complaining of left cervical mass. She was diagnosed as a left internal carotid artery (ICA) aneurysm at the neck. After the following up during 2years, the size of aneurysm gradually increased to 38mm and dysphagia appeared. For the lesion we performed subtotal aneurysmectomy and end-to-end anastomosis of ICA.

Case2 was 38-years-old woman with pharyngeal pain from an extracranial left carotid artery saccular aneurysm. The lesion gradually increased to 32mm, and furthermore, it included the intramural thrombus. Then the aneurysmectomy and end-to-end anastomosis of ICA was performed.

**Results:** In both cases, postoperative courses were good and there were no residual lesions. Pathological findings revealed arteriosclerotic aneurysms.

**Conclusions:** Considering the surgical strategy for extracranial carotid artery aneurysms, various methods such as proximal ligation, combined

EC-IC bypass have been reported, but the prognosis was not so good. Recently, the endovascular therapy is reported but mass effect might remain and the long-term outcome is unclear. While this treatment strategy is possible only for limited patients and has a risk of IC occlusion, we consider it is the best treatment for this type aneurysm; because of complete prevention of aneurysm occurrence and removal of these effects. Now, we report 2 cases of ICA aneurysm at the neck and review of the literatures.

**Trial registration number:** N/A

**AS28-033****USE OF "WEB SL" DEVICE IN THE TREATMENT OF INTRACRANIAL ANEURYSM EMBOLIZATION: A MONOCENTRIC EXPERIENCE****G. Guzzardi<sup>1</sup>, B. Del Sette<sup>1</sup>, C. Stanca<sup>1</sup>, A. Paladini<sup>1</sup>, S. Tettoni<sup>1</sup>, A. Galbiati<sup>1</sup>, M. Spinetta<sup>1</sup>, M. Cernigliaro<sup>1</sup>, A. Carriero<sup>1</sup> and A. Stecco<sup>1</sup>**<sup>1</sup>Ospedale Maggiore della Carità, Radiology and Interventional Radiology, Novara, Italy

**Background and Aims:** Aim of our study was to retrospectively evaluate all patients treated for intracranial aneurysms with intrasaccular disruptor device "WEB SL".

We reported clinical and radiological follow-up up to one year from treatment.

**Methods:** We retrospectively evaluated 17 patients, treated with "WEB-SL" device for intracranial aneurysm embolization.

Fourteen patients were treated in emergency settings due to subarachnoid haemorrhage.

All patients were evaluated pre-operatively with CT and CTA to analyze the dome-neck ratio and feasibility of the endovascular procedure.

Exclusion criteria were a dome-neck ratio >1.6 or aneurysm size >1 cm. Radiological follow-up was performed with DSA or CTA at 3, 6 and 12 months.

Primary outcome was angiographic aneurysm obliteration.

Secondary outcomes were early re-bleedings, complications and patient outcome (death and modified Rankin Scale).

**Results:** Out of 17 treated patients, no failure of deployment were witnessed.

We registered only one procedural complication due to distal embolization during catheterization which caused persistent disability at discharge (mRS: 4).

Complete exlusion was witnessed in 59% of the patients while 30% of the patients presented small neck remnant that did not require intervention. Only one patient presented a significant aneurysm remnant at 3 months follow-up which required retreatment.

At clinical follow-up no rebleeding were witnessed; three patients died due to infective complications (mortality: 19%) during intensive care unit stay while one patient developed tetraplegia and was sent to hospice care (mRS: 5).

Overall patient morbidity was 19%.

**Conclusions:** In our small experience treatment appeared to be safe and effective, with low rate of complications and no rebleeding in the short-medium period.

**Trial registration number:** N/A

**AS28-005****EFFICACY OF PREOPERATIVE EMBOLIZATION WITH ONYX FOR INTRACRANIAL AVM SURGERY**

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**Background and Aims:** Preoperative embolization with Onyx for intracranial arteriovenous malformations (AVMs) has been becoming an established treatment. However, the marginal usefulness of the modality were reported. The purpose of this study is to elucidate the efficacy of combined preoperative embolization using Onyx and microsurgical removal of AVMs.

**Methods:** We introduced the Onyx embolization at our institution on May 2014. Patients who underwent combined preoperative embolization and microsurgical removal of AVMs were included in this study. The patients were divided into two groups; pre-Onyx era ( $n=16$ ) and Onyx era ( $n=12$ ), and retrospectively analyzed. The variables analyzed included age, sex, location, Spetzler-Martin (SM) grade, clinical symptoms, operation time, intraoperative bleeding during surgical removal, complications, and obliteration rate.

**Results:** There was no statistically significant difference in patient characteristics including sex, age, location, clinical presentation, and SM grade between two groups. Mean embolization rate were 61.8% in pre-Onyx era group and 42.3% in Onyx era group ( $p=0.037$ ). There was no difference in operation time between two groups (7 hours 37 minutes in pre-Onyx era group and 7 hours 33 minutes in Onyx era group,  $p=0.96$ ). On the other hand, intraoperative bleeding in Onyx era group (178.1ml) was significantly less than that in pre-Onyx era group (421.5ml) ( $p=0.018$ ). Total surgical obliteration was achieved in all cases except for one case of residual nidus in pre-Onyx group. There was no statistically significant difference in postoperative complication rate and surgical outcome between two groups.

**Conclusions:** The preoperative embolization using Onyx may provide a blood-less operative field leading to safe surgery for AVMs.

**Trial registration number:** N/A

**AS28-018****FACTORS CORRELATION WITH CBF, CVR CHANGE AFTER REVASCULARIZATION SURGERY FOR PATIENTS WITH MOYAMOYA DISEASE**

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**Background and Aims:**

**INTRODUCTION:** There are few reports examined the changes in the cerebral circulation after revascularization surgery for Moyamoya disease (MMD) in detail. Changes in cerebral blood flow (CBF) and cerebrovascular reserve (CVR) associated with surgery were examined using <sup>123</sup>I-IMP-SPECT (SPECT).

**Methods:** Fifty cases were performed SPECT including acetazolamide administration among 66 consecutive revascularization surgeries for MMD. Combined revascularization is the basic procedure for operation, but in 5 cases only indirect revascularization was performed. Thirteen males, 37 females, ages 3 to 65 years old (median 16 years old). The duration to the postoperative SPECT which was used for analysis from surgery is 12.8 months on average. Changes in factors such as age,

gender, Suzuki classification, onset pattern, surgical operation type and changes in CBF and CVR in ACA, MCA, PCA area were examined.

**Results:** There was a significant increase in CVR and CBF in the ACA and MCA area postoperatively. Both showed the greatest effect in the front area of the MCA, increasing by 17.1% and 239.8%, respectively. There was no difference in CBF increase in patients under the age of 18 years and adults, but the CVR increased in the ACA and MCA areas of adults significantly. The increase in CVR was significantly higher in cases where double bypass was performed compared to the case with indirect revascularization alone.

**Conclusions:** Changes in postoperative cerebral circulation are related to age, onset pattern, surgical procedure. Combined revascularization procedure is effective for improving the cerebral circulation, especially in the front area of MCA.

**Trial registration number:** N/A

**AS28-010****THE NATURAL COURSE OF CEREBROSPINAL FLUID PARAMETERS  $\leq 20$  DAYS AFTER ANEURYSMAL SUBARACHNOID HEMORRHAGE**

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**Background and Aims:** The natural course of cerebrospinal fluid (CSF) parameters after aneurysmal subarachnoid hemorrhage (aSAH) is unclear. As a result, it can be difficult to distinguish between an inflammatory CSF response after aSAH and a nosocomial bacterial meningitis in patients with external CSF drainage. We investigated CSF erythrocyte/leukocyte ratio and glucose- and protein concentrations  $\leq 20$  days after aSAH in patients without bacterial meningitis.

**Methods:** Patients with aSAH admitted between 2010 and 2017 with at least one CSF sample  $\leq 20$  days after ictus were included from a prospectively collected database. CSF samples were excluded if the patient used antibiotics or if the CSF culture was positive. We calculated estimated marginal means with 95% confidence intervals (CIs) with linear mixed models for CSF cell counts, glucose- and protein concentrations.

**Results:** We included 209 patients with 306 CSF samples. Leukocyte count did not exceed 274 (95% CI:204-368)  $10^6/L$ , the nadir of the erythrocyte/leukocyte ratio was 119 (95% CI:76-185) on day 14. Glucose concentrations remained within the normal range. The protein concentration decreased from 3.4 g/L (95% CI:2.6-4.3) on day 0 to 0.9 g/L (95% CI:0.8-1.1) on day 14.

**Conclusions:** Basic CSF parameters in aSAH patients without a meningitis show a clear inflammatory response in the CSF. CSF results beyond the limits we found may indicate a nosocomial bacterial meningitis in aSAH patients with an external CSF drain.

**Trial registration number:** N/A

**AS28-021****PRE-ECLAMPSIA IN PATIENTS WITH SACULAR INTRACRANIAL ANEURYSM DISEASE**

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**Background and Aims:** Pre-eclampsia is an extensive cause of maternal mortality globally. It is a hypertensive disease, with multisystem involvement complicating 2–8% of pregnancies. Furthermore, pre-eclampsia is an acknowledged risk factor for stroke during pregnancy and later in life. We studied the prevalence of pre-eclampsia and other hypertensive disorders during pregnancy in a defined population of patients with saccular intracranial aneurysms (sIAs).

**Methods:** We included 74 unruptured and 98 ruptured sIA patients first admitted to Neurosurgery of Kuopio University Hospital from 1980 to 2015 that had given birth for the first time 1990 or later. Their clinical data was fused with prescription drug usage, hospital diagnoses and causes of death from nationwide registries. Medical records of all 172 patients were screened to confirm or exclude hypertensive disorders during pregnancy. Population controls, 3 for each patient, were matched by age, sex, and birthplace. The controls that had given birth (n=367) were included.

**Results:** Among the 172 sIA patients, 22 (13%) had pre-eclampsia and 32 (19%) had other hypertensive disorder during pregnancy. In 367 matched controls the prevalence of pre-eclampsia was 4.9% (n=18). sIA patients with pre-eclampsia had more frequently an irregularly shaped aneurysm ( $p = 0.003$ ).

**Conclusions:** 13% of sIA patients had pre-eclampsia compared to only 4.9% of matched controls. Irregularly shaped aneurysms were more frequent in sIA patients with pre-eclampsia than in general sIA population. In clinical practice, history of pre-eclampsia may indicate an elevated risk for sIA disease, and be an additional risk factor for growth or rupture of diagnosed sIAs.

**Trial registration number:** N/A

## AS28-019

### INDIVIDUAL HYPOTHERMIC TARGETED TEMPERATURE MANAGEMENT (TTM) IN SEVERE SUBARACHNOID HEMORRHAGE LEADS TO FAVORABLE OUTCOME – RESULTS OF A CASE SERIES

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#### Background and Aims:

**Background:** Severe subarachnoid hemorrhage (SAH) is frequently complicated by vasospasm, delayed cerebral ischemia (DCI) and increased intracranial pressure (ICP). So far there is no evidence based therapy. We use an individual hypothermic targeted temperature management for severe vasospasms to avoid DCI and increased ICP.

**Methods:** Nine Patients with severe aneurysmatic SAH (Fisher III) were treated by TTM if they developed recurrent ICP-crisis and/or severe vasospasm diagnosed by transcranial duplex sonography and angiography. Once these complications were detected, body core temperature (BCT) was rapidly decreased to 35°C or 33°C by surface cooling. Hypothermia < 36°C was sustained for 116 – 318 hours (< 35°C 185 +/- 13h, < 34°C 122 +/- 21h, ≥ 33°C 88 +/- 72h). Rewarming was performed gradually by 1°C if surrogate parameters for macrovascular

vasospasm and ICP were regular. In case of worsening BCT was decreased again to the last effective level.

**Results:** By hypothermic TTM ICP could be normalized and intracerebral stream velocities of MCA could be reduced. 6 patients showed a mRS ≤ 2 at discharge to rehabilitation and improved to 0 – 1 in follow-up examinations. Only 3 patients showed DCIs being associated with severe disabilities. These patients died due to septic shock with therapy limitation or brain edema in the course. Nine patients developed an infection during treatment.

**Conclusions:** In a large proportion of our patients our TTM strategy improved surrogate parameters for vasospasms and normalized intracranial pressure. Therefore it led to a favorable outcome and should be investigated further in a controlled randomized trial.

**Trial registration number:** N/A

## AS28-028

### MACHINE LEARNING TO PREDICT SUBARACHNOID HEMORRHAGE OUTCOMES

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**Background and Aims:** Patients suffering from subarachnoid hemorrhage (SAH) have poor long-term outcomes. There are predictive models for ischemic and hemorrhagic stroke. However, there is paucity of models for SAH. Machine learning concepts were applied to build multi-stage Neural Networks (NN) and Support Vector Machines (SVM) to predict SAH outcomes.

**Methods:** A database of 792 aneurysmal SAH patients from Kasturba Medical College was utilized. Baseline variables of World Federation of Neurosurgeons 5-point scale (WFNS 1–5), age, and presence/absence of hypertension and diabetes were considered in stage 1. Stage 2 included stage 1 variables along with presence/absence of vasospasm and ischemia. Stage 3 includes earlier 2 stages and discharge Glasgow Outcome Scale (GOS 1–5). GOS at 3mo was predicted using NN/SVM models on the five point categorical scale as well as dichotomized to dead/alive and favorable (GOS 4–5) or unfavorable (GOS 1–3). Prediction accuracy of models was compared to the recorded GOS.

**Results:** Prediction accuracy shown as percentages (Table) are higher in SVM compared to NN for all three stages considered. Accuracy was remarkably higher with dichotomization compared to the complete five point GOS categorical scale.

Models/ Stage Stages	Stage 1			Stage 2			Stage 3			
	Dichotomized			Dichotomized			Dichotomized			
	Categorical	GOS (1–5)	Fav/ Unfav	Dead/ Alive	GOS (1–5)	Fav/ Unfav	Dead/ Alive	GOS (1–5)	Fav/ Unfav	Dead/ Alive
NN	46	66	91	53	76	91	75	94	96	
SVM	48	67	92	54	78	92	76	95	98	

**Conclusions:** SVM and NN can be used to predict SAH outcomes to a high degree of accuracy. These powerful predictive models can be used to prognosticate and select patients into trials.

**Trial registration number:** N/A

**AS28-022****CORRELATION OF AGE AT TIME OF ANEURYSMAL SUBARACHNOID HEMORRHAGE WITHIN FAMILIES**

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**Background and Aims:** The optimal preventive screening strategy for intracranial aneurysms in first degree relatives (FDRs) of patients with aneurysmal subarachnoid hemorrhage (aSAH) remains unclear. We aimed to evaluate the correlation of age at time of aSAH in FDRs, to assess if age at time of aSAH may be a factor to consider in determining the optimal screening strategy.

**Methods:** In a series of Dutch, Finnish and French families with  $\geq 2$  relatives with aSAH, Intraclass Correlation Coefficients (ICCs) for age at time of aSAH and age differences at time of aSAH between FDRs were calculated. We performed subanalyses on siblings only and on Dutch and French families as different patient characteristics are reported for the Finnish.

**Results:** We included 146 families in total (87 Dutch, 43 Finnish and 16 French) with 319 FDRs with aSAH. The ICC of age at time of aSAH was 0.21 ( $p < 0.001$ ). The correlation slightly increased to 0.34 ( $p < 0.001$ ) when analyzing siblings only. On analyzing the Dutch and French families only the ICC remained comparable (0.29,  $p < 0.001$ ). An age difference at time of aSAH of 20 years or less was observed in 84% of all FDRs, in 86% of siblings, and in 86% of FDRs of the Dutch and French families.

**Conclusions:** Our study shows a poor correlation of age at time of aSAH within families. We did not find evidence that age at time of aSAH is a contributing factor in determining the optimal screening strategy for intracranial aneurysms.

Trial registration number: N/A

**AS28-007****FOCALLY STRONG ENHANCEMENT OF ANEURYSM WALL ON MRI INDICATES INTRALUMINAL THROMBUS AND THE RUPTURE SITE**

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**Background and Aims:** Aneurysm wall enhancement (AWE) in vessel wall imaging (VVI) of intracranial aneurysms could be informative to identify ruptured one with high sensitivity and specificity. However, the precise mechanism of AWE in ruptured intracranial aneurysms on VVI remains unclear. The purpose of this study was to investigate correlation between VVI findings and clinicopathological features in ruptured intracranial aneurysms.

**Methods:** Thirteen patients were evaluated by MR-VVI before microsurgical clipping and a total of 4 aneurysms were available for histopathological examinations. The ratio of intensity of AWE to the pituitary stalk (AWE ratio) was calculated. We defined AWE ratio above 0.7 as strong AWE and explored correlations between AWE & intraoperative findings and histopathological aneurysm wall architecture to clarify the structures that were actually enhanced.

**Results:** AWE was identified in 10 of 13 ruptured aneurysms. Among these 10 aneurysms, AWE was focally strong in 5, focally strong with circumferential in 2 and circumferential in 3. Focally strong AWE showed higher AWE ratio than circumferential one (0.91 versus 0.43;  $p < 0.005$ ). Intraoperative findings confirmed rupture points consistent with focally strong AWE sites. Histopathological studies revealed that focally strong AWE was associated with fresh intraluminal thrombus at the rupture site, whereas circumferential AWE suggested wall thickening with abundant neovascularization and inflammatory cells.

**Conclusions:** Two different AWE patterns of focal and circumferential were observed in ruptured intracranial aneurysms. Focally strong AWE could suggest the rupture site of the wall and be helpful for our anatomical comprehension before microsurgical clipping.

Trial registration number: N/A

**AS28-012****CLINICOPATHOLOGICAL INSIGHTS FROM VESSEL WALL IMAGING OF UNRUPTURED INTRACRANIAL**

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**Background and Aims:** It remains a challenge to predict unruptured intracranial aneurysms (UIAs) that are prone to rupture. Vessel wall imaging (VVI) is a current topic whether it might predict unstable aneurysms. We investigated the correlations between VVI findings and morphological aneurysm factors with exploring histopathologic aneurysm wall architectures.

**Methods:** A total of 125 UIAs were investigated by VVI and visualization of the aneurysm wall enhancement (AWE) was evaluated. Univariate analysis was performed to assess the correlation between VVI findings and the PHASES score (calculating patient demographics and aneurysm morphologic risk factors). A total of 12 UIAs were available for histopathological examination.

**Results:** In UIAs, AWE was identified in 43 of 125 UIAs (34.4%). Aneurysmal maximum diameter ( $7.6 \pm 0.7$  versus  $4.5 \pm 0.2$ ,  $p < 0.001$ ), irregular shape (79% versus 34%,  $p < 0.001$ ) and the PHASES score ( $9.1 \pm 0.7$  versus  $6.0 \pm 0.3$ ,  $p = 0.03$ ) were significantly associated with AWE. Histopathological studies revealed that wall thickening accompanied by atherosclerosis, neovascularization, and macrophage infiltration corresponded to AWE. The thicker wall was characterized by loss of mural cells and mucinous degeneration as well. Among 64 UIAs with serial follow-up, aneurysm growth with daughter sac formation was significantly associated with AWE ( $p < 0.05$ ).

**Conclusions:** In the present study, one-third of UIAs showed AWE and might not provide informative rupture risk estimation beyond the PHASES score at this moment. However, VVI of intracranial aneurysms can detect what is going on in the aneurysm wall.

Trial registration number: N/A

**AS28-032****TIME TO INTERVENTION OF ANEURYSMAL SUBARACHNOID HAEMORRHAGE CASES IN A RETROSPECTIVE POPULATION-BASED COHORT**

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**Background and Aims:** Little known about the time to treatment or patient pathways from onset of symptoms of aSAH to intervention following an aSAH. This lack of knowledge may be contributing to less than optimal care for people with aSAH.

**Methods:** A statewide retrospective cohort study of confirmed or probable aSAH was undertaken within Tasmania (population ~500,000), Australia from 2010–2014. Data were collected from administrative records, medical records and the death registry. We calculated the median (IQR) times from symptom onset to intervention and the proportion of time spent pre-hospital, before diagnosis and to intervention for directly admissions and transfers to the neurosurgical centre.

**Results:** From a cohort of 205 aSAH admissions, n = 175 (85.4%) received endovascular or neurosurgical treatment and n = 101 (81.5%). Of the 124 regional admissions, 101 experienced an inter-hospital transfer to the statewide neurosurgical centre. The median (IQR) time to treatment was 17.17 (IQR 7.82, 24.47) hours for direct admissions and 24.52 (IQR 18.40, 40.29) hours for transfers ( $p < 0.05$ ). Pre-hospital time was similar for direct admissions and transfers while transfers spent 28% of their time being transferred.

**Conclusions:** The time to intervention was negatively influenced by inter-hospital transfers, which are necessary in a large proportion of people with aSAH due to their need for specialized treatment and management. Efforts to improve workflow in aSAH, including through regional clinical pathways, should be explored.

**Trial registration number:** N/A

## AS28-042

### CLINICAL OUTCOME OF RUPTURED ANTERIOR CHOROIDAL ARTERY ANEURYSMS AFTER FLOW DIVERTER TREATMENT

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**Background and Aims:** Anterior choroidal artery (AchoA) aneurysms account for 2%–5% of all intracranial aneurysms. The importance of the AchoA is related to its supply of crucial anatomic structures, such as the internal capsule. Although it is easy to reach surgically, the mortality rate and the treatment-related permanent morbidity rate of surgical clipping of AchoA aneurysms range from 6% to 33% and 10% to 28.6%, respectively.

Flow diversion (FD) treatment is an alternative method of embolization of aneurysm alternative to clipping or coiling.

**Methods:** In the period of 2016–2018, twenty two patients (13 women and 9 men) with FD-treated aneurysms were included in this study. Mean patient age was 47. Aneurysm sizes ranged from 3 to 15 mm. 8 aneurysms were unruptured; 14 were ruptured. The mean clinical follow-up time was 12 months.

**Results:** In the results, 1 patient has treatment-related complications, transient AchoA flow insufficiency was occurred. Two recurrences were found in the first year of follow-up, and re-treatment.

**Conclusions:** Our study demonstrated that treatment of anterior choroidal artery aneurysms with the FD is effective and reliable treatment method.

**Trial registration number:**

## AS28-040

### THE INFLUENCE OF INCREASED DETECTION AND TREATMENT OF UNRUPTURED INTRACRANIAL ANEURYSMS ON THE INCIDENCE OF SUBARACHNOID HEMORRHAGE; STUDY BASED ON THE NATIONAL HEALTH INSURANCE DATABASE

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**Background and Aims:** Although the diagnosis and treatment of unruptured intracranial aneurysms (UIA) are increasing, little is known about its effect on the incidence of subarachnoid hemorrhage (SAH). We performed this study to evaluate whether the increasing application of preventive treatment for UIA is associated with reducing the incidence of SAH or not.

**Methods:** The incidence of UIA and SAH was estimated in serial cross-sectional design using the database of the Korean National Health Insurance Service (KNHIS) and claim information from 2005 to 2015. Annual percent change (APC) and parallelism tests were estimated. We also evaluated whether any shift in treatment modality for UIA and SAH during study period.

**Results:** The incidence of UIA increased from 6.1 per 100000 of the general population in 2005 to 28.3 in 2015. In contrast, the incidence of SAH decreased gradually over the study period (from 20.0/100 000 to 13.7/100 000) and the APC of SAH incidence was  $-3.93\%$  (95% CI  $-4.2$  to  $-3.7$ ). In the UIA group, the proportion of the treated patients by coiling or clipping increased to a peak of 38.4% in 2011 (35.1% in 2005) and then decreased to 34.8% in 2015. Whereas in the SAH group, percentages treated increased steadily. The proportion of patients treated by coiling increased with time (from 48% to 62% in UIA group, from 23% to 58.4% in SAH group).

**Conclusions:** The marked increase in the detection and treatment of UIA might have contributed to the decreasing incidence of SAH, though the level of contribution could not be measured exactly.

**Trial registration number:** N/A

## AS28-014

### USE OF TRANSCRANIAL DOPPLER FOR CEREBRAL VASOSPASM MANAGEMENT AFTER SUBARACHNOID HEMORRHAGE

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**Background and Aims:** The occurrence of stroke & permanent ischemic brain damage from cerebral vasospasm (VSP) continues to be a clinical problem in patients following subarachnoid hemorrhage (SAH). The prompt recognition of this condition depends on accurate diagnosis. Aim is to make early diagnosis of VSP at its onset so as to institute early appropriate treatment to prevent complications.

**Methods:** In our series of 120 patients admitted with SAH due to aneurysm rupture, post traumatic SAH following head injury CT scan & TCD was done in all the patients. TCD was done on DAY 1 of admission & TCD was repeated every day till the patient was discharged from the hospital. Mean flow velocities (MFV), Peak systolic velocities (PSV), End diastolic Velocities (EDV), pulsatility indices (PI) were noted for all the arteries of the base of the brain. Daily fluctuations in the above parameters were noted.

**Results:** we had 83 males & 37 female patients in the age group 24 to 76 years. Nearly 70 % of patients showed evidence of VSP on TCD. Majority of VSP started developing from the 3 rd day post SAH. VSP tended to progress for 4 to 5 days followed by spontaneous regression in 60 % of patients. The remaining patients were treated medically & the spasm regressed in the majority. 5 patients needed intra arterial treatment to reverse the VSP.

**Conclusions:** TCD can detect asymptomatic vasospasm onset. TCD can follow VSP progression & facilitate treatment. TCD can identify patients with severe Vasospasm. It can monitor the effect of therapies & interventions. It can detect VSP resolution

**Trial registration number:** N/A

## AS28-034

### ENDOVASCULAR TREATMENT OF ANGIOGRAPHIC VASOSPASM – A SINGLE-CENTRE STUDY

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**Background and Aims:** One third of patients with aneurysmal subarachnoid haemorrhage (aSAH) develop delayed cerebral ischemia, a multifactorial condition associated with the combination of vasospasm, microthrombosis and cortical spreading depolarization. The only pharmacological agent recommended with high-quality evidence is enteric nimodipine. Endovascular administration of intra-arterial vasodilators is an available option when other therapeutic measures fail.

We describe our experience with two pharmacological agents used in the treatment of angiographic vasospasm: verapamil and milrinone.

**Methods:** Over a three-year period, we identified 22 patients with medically refractory vasospasm due to aSAH. Age, gender, Hunt and Hess and Fisher grades, aneurysm location and treatment, day of vasospasm onset, intra-arterial drugs dosages, recent ischemic areas on CT, and mRS score at last clinical evaluation were collected retrospectively.

**Results:** A total of 49 sessions were performed. Verapamil was the most used drug ( $n = 47$ ; 75%), followed by milrinone ( $n = 9$ ; 14%), and both ( $n = 7$ ; 11%). The average dose of verapamil/session was  $24.47 \pm 16.25$  mg, while of milrinone was  $8.0 \pm 0.0$  mg. After all sessions most patients had total resolution of stenosis ( $n = 16$ ; 73%), while 6 remained with residual stenosis ( $n = 6$ ; 27%). There were 10 patients who developed ischemic events on CT. Between 1 to 24 months after discharge, most patients ( $n = 18$ ; 86%) had a mRS score  $\leq 2$ .

**Conclusions:** Endovascular administration of verapamil and/or milrinone on patients with medically refractory vasospasm led to an almost immediate angiographic response and mostly good functional outcomes (mRS  $\leq 2$ ).

**Trial registration number:** N/A

## AS28-027

### CLINICAL AND EPIDEMIOLOGICAL CHARACTERISTICS OF PATIENTS WITH DELAYED CEREBRAL ISCHEMIA (DCI) AFTER ANEURYSMAL SUBARACHNOID HEMORRHAGE (SAH) IN A MULTIETHNIC POPULATION

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**Background and Aims:** SAH may be a devastating condition. DCI is defined as the occurrence of new focal deficits or a decrease in level of

consciousness (LOC) that lasts for at least one hour. 30% of SAH patients develop DCI, leading to a worse prognosis. The clinical and epidemiological profile and treatment response of DCI patients are not well described in literature.

**Methods:** We evaluated consecutive patients admitted to a high volume center in Brazil who developed DCI after SAH, from June 2016 to June 2018.

**Results:** 21 patients developed 27 episodes of DCI. There was a total of 85.7% of females, with a mean age of 50.41 years old ( $\pm 12.52$ ). Hypertension (61.9%) and tobacco (42.8%) were the main risk factors. A total of 77.8% had a low grade clinical SAH (WFNS 1–3), however, 81.5% had modified Fisher Scale of 3–4. DCI happened within  $11.59 \pm 3.4$  days of the bleeding, with its main manifestations being decreased LOC (70.4%), followed by hemiparesis (59.3%). In 22.2% it was only detected by transcranial Doppler or CT perfusion. 12 DCI episodes were treated with norepinephrine and 15 with milrinone. NIHSS significantly dropped post treatment (13 to 9,  $p < 0.01$ ). Therapy was maintained for 86.89 hours ( $\pm 80.33$ ). 44.4% and 62.5% of the patients had a modified Rankin scale  $\leq 2$  at discharge and 3 months, respectively.

**Conclusions:** If properly treated patients with SAH and DCI can have good outcomes. Knowing the clinical profile of DCI patients is of utmost importance for designing clinical trials that incorporates new SAH concepts.

**Trial registration number:** N/A

## AS28-035

### THE VASOGRADE SCALE IS ASSOCIATED WITH FUNCTIONAL OUTCOMES AFTER ANEURYSMAL SUBARACHNOID HEMORRHAGE

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**Background and Aims:** The VASOGRADE is a simple grading scale, which combines the modified Fisher (mFisher) and the World Federation of Neurosurgeons scores (WFNS), and allows risk stratification of delayed cerebral ischemia (DCI) after aneurysmal subarachnoid hemorrhage (aSAH). The relationship between the VASOGRADE scores and functional outcomes after aSAH is not well established.

**Methods:** We retrospectively evaluated patients admitted with aSAH to a tertiary center in Brazil from November 2015 to January 2018. All patients were classified according to the severity of the clinical presentation and amount of blood seen at the initial CT scan using the WFNS scores, the mFisher scale and the VASOGRADE. At discharge, functional outcome was evaluated using the modified Rankin scale.

**Results:** A total of 96 patients (mean age  $51.6 \pm 13.6$ , 73% females) were evaluated. The WFNS scores distribution was (1: 50%, 2: 27.1%, 3: 2.1%, 4: 7.3% and 5: 13.5%). Most patients had a mFisher of 2 (25%) or 3 (36.5%) and a VASOGRADE yellow or red (57.1%). Patients with worse VASOGRADE scores had a higher frequency of pneumonia (Green: 5.6%, Yellow: 21.2%, Red: 36.8%  $p = 0.01$ ) and infarction caused by DCI (Green: 2.8% Yellow 15.2%, Red: 31.6%,  $p = 0.01$ ). A change from either green to yellow or yellow to red was associated with an odds ratio of 12.8 [95% CI 4.5–36.1] of poor functional outcome (mRankin  $> 2$ ).

**Conclusions:** VASOGRADE is a simple score and can predict not only the risk of DCI but also functional outcomes at discharge after aSAH. The performance of VASOGRADE to predict functional outcomes deserves further investigation.

**Trial registration number:** N/A

**AS28-024****TRENDS IN LENGTH AND COST OF STAY OF UNRUPTURED INTRACRANIAL ANEURYSMS TREATED BY SURGICALLY CLIPPING OR ENDOVASCULAR COILING FROM 2010–2014**

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**Background and Aims:** Detection of unruptured intracranial aneurysms (UIA) has increased in recent years due to the availability of non-invasive imaging. Here, we evaluated recent trends in the length and cost of stay of UIAs patients from the National Inpatient Database who underwent treatment with coiling or clipping.

**Methods:** The National Inpatient Sample database was analyzed for patients with a primary diagnosis of UIA (ICD9 437.3) admitted for elective or non-elective endovascular coiling or surgical clipping between 2010 and 2014. Patients with a primary diagnosis of subarachnoid hemorrhage, trauma, cerebral arteritis, had cerebral angiography only, or did not have a documented procedure day were excluded from the study. Mean length of stay and cost of stay (inclusive of procedural costs) were extracted and costs were adjusted for inflation. Data was extracted and analyzed using SAS version 9.4.

**Results:** From 2010 to 2014, a total of 46,268 patients undergoing elective ( $n = 38,654$ ) and non-elective ( $n = 7,614$ ) treatment for UIAs were included in our analysis. There was no significant difference in cost of endovascular or surgical treatment in patients undergoing elective treatment of UIAs. In the non-elective cohort, cost of stay was significantly higher in the surgical group in 2011. Mean length of stay was consistently shorter in the endovascular group. Cost of stay was not correlated to hospital size in our study.

**Conclusions:** There was an overall significant difference in treatment costs between surgical clipped and endovascular coiled UIAs. Length of stay was shorter in patients undergoing endovascular treatment.

**Trial registration number:** N/A

**AS28-038****ENDOVASCULAR TREATMENT OF LIFE THREATENING EPISTAXIS SECONDARY TO INTERNAL CAROTID ARTERY (ICA) PATHOLOGIES— AN INSTITUTIONAL EXPERIENCE**

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**Background and Aims:** Massive epistaxis can occur from internal carotid artery pathologies, especially involving its cavernous segment. Endovascular methods are crucial for their management. We intend to analyse our cases for angiographic features, management and outcome.

**Methods:** We retrospectively analysed clinical and imaging records of 19 patients who presented to our Institution with severe epistaxis and were treated by endovascular means, during 2010 to 2018.

**Results:** All our patients except one were male and were aged between 19 and 72 years. Eleven patients had history of road traffic accident, 6 iatrogenic injury during skull base surgery and 2 had spontaneous rupture of cavernous ICA aneurysms. Eight had associated carotico-cavernous fistula (CCF). All had involvement of cavernous segment of ICA with most of them (13) located at the anterior genu. All were managed endovascularly. Six were managed by coiling of the pseudoaneurysm with

parent vessel preservation, 5 by detachable balloons, 3 by stent graft and one by trans-venous coiling of sac while 3 patients were treated by coiling with parent vessel occlusion. Collateral/ Cross flow study done in all 19 patients showed patent cross flow in 17. None of our patients showed recurrence of symptoms during a mean follow up of 12 months. One patient, treated with detachable balloon showed asymptomatic residual aneurysm, later treated by stent assisted coiling. One patient presented with recurrent epistaxis after 2 weeks due to deflation of balloon, which was then treated with parent artery occlusion.

**Conclusions:** Epistaxis due to cavernous ICA pathologies can be effectively treated by endovascular means.

**Trial registration number:** N/A

**AS28-020****USEFULNESS OF MEASUREMENT OF HAPTOGLOBIN FOR PREDICTION OF CLINICAL OUTCOME OF SUBARACHNOID HEMORRHAGE**

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**Background and Aims:** Haptoglobin (Hp) allele heterogeneity has been implicated in differential reactive oxidant inhibition and inflammation. In recent years, the genotype of Hp has described as a predictor of clinical outcomes in aneurysmal subarachnoid hemorrhage (aSAH), and a common single nucleotide polymorphism (SNP), rs2000999, located in a Hp-related gene is reportedly a strong genetic predictor. We investigated the usefulness of the serum Hp level and rs2000999 genotype as makers for prediction of clinical outcome after aSAH prospectively.

**Methods:** The blood samples of patient with aSAH at day 0, day 4, and day 14 were collected and determine the serum Hp level (mg/dL). Gene analysis of rs2000999 was performed by real time PCR based on the TaqMan-probe method. Patients with aSAH were classified into good and poor outcome by modified rankin scale (mRS) at day 30 (good outcome; <mRS2, poor outcome; >mRS3).

**Results:** In a total of 28 patients (23 female), 10 patients with good outcome (35.7%) showed a tendency of having higher serum Hp levels compared to the patients with poor outcome at Day 0( $p = 0.08$ ). However, considering the outcome of day 4, 14, there was no relationship between serum Hp level and clinical outcome of aSAH. On the other hands, G/A (85.7%) and A/A(50%) genotypes of rs2000999 were likely associated with poor outcome and higher severity than G/G(40%) in aSAH about 5.2 fold.

**Conclusions:** G/G genotype of rs2000999 have possibility to be a predictor for good outcome at aSAH patients. We suggested that the serum Hp level and rs2000999 genotype will be useful as genetic biomarkers for predicting the clinical outcome of aSAH.

**Trial registration number:** N/A

**AS28-008****IMPACT OF EARLY BRAIN INJURY ON THE OUTCOME IN PATIENTS WITH SUBARACHNOID HEMORRHAGE**

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**Background and Aims:** The incidence of delayed cerebral ischemia (DCI) due to major cerebral artery stenosis in patients with subarachnoid

hemorrhage (SAH) decreases along with the development of modern treatment strategies. On the contrary, poor clinical outcome in patients with SAH due to early brain injury (EBI) has been noticed recently. In the present study, we evaluated the impact of EBI on outcome of SAH patients.

**Methods:** Data of 39 patients with SAH due to rupture of saccular aneurysm treated at our institution during the periods of 3.5 years from January 2015 was retrospectively analyzed. Baseline characteristics were compared using  $\chi^2$  test. Multivariate logistic regression analyses were performed to account for patients' characteristics and clinical parameters.

**Results:** In univariate analyses, older age, LOC at ictus, initial WFNS poor grade, radiographic vasospasm, and DCI were associated with poor outcome. Multivariate logistic regression analyses revealed older age ( $p < 0.0001$ ) and LOC at ictus ( $p = 0.0018$ ) were associated with poor outcome.

**Conclusions:** The influence of EBI on outcome in patients with SAH emerges along with the development of modern treatment strategies those prevent vasospasm. Finding out the pathologic clarification of EBI as well as developing new therapeutic strategies to prevent EBI seems to be important in the future.

**Trial registration number:** N/A

## AS28-048

### EARLY IMMUNE CELL CHANGES AFTER SUBARACHNOID HEMORRHAGE: ROLE IN PREDICTING VASCULAR DYSFUNCTION DETECTED BY TRANSCRANIAL DOPPLER ULTRASONOGRAPHY

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**Background and Aims:** Aneurysmal subarachnoid hemorrhage (aSAH) is a devastating neurological injury commonly resulting from the rupture of cerebral aneurysms. Early brain injury (EBI) occurs within the first 48–72h post hemorrhage and is characterized by an intense neuroinflammatory response, microvascular dysfunction, edema, and neurovascular uncoupling. Transcranial Doppler (TCD) ultrasound is routinely used in aSAH to monitor for vascular dysfunction. Pulsatility index (PI), as determined by TCD, correlates with microvascular compliance. In comparison, the Lindegaard ratio (LR), is typically used to estimate the caliber of the middle cerebral artery.

**Methods:** In this study we sought to investigate the relationship between cerebrospinal fluid (CSF) immune cells, peripheral immune cells, and changes in the PI and LR. Subjects were recruited from a tertiary referral center. CSF was obtained only from those patients receiving a ventricular drain, while serum samples were obtained from all patients. Samples were collected daily for 5 days following admission. Linear regression and ANOVA were used to assess correlation between immune cells, PI, and LR.

**Results:** A total of 170 aSAH patients were included in the analysis. Mononuclear cells in the CSF correlated with PI at day 1 ( $R^2 = 0.524$   $p = 0.011$ ) and day 3 ( $R^2 = 0.877$   $p < 0.0001$ ). Total CSF leukocytes on day 3 also showed modest correlation to elevated LR on day 5 ( $R^2 = 0.3683$ ,  $p = 0.0164$ ).

**Conclusions:** Results of this study support the notion that early immune cell changes in the CSF are associated with microvascular compliance. Future studies are necessary to assess the effect of these early changes in outcome.

**Trial registration number:** N/A

## AS28-045

### THE RELATIONSHIP BETWEEN ANGIOARCHITECTURAL CHARACTERISTICS OF BRAIN ARTERIOVENOUS MALFORMATIONS AND SPECIFIC FEATURES OF CLINICAL PRESENTATION

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**Background and Aims:** The persistence of arteriovenous shunting causes changes in cerebral hemodynamics, which lead to chronic headache, cognitive impairment and focal neurological deficit. Understanding of AVM angioarchitectural and hemodynamic features is important to determine treatment strategy. Aim: to investigate the relationship between angioarchitectural characteristics of AVM and specific features of clinical presentation.

**Methods:** From 2014 to 2018, we collected the data of 296 patients with brain AVM-related. Clinical, neuropsychological, angiographic, CT perfusion and MRI examination was done.

**Results:** AVM manifested with hemorrhage in 140 (47%) patients. A multivariate model of logistic regression revealed an independent association of hemorrhage with AVM size less 3 cm (OR 3.15), single feeding artery (OR 2.17), single drainage vein (OR 1.96), drainage into the deep veins (OR 4.49) comorbid aneurysms (OR 4.39). Among the patients patients with non-hemorrhagic course, headache like AVM manifestation was detected in 57% of patients. It associated with occipital region AVM (OR 1.03; 95% -CI 1.00–2.05), with superficial AVM (OR 2.14), with existing of transdural communication (OR 3.46). The formation of cognitive impairment was independently associated with the presence of high-flow shunting (OR 5.11), long pial course of draining vein (OR 1.79), signs of arterial steal (OR 3.84) and hydrocephalus (OR 4.44) and was found in 17%. Manifestation AVM with focal neurological deficit was detected in 26% and associated with deep AVM location (OR 4.16), localization in brainstem (OR 5.62), presence of perifocal gliosis and venous stasis (OR 1.91).

**Conclusions:** The angioarchitectural features of AVM have an important influence on the formation of clinical presentations.

**Trial registration number:** N/A

## WITHDRAWN

**AS28-004****STENTING FOR TREATMENT OF CEREBRAL ANEURYSMS IN ACUTE SUBARACHNOID HEMORRHAGE****G. Wong<sup>1</sup>, S. Yu<sup>1</sup>, J. Zhuang<sup>1</sup> and S. Wong<sup>1</sup>**<sup>1</sup>The Chinese University of Hong Kong, Neurosurgery, Hong Kong, Hong Kong S.A.R**Background and Aims:** The purpose of this study was to report the authors' experiences in stenting for ruptured cerebral aneurysms in the acute period and to evaluate the risks associated.**Methods:** Over a six year period between January 2013 and October 2018, fifty-four patients had stenting with or without coiling for treatment of acutely ruptured cerebral aneurysms that were not amenable to coiling alone. Hospital notes were retrospectively reviewed. All patients had a dose of intravenous abciximab 10mg and heparin 2000unit before stenting and dual antiplatelet loading and daily treatment started after procedure.**Results:** Of the 54 patients, twenty-two (41%) patients were poor grade and had ICP catheter insertion. There was 2(4%) rebleed in two patients with braided stent and partial embolization resulting in mortality. There were 8 infarcts with the first 14 days after subarachnoid hemorrhage, three (6%) were procedure-related (one was associated with in-stent thrombosis, one was associated with rebleed, and four were related to delayed cerebral infarction. There were 3(6%) significant intraventricular hemorrhage and intracerebral hemorrhage, all were related to ICP catheters. There were 2(4%) extracranial complications (cervical vertebral artery dissection: 1, infected femoral hematoma: 1).**Conclusions:** In patients undergoing stenting for acutely ruptured cerebral aneurysms, partial embolization of a major saccular component with rebleeding have high mortality. Procedure-related infarction rate was 6% and significant ICP catheter-related hemorrhage was 6%.**Trial registration number:** N/A**WITHDRAWN****Service Organisation****AS12-071****THE EFFECT OF HOW STAFF ARE DEPLOYED OVERNIGHT ON PERFORMANCE IN THROMBOLYSIS****E. Abdelgadir<sup>1</sup>, S. Weatherby<sup>1</sup>, P. Fisher<sup>2</sup> and M. Wanderi<sup>2</sup>**<sup>1</sup>Plymouth Hospitals NHS Trust, Neurology, Plymouth, United Kingdom;<sup>2</sup>University of Plymouth, Neurology, Plymouth, United Kingdom**Background and Aims:** Previous audit data of thrombolysis identified slower door to needle times at night of 2 hours; over twice as slow as the day.

A delay of 2.5-3 hours means the number of good outcomes is halved (See Fig.1)

Our objectives were:

- To determine whether staffing specialties and numbers had an effect on overnight performance of the unit
- To provide evidence and justification for a more standardized overnight team set-up for stroke units.

**Methods:** •Identified the 'A' and 'D/E' graded stroke units for thrombolysis performance using the Sentinel Stroke National Audit Programme data DEC-MAR 2018.

- Contacted each stroke unit through telephone or e-mail.

- Asked the following questions:

Which member of the team was responsible for assessing potential stroke patients for overnight admissions?  
Was stroke nurse cover available overnight?

Who decides whether a patient should undergo thrombolysis?

**Results:**

- The majority of higher performing units utilize either a specialist stroke, medical or emergency department registrar as the first medical assessor. (See Fig.2)
- All 'A' grade units have a stroke specialist nurse on rota overnight. (See Fig.3)

- Grade 'A' units tend to have an on call consultant as the thrombolysis decision maker. (See Fig.4)
- Grade D/E units tend to utilize Telemedicine as a thrombolysis decision making tool.

**Conclusions:**

- This evidence supports that Stroke specialists delivering the service at the door is associated with better performing units.
- There is a national lack of standardization of how overnight stroke teams are set up.
- Stroke units should assess whether they need to alter their overnight team set up to improve thrombolysis performance.

**Trial registration number:** N/A

## AS12-087

### DEVELOPMENT OF A STROKE CARE NETWORK IN THE HAIL REGION OF SAUDI ARABIA.

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**Background and Aims:** Hail is a region of Saudi Arabia with a low population density and an underdeveloped stroke care service provision, with no stroke unit for the whole region. The aim of this study was to determine the cost-effectiveness of developing a stroke network under a "Hub-and-Spoke" model assisted by telemedicine in Hail to improve ischemic stroke management by increasing patient access to effective treatments.

**Methods:** A decision tree model was used to compare the costs and effectiveness of developing a hub-and-spoke network using telemedicine for 10 consecutive cohorts of patients over a lifetime horizon. The model considers the establishment of one Hub and nine additional Spokes with telstroke, increased access to reperfusion treatments, long-term costs, and societal costs. All costs were based on local data, and clinical outcomes were estimated based on international evidence validated by local experts.

**Results:** The model predicts that developing such a network could lead to 913 more patients receiving reperfusion treatments and 391 achieving functional independence. The implementation of a stroke network yielded a 0.39 QALY gain and additional costs of 66,879,929 Saudi Riyals, resulting in an incremental cost-effectiveness ratio of 38,759 (SR). The probabilistic sensitivity analysis indicates that the stroke network was cost-effective in >90% of the simulations at a willingness-to-pay threshold of 100,000 SR (US\$ 26,667) per QALY.

**Conclusions:** The model suggests that developing a stroke network in Hail is cost-effective. Implementing specialized stroke units and providing access to thrombolytic treatments is effective in improving patient outcomes and overall stroke care in the region.

**Trial registration number:** N/A

## AS12-028

### QUALITY OF ACUTE STROKE CARE IN R. MACEDONIA- DATA ANALYSIS FROM THE RES-Q REGISTRY 2018

**A. Arsovska<sup>1</sup>, M. Bozhinovska<sup>2</sup>, F. Stojkovska<sup>3</sup>, J. Mitrevska-Velkov<sup>1</sup>, E. Lichkova<sup>4</sup>, E. Simeonovska-Joveva<sup>4</sup>, S. Ristevska<sup>5</sup>, A. Doneva<sup>6</sup>, D. Samoilovska-Vojtikiv<sup>7</sup>, A. Grecu<sup>8</sup> and R. Mikulik<sup>8</sup>**

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**Background and Aims:** Since 2017, R. Macedonia has implemented the Angels Initiative and the RES-Q Registry, in order to evaluate and optimize the quality of care of acute stroke patients. The aim was to analyze the current situation regarding acute stroke data in R. Macedonia from the RES-Q Registry and establish measures for improvement.

**Methods:** We collected the data from 949 stroke patients in 5 centers, during the period January-December 2018.

**Results:** Ischemic stroke represented 77,24% of the patients; median age was 69 years, mostly males (55,85%). More than half of the patients (57,85%) were hospitalized in a stroke unit/ICU. NIHSS was performed in 55,33%, CT/MRI was performed in 95,25%, in 67,18% CT/MRI was performed within 1 hour after admission. The rate of recanalization treatment (with intravenous thrombolysis) was low, only 3,96%, and median DTN time was 40 minutes, with 82,76% of the patients treated with door to recanalization therapy < 45 minutes. Hemicraniectomy was not performed at all. Screening for dysphagia was performed in 36,85%. At discharge, 89,69% patients were prescribed antiplatelets without aFib, 76,7% were prescribed anticoagulants with aFib and 60,58% were prescribed statins. Only 35,49% were assessed for rehabilitation and majority of the patients (73,34%) were discharged to home.

**Conclusions:** With the RES-Q registry data, we identified our weakest points (acute stroke treatment, DTN time, dysphagia screening and rehabilitation assessment) of the in-hospital stroke management in R. Macedonia. Our next steps include implementation of stroke care protocols, staff education, creation of stroke network and continuing the data registry and analysis.

**Trial registration number:** N/A

## AS12-051

### TREATMENT OF ISCHEMIC STROKE IN AZERBAIJAN: FIRST ANALYSIS OF ESO-EAST AND RES-Q REGISTRY

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**Background and Aims:** Stroke is the second leading cause of death worldwide. Approximately 82–92% of all strokes are ischemic (IS). The goal of this study is enhancing management of acute IS based on ESO-EAST (Enhancing and Accelerating Stroke Treatment) RES-Q (Registry of Stroke Care Quality) data. The first goal of this study was to measure the current quality of stroke care to define the differences between countries and hospitals in a country level. Azerbaijan is participated in this project from 2017.

**Methods:** We analyzed data collected in RES-Q for March 2018. 101 patients (43.56% men, 56.44% women) from six hospitals were involved to the research during study period. 67 of them (66.34% of all strokes) have experienced IS. The statistical analysis of data was performed centrally.

**Results:** Brain CT/MRI was performed for 98.95% of patients, in 62.77% cases – within a hour after the onset of first symptoms. However, only 4.48% of patients treated with rTPA. Carotid artery imaging was performed for 54.41% of patients. 29.17% of patients had 50–70% stenosis, 5.56% more than 70% stenosis. Antihypertensive treatment was prescribed in 97.78% cases. 73.97% of patients took antiplatelets, 17.81% Vit. K antagonists, 2.74% dabigatran. 71.43% of patients with atrial fibrillation took anticoagulants. Statins were prescribed in 66.67% cases.

**Conclusions:** Considering the fact, that very low percentage of patients was treated with intravenous thrombolysis, despite the early brain imaging was performed should be increased awareness for the management of acute IS. Establishment of stroke units will have a crucial role in acute stroke management in Azerbaijan.

**Trial registration number:** N/A

## AS12-080

### MOTHERSHIP VS-DRIP AND-SHIP MODEL OF MECHANICAL THROMBECTOMY FOR ACUTE ISCHAEMIC STROKE IN ROUTINE CLINICAL SETTING: IS THERE A COST DIFFERENCE?

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**Background and Aims:** Mothership (direct admission to a thrombectomy centre) vs drip-and-ship (initial admission to a non-thrombectomy centre) are alternative, but complimentary models for delivery of mechanical thrombectomy (MT). Data are limited on the cost differences between the two models.

**Aim:** To establish the cost differences between mothership and drip-and-ship models of MT delivery.

**Methods:** A micro-costing approach was utilised with detailed resource-use and unit-costs identified from pre-hospital transportation (PHT) up to 24-hours post-MT, across four UK sites between 2015 and 2018.

**Results:** A total of 225 patients underwent MT; 127 mothership and 98 drip-and-ship. The mean 24-hour costs of MT were £8,541 (SD £2,467) for mothership and £9,196 (SD £2,695) for drip-and-ship; mean difference = £655 (95% CI: £1,336 to -£25) in favour of mothership. The cost difference was driven by PHT costs: Mothership: £187 (SD: £100) vs Drip-and-ship: £753 (SD: £288), p < 0.001. There were also significant differences between mothership and drip-and-ship in emergency-hospital-attendance costs: £514 (SD: £95) vs £429 (SD: £110) p < 0.001 and imaging costs: £318 (SD: £114) vs £468 (SD: £244 p < 0.001). No significant difference in procedural costs: mothership = £6,450 (SD £2,471) vs drip-and-ship = £6,417 (SD £2,549), p = 0.92 or 24-hour hospital admission: Mothership = £1,072 (SD £417) vs Drip-and-ship = £1,129 (SD £537), p = 0.36.

**Conclusions:** The significant differences were mainly in costs associated with inter-hospital transportation, repatriation and imaging. These indicative findings merit validation in larger samples and need to take account of differences in distance from MT centres of patients treated via drip-and-ship pathway compared to mothership patients.

**Trial registration number:** N/A

## AS12-088

### THE COST OF DELIVERING MECHANICAL THROMBECTOMY WITHIN 24 HOURS IN THE UNITED KINGDOM

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**Background and Aims:** Clinical efficacy and cost-effectiveness of mechanical thrombectomy (MT) for the treatment of large vessel occlusion stroke is well established. However, uncertainty remains around the true cost of delivering this treatment in routine care.

**AIM:** To establish the true cost of providing MT within the first 24 hours of stroke care in routine clinical practice in the UK.

**Methods:** Micro-costing methods were used to enable a precise assessment of the costs of MT to be obtained from an NHS perspective. Data from four UK neuroscience centres (between 2015 and 2018) on resources used and their costs were collected on both drip-and-ship and mothership patients transported via emergency ambulance up to 24-hours post-MT.

**Results:** Data were collected on 225 patients with acute stroke treated with MT. The mean (SD) total cost of providing MT and inpatient care within 24 hours was £8,676 (£2,581) per patient. The main costs were thrombectomy procedure (73%); post-MT care (12%); transportation (5%); and imaging (4%). Costs were higher for drip-and-ship (mean £9,196, SD £2,695) than mothership patients (mean £8,541, SD £2,467); patients admitted to an intensive care unit/high dependency unit (ICU/HDU) (mean £9,626, SD: £2,788 than those not admitted to ICU/HDU (£8,618, SD £2,452); and for patients with carotid stenosis needing stenting/angioplasty (mean £10,238, SD £2,087) than those without stenting/angioplasty (mean £8,675, SD £2,533).

**Conclusions:** Major factors contributing to costs of MT for stroke are: interventions; using ICU/HDU; inter-hospital transport and repatriation. These findings could be used to better estimate the cost of MT for strategic planning of stroke services.

**Trial registration number:** N/A

## AS12-016

### THE TUSCANY STROKE NETWORK: TEAM IS BRAIN

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**Background and Aims:** In January 2015 a major system change for acute ischemic stroke (AIS) care was implemented across Tuscany: the Tuscany Stroke Network (TSN). AIS patients are first taken to the nearest spoke hospital for possible t-PA treatment, assessed for eligibility to endovascular intervention, and quickly transferred to the hub hospital, where appropriate. We investigated differences in quantity of treatments for acute ischemic stroke (AIS) patients before and after the TSN implementation, to explore and monitor its effectiveness.

**Methods:**

We included all patients with AIS consecutively treated in each of the 22 TSN stroke hospitals from January 1, 2014 to December 31, 2017. We estimated an expected number of 9000 AIS patients per year. We measured TSN efficacy by comparing annual numbers and rates of AIS treatments, as well as health benefits in terms of Disability-Adjusted-Life-Years (DALYs) avoided, based on 0,605 DALYs avoided for each treated patient, before (2014) and after (2015-2017) TSN implementation.

**Results:** Number and rates of treatments increased up to 669 (7,4%) in 2015 and to 1078 (12%) in 2017, being 382 (4.2%) in 2014. The implementation of the TSN resulted in 1014 additional patients treated with t-PA from 2015 to 2017, yielding an health benefit of 613,5 DALYs avoided. The increasing number of secondary transfers yielded to an increasing number of thrombectomies performed by the hub-hospitals.

**Conclusions:** The logistic interventions provided by the TSN resulted in more stroke patients receiving the benefits of t-PA and thrombectomy, that are highly cost-effective, providing savings both in economic and in DALYs areas.

**Trial registration number:** N/A

## AS12-053

### ACCESS TO REHABILITATION FOR PATIENTS WITH STROKE IN FLORENCE, ITALY

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**Background and Aims:** Disability is the main cost driver for stroke. Information about poststroke rehabilitation utilization trajectories from a stroke patient caregiver dyadic perspective is essential to improve healthcare delivery, practices and long-term outcomes for stroke patients.

**AIM:** To audit and provide feedback about access, quality and effectiveness of post-acute rehabilitation phase in Florence (Italy).

**Methods:** Prospective evaluation of all stroke patients discharged from all the in-patient rehabilitation facilities in the Florence area from October 1, 2016 to September 30, 2017. Patient- and caregiver-perceived rehabilitation accessibility, duration and effectiveness were evaluated by trained physiotherapists through standardized telephone questionnaire at 6 and 12 months after rehab-facility discharge. Functional outcomes were estimated by the means of modified Rankin scale score.

**Results:** After excluding patients who died or received palliative care, 120 stroke patients were enrolled, their median age was 74 years (IQR, 64–83 years) and 51,7% were men. Out of the 80 (67%) stroke patients prescribed with ongoing rehabilitation, the 31,3% could not use public services, mainly for logistic reasons, and the 36% contacted private services. Most patients (89,8%) perceived rehabilitation as effective, but of short duration. All the 45 stroke patients (56,3%) who managed to continue rehabilitation beyond the first 6 months acknowledged further effectiveness.

**Conclusions:** We described the trajectory of healthcare service utilization by stroke patients over 1-year post-stroke and could highlight the unmet needs of extending rehabilitation by public services beyond the current availability (two 1-month rounds), and of supporting logistics to enable all stroke patients to benefit from post-acute rehabilitation.

**Trial registration number:** N/A

## AS12-069

### THE WORLD STROKE ORGANIZATION GLOBAL STROKE BILL OF RIGHTS

**S. Nelson<sup>1</sup>**

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**Background and Aims:** In 2014 the World Stroke Organization launched a Global Stroke Bill of Rights (GSBoR). A working group of survivors and caregivers from across the world led its development which was informed by two online surveys.

In 2017, WSO gathered feedback on the use of the GSBoR through an online survey, to understand what outcomes, if any, had been achieved in regard to the needs that the GSBoR sought to address.

**Methods:** The online survey was sent to people who had signed the GSBoR and also people who had been signposted to it, but had not signed. The survey had eight questions.

**Results:** This survey, although only including a small sample, found that the majority of respondents view the GSBoR as a useful document. Experience of its usefulness across awareness raising, policy change and increasing the number of advocates varies, with awareness raising seen as the most useful aspect of the document. The document is versatile; its tone and credibility allows it to be used with a range of stakeholders, in different settings and with a specific focus. Its global nature and rights based approach means that it is aligned with major international declarations and treaties on NCDs.

**Conclusions:** While there were a number of barriers highlighted in the use of the document, the ongoing engagement by respondents with the GSBoR indicates that developing strategies to address some of these barriers is important and worthwhile. As such a strategy to promote, operationalise and monitor the GSBoR has now been developed.

Trial registration number: N/A

## AS12-058

### ESO-EAST – RECENT EXPERIENCES WITH RES-Q IN HUNGARY

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**Background and Aims:** To overcome the West-East gap in stroke morbidity and mortality several initiatives have been launched to improve stroke care in Central and Eastern Europe. For auditing stroke services and for international comparisons, collection of reliable data is essential. The Hungarian Stroke Society supports such activity in the 39 stroke centers throughout the country by promoting quality assurance programs like Angels, SITS-EAST and RES-Q.

**Methods:** We performed a survey of data of the RES-Q database supplied by individual Hungarian stroke centers and returned for the current analysis from the central database for 2017 and 2018.

**Results:** In 2017 there were 6 participating stroke units with data of 486 patients with a median age of 69 years, a median stroke severity of a score of 6 on the NIHSS, and a neuroimaging rate of 99%. Of all stroke cases 434 patients (89%) had ischemic stroke. Intravenous thrombolysis (IVT) rate was 19.1%, and in 29 cases (6.7% of all ischemic strokes) mechanical thrombectomy followed IVT. In the next year (2018) the number of reporting centers increased to 12, with data of 1155 patients. The rate of ischemic strokes was 87% in 2018, the neuroimaging rate and IVT rate did not change (99% and 19%). Four of the 12 centers reported selectively (mostly or exclusively only patients with recanalization treatment).

**Conclusions:** The reporting willingness to RES-Q increased considerably from 2017 to 2018. Selective reporting prevents full range quality assurance use of the data. A decision should be made on future reporting strategy.

Trial registration number: N/A

## AS12-075

### CROATIAN EXPERIENCE ON RES-Q REGISTRY FOR MONITORING THE QUALITY OF STROKE CARE DURING 2018 YEAR

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**Background and Aims:** Stroke registry is a tool for improving stroke care and achieving goals pointed in Stroke Action Plan for Europe. The Registry of Stroke Care Quality (RES-Q) was launched by ESO-EAST (Enhancing and Accelerating Stroke Treatment) in November 2016 to provide a tool for monitoring the quality of stroke care in hospitals throughout Europe. The aim was to show results captured from RES-Q registry in Croatia during 2018.

**Methods:** Data on demographics, stroke care pathway, specific acute treatment issues, stroke prevention issues in all acute stroke admissions in Croatia during 2018 through RES-Q registry were analysed.

**Results:** Thirteen out of twenty-three acute hospitals which provide stroke treatment recruited 578 patients during 2018 year.

Figure 1. shows map of Croatia with participating centers (in green).



Table 1. shows number of patients recruited by site and time period.

<b>Croatia – Hospitals with recruited number of patients</b>	
University Hospital Center Zagreb (November-December)	103
IVT+ endovascular treatment available	
Sveti Duh University Hospital-Zagreb (February-March)	85
Clinical hospital center Rijeka (March)	65
Regional Hospital Vinkovci (February – March)	58
University Hospital Dubrava (March)	54
General Hospital Pula (March)	45
General County Hospital Vukovar (March)	41
General Hospital Virovitica (March)	29
General Hospital "Dr. Ivo Pedišić" Sisak (March)	24
General Hospital Bjelovar (March)	23
General Hospital Zabok (March)	21
General County Hospital Pozega (March)	16
County Hospital Cakovec (March)	14

Table 2. shows patients main baseline characteristics and outcome measures.

<b>Main baseline data and outcome results</b>	
Recruited patients (N)	578
Main stroke types (%)	
Ischemic	85.64
Intracerebral hemorrhage	11.59
Subarachnoid hemorrhage	2.42
Age (median) - years	76 (67.5-80)
% Female patients	50.87
NIHSS (median)	8 (4-12)
% NIHSS performed	49.11
CT/MR performed on admission (%)	99.47
Within 1 hour	80.18
Intravenous thrombolysis rate (%)	9.29
Door-to-Needle time (median)	51 (30-120)
Mechanical thrombectomy rate (%)	2.62
Door-to-Groin time (median)	118 (90-171)
mRS (discharge) median	3
Hospital stay (median)	8 days
Mortality rate (%)	14.71
Dysphagia screening (%)	96
Rehabilitation assessment	83.83
Discharge	
Home	57.79
Same center	6.92
Another center	7.61
Social facility care	12.98
Secondary prevention	
% antihypertensives (all stroke)	90.25
% antiplatelets after ischemic stroke without AFib	75.83
% anticoagulants in patients with ischemic stroke and AFib	79.44
% statins prescribed	52.02
% smoking cessation (in smokers)	13.59

**Conclusions:** Our results showed still low rates of recanalisation therapies across the Croatia. Secondary stroke prevention might be improved by increasing by the usage of statins and performing smoking cessation programs. In future, all stroke centers should be involved in stroke registry to achieve more accurate data which could guide us to improve stroke care in Croatia.

**Trial registration number:** N/A

## AS12-052

### 10 YEARS OF IMPLEMENTING THE AUSTRALIAN STROKE CLINICAL REGISTRY: ADAPTING TO CHANGING WAISTLINES AND HAIRSTYLES

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**Background and Aims:** In an era of value-based health care, consistent reporting of clinical care against national guidelines and patient-reported outcomes are necessary. National clinical quality registries are a 'one-stop-shop' for clinicians to access performance data and monitor quality of care and outcomes, whilst also providing a vehicle for research. We report our experience, outcomes achieved, and future directions, since establishment of a national stroke registry in Australia in 2008.

**Methods:** Pilot development of the electronic data tool, data dictionary and operational and governance Committee processes from 2009 with alignment to international registries. Surveys of clinical users to improve the registry. Eligible patients are followed-up at 90–180 days, survival data are updated annually via data linkage, and hospital benchmarking is provided through online reports. Aggregate data are disseminated via annual reports, journal articles, clinical meetings, and quality improvement workshops.

**Results:** 2009: 469 episodes registered from 6 pilot hospitals; by end 2018: 74076 episodes from 71 contributing hospitals (Figure). In 2016, transition to an integrated data management system permitted an expanded set of clinical care variables to be collected. Two-thirds of clinicians who returned the 2018 feedback survey believe AuSCR has improved their stroke service. Over 20 research applications to use the data or access patients including for new clinical trials. Data linkage with administrative datasets (e.g. medications, doctor visits, readmissions) will enable monitoring the full continuum of care.

**Conclusions:** Our national registry was established over several years. Registries must be adequately supported and adaptable to permit innovation that meets patient, clinician, government and researcher needs.

**Trial registration number:** N/A

**AS12-045**

## PRE-HOSPITAL ACT-FAST PARAMEDIC TRIAGE ALGORITHM IS HIGHLY PREDICTIVE FOR LARGE VESSEL OCCLUSION AND REQUIREMENT FOR COMPREHENSIVE STROKE CENTER CARE

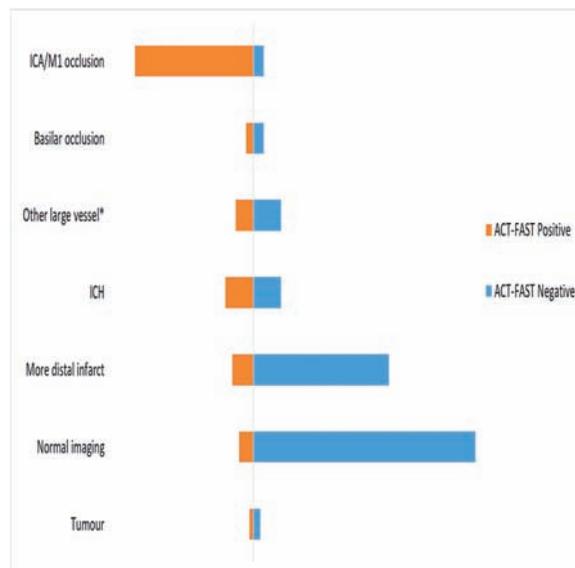
H. Zhao<sup>1,2</sup>, K. Smith<sup>3</sup>, S. Bernard<sup>3</sup>, S. Michael<sup>3</sup>, M. Parsons<sup>1,2</sup>, N. Yassi<sup>1,2</sup>, S. Davis<sup>1,2</sup> and B. Campbell<sup>1,2</sup>

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**Background and Aims:** Potential concerns regarding severity-based clinical tools for endovascular thrombectomy triage include comprehensive stroke center (CSC) overburdening and delayed thrombolysis in non-thrombectomy patients. We analyzed the implications of using the 2-step ACT-FAST paramedic triage algorithm in a real-world prehospital stroke population.

**Methods:** Data were included from the ongoing in-field paramedic validation study since November 2017. Ambulance Victoria paramedics assessed pre-hospital ACT-FAST (arm drift followed by speech if right arm weak, or shoulder tap for inattention if left arm weak) in suspected stroke patients in the state of Victoria, Australia after watching a 8min training video. Algorithm results were validated against prespecified comparators of ICA/M1-occlusion and requirement for CSC or neurosurgical care.

**Results:** Of n=196 pre-hospital assessments (n=72 ICA/M1-occlusion), ACT-FAST had 93.8% sensitivity and 74.4% specificity. Positive predictive value for ICA/M1-occlusion was 41.7%, with remaining positive assessments comprising: basilar occlusion (2.7%), proximal M2 occlusion (5.5%), dissection/intracranial atherosclerosis (4.2%), intracranial hemorrhage (22.2%), intracranial tumor (1.4%), distal infarcts (15.3%) and normal imaging (6.9%). Positive predictive value for requiring CSC/neurosurgical care (large vessel occlusion, hemorrhage and tumor) was 77.8%. Median additional travel time in metropolitan Victoria from closest thrombolysis hospital to CSC was 7min (IQR 4–9) calculated using prior transfer cases.



**Conclusions:** Paramedic pre-hospital assessment of the severity-based ACT-FAST triage algorithm identified the majority of patients requiring thrombectomy and comprehensive stroke unit care. If used to bypass patients to CSC, the false-positive workload appears manageable. Relatively few non-thrombectomy patients would bypass the nearest thrombolysis centre, and potential delay in thrombolysis is likely minimal in metropolitan areas given the transport time differential.

**Trial registration number:** N/A

**AS12-020**

## THE PROBLEM WITH FIGURES!

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**Background and Aims:** National Stroke report was published in November 2018, the data populates the National Stroke Key Performance Issues (KPIs).

These KPIs are discussed with senior service managers and hospital CEOs.

We analysed our local data (LD) against the published National data (ND).

**Methods:** Using the hospital database we were able to download all information sent to the National Team.

Analysis of our local stroke data (LD) enabled us to compare us against the National data (ND).

**Results:** 3481 (56.5% males) patients National report versus 346 (51.7% males) local patients. ND, mean age 71.8 years males and 73.1 years females against 73 and 76 years for respectively for LD. The LD had older patients (age >79 years) compared to ND; male patients [ $p = 0.02$ ] and LD female cohort [ $p = 0.06$ ]. There were more infarcts in ND versus LD cohort (87% v 75%). Our LD cohort had a higher pre-stroke Rankin compared with ND cohort ( $p < 0.0001$ ). Mortality in the LD cohort increased with increasing pre-stroke Rankin. Discharge home – 53.3% of ND cohort (Length of stay median 9 days (IQR 5 – 19) versus 45.6 % of LD cohort (Median 11 days; IQR 5 – 26). National Mortality 10.8% in infarcts, 36.2% for haemorrhages versus 18% and 37% respectively for LD cohort.

**Conclusions:** Fundamental differences in case mix between hospitals will be among the reasons for differences in mortality and outcomes. While the use of data may drive improved care, adjustments for case mix and pre-stroke function are required for a meaningful discussion.

**Trial registration number:** NA

**AS12-083**

## DATA COLLECTION RESULTS RES.Q-REGISTRY FOR 2018 IN UKRAINE

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#### Background and Aims:

**Background and Purpose:** Ukraine has participated in the ESO-EAST programme aiming to improve quality of stroke since 2016. Here, we present results of quality monitoring in the Registry of Stroke Care Quality (RES-Q).

**Methods:** Voluntary participation in ESO-EAST and collection of quality metrics in RES-Q was promoted by Ukrainian ESO-EAST/Angels Steering Committee. Data were entered into a web-based platform directly from hospitalst. Presented data on all acute stroke admissions include hospitals with >25 patients submitted from January to March 2018 and are presented as a range from minimum to maximum

**Results:** 25 hospitals/departments out of several hundred hospitals in Ukraine participated providing data on 1670 patients (representing about 6,9% of the national total by estimation). 86% were ischemic strokes. Compliance with quality metrics across hospitals ranged as follows: 58–100% of patients had baseline CT or MRI, 11–100% had CT or MRI performed within 1 hour after admission, 4–100% were admitted directly to specialized stroke units, 1–32% stroke patients had recanalization procedures, dysphagia screening was performed in 4–100%, and atrial fibrillation/flutter were detected at hospitalization in 1–16% cases. Rate of statin administration was 11–100%

**Conclusions:** These data on stroke care quality provide important first quasi-national statistics on stroke care quality. Although they lack representativeness, they already illustrate large disparities in quality of stroke care. The participation of more hospitals is needed, however lack of motivation to participate and legislative platform, Internet access within neurological department of secondary level of Public Health Care hospitals poses a challenge.

Trial registration number: N/A

#### AS12-015

### ORGANIZATIONAL MODELS FOR THROMBECTOMY OF ACUTE ISCHEMIC STROKE: “MOBILE INTERVENTIONALIST” VERSUS “DRIP AND SHIP”

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**Background and Aims:** Thrombectomy of acute ischemic stroke requires changes to acute stroke services since most hospitals do not have on-site thrombectomy facilities. We aimed to compare two different models in use in eastern Lombardy (Italy).

**Methods:** We compared process performance (onset-to-groin puncture times), clinical (survival and functional outcome at discharge) and radiological outcomes (status of the occluded artery after recanalization therapy) under two different models: the “drip-and-ship” (patient transport to hub after intravenous thrombolytic treatment in spoke) and the “mobile interventionalist” (interventionalist moves from the hub to the spoke, to carry out thrombectomy). The two models were used in two different hospitals depending on the same hub.

**Results:** A total of 75 patients with acute ischemic stroke was treated with thrombectomy from January 2017 to December 2018: 39 under the “mobile interventionalist” model and 36 under the “drip-and-ship” model (Table). The “mobile interventionalist” model allowed to initiate thrombectomy more than 2 hours earlier ( $p=0.009$ ), however, clinical and radiological outcomes were similar in the two models.

Variable	Mobile neuroradiologist	Drip And Ship	Chi squared	p value	OR	95% Confidence Interval
Mean age (years)	71.7	70.1	0.502*	0.617		
Age (years range)	40.9 - 91.0	40.9 - 88.8				
Median age (years)	75.9	71.1				
Gender						
Male	20 (51.3%)	21 (58.3%)	0.376	0.540 0.752	[0.302 - 1.873]	
Female	19 (48.7%)	10 (41.7%)				
Mean NIHSS Basal score	13.8	15.6	-1.680*	0.098	[5.506 - 0.472]	
Median NIHSS Basal score	14.0	16.0				
Atrial fibrillation						
Yes	16 (42.1%)	13 (39.4%)	0.054	0.817 1.119	[0.433 - 2.893]	
No	22 (57.9%)	20 (60.6%)				
Mean Onset To Puncture (min.)	275	398	-2.697*	0.009	[212 - 31]	
Onset To Puncture (min. range)	125 - 795	155 - 1237				
Median Onset To Puncture (min.)	217	330				
TICI						
Arterial Patency	28 (71.8%)	28 (77.8%)	0.354	0.552 0.727	[0.254 - 2.080]	
Arterial Occlusion	11 (28.2%)	8 (22.2%)				
Mean Outcome NIHSS at discharge	6.9	5.9	0.732*	0.467	[1.8 - 3.8]	
Median NIHSS at discharge	6.0	5.0				
NIHSS at discharge (range)	0 - 18	0 - 20				
mRS						
Favorable	15 (71.4%)	20 (64.5%)				
Poor	6 (28.6%)	11 (35.5%)	0.272	0.602 1.375	[0.415 - 4.561]	
Death						
Yes	2 (8.0%)	2 (6.3%)				
No	23 (92.0%)	30 (93.7%)	0.066	0.797 1.304	[0.171 - 9.970]	

\* t-student

**Conclusions:** In hospitals without on-site interventionist, the “mobile interventionalist” model as compared to the “drip-and-ship” model, can reduce onset-to-groin puncture times. Further studies to assess the clinical efficacy of this model are warranted.

Trial registration number: N/A

#### AS12-022

### MODELLING STROKE NETWORKS WITH TELEMEDICINE IN 4 ITALIAN REGIONS

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<sup>5</sup>Stroke, Neurology, Città di Castello, Italy; <sup>6</sup>Emergency, Medicine, Foligno, Italy; <sup>7</sup>Stroke, Neurology, Foligno, Italy

**Background and Aims:** The ESO Telestroke recommendations described criteria for Telestroke networks sustainability. Italy has large underpopulated areas with seasonal population variability and reduced stroke care. A group of experts selected in 4 Italian regions (Tuscany, Emilia-Romagna, Lazio, and Umbria) areas underserved in the local stroke networks. We suggested a coverage of these areas using a Telestroke Units (TSU) and or Telethrombolysis units (TTU) services according to the ESO recommendations.

**Methods:** When choosing the right service for a telestroke network two rules should be applied: (1) the TSU should treat at least 200 stroke patients per year and (2) acute stroke care should be within reach of 45 min for 90% of the population. Minimum area size to be covered by a single stroke unit can be calculated by the Hubert formula. Size is inversely related to population density (population/km<sup>2</sup>) and stroke incidence (number of strokes/ 100.000/year). Transport times were calculated using google maps simulations.

**Results:** Four different isolated areas were identified: Lunigiana, Valnerina, Reggio Emilia county, Latina coast. The population density was ranging between 69 and 254 people per sq/km with a stroke incidence of 0.0016. The area size range was 566–2256 sq/km. One area satisfied criteria 1 for TSU (Latina coast) and 3 others fulfilled criteria 2 for TTU (Reggio-Emilia county, Lunigiana, Valnerina).

**Conclusions:** Access to thrombolysis may be further guaranteed by telemedicine coverage with appropriately deployed services. Modeling stroke care with telemedicine networks offers to the stakeholders a chance of understanding the most sustainable solutions for increasing access to stroke care.

**Trial registration number:** N/A

## AS12-032

### OPTIMISING CLINICAL OUTCOME BY HYPERACUTE RESEARCH RECRUITMENT

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<sup>1</sup>Stroke Unit, Stroke Unit- Cambridge University Hospitals trust-Cambridge- CB4 1LQ- UK, Cambridge, United Kingdom; <sup>2</sup>Stroke unit- Cambridge university hospitals- Cambridge- UK, Stroke unit, Cambridge, United Kingdom; <sup>3</sup>Cambridge University hospital, Stroke unit, Cambridge, United Kingdom; <sup>4</sup>Cambridge University hospital trust, stroke unit, cambridge, United Kingdom

**Background and Aims:** Research evidence drives developments in hyper acute stroke care. Recent trials of thrombectomy, novel thrombolysis, complex imaging are challenging for recruitment and costly in terms of time and resources. Out of hours recruitment presents additional problems. We describe our approach:

**Methods:** Our established hyperacute research centre tried many recruitment strategies, with varying success, until we integrated research nurses into the acute bleep nurse team. Trained through formal clinical and research education, competencies and case discussion; they work as experts to deliver:

- Acute assessment and triage to treatment
- Hyperacute care,
- Research recruitment
- Nurse led research
- Primary investigator trials
- CTIMPS with medical support

**Results:** UK: top two position 2 years running for hyperacute stroke trials, leading UK centre for TASTE and TWIST, internationally leading recruitment for: SOS penumbra, Headpost, DNA Lacunar, 2. Delivered new and novel trials (GYPSIE). Hyperacute stroke trials recruitment: 2014: 44 2017: 111 2018: 99.

Increase in:

Recognition nationally and internationally:

Approaches by new industry and academic trials

Funding:

Applications for employment

Discussion

Initial reticence from clinical and research finance was twofold: i) Funding joint teams and delivery of objectives, ii) Governance of staff. Audit demonstrated doubling of recruitment to hyperacute trials and improved quality of care shown in national audits.

**Conclusions:** By nurses working across the research – clinical divide we improved outcomes for:

Our patients (reflected in national audit)

Equality of care – research studies out of hours.

Hyperacute trial recruitment

Retention and development of staff.

Nursing and therapist leading research.

**Trial registration number:** N/A

## AS12-004

### PLANNING FOR MECHANICAL THROMBECTOMY SERVICE EXPANSION – A DISCRETE EVENT SIMULATION FOR A DRIP AND SHIP CENTRE IN A UK REGIONAL STROKE NETWORK

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**Background and Aims:** Mechanical thrombectomy (MT) is provided by neuroscience centres (NSC) which receive patients directly and via transfer from drip and ship centres (DSC). Most NSCs in the UK currently provide a working hours service but service expansion is underway. DSCs will also have to expand their MT assessment and transfer pathways. We used discrete event simulation (DES) to model workflow options for a DSC in a UK regional stroke network.

**Methods:** Sentinel Stroke National Audit Programme (SSNAP) and local audit date for one DSC were used to provide inputs for 3 alternative DES models (A, B and C) which were compared using a one factor ANOVA design for door-in-door-out (DIDO) times and onset to arrival at the NSC. Simulated treatment times were extrapolated to expected MT outcomes.

**Results:** For presentations within 6hrs of onset in one year at our centre, 112/823 (13.6%) met the criteria (NIHSS $\geq$ 6, mRS $\leq$ 2) for MT assessment. Model C, which simulated stroke specialist presence from 8 am to 8pm, out of hours (OOH) network telemedicine support and enhanced priority for ambulance transfers enabled 65% of potential MT patients to receive the shortest DIDO time (fig 1) of median 11.3 minutes less than model A ( $p < 0.001$ ) within hours (WH) and 34.4 minutes less ( $p < 0.001$ ) OOH. Median simulated onset to arterial puncture times were 282m WH and 346m OOH predicting 3 months mRS scores of 0–2 for 36/82 (44%) patients treated.

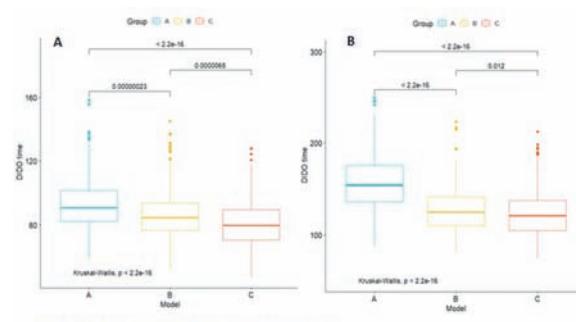


Fig 1. DIDO times within (A) and out of hours (B)

**Conclusions:** DES can facilitate planning and optimisation of workflow options for efficient drip and ship MT pathways.

**Trial registration number:** N/A

## AS12-017

### OFF-HOUR EFFECT: IS TELESTROKE ENOUGH? A COMPARATIVE STUDY IN A HOSPITAL WITH A MIXED SYSTEM.

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**Background and Aims:** Stroke Neurologists (SN) 24/7 avoid differences in stroke care processes and outcomes for acute stroke patients arriving during off-hours. Telestroke systems (TS) provide larger availability of specialized care when SN are not available. Both systems are rarely coexisting in a Hospital.

**Objective:** To compare each step of the continuous specialised care in a single centre with both SN and TS according to time of admission and final outcome.

**Methods:** Prospective study of consecutive acute stroke patients admitted to the Emergency Department 2015–2017. Patients were classified into two groups according to arrival time: SN and TS (weekends and any time other than 8:00 am to 3:00 pm on weekdays). Differences in time to diagnostic procedures, tPA administration, stroke outcome (modified Rankin Scale, mRS) and in-hospital fatality rates were analysed.

**Results:** 214 patients were evaluated, 130 (60,7%) by TS. No differences in stroke severity were found between SN and TS. Median times to blood test results and cranial CT scan were higher for TS: 35 min vs. 45 min; P <.01 and 34 min vs. 56 min; P <.01). Intravenous tPA was administered to 15,5 % SN vs. 10,8% TS ischaemic stroke patients (P n.s), but door to needle time was higher for TS (100 min vs. 56 min, P <.01). TS evaluation was not associated with poorer outcome (mRS ≥3) at discharge, on 3-month follow-up, or in-hospital fatality rates.

**Conclusions:** In a Hospital with both SN and TS attention, we found significant differences between times to procedures and treatment, with no repercussion on tPA administrations or outcomes.

**Trial registration number:** n/a

## AS12-046

### THE STROKE REFERRAL PATHWAY IN THE ROYAL BROMPTON HOSPITAL – A TERTIARY CARDIOLOGY CENTRE

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<sup>2</sup>Charing Cross Hospital, Neurology, London, United Kingdom

**Background and Aims:** Acute stroke is a known complication after cardiac catheterisation and surgery (incidence up to 7% and 5.2% respectively). Given the frequent use of anticoagulation in these patients, there have been limited options for treatments historically. The advent of mechanical thrombectomy has revolutionised stroke care in groups previously ineligible for intervention. As the Royal Brompton Hospital is a stand-alone specialist cardiac centre, it is fundamental that clinicians are aware of the pathway and able to follow it easily in order to expedite care.

**Methods:** The local stroke pathway was analysed and incorporated into an easy to follow pro-forma. A sample of clinicians were surveyed to assess awareness of the pathway, and showed significant gaps in knowledge. An information dissemination campaign was launched involving word of mouth updates, departmental teaching and distribution of the proforma. Clinicians were re-surveyed and results were analysed with Fisher's exact test to assess for significant improvement.

**Results:** Following the campaign, awareness of the pathway improved. Knowledge of the thrombectomy service and the appropriate referral information required improved from 47% to 93% ( $p = 0.0142$ ) and 40% to 90% ( $p = 0.0052$ ) respectively. Knowledge of the ROSIER tool (used in the pathway) rose from 20% to 87% ( $p = 0.0007$ ). Understanding that a CT head should not be done locally, but at the HASU instead improved from 35% to 100% ( $p < 0.0001$ ).

**Conclusions:** Dissemination of information to the appropriate stakeholders significantly improved awareness of the stroke pathway. This could potentially reduce delays in transfer (making mechanical thrombectomy an option for more patients), and possibly improve clinical outcomes.

**Trial registration number:** N/A

## AS12-066

### PROVIDING ONLINE DASHBOARDS FOR MONITORING STROKE QUALITY OF CARE USING OPEN SOURCE SOFTWARE WITHIN RES-Q

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**Background and Aims:** The Registry for Stroke Care Quality (RES-Q, [www.qualityregistry.eu](http://www.qualityregistry.eu)) was launched in 2016 to provide an easy-to-use platform for hospitals and national stroke societies to capture key stroke care performance metrics. With registries, there can be significant delay between data capture, and results publication, which can limit data utilization. Therefore, we have investigated implementing online dashboards for real-time registry data monitoring within RES-Q.

**Methods:** Sustainability and extensibility were considered key factors in our investigation. Proprietary data analytics software packages were excluded as too costly. The free, open-source software Metabase ([www.metabase.com](http://www.metabase.com)) was chosen as the core component of RES-Q dashboards. Metabase was integrated with the RES-Q software platform to provide shared authentication and granular access control to dashboard functionality. Key metrics are displayed in various dashboards (e.g. Hospital level, National level). Automated data processing software developed for RES-Q was used to generate the results.

**Results:** RES-Q Reports ([www.qualityregistry.eu/data](http://www.qualityregistry.eu/data)) launched in early 2019 and provides two distinct components: dashboards which show a graphical daily overview of current stroke care performance, and a secure portal for downloading quarterly official registry reports. Access to the dashboards and reports requires registration on the RES-Q platform, however a public dashboard is available for project transparency (<https://qualityregistry.eu/live-metrics>).





**Conclusions:** It is possible to deliver useful data analytics based on registry data in near real-time with existing open-source software. There is significant technical challenge to implementation when compared with off-the-shelf software solutions. We expect to make additional improvements to the RES-Q dashboards in the future based on participant feedback.

**Trial registration number:** n/a

## AS12-040

### CIRCADIAN VARIATION IN THE TIMING OF HOSPITAL ADMISSION FOR SEVERE ISCHEMIC STROKE – A REGISTRY ANALYSIS

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<sup>1</sup>Helios Klinik Müllheim, Department of Neurology and Geriatrics, Müllheim, Germany; <sup>2</sup>Baden-Württembergische Hospital Association, Office for Quality Assurance in Hospitals, Stuttgart, Germany; <sup>3</sup>University of Heidelberg, Department for Neurology, Heidelberg, Germany; <sup>4</sup>Klinikum Kempten, Department of Neurology, Kempten, Germany; <sup>5</sup>German Cancer Research Center DKFZ, Division of Clinical Epidemiology and Aging Research, Heidelberg, Germany

**Background and Aims:** Acute ischemic stroke (AIS) hospital admission rates follow a characteristic diurnal pattern. We aimed to explore the admission rate of patients with severe AIS potentially eligible for endovascular therapy.

**Methods:** 90,609 AIS patients collected in the Baden-Württemberg Stroke Registry from 2008 to 2012 were taken into analysis. Based on the NIHSS score at admission stroke severity was categorized into light (NIHSS  $\leq 3$ ), moderate (NIHSS 4–8), and severe (NIHSS  $\geq 9$ ). Diurnal admission rates were calculated in 3h-time intervals and multivariable regression models were used to assess the relationship between diurnal hospital admission and stroke severity. Admission numbers of patients with severe AIS were then stratified by stroke service level (stroke centers, hospitals with regional, local or no stroke unit) and calculated for working/non-working hours and a three-shift model.

**Results:** Admission numbers were N = 38,747 (36%) for patients with light AIS, N = 27,425 (25%) with moderate AIS, and N = 24,437 (23%) with severe AIS. Patients with severe AIS demonstrated the most continuous admission rate (max. 38% between 3:01 and 6:00, min. 24%

between 12:01 and 15:00). Of these, 62% were admitted during working hours, 54% in the early shift, 36% in the late shift and 10% in the night shift.

**Conclusions:** Patients with severe AIS demonstrated the most constant hospital admission rate over the range of the day. Nevertheless, the majority are admitted during daytime and evening hours. The presented data might help to adjust emergency medical service transportation capacities and to define appropriate time intervals to offer mechanical thrombectomy outside stroke centers.

**Trial registration number:** N/A

## AS12-008

### DOING THE 1 IN 6. THE BALLARAT HEALTH SERVICES STROKE RISKOMETER CHALLENGE

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#### Background and Aims:

**Background:** People in regional Australia have a higher risk of stroke. Recent evidence indicates that approximately 90% of strokes may be attributed to a combination of 10 modifiable risk factors. The Grampians region, consisting approximately 240,000 people spread over 48,000km<sup>2</sup>, has a high incidence of stroke risk factors. In line with primary prevention strategies, Ballarat Health Services (BHS) sought to access the community using the Stroke Riskometer app to provide stroke education and reduce our stroke numbers.

**Aim:** To decrease the incidence of stroke by educating the community about risk factors and stroke using the Stroke Riskometer app.

**Methods:** A three stage model was developed to promote the Stroke Riskometer app using the '1 in 6 people' stroke campaign promoted by the World Stroke Organization. People were asked to complete the app and encourage six other people in their lives to do the same.

- Stage one involved engaging staff within Ballarat Health Services
- Stage two involved promoting the stroke riskometer app via social media and targeting high traffic areas within the hospital to reach non-clinical staff, visitors and volunteers
- Stage three aims to engage local business, media and schools

**Results:** Ongoing internal auditing will take place to identify trends in stroke presentations within the hospital.

#### Conclusions:

**Discussion:** In collaboration with the team at Auckland University of Technology, Ballarat Health Services will monitor the amount of downloads that occur during the time frame to ascertain if the riskometer is being well utilised within the community.

**Trial registration number:** N/A

## AS12-026

### DRIP AND SHIP, MOTHERSHIP OR HYBRID? MAXIMISING THE POPULATION DISABILITY BENEFIT FROM THROMBOLYSIS AND THROMBECTOMY IN NORTHERN IRELAND, UK: A MODELLING STUDY

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<sup>5</sup>Public Health Agency, Department of Health & Social Security, Belfast, United Kingdom

**Background and Aims:** Reconfiguring hyperacute stroke services to yield the maximum benefit from time-critical treatments (thrombolysis [IVT] and thrombectomy [MT]) is a policy priority for many countries, including the UK.

**Methods:** We used outcome data from individual patient metaanalyses of IVT and MT to construct a computer simulation model of hyperacute stroke care for the 1.9 million population of Northern Ireland ( $\sim 2,800$  strokes/year). We used a genetic algorithm that sought solutions that maximised disability benefit (numbers of people with stroke with little or no residual disability at 90 days) balanced against other competing factors eg. institutional size, and mapped the outputs.

**Results:** The greatest population benefit (a two-fold increase) accrued from driving significant improvements in existing door-to-treatment times and treatment rates. Subsequent models identified an approximately equivalent degree of population benefit from a range of solutions based on the present 8 centres to as few as 3,4 or 5 IVT centres, one of which provides MT. Median travel times to an IVT centre were 17 minutes for the current state, and 28 minutes for 3 centres; travel times to the MT centre fell from 100 minutes to 82 mins. Reconfiguration resulted in fewer, larger centres with between 520 and 1,613 admissions with acute stroke/year.

**Conclusions:** Policy decisions regarding stroke service reconfigurations intended to maximise benefit from time-sensitive treatment in specialist centres can be usefully illuminated by computer simulation using outcome data from randomised trials. This approach has extensive potential to support policy-making and public debate, particularly regarding the development of new thrombectomy capacity.

**Trial registration number:** N/A

## WITHDRAWN

## AS12-062

### PROSPECTIVE VALIDATION OF NEUROLOGICAL SIGNS ASSESSED BY EMS FOR PREHOSPITAL TRIAGE OF SEVERE STROKE

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**Background and Aims:** Rapid clinical identification of stroke patients with proximal arterial occlusion or intracranial hemorrhage (ICH) is crucial for immediate referral to comprehensive stroke centers (CSC) with facilities for mechanical thrombectomy and neurosurgery. We aimed to examine the diagnostic accuracy of prehospital identification of such patients through recognition of warning neurological signs by emergency medical services (EMS) staff.

**Methods:** We prospectively collected data from consecutive stroke cases admitted via EMS in September 2017 in St. Petersburg, Russia. Neurological status was recorded in the prespecified form. Patients with proximal arterial occlusion, critical ( $\geq 60\%$  on CTA or DSA) arterial stenosis, and ICH were considered as candidates for CSC.

**Results:** Three hundred fourteen stroke victims were identified, 139 (45%) males, median age 69.5 (interquartile range (IQR) 60.5-80), median admission NIHSS score 5 (IQR 3-9), of those 18 (7%) had ICH, 245 (93%) had ischemic stroke, of which 82 (27%) were caused by proximal arterial occlusion or critical arterial stenosis. Combination of hemiparesis (unability to hold arm and leg against gravity) with decreased level of consciousness, eye deviation, or aphasia was suggestive of need of transportation to CSC with sensitivity 55%, specificity 86%, diagnostic accuracy 76% (AUC 0.7). Diagnostic accuracy of the combination exceeded that of each sign.

**Conclusions:** In a prospective study, the combination of hemiparesis with any of 3 stroke signs (decreased level of consciousness, eye deviation, or aphasia) was easily recognized by EMS staff and associated with a need of transportation to CSC, thus representing a promising clinical tool for early triage of stroke victims.

**Trial registration number:** N/A

## AS12-055

### QUALITY IMPROVEMENT PROGRAMS FOR STROKE IN ESTONIA

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**Background and Aims:** In 2015 quality improvement program with the aim to improve the management of stroke in Central and Eastern Europe was launched by ESO-EAST. On the same time, a national program in cooperation of the University of Tartu and Estonian National Health Insurance Fund (NHIF) was started in Estonia.

**Methods:** The RES-Q database is a tool for prospective clinical data collection from participating hospitals for continuous monitoring, evaluation and improvement of health care quality in ESO-EAST countries. The data for the national quality indicators program derive from the NHIF database (data from bills for acute stroke services in all Estonian

hospitals linked with national death registry and medication prescription database). The results for 2017 are presented.

**Results:** According to the national quality indicators program, a total of 80% (95% CI 79–82%) of 3598 acute strokes were managed in 6 Estonian stroke-ready hospitals in 2017. Totally, 21% (95% CI 20–23%) of ischemic stroke patients in Estonia received acute recanalization therapies. However, inpatients rehabilitation services within 30 days after stroke were available only for 21% (95% CI 20–22%) of patients. Four of the stroke-ready hospitals have joined RES-Q and a total of 417 stroke cases from 4 centres are registered into the database by January 2019 during the annual 1-month collection period (March/April) since 2017.

**Conclusions:** The data from national quality indicators project and RES-Q database jointly provide information for developing a national strategy of stroke management and certify stroke units. Permanent communication with the Ministry of Social Affairs and the NHIF is in progress.

**Trial registration number:** N/A

## AS12-060

### USE OF MRI IN ACUTE STROKE DOES NOT INCREASE THE TOTAL COSTS OF HOSPITALIZATION – A QUASI-RANDOMIZED CLINICAL TRIAL

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**Background and Aims:** CT-head is fast and feasible in most acute stroke-patients but MRI is superior in detection of acute ischemia and cerebrovascular pathology and thus potentially accelerates the diagnostic evaluation and ultimately the duration and costs of hospitalization.

The aim of this study was to compare the total costs of hospitalization, from admission to discharge, for stroke patients randomized to Computer Tomography (CT) versus Magnetic Resonance Imaging (MRI) prior to administration of Intravenous-tissue-Plasminogen-Activator (iv-tPA).

**Methods:** Consecutive patients ( $n=444$ ) with symptoms of acute stroke were randomized (1:1) to CT or MRI prior to potential iv-tPA-treatment. Salary costs for the acute stroke-team, length of hospital-stay and total running costs of hospitalization were established and compared for CT and MRI-allocated patients.

**Results:** Though MRI-based acute stroke assessment (median 225 min (IQR 187–274 min)) prior to iv-tPA obtained significantly more staff-time and thus higher salary costs than CT-allocated assessment (median 201 min (IQR 171–235 min)) ( $p < 0.0001$ ), the total costs of hospitalization from admission to discharge were alike for CT and MRI-allocated patients ( $p=0.415$ ). The number of additional image examinations conducted during hospitalization were regardless of patients being allocated to CT or MRI on admission, ( $p=0.142$ ). No significant difference in length-of-hospital-stay was detected between CT (median 3.5 days (IQR 1.0–10.0)) and MRI-allocated patients (median 4 days (IQR 1.0–8.8)),  $p=0.890$ .

**Conclusions:** As MRI in acute stroke does not increase the total costs of hospitalization, choice of image-modality should not be based on health economic grounds but alone on diagnostic considerations and feasibility.

**Trial registration number:** ClinicalTrials.gov Identifier: NCT02780843

## AS12-072

### DEVELOPMENT OF CZECH NATIONAL STROKE GUIDELINES

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**Background and Aims:** High quality guidelines development can be achieved by using strong and comprehensive methodology of guideline development, implementation and evaluation within national or international settings with sufficient resources.

The aim is to describe the methodology of the Czech stroke guidelines development.

**Methods:** The guideline development group of specialists in stroke medicine and guideline methodologists was established. The stroke secondary prevention with antithrombotic treatment for patients with cardioembolic ischaemic stroke was considered for a pilot guideline development. PICO and GRADE methodology as exclusion criteria were used. Search strategy for systematic review of existing guidelines were developed and performed followed by two-stage evaluation based on primary and secondary criteria. One current clinical practice guideline on stroke developed by Australian Stroke Foundation (ASF) in 2017 using the GRADE methodology was found and included in further assessment with AGREE II instrument. Adaptation was used as a method for the guideline development. The adopted guideline was peer reviewed by a panel of lead specialists in cardiology, clinical pharmacology, general internal medicine, emergency medicine, general practice medicine as well as lay person. After the peer review, the quality was evaluated and agreed by the Methodology board and supplied for final approval to the Board of Guarantors.

**Results:** Adapted guideline on stroke secondary prevention with anti-coagulants was developed by adaptation of 2017 ASF guideline.

**Conclusions:** Adapted clinical practice guideline on stroke secondary prevention with anticoagulants based. There is a structured plan for systematic updating of the guideline as well as the plan for further national stroke guideline programme development.

**Trial registration number:** N/A

## AS12-085

### NATIONAL INITIATIVE IN ENGLAND TO REDUCE UNWARRANTED VARIATION: GETTING IN RIGHT FIRST TIME (GIRFT) – STROKE PROGRAM

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**Background and Aims:** Reducing unwarranted variation is vital if centrally (taxation) funded health care is to remain affordable. Estimates in England suggest savings of >£5 billion (4%), of which £2 billion are in workforce efficiency. The GIRFT stroke program is a clinically led NHS Improvement program using process markers of care, along with outcome data including recurrence rates and costs, with patient reported outcomes to reduce unwarranted variation and support networked quality improvement.

**Methods:** Using existing process markers of care (SSNAP) with Hospital Episode coded activity (HES), Diagnostic imaging data (DIDs), observed mortality data (ONS) and patient reported outcome measures (PROM's) a geographic representation of variation of care will be formed.

Regional workshops supporting individual hospital teams with 'deep dives' will highlight variation, celebrating excellence and providing networked support for improvement. 122 acute stroke provider organisations in England will have individualised data with clinically lead focused discussions grouped geographically in 2019.

**Results:** 20 hospitals have had pilot visits over 2 regions in 2018 >12,000 patient episodes

7% variation in adjusted mortality/14 day variation in length of hospital stay

4% variation in stroke recurrence rate at 1 year

10% variation in need for antibiotics in first 7 days post stroke

12% variation in IV thrombolysis rate

80% variation in timely SLT assessment

30% variance in use of MRI scanning

£200 variance in one bed day care costs

**Conclusions:** Significant variation exists between pilot sites with in the same region. Through delivering networked improvement methodology a reduction in unwarranted variation and improved efficiency is envisaged.

**Trial registration number:** N/A

## AS12-042

### STROKE QUALITY MANAGEMENT REGISTRY RES-Q : FIRST COMMUNITY – BASED STROKE REGISTER INCLUDED IN STROKE ROADMAP IN KYRGYZSTAN

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and L. Imanbekova<sup>2</sup>**

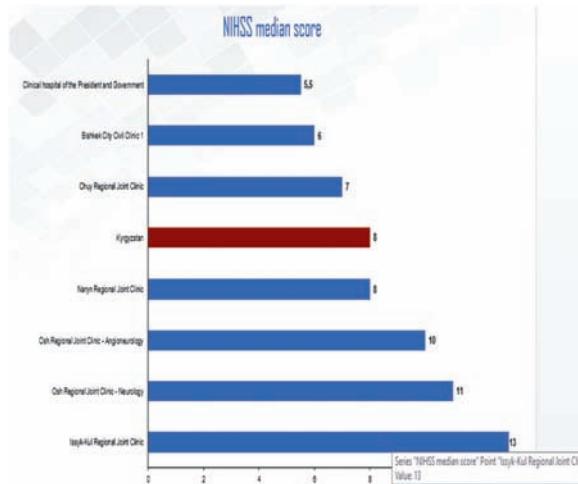
<sup>1</sup>Kyrgyz State Medical Academy, Online and Distance Learning, Bishkek, Kyrgyzstan; <sup>2</sup>Issyk-Kul Regional Hospital, Neurology, Karakol, Kyrgyzstan

**Background and Aims:** Due to transport and internet barriers, it was not possible earlier to make a comparative analysis of stroke on different altitudes in Kyrgyzstan. Aim was to include RES-Q register, created by ESO, in the ROADMAP for stroke in Kyrgyzstan to help rural regions to monitor acute stroke care.

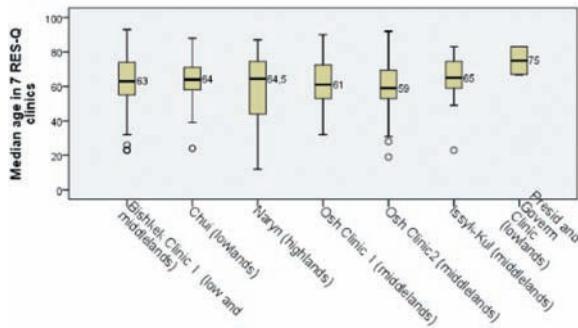
**Methods:** The data collection was via paper-based forms followed the RES-Q site filling out. 7 acute stroke departments from lowlands, middlelands and highlands were included. 24 variables were analyzed including demographic parameters, stroke types, onset-to-door time, treatment at discharge. Median NIHSS and mRs were compared within the altitudes.

**Results:** We registered 647 cases of strokes, 329 (50.9%) were men; median age was 63 (55;72), patients with IS from highlands were significantly younger: median age 54 (52;68), p = 0.0001. Ischemic stroke (IS) prevails on all altitude, dominating on low and middlelands: 69% of cases. Median NIHSS was significantly higher in Issyk-Kul region (middle and highlands): 13, than in middlelands: 8, and even on lowlands: 6; p = 0.0001. 38% of IS patients have secondary hemorrhagic transformation and 55% of stroke patients underwent neuroimaging in remote areas, among which only 24% of the imaging procedures were performed within 1 hour from hospital admission. Patients on highlands admitted more in

unconsciousness and inhospital mortality in acute period was higher (27.7% vs. 6%).



Median age of patients in seven hospitals in Kyrgyzstan, participating in RES-Q Stroke Registry



**Conclusions:** RES-Q is the first stroke registry, included in Roadmap, which displayed stroke statistics within low medium and high altitudes in Kyrgyzstan. It allowed policy makers realistic planning of health policies and stroke best practice implementation in Kyrgyzstan.

**Trial registration number:** n/a

## AS12-073

### FIRST “FAST – SOKKU” STROKE RECOGNITION CAMPAIGN IN KYRGYZSTAN: SUCCESSFUL IMPLEMENTATION OF FAST- LIKE ADAPTED IN ALGORITHM SOKKU FOR RAISING STROKE AWARENESS IN POPULATION.

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N. Moloshova<sup>1</sup>, D. Gerasimova<sup>1</sup>, S. Omurbekov<sup>1</sup>,  
D. Nazhmudinova<sup>1</sup>, A. Sultanova<sup>1</sup> and A. Ismailova<sup>1</sup>**

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**Background and Aims:** Over a third of adults in Kyrgyzstan have three or more cardiovascular risk factors, dying from a noncommunicable

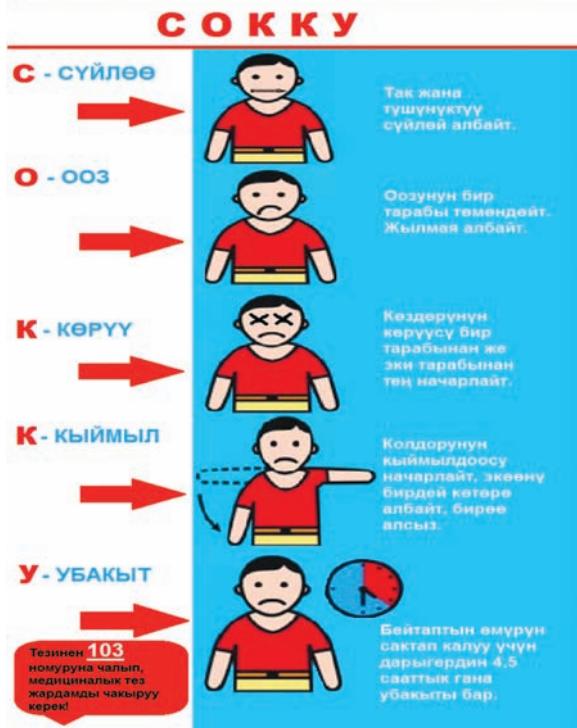
disease (NCD) between the ages of 30 and 70 years is 28%. We aimed to create FAST-like algorithm in Kyrgyz language and to educate patients with stroke risk factors, assessing public knowledge of stroke.

**Methods:** Kyrgyz ESO-EAST team developed "SOKKU"- algorithm, an acronym from "to speak, to see, to move, to sense and to act" which was validated in Kyrgyz language. We used a questionnaire on stroke awareness about stroke symptoms, ideas of patients about stroke risk-factors, methods of prevention. We educated 130 patients with stroke and other cerebrovascular diseases by trainings and distributed printouts of "SOKKU" in vascular neurology clinics of Bishkek.

**Results:** Median age was 56.00 (22;83), with 79 (60.8%) women in the sample. Only 30.61% of patients would recognize stroke and mostly those, who has had it or their direct relatives (97%). Patients did not correlated stroke with heart diseases and avoided taking blood pressure medications on a regular basis. 97% of patients volunteered to be educated on SOKKU algorithm and wanted to be pictured with it and perform in mass-media. 98% of patients pointed out the easiness of remembering the SOKKU and 67% of them volunteered to teach relatives.

**Conclusions:** The set of trainings has confirmed the effectiveness of the SOKKU campaign in raising public awareness of stroke and stroke warning signs. SOKKU is included in stroke Roadmap for the primary level to raise population stroke awareness.

#### Инсультту аныктоого төмөнкү тест жардам берет



Trial registration number: n/a

#### AS12-059

### ORGANISATIONAL MODELS OF TREATMENT DELIVERY FOR PATIENTS WITH ACUTE ISCHAEMIC STROKE

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**Background and Aims:** The efficacy of intravenous thrombolysis (IVT) and intra-arterial thrombectomy (IAT) for acute ischaemic stroke is strongly time-dependent. In this review we identify the (dis) advantages of the various organisational models and research methods used, reveal knowledge gaps and propose a systematic and analytic way forward.

**Methods:** Pubmed, Embase, Medline and Web of Sciences were systematically searched for the terms 'stroke', 'intra-arterial thrombectomy' and 'organisational model (s)' and their synonyms. Primary outcome measures included functional outcome at 90 days and time to IVT and IAT treatment.

**Results:** Two dominant organisational models have evolved. In the 'drip and ship' model patients are routed via a primary stroke centre (IVT-capable) to a comprehensive stroke centre (CSC, IVT and IAT-capable). In the 'mothership' model patients are directly transferred to the CSC. Routing is mostly determined by geographical location, and time to nearest IVT-capable facility. Studies reported shorter onset-to-IVT times and onset-to-IAT times in 'mothership' patients compared to 'drip-and-ship' patients. Furthermore, a few studies reported better clinical outcomes for 'mothership' patients. Currently, alternative organisational models are evolving to identify patients with large vessel occlusion suitable for IAT, for example with pre-hospital screening scales, telemedicine and mobile stroke units.

**Conclusions:** Several organisational models can be used for timely delivery of treatment in AIS patients. The model of choice depends on the

stroke onset location. Fine-tuning of current models can be improved by workflow management and optimising transportation modalities.

**Trial registration number:** N/A

## AS12-086

### THE PILLARS OF STROKE VICTOR RECOVERY STROKE RECOVERY IS A LIFE-LONG JOURNEY THAT IS FULL OF UNIQUE OPPORTUNITIES FOR GROWTH IF YOU KNOW HOW.

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**Background and Aims:** We are a stroke support organization in the United States where the healthcare system is not what it is in much of Europe, and the rest of the world. There are very few true post-stroke support services in our country, and what there are is very geocentric. As such we are constantly researching to learn new ways to help our community. Often we learn by participating in forums such as ESOC, and we salute you.

A strong mission of our Foundation is post-stroke to assist the survivor and their caregiver partner to create a new and rich post-stroke lifestyle which emphasizes continued recovery progress. To that end, we innovated a concept we call. The Pillars of Stroke Victor Recovery. Our aim is to educate all regarding an experiential approach to a lifetime of recovery.

**Methods:** Personal exploration and understanding the world of extended healthcare go a long way to implement our strategies. This, combined with depression mitigation and an active caregiver advocating for change makeup key components of our road map to success.

**Results:** More recent research, since the introduction of the original concept last year, has resulted in the addition of 3 additional Pillars for a total of 12 Pillars from the original 9. Each of the Pillars has been created as a result of research and personal experience of motivated survivors'.

**Conclusions:** Stroke survivors and their caregiver partners can lead an exciting and constructive "NEW Me" lifestyle by following the 12 Pillars Roadmap to Success.

**Trial registration number:** N/A

## AS12-043

### EGYPTIAN STROKE CARE NETWORK, ALEXANDRIA PROJECT; SOLUTION KITS EXAMPLE TO ORCHESTRATE STROKE CARE CHAOS IN DEVELOPING COUNTRIES

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**Background and Aims:** Egypt is the most populated nation in the ME, with a crude prevalence of 963/100000 inhabitants. A huge practice gap and lacking for the milestones in the fight against stroke, are the leading cause of death and disability. Absence of prehospital pathways and categorization of stroke facilities are the main obstacles to organize stroke chain at Alexandria city level (11 million inhabitant).

**Aims:** organizing the stroke services at the city level by Applying certain policy to maximize treatment utilization.

**Methods:** compare the main characteristics of stroke care, in a Alexandria city, before 2016 and between 2016 and 2018 with updated results after applying ESC-Alexandria Prototype Policy: based on 2 components ; First; ranking the stroke ready facilities on a 6 levels (color coded grading system) according to the capability to present stroke bundles of care. Second; organizing prehospital phase to maximize the

number and shorten the times to AIS treatment via using Arabic interface smartphone app to triage and organize workflow.

**Results:** During 2 years of policy implementation; there was a major increase in the number of stroke ready facilities in the Alexandria City, and in the number of reperfused strokes (either by IV-rtpa or MT). there was increase in funding for stroke rehabilitation; for training of healthcare professionals and stroke awareness with Improving Pre-hospitals Phase using ESN-App.

**Conclusions:** The evolution of stroke care in Alexandria over the last 2 years is a pathway that exemplifies the challenges that middle-income countries have to face in order to improve stroke organization.

**Trial registration number:** ClinicalTrials.gov-Identifier NCT03723382

## AS12-019

### CHARACTERISTICS OF STROKE ALERT PROCESS ATENDED BY 061 ARAGON ASSITANCE UNITS FROM 2010 TO 2016. FACTORS INFLUENCING TIMES OF RESPONSE AND ACCES TO RTPA TREATMENT.

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**Background and Aims:** Study the response times of stroke code assistance by care units of 061 ARAGÓN, analyzing factors involved and their relationship with availability to fibrinolytic treatment in the hyperacute phase.

**Methods:** Cross-sectional descriptive study on out-of-hospital care by 061 ARAGÓN care units for stroke patients, based on the registry of cases treated as stroke code during the period of 2010–16.

**Results:** A total of 1743 patients were attended: 54.6% were males, with a mean age of 72.83 (13.1) years. There was an increase in strokes attended in 2015 and 2016 (372 and 366 respectively), compared to the average of 249 strokes per year in the rest of the years. 27.2% of patients were treated between 08:00-11:59 hours. Regarding the time it took to take care of the patient, the average was 71.93 minutes (SD 33.64); Attending to regions, significant differences were found, with a longer response time in Teruel (rural area). When influence of the hour interval on the percentage of cases treated with fibrinolysis was analyzed, a higher rate of fibrinolysis was observed when it was activated between 12:00-15:59h, however, in the intervals 20:00-23:59h and 4:00-07:59h, significantly lower percentages were observed (19.8% and 16%, respectively).

**Conclusions:** In 55.3% of patients, the "061 response time" was greater than 60 minutes, but these times were not conditioned by the activation time. However, there were differences in the percentage of cases fibrinolysed in the different time intervals, suggesting that factors other than the response time of 061, which must be analyzed, influence the indication of fibrinolytic treatment.

**Trial registration number:** N/A

**AS12-034****NATIONWIDE STUDY IN THE CZECH REPUBLIC ON QUALITY OF STROKE SERVICES AS A FUNCTION OF VOLUME OF STROKE CENTERS**

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**Background and Aims:** The quality of medical services could be volume dependent. We therefore tested whether the quality of stroke services is dependent on the volume of stroke admissions using data from the national quality registry RES-Q.

**Methods:** All three collecting periods (March 2017 and 2018, and October 2018) were analyzed. Hospitals were divided into quartiles based on volume of stroke admissions. Compliance with quality metrics was compared across quartiles of hospital admissions using a 4x2 Chi-square test.

**Results:** All 45 certified stroke centers in the Czech Republic provided data on 4929 cases with the median number of hospital admissions per 3 months 147 (25-75 quartile: 88–170). Compliance with quality metrics in different quartiles of hospitals (from highest to lowest volume quartiles) was as follows: percent of patients admitted to stroke unit/monitored bed 76%, 77%, 68%, 72% ( $p < 0.001$ ), recanalization treatments or referred for such a treatment 42%, 35%, 26%, 26% ( $p < 0.001$ ), NIHSS examined 75%, 68%, 80%, 68% ( $p < 0.001$ ), dysphagia screening with GUSS test 40%, 34%, 35%, 30% ( $p < 0.001$ ), anticoagulation for AF 56%, 56%, 56%, 70% ( $p = 0.001$ ), ICA imaging within 7 days 82%, 75%, 72%, 80% ( $p < 0.001$ ), statin prescription 67%, 59%, 63%, 73%

( $p < 0.001$ ), and antihypertensives prescription 75%, 72%, 77%, 70% ( $p = 0.002$ ).

**Conclusions:** Higher volume stroke centers had better compliance only with some of the quality metrics and the absolute differences were not clinically substantial. Within a certified and quality-controlled network, stroke centers with different volume of stroke patients provide a similar quality of stroke care.

**Trial registration number:** N/A

**AS12-065****BARRIERS TO DEFINITIVE HYPER-ACUTE MANAGEMENT OF STROKE AT A TERTIARY CENTRE IN NAIROBI, KENYA**

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**Background and Aims:** Hyper-acute stroke management remains significantly low in developing countries, largely due to country-specific pre-hospital factors. We conducted a study to determine the barriers for hyper-acute stroke management in our setting, and present our interim findings.

**Methods:** In a descriptive cross-sectional study, we prospectively consented and enrolled the next-of-kin/guardian of patients with acute stroke (ischaemic and haemorrhagic). We administered a questionnaire that captured information on pre-hospital barriers, including knowledge of stroke. We used the onset-to-door time (ODT) of  $\leq 3.5$  hours.

**Results:** For 69 patients (mean age 60.2 years, 58% men): 87% had ischaemic stroke including transient ischaemic attacks (TIA), of which 19% non-TIA cases underwent intravenous thrombolysis. 81% had symptom-onset at home, but only 42% arrived  $\leq 3.5$  hours. Distance from hospital was a significant ODT factor: median distance = 8km for ODT  $\leq 3.5$  hours versus 15km for  $> 3.5$  hours ( $p$ -value = 0.017). Only 22% arrived by ambulance; 76% used private cars/taxis. 12% visited another hospital first. From respondents: top stroke symptoms were dizziness (74%) and unilateral weakness (68%). 94% correctly identified one major stroke risk factor, but 81% also identified "stress" as one. Only 29% would call an ambulance for someone with acute stroke; 62% would drive them to hospital, and 32% identified traffic as a major delay-in-transit factor. 51% correctly identified acute stroke treatments (thrombolysis, aspirin).

**Conclusions:** Travel (mode, choice, traffic and, significantly, distance) is a major pre-hospital barrier. Dizziness and stress are perceived as top symptoms and factors for stroke respectively. Our findings can target local policy-making/public awareness to improve access to stroke care.

**Trial registration number:** N/A

**AS12-024****TELEVERTIGO 2.0: DIAGNOSING STROKE IN A TELEMEDICAL SUPPORTED SYSTEM OF CARE FOR ACUTE DIZZINESS/VERTIGO**

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**Background and Aims:** Identifying strokes in acute dizziness or vertigo is a common problem in emergency departments (ED). The diagnosis is based on neurological and neurootological examinations, which are often

not available in the ED of rural hospitals. A solution might be a telemedicine-based approach.

The authors aim to present a concept of a telemedical supported system of care to identify strokes in acute dizziness or vertigo presentations.

**Methods:** The key technical feature is a video-head-impulse test (vHIT) for quantitative measurement of the vestibulo-ocular reflex during head trusts, integrated into an adapted videoconference system of existing TeleStroke Unit networks.

**Results:** The concept comprises three stages of inpatient work up: (1) A triage in the ED to identify all strokes immediately and reliably by physicians supported by TeleStroke consultants. Therefore, an algorithm based on the HINTS rule (head impulse test, nystagmus, test of skew) was developed which includes the vHIT. (2) On the following working day, the on-site neurologist performs an elective examination with telemedical assistance of the TeleVertigo team of the centre. (3) Trained physiotherapists offer adequate therapy for strokes and non-strokes, e.g., reposition treatment and vestibular restoration therapy. Additional structural features include treatment standards, training programs and quality assessment.

**Conclusions:** This concept suggests a new approach to identify stroke patients with vertigo and dizziness. It is based on already existing telemedicine infrastructure and implements the vHIT. This is a major step towards a broadly available evidence-based and state of the art diagnosis and therapy for these patients, especially in rural areas.

**Trial registration number:** N/A

## AS12-036

### PATIENT CHARACTERISTICS AND PREDICTORS OF SIX-MONTH POST-STROKE REVIEWS: A MULTI-CENTRE PROSPECTIVE COHORT STUDY USING INFORMATION FROM THE SENTINEL STROKE NATIONAL AUDIT PROGRAMME

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**Background and Aims:** Six-month post-stroke reviews help address unmet needs and can be used to identify the impact of acute care and rehabilitation. Guidelines recommend all patients receive a six-month review. We evaluate which factors determine whether reviews are conducted.

**Methods:** Data from the Sentinel Stroke National Audit Programme (SSNAP) collected from April 2013 to March 2018 were used. Group differences were compared using both bivariate and hierarchical regression analyses.

**Results:** 327,156 stroke survivors were included, median age 76 years [IQR 65–84], 52.2% males, 91% had ischaemic strokes, median time to follow-up 6 months [5-7]. Estimated rate of six months review was 24% (95%CI 23.9-24.2). Patients with six months review were significantly more likely to be between 61–80 years (63% vs 57.7%), white (90.4% vs 87.5%), pre-stroke mRS ≤ 2 (88.5% vs 83.4%), hypertensive (55.5% vs 53.5%), receive thrombolysis (13% v 11%) and attained better key indicators. After adjustment, best predictors for six-month review were receipt of early supported discharge (OR 3.2, 95%CI 2.78-3.67), requiring psychological support during admission (1.18, 1.05-1.32), having received thrombolysis (1.13, 1.05-1.21). Discharge to nursing home was the most relevant predictor of missing six-month review (0.63, 0.57-0.69).

**Conclusions:** Six-month post-stroke reviews rates were suboptimal. Inequalities for attendance were identified and indicate that those who do receive a review are not representative of the whole population. This information should be used to inform quality improvement initiatives in stroke care.

**Trial registration number:** N/A

## AS12-041

### TITLE: TELESTROKE/TELEMEDICINE IN LOMBARDIA (ITALY): ASST OVEST MILANESE EXPERIENCE

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**Background and Aims:** Telestroke (TS) is widespread in rural regions.

**Methods:** We report one year of application of Telestroke in our contest consisting of three hospitals (one hub and two spoke centers) in the north of Italy (Lombardia) near to Milan. Hub and Spoke centers are almost 30 kilometers apart, but 90–120 minutes are required to transfer a patient in emergency condition.

**Results:** In 2017 the total number of TS neurological consultations was 33; 16/33 patients underwent recombinant tissue plasminogen activator (rTPA) administrations and/or endovascular approach. We compared the group of TS treated patients with a group of 8 patients coming from the Spoke center and treated in the Hub in the pre-TS era (2016). In the group of TS treated patients mean door to needle time was 88 minutes, mean discharge modified Rankin scale (dMRS) was 1 and mean time hospitalization was 10.9 days. In pre-TS group mean door to needle was 177 minutes, mean dMRS was 2 and mean time of hospitalization 16.7 days. There was no increase of bleeding rate in the 24 hours CT scan after treatment.

**Conclusions:** Our network represents a novel urban experience of TS. Our experience confirm that TS is reliable and safe, clinical neurological evaluation using teleconsultation is as accurate as a bedside visit. The main advantage of TS system is to reduce the door to needle time. This great time sparing is associated with improved functional outcomes and less institutionalization rate, resulting in lower healthcare costs over the long term, with no increase of symptomatic intracerebral hemorrhages.

**Trial registration number:** N/A

## AS12-079

### SNAPSHOT AUDIT TO ASSESS THE FEASIBILITY OF COLLECTING DATA AND TO UNDERSTAND CONTEXTS OF CARE FOR PEOPLE WITH STROKE AND ACUTE CORONARY SYNDROME IN KYRGYZSTAN

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**Background and Aims:** Continual longitudinal clinical audits, gathering insight into the process of care of cardiovascular patients, are necessary

to improve services for stroke and ACS patients. Nevertheless, these are not always available in lower- and middle-income countries. We carried out a snapshot audit in Kyrgyzstan, in Bishkek and its surrounding region, with the objectives of:

- collecting data on quality indicators,
- performing a first process-based audit
- understanding the diverse contexts in which care is delivered.

**Methods:** The snapshot audit took place in July 2018, and it was carried in private sector facilities and public sector institutions.

Two teams of auditors examined up to 20 records in each facility, related to patients admitted in the two months before the audit. Selected patients all received a diagnosis of Stroke (ischaemic, haemorrhagic or transient ischaemic attack) or ACS (acute myocardial infarction with and without ST elevation, and unstable angina).

**Results:** Overall, 131 records were examined (62 stroke and 69 ACS patients). All records (100%) included demographics, day and time of admission, day of discharge, diagnosis, in-hospital drug therapy, information about how the patient arrived at the hospital and which diagnostic procedures were performed and when.

**Conclusions:** Many points emerged, such as preference in use of Neuroimaging in stroke, and use of reperfusion therapies for MI in acute phase. We demonstrated that snapshot audits can be conducted in Kyrgyzstan (and in other lower- and middle-income countries) and that this system can monitor the process of care and some indicators, although with some limitations.

**Trial registration number:** N/A

## AS12-021

### MAPPING HYPERLINK WEB STRUCTURES OF THE STROKE FOUNDATION AND FIVE HEALTH INDUSTRY LOBBY GROUPS

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**Background and Aims:** Health industry lobby groups act as patient advocacy groups, shaping health policy, funding and promote research in their respective fields. The relationship between their hyperlink web structure and successes with funding is not known. In this study we explored hyperlinks underlying web structures and successes with funding.

**Methods:** The hyperlink web structure of six health industry groups (Stroke Foundation [SF], Motor Neurone Disease Australia, Multiple Sclerosis Australia, Heart Foundation [HF], Dementia Australia, Cancer Council) were mapped using VOSON software. The web crawl was set to find up to 1000 web pages with hyperlinks to these organisations. The network properties were explored in terms of webpages, links and PageRank (rank importance of web page based on the importance of their links).

**Results:** The search yielded 1704 related web pages and 2086 hyperlinks in total. The mean number of webpages per lobby group was  $327.8 \pm 26.9$ , hyperlinks  $331.1 \pm 26.9$ , and PageRank  $0.143 \pm 0.201$ . Cluster analyses showed six major distinct communities (representing the six health industry groups) with few shared hyperlinks between them. In regression analyses revenue was related to network metric (after removing outlier HF) but not disease prevalence. HF was ranked fourth in web metrics but first in funding revenue. By contrast, the SF was ranked third for both web metrics and funding.

**Conclusions:** With the exception of one outlier, the hyperlink structures of lobby groups appear to be related to funding revenue.

**Trial registration number:** N/A

## AS12-084

### EVALUATION OF A REGIONAL SYSTEM OF ACUTE ISCHEMIC STROKE CARE IN A MOUNTAIN DISTRICT: COMPARISON BETWEEN PATIENTS FROM URBAN AND RURAL AREAS IN TRENTO

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**Background and Aims:** Acute ischemic stroke (AIS) network in Trentino is organized as a hub-and-spoke system with 5 spoke centers referring to Trento Stroke Unit. Trentino is an alpine region, with approximately 540000 inhabitants, 34% in Trento suburban area, and a population density of 78,64 ab./km<sup>2</sup>. We argued if AIS patients from rural and urban area would have access to the same treatment.

**Methods:** All consecutive AIS patients admitted in Trentino emergency departments (EDs) in 2017 were reviewed. Variables included demographics, symptom onset time and features, ED admission modality, acute management. Patients were classified as "urban" or "rural" based upon their residency.

**Results:** AIS patients in 2017 were 949, 27% urban and 73% rural. Between the groups baseline characteristics were different for gender (38.1% male in urban vs 47.7% in rural, p = 0.01) and age (median 81 years [72-88] in urban, 78 [69-86] in rural, p = 0.043). These differences disappeared after multivariate analysis. Acute treatment was performed in 12.4% of all AIS, equally in the two groups. Among treated patients, urban were significantly older than rural (85 [73-90] vs 78 [67-84], p = 0.03), whereas untreated patients showed no differences. The two groups did not differ for admissions before 4.5 hours from symptoms onset, with self-presentation, nor directly in the hub ED.

**Conclusions:** Rural and urban patients seem to access equally to the AIS network. However, as demonstrated by a different median age, rural patients appear to be in some way differently "selected" for acute therapy. This finding should be investigate to assure homogeneous access to AIS therapy.

**Trial registration number:** N/A

## AS12-056

### CITY STROKE EMERGENCY MAP IMPROVES ACCESS TO RT-PA FOR PATIENTS WITH ACUTE ISCHEMIC STROKE

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**Background and Aims:** Prehospital delay is one of the major causes of low rate of intravenous rt-PA thrombolysis for acute ischemic stroke in China. Regional emergency systems have been proved a successful approach to improve access to thrombolysis. To improve rapid access to rt-PA thrombolysis in Shenzhen, Shenzhen stroke emergency map, as the first city emergency map in China, was implemented by Shenzhen healthcare administrations,

**Methods:** This map comprised certification of qualified local hospitals, identification of stroke patients, acute stroke transport protocol and maintenance of the map. We conducted a retrospective observational study to compare consecutive patients with acute stroke arriving qualified local hospitals before and after implementation of map.

**Results:** After implementation of map, the rate of patients receiving rt-PA thrombolysis increased from 8.3% to 9.7% (P = 0.003), and the rate of patients treated with endovascular thrombectomy increase from 0.9% to 1.6% (P < 0.001). Sixteen hospitals (16/20) have an increase in the number

of patients treated with rt-PA thrombolysis. The median time between the receipt of the call and the arrival on the scene reduced significantly (17.0 minutes vs 9.0 minutes,  $P < 0.001$ ). In Shenzhen Second People's Hospital, the median onset-to-needle time and door-to-needle time was reduced ( 175.5 min vs 149.5 min,  $P = 0.039$ ; 71.5 min vs 51.5min,  $P < 0.001$  ). Currently, there are more than 40 cities implementing stroke emergency map in China.

**Conclusions:** The Shenzhen stroke emergency map improves access to rt-PA thrombolysis for acute ischemic stroke, and the novel mode has been expanded to multiple areas in China. Future efforts should be conducted to optimize stroke emergency map.

**Trial registration number:** N/A

## AS12-076

### MEMPHIS HOMICIDES BY STROKE TYPE STUDY AREA

**J. Rhudy<sup>1</sup>, J. Rike<sup>1</sup>, T. Bryndziar<sup>1</sup>, W. Dusenbury<sup>1</sup>, V. Swatzell<sup>1</sup>,  
A. Alexandrov Alexandrov<sup>1</sup> and A. Alexandrov Alexandrov<sup>1</sup>**

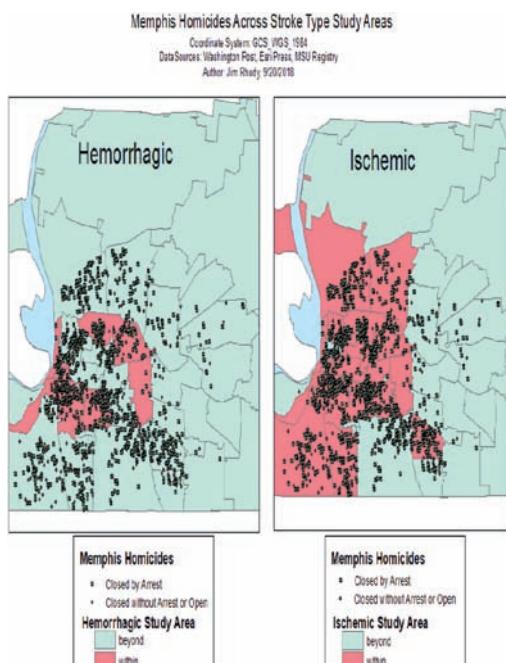
<sup>1</sup>College of Medicine, Department of Neurology, Memphis, USA

#### Background and Aims:

**Background:** Our Memphis, Tennessee Mobile Stroke Unit (MSU) team has noted that incidence of stroke, especially the hemorrhagic subtype, is concentrated in smaller, and more disadvantaged, areas within the urban core as one approaches from the relatively affluent suburbs.

**Methods:** We subset our first two years' MSU registry data by stroke type as hemorrhagic and ischemic. We aggregated raw counts of each stroke type by zip code, normalized raw counts to population, and symbolized the resulting incidence rate by mathematical natural break into two groups to allow the mathematics, and not our preconceptions, to define areas of high incidence. We then overlaid spatially enabled data regarding incidents of total and unsolved homicide for the Memphis area over an eleven-year period. We sought to determine the proportion of total and unsolved homicides within vs. beyond our high incidence study area boundaries for each stroke subtypes.

**Results:** We found that the disadvantage gradient of proportion within vs. beyond the study areas was 5.066 for total and 5.159 for unsolved homicides across the ischemic study area boundary and 2.547 for total and 2.360 for unsolved homicides across the hemorrhagic study area boundary.



**Conclusions:** We conclude that violent crime is considerably more frequent within vs. beyond our study areas and that as one approaches the urban core most of the risk has already been encountered in the larger study area. We urge caution for clinical and research teams serving such areas and recommend that intervention and study design take this risk into consideration.

**Trial registration number:** N/A

## WITHDRAWN

## AS12-039

### PROFILE, RISK FACTORS AND IN-HOSPITAL OUTCOME OF OVER 1300 STROKE PATIENTS FROM A SINGLE TERTIARY CARE HOSPITAL STROKE REGISTRY IN INDIA

**J. Roy<sup>1</sup>, S. Dey<sup>1</sup> and D. Chakraborty<sup>1</sup>**

<sup>1</sup>AMRI Institute of Neurosciences- Mukundapur, Neurology, Kolkata, India

**Background and Aims:** Large hospital-based stroke registry from India are limited in number. We aimed to study the same in patients admitted to our centre. We analysed consecutive patients admitted with acute stroke in our stroke centre over the last 5.5 yrs

**Methods:** All ischemic stroke patients underwent CT/MR brain, neck vessel Doppler and echocardiography. CT Angiography (arch to vertex), 24/48 hr Holter, trans-esophageal echocardiography and atypical stroke screening were done as and when required. Baseline and discharge NIHSS, vascular risk factors, medical & imaging records and patient demographics were recorded

**Results:** Out of 1304 patients admitted, 804 (61.6%) had ischemic while 500 (38.4%) had hemorrhagic stroke. The mean age was  $58.4 \pm 13.3$  with 54 % men. In ischemic stroke, large vessel atherosclerosis was found in 190(23.6%), cardio embolic 170 (21.1%), and small vessel disease in 135 (16.8%) patients, while 40(4.9%) had other causes and 269 (33.4%) were undetermined. Of 500 patients of ICH, 221 (44.2%) had basal ganglia, 101 (20%) had thalamus, 109 (21.8%) had lobar, 30 (6%) had cerebellar, 16 (3.2%) had brain stem and 23 (4.6%) had primary IVH. The commonest vascular risk factors were hypertension (84.48%) followed by diabetes (51.73%), smoking (30.7%) and dyslipidemia (19.5%). The median NIHSS score at admission and discharge were 11 & 6 respectively with in hospital mortality of 3.4%

**Conclusions:** In our registry, major mechanism of ischemic stroke is undetermined while basal ganglia is the most common location of bleed for hemorrhagic stroke. Hypertension remained the commonest risk factor overall. In-hospital mortality is low

**Trial registration number:** N/A

## AS12-063

### A GAP ANALYSIS FOR FUTURE ISCHAEMIC STROKE HEALTH CARE PROFESSIONAL REQUIREMENTS: THE CASE OF RIYADH, SAUDI ARABIA.

**M. Salawati<sup>1</sup>, F. Al-Senani<sup>1</sup>, M. AlJohani<sup>1</sup>, M. Cuche<sup>2</sup>, V. Seguel Ravest<sup>3</sup> and S. Egginton<sup>4</sup>**

<sup>1</sup>National Neurosciences Institute- King Fahad Medical City, Department of Neurology, Riyadh, Saudi Arabia; <sup>2</sup>Medtronic International Trading Sarl, Neurovascular Health Economics and Reimbursement, Tolochenaz, Switzerland; <sup>3</sup>Medtronic Ltd, Neurovascular Health Economics and Reimbursement, Watford, United Kingdom; <sup>4</sup>Medtronic International Trading Sarl, Corporate Health Economics & Reimbursement, Tolochenaz, Switzerland

**Background and Aims:** The Ministry of Health in Saudi Arabia has identified a need to expand and develop care for patients with ischaemic stroke to improve patient outcomes and meet growing demand from an ageing population. Our goal was to determine the gap between current staff availability (covering acute care and rehabilitation) and that required under a new care model, taking into account changes in stroke incidence, for the Riyadh region of Saudi Arabia over a ten-year period, and calculate additional costs.

**Methods:** We researched existing staffing in Riyadh, collecting data on the number of staff available to work with stroke patients, undertook epidemiological modelling to predict ischaemic stroke incidence over the next ten years, and used international staffing recommendations for acute care and rehabilitation to develop a care pathway to provide state-of-the-art stroke services. This information was used to determine the additional staff requirements for the region, with costs calculated using salary data from the Ministry of Health.

**Results:** Based on an estimated increase of 77% in ischaemic stroke over ten years, additional staff would be required across acute and rehabilitation services in several disciplines: stroke consultants (7.1 additional full-time equivalents), interventional neuroradiologists (6.8 FTE), occupational therapists (26.8 FTE), and speech and language therapists (13.4 FTE). Total estimated associated costs would be around 25m Saudi riyals (\$6.7m) over ten years.

**Conclusions:** Increasing stroke incidence will require additional resources to provide optimal patient care. Our analysis suggests that significant investment in various staff types will be needed to meet this demand in the Riyadh region.

**Trial registration number:** N/A

## AS12-074

### IDENTIFYING STROKE IN PRE-HOSPITAL EMERGENCY CARE

**C. Sammut-Powell<sup>1</sup>, C. Ashton<sup>2</sup>, C. Soiland-Reyes<sup>3</sup>, C. O'Donnell<sup>3</sup>, S. Bennett<sup>4</sup> and A. Parry-Jones<sup>1</sup>**

<sup>1</sup>University of Manchester, School of Medical Sciences, Salford, United Kingdom; <sup>2</sup>Salford Royal NHS Foundation Trust, Greater Manchester Stroke Operational Delivery Network, Salford, United Kingdom;

<sup>3</sup>University of Manchester, NIHR CLAHRC Greater Manchester, Salford, United Kingdom; <sup>4</sup>Salford Royal NHS Foundation Trust, Health Informatics, Salford, United Kingdom

**Background and Aims:** Pre-hospital clinicians use the FAST test to divert suspected stroke patients to hyperacute stroke units (HASUs) in our regional centralised acute stroke pathway. Audits suggest that approximately 50% of patients diverted to HASUs are false positives. This diverts resources from patients with stroke and may impact the care quality for non-stroke patients.

**Objective:** To develop an improved stroke recognition tool for use in our region.

**Methods:** All patients brought by ambulance and assessed by the acute stroke team at our comprehensive stroke centre between 01/09/2015 and 01/03/2017 were identified from electronic patient records as well as all patients with a discharge diagnosis of stroke. Additional data were extracted from linked pre-hospital records. Model selection was applied to find the optimum logistic regression model for predicting a diagnosis of stroke. A cut-off was applied, such that the proportion of false negatives was equal to that from the FAST test. Random forest models were also used to develop a new tool to compare with the logistic model and the FAST test.

**Results:** 4216/5365 (78.6%) were suspected to have a stroke by pre-hospital clinicians. Only 2213/4216 (52.5%) of suspected strokes had a final diagnosis of stroke. The FAST test had a positive predictive value of 54.5% and a sensitivity of 81.9%. The models were compared and internal validation on test data showed that additional variables could improve the positive predictive rate without increasing the number of false negatives.

**Conclusions:** The FAST test can be improved to better identify true negatives.

**Trial registration number:** N/A

## AS12-068

### STROKE HUB WALES

**A. Seckam<sup>1</sup>**

<sup>1</sup>Cardiff Metropolitan University, Cardiff School of Sports and Health Sciences, Cardiff, United Kingdom

**Background and Aims:** Stroke remains a top cause of death worldwide. Stroke research, innovation and education is a critical enabler, contributing to effective delivery of evidence-based medicine; attracting investment and high quality research talent and is vital for laying the foundation to the next phase of health and social care delivery in Wales. Stroke Hub Wales (SHW) was launched in 2017 and is a Welsh Government funded initiative. Our vision is to achieve a step-change in high impact stroke research for the benefit of the health, wellbeing and prosperity of the people in Wales.

Set up a research agenda and funding streams

Build an infrastructure able to deliver a stronger portfolio of research Sustainable research environment

**Methods:** N/A

**Results:** Some key deliverables include-

Designed and set up a SHW web pages as a central resource and point of contact, information, and support.

Has gained >40 friends and collaborators, including 7 HBs and 7 HEIs across the UK, 10 Charities and >13 Industry partnerships.

Presented at >15 events, meetings and conferences,  
Facilitated and disseminated >10 portfolio studies to HBs.  
Recruited >2500 participants to MMM (May Measurement Month)  
Facilitated and supported grant proposals (Stroke Association project grant, HCRW Health Innovation)  
Established 2 x Welsh Cochrane Stroke Fellowships  
Re-established the Stroke Association Lectureship (Wales)  
**Conclusions:** SHV provides for the first time a coordinated link between stroke researchers, clinicians, AHPs, patients and the public. It also provides a coordinated, all Wales approach to funding – an essential component in applying for competitive funding streams at a National level.  
**Trial registration number:** N/A

## AS12-061

### CLINICAL AND ECONOMIC IMPLICATIONS OF DEVELOPING STROKE CARE IN RIYADH, SAUDI ARABIA

F. Al-Senani<sup>1</sup>, M. Salawati<sup>1</sup>, M. Al-Johani<sup>1</sup>, M. Cuche<sup>2</sup>, V. Seguel Ravest<sup>3</sup> and S. Egginton<sup>4</sup>

<sup>1</sup>National Neurosciences Institute- King Fahad Medical City, Department of Neurology, Riyadh, Saudi Arabia; <sup>2</sup>Medtronic International Trading Sarl, Neurovascular Health Economics and Reimbursement, Tolenchaz, Switzerland; <sup>3</sup>Medtronic Ltd, Neurovascular Health Economics and Reimbursement, Watford, United Kingdom; <sup>4</sup>Medtronic International Trading Sarl, Corporate Health Economics & Reimbursement, Tolenchaz, Switzerland

**Background and Aims:** The efficacy of treatments for ischemic stroke such as intravenous thrombolysis and mechanical thrombectomy has been broadly demonstrated. However, these treatments are not widely available in the Riyadh region, leading to sub-optimal patient outcomes. Furthermore, the expected increase in the burden of stroke accentuate the need to improve care organization. The purpose of this study was to compare the clinical and economic implications of developing stroke care in Riyadh to increase patient access to effective treatments.

**Methods:** We developed a model using a decision tree and Markov structure based on the modified Rankin Scale to characterize the health states after stroke. Using projected stroke incidence over a 10-year period, ten cohorts of patients were combined with local cost data and clinical outcome data for reperfusion and non-reperfusion treatments to predict aggregated long-term costs over a lifetime horizon. We accounted for costs of acute and long-term care, plus societal costs.

**Results:** With a total of 41,179 ischemic stroke patients modelled over 10 years, the implementation of a new stroke care model and gradual expansion of the use of reperfusion treatments could lead up to 3,834 more patients achieving functional independence at 90 days. The new stroke care model is associated with total cost savings of \$224 million, from which \$97 million are due to indirect costs saved to society. Sensitivity analysis suggest the results are robust.

**Conclusions:** Upgrading a fragmented stroke care system could lead to better patient outcomes and cost savings for the healthcare system and society in the Riyadh region.

**Trial registration number:** N/A

## AS12-050

### MUTATION IN THE STROKE OF IRAN.

E. Sharifipour<sup>1</sup>, B. Zamani<sup>2</sup>, M. Mehrpour<sup>3</sup>, S. Hojabri<sup>4</sup>; on behalf of investigators of 724 Iranian national stroke project.

<sup>1</sup>Neuroscience Research Center of Qom University of medical Sciences, Neurology, Qom, Iran; <sup>2</sup>Iran University of Medical Sciences. Head of Iranian Stroke society, Neurology, Tehran, Iran; <sup>3</sup>Iran University of Medical Sciences. Iranian Stroke society, Neurology, Tehran, Iran;

<sup>4</sup>Ministry of Health of Iran, Medicine, Tehran, Iran

**Background and Aims:** Stroke incidence in Iran is considerably greater than the most European and Western countries, with stroke occurring at younger ages. Since 2016, a national stroke committee (named as 724) in the Ministry of Health of Iran has been organized. The goals of this committee were to register all stroke patients (a hospital-based registry), propagation of acute stroke management (thrombolytic therapy and endovascular approaches) and the establishment of stroke units throughout the country. The aim of this study was to demonstrate and evaluate the variables of stroke patients who entered this national project.

**Methods:** In an analytical descriptive study, all stroke patients (25182) who registered in this project were evaluated from August 2016 to December of 2018 from 60 centers across the country. Demographic data, important times, stroke severity, neuroimaging findings, treatment types, admission duration and mortality of all patients were studied.

**Results:** the mean age of patients was 66.21, which 13410 patients (53.3%) were male and 11772 (46.7%) were female. Of total registered patients, 4024 (16%) received intravenous thrombolytic therapy and in 219 patients (0.86%) thrombectomy was performed at angiography units. The mean National Institutes of Health Stroke Scale (NIHSS) score, modified Rankin scale (mRS) and duration of admission were 12.3, 4.1 and 16.2 respectively. NIHSS and mRS changes at discharge time, duration of admission and death were significantly lower at the patient who received thrombolytic therapy or thrombectomy ( $p < 0.05$ ).

**Conclusions:** The 724 Iranian national stroke project has possessed a positive impact on the treatment and outcome of Iranian stroke patients.

**Trial registration number:** N/A

## AS12-018

### DOES COMPREHENSIVE STROKE CENTER RECOMMENDED NURSE TRAINING RESULT IN EARLIER IN-HOSPITAL STROKE RECOGNITION?

E. Sidorov<sup>1</sup>, D. Gordon<sup>1</sup>, J. Santucci<sup>2</sup> and T. Gregath<sup>3</sup>

<sup>1</sup>University of Oklahoma Health Sciences Center, Neurology, Oklahoma city, USA; <sup>2</sup>Cleveland clinic, Neurology, Cleveland, USA; <sup>3</sup>Bryan Health Hospitals, Neurology, Lincoln, USA

**Background and Aims:** Early recognition of acute ischemic stroke (AIS) symptoms leads to better revascularization outcomes. In-hospital strokes have potential for more rapid assessment, but strokes are often missed and not timely addressed. In 2012 The Joint Commission recommended 8 hours of special stroke training for nurses who work in areas of the hospitals where stroke patients are commonly admitted. We aim to assess if nurses who had special stroke training (eight hours per year) better recognize stroke symptoms and quicker initiate stroke alerts than nurses who receive regular stroke training (2 hours per year).

**Methods:** Five year retrospective chart review of patients who had in-hospital stroke alerts. Advanced Stroke Life Support (ASLS) course was used to provide special stroke training.

**Results:** During time of evaluation there were 223 inpatient stroke alerts. Sixty seven stroke alerts were initiated by nurses with special stroke training (30%) and 156 (70%) were initiated by nurses with regular stroke training. Nurses with special training quicker paged stroke alerts (145 vs. 178 minutes,  $p = 0.03$ ) and better recognized stroke symptoms. They more often paged stroke alerts for focal neurological symptoms such as hemiparesis, hemianopsia, hemisensory loss, and aphasia (78.8% vs. 62.8%,  $p < 0.02$ ) and quicker transported patients to head CT (23.7 vs. 29.9 minutes,  $p = 0.02$ ). We found no difference in rate of IV tPA administration or thrombectomy ( $p = 0.2$ ).

**Conclusions:** Nurses with special 8 hours stroke training better and quicker recognized stroke symptoms, and quicker transported patients to head CT.

**Trial registration number:** N/A

**AS12-009****CT ANGIOGRAM – WHO AND WHEN?****H. Sims<sup>1</sup> and L. Shaw<sup>2</sup>**<sup>1</sup>Royal United Hospital Bath, Older Peoples Unit, Bath, United Kingdom;<sup>2</sup>Royal United Hospital Bath, Stroke, Bath, United Kingdom**Background and Aims:**

**Background:** The rapid growth of thrombectomy in acute ischaemic stroke management over the past 5-years has resulted in adjustments in assessment and investigation of patients presenting to hospital with signs of stroke. Thrombectomy services in the UK are still developing, with available services varying greatly across different regions, times and days. This, alongside time frames in which thrombectomy can be done extending, mean ensuring all eligible patients receive appropriate imaging is a challenge. We asked; are all thrombectomy-eligible patients being identified? Who is 'eligible'? When should we do CT angiogram vs. plain CT?

**Methods:** We looked retrospectively at all acute stroke admissions over three-months (July-September 2018) in our district general hospital. Using SSNAP data and patient notes we investigated imaging modality, treatment received, effect on renal function, and patient outcomes including mRS and discharge location.

**Results:** 151 patients were identified. 27 had CT-angiography (17.8%). Three patients went on to have thrombectomy (11.1%). Safety-wise, renal function was generally unaffected, with only 5 patients having a non-significant decrease of  $\leq 11$  in eGFR post-contrast.

**Conclusions:** With only 17.8% of patients having CT-angiography it is possible that we are missing patients eligible for thrombectomy. With changing guidelines, services and goalposts for thrombectomy (eg. POCS being considered up to 24-hours after onset of symptoms) it is difficult to define clear criteria for which patients should get CT-angiogram on presentation. We suggest that all patients should receive CT-angiogram, to ensure all patients eligible for thrombectomy are identified while the provision of this intervention is still evolving.

**Trial registration number:** N/A**AS12-070****DEVELOPING AN EXTENSIBLE E-LEARNING SOLUTION TO TEACH THE LAY PUBLIC HOW TO RECOGNIZE AND REACT TO STROKE SYMPTOMS****S. Simšic<sup>1</sup>, A. Grecu<sup>1</sup>, H. Pokorná<sup>1</sup>, L. Vondráčková<sup>1</sup>, E. Gatchalian<sup>1</sup>, M. Jankujová<sup>1</sup>, V. Svobodová<sup>1</sup> and R. Mikulík<sup>1,2</sup>**

<sup>1</sup>International Clinical Research Center of St. Anne's University Hospital Brno, Neurology – Stroke, Brno, Czech Republic; <sup>2</sup>St. Anne's University Hospital Brno, Neurology Department, Brno, Czech Republic

**Background and Aims:** Despite the high incidence of stroke, there is still low public awareness in properly identifying and reacting to stroke symptoms. The HOBIT Project was launched in the Czech Republic to educate schoolchildren about stroke. The project used custom software to deliver a one-hour lesson conducted at schools. Initial results demonstrated the need to expand this program, therefore we attempted to create a scalable and user-friendly e-learning platform to accommodate additional users and deployment in other countries.

**Methods:** The new HOBIT platform was built on free, open-source technology, and includes 2 e-learning modules; an updated module for schoolchildren, and a module for the general public. The HOBIT website is built on Joomla CMS, and the School e-learning module is a custom component for it. The Public module has been developed in Moodle to offer an efficient, user-friendly experience. The platforms have been integrated with bespoke software that enables shared authentication.

**Results:** Development of the new platform took approximately 1 year. 7052 schoolchildren and 323 members of the general public have already

used the new platform. All modules are available on the HOBIT Project website (<https://www.projekthabit.cz>) where users can access courses, download supplemental materials, and view educational videos. The software is also portable to other countries.

The screenshot shows the HOBIT Project website interface. At the top, there is a navigation bar with links for HOME, ABOUT US, GALLERY, EXTRA, AMBASSADORS, and language selection (Czech, English). Below the navigation, there is a tagline: "Learn to save a human life when the most serious diseases occur." The website features four main sections represented by colored boxes:

- SCHOOLS**: portal for teachers and students. It features an illustration of a teacher standing next to a globe and a graduation cap.
- SENIORS**: portal for LGA students and senior clubs members. It features an illustration of an elderly woman with glasses.
- THE PUBLIC**: portal for parents and the public. It features an illustration of a hand holding a smartphone.
- RESEARCH & COOPERATION**: portal for professional society. It features an illustration of a graduation cap.

Below these sections, there is a video player showing a woman in an elevator. The video title is: "A young woman phones her mother near the elevator. The mother responds confusedly, she cannot properly understand." The video player includes a progress bar showing 0:00 / 0:28.

At the bottom of the page, there are two sets of questions with multiple-choice answers:

**Do you recognize the kind of disease?**

- 1. Stroke / a disease with a neurological origin
- 2. Myocardial infarction / a disease with a cardiac origin
- 3. Something else

**What would you do if you were a witness to the following situation? Every answer may be correct.**

- 1. I would immediately call the 155.
- 2. I would immediately escort him/her to a doctor, or call a doctor.
- 3. I would suggest waiting for an hour and then I would decide what to do next.
- 4. I would suggest waiting until the next day and then I would decide what to do next.

**Conclusions:** We've successfully developed a more robust software package to expand the HOBIT project. We've demonstrated that it is possible to implement a low-cost, scalable, e-learning solution for stroke education. Intended future directions include expansion to other countries and evidence-based enhancements to the e-learning component.

**Trial registration number:** N/A

## AS12-090

### FACTORS CONTRIBUTING TO MISSED STROKE CASES AT PRESENTATION

**A. Sivagnanaratnam<sup>1</sup>, J. Zhao<sup>1</sup> and S.S. Khara<sup>1</sup>**

<sup>1</sup>London Northwest University Hospital NHS Trust, Stroke Department, Harrow, United Kingdom

**Background and Aims:** As one of the eight Hyper-acute stroke units in London, we constantly work to improve the quality of service we provide to patients. Diagnosing the stroke at the earliest opportunity is vital for optimal management and favourable outcome for patients.

**Methods:** We compared the clinical records of all stroke patients for the period of six months in 2014 and 2018 respectively. All missed stroke cases were identified and studied from both periods. Baseline data included stroke subtype, presenting symptoms, pre-existing conditions and timing of the first imaging. We also obtained the time taken to be triaged, time taken for the Emergency doctors and subsequently for the stroke doctors to review the patients. We compared the both periods to analyse any differences as well as possible influencing factors. Logistic regression was used to determine the risk ratio/odds ratio of the influence factors.

**Results:** We treated 601 patients in 2014, and 787 patients in 2018, an increase of 30.95%. The missed stroke cases were 3.83% in 2014 and 4.07% in 2018( $p>0.05$ ). The delayed referral to the stroke team was 1.50% in 2014 and 7.37% in 2018( $p < 0.01$ ). We are currently collecting data to determine the possible influencing factors.

**Conclusions:** The quality of care we provide remained the same despite the increased number of patients we treated in 2018. We also demonstrated that there had been a significant delay in referring possible stroke patient to stroke service in recent times. We aim to address this issue once we identify the influencing factors for the delay.

**Trial registration number:** N/A

## AS12-089

### IMPACT OF THE SYSTEMATIC PRESENCE ON-SITE OF A NEUROHOSPITALIST ON DOOR-TO-NEEDLE-TIME (R-TPA ADMINISTRATION) IN ACUTE ISCHEMIC STROKE PATIENTS MANAGED IN STROKE UNITS

**R. Sood<sup>1</sup>, A.M. Humm<sup>2</sup>, E. Accolla<sup>3</sup>, O. Bill<sup>4</sup>, G. Toledo<sup>4</sup>, J.M. Annoni<sup>3</sup>, J. Niederhauser<sup>4</sup> and F. Medlin<sup>3</sup>**

<sup>1</sup>Hopital de Fribourg, Internal medicine, Fribourg, Switzerland; <sup>2</sup>Hopital de Fribourg, Neurologz, Fribourg, Switzerland; <sup>3</sup>Hopital de Fribourg, Neurology, Fribourg, Switzerland; <sup>4</sup>Hopital de Nyon, Stroke Unit, Nyon, Switzerland

**Background and Aims:** Timely administration of r-tPA improves clinical outcomes in acute ischemic stroke (AIS) patients. This study explores the influence of systematic presence on-site of neurohospitalists on door-to-needle time (DNT).

**Methods:** This two-centre retrospective cohort study included r-tPA treated patients in Swiss Stroke Units, GHOL and HFR, between February 2014 and September 2018. DNT was analysed for patients admitted during working hours (WH, weekdays 8a.m.-6p.m.) and outside-of-working hours (OWH). The latter was compared between

centres; OWH every patient was evaluated prior to thrombolysis by a neurologist on-site in Nyon, while Fribourg adopted distance neurological supervision with teleradiology. Statistical analyses used jamovi (significance  $p < 0.05$ ).

**Results:** Baseline characteristics were comparable for 258 r-tPA treated AIS patients, including age, gender, cardiovascular risk factors (hypertension, diabetes, smoking, atrial fibrillation) and pre-mRs. Patients in Fribourg presented with more severe strokes (median NIHSS score (6 (6.88)(GHOL),8(6.97)(HFR),  $p < 0.001$ ), yet were less often anticoagulated (6.9%(GHOL) vs 0.6%(HFR),  $p = 0.004$ ). While both centres demonstrated significantly longer median DNT OWH (Table 1), analysis-of-variance using the Kruskal-Wallis test following logarithmic transformation revealed no significant differences between centres OWH ( $F (1,266) = 0.005; p = 0.94$ ), (Figure 1).

Figure 1 DNT during WH and OWH per centre

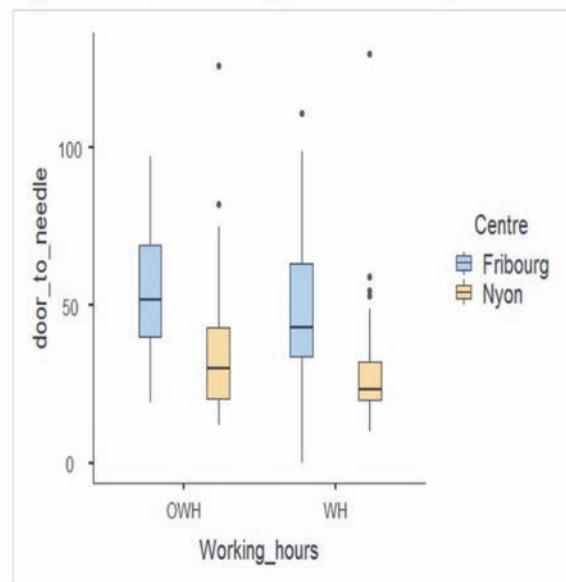


Table 1 DNT according to admission time

	DNT, median(SD), minutes			$p$ -value <sup>a</sup>
	WH(n=168)	OWH(n=90)	Total(n=258)	
Total(n=258)	36.5(21.6)	43.5(23.2)	37.5	0.037

<sup>a</sup> $p$  value: Mann-Whitney-U test.

**Conclusions:** On-site systematic evaluation by a neurohospitalist didn't appear to influence DNT OWH, suggesting distance supervision is time-efficient in thrombolysis. The relevance lies in reducing workload considering the increasing demand for emergency neurological management. Prospective studies are required to confirm the aforementioned findings and evaluate quality parameters (including triage errors: mimic thrombolysis, missed strokes).

**Trial registration number:** N/A

**AS12-081****COMPARISON OF REHABILITATION SERVICES FOLLOWING STROKE IN TWO STUDY AREAS OF THE CENTRAL REGION OF DENMARK AND THE NORTHERN REGION OF NORWAY**

**H.H. Stabel<sup>1</sup>, J.F. Nielsen<sup>1</sup>, G.A. Heiberg<sup>2</sup>, S.G. Pedersen<sup>3</sup>, C. Røe<sup>4</sup> and A. Anke<sup>2</sup>**

<sup>1</sup>Hammel Neurorehabilitation Centre and University Research Clinic, Research Unit, Hammel, Denmark; <sup>2</sup>Faculty of Health Sciences-University of Tromsø, Department of Clinical Medicine, Tromsø, Norway; <sup>3</sup>Faculty of Health Sciences – University of Tromsø, Department of Health and Care Science, Tromsø, Norway; <sup>4</sup>Institute of Clinical Medicine- University of Oslo, Department of Physical Medicine and Rehabilitation, Oslo, Norway

**Background and Aims:** Improved treatment and rehabilitation services have reduced mortality and improved outcome following stroke. Though, geographical variations and differences in the organization of rehabilitation services may have impact on outcome. Aim is to reveal similarities and differences in the organization of rehabilitation services provided to a cohort of stroke patients in a region of North Norway and Central Denmark.

**Methods:** Data were collected from national stroke registries and through a telephone interview approximately three months post stroke. Results are presented using the International Classification of Service Organization in Rehabilitation (ICSO-R).

**Results:** Both countries have public tax financed healthcare systems but the Danish and Norwegian study areas differ significantly; respectively 1.288 versus 30.000 square kilometers and inclusion of two versus 30 municipalities. Danish participants receive acute treatment at two stroke units in one hospital while Norwegian participants are referred to three stroke units at three locations. In both countries rehabilitation settings are available at several locations. Preliminary results show that Danish participants have shorter acute length-of-stay, receive less in-patient and more home- and community-based rehabilitation compared to Norwegian participants. The part of participants needing prolonged in-patient rehabilitation is transferred directly from stroke units to rehabilitation settings at the same level.

**Conclusions:** The dimensions of the ICSO-R were useful for comparison of the organization of treatment and rehabilitation. Despite the thought of somewhat homogeneous healthcare systems several differences were revealed. Preliminary results draw attention to the importance of uniform standards in descriptions of treatment and rehabilitation services to enable interpretations and comparisons of stroke outcome.

**Trial registration number:** NCT02311426

**AS12-006****STROKE SERVICE IN THAILAND**

**S. Tiamkao<sup>1</sup>, K. Kongbunkiat<sup>1</sup>, N. Kasemsup<sup>1</sup>; G. On Behalf of North EasternStroke Research Group<sup>2</sup>**

<sup>1</sup>Faculty of Medicine- Khon Kaen University, Medicine, Khon Kaen, Thailand; <sup>2</sup>North Eastern Stroke Research Group, Khon Kaen university, Khon Kaen, Thailand

**Background and Aims:** Stroke is a major non-communicable disease in Thailand. The incidence of acute stroke in 2009 was 172: 100,000 people aged 15 years and over, and increase to 286: 100,000 in 2018. Acute cerebral infarction (ACI) was 90: 100,000 in 2009 to 183: 100,000 in 2018. Developing a stroke fast track service system started in 2009. Aims for study outcome of the development of stroke fast track service system.

**Methods:** Study from reimbursement database, universal health care coverage treatment rights in 2009–2018.

**Results:** Patients with universal health care coverage rights, covering approximately 75% of the Thai population. The incidence of acute stroke in 2009–2018 was 172.25, 179.78, 199.15, 210.07, 220.61, 239.32, 253.85, 269.9, 289.6, and 286.58: 100,000, respectively. The incidence of ACI in 2009–2018 was 90.37, 100.79, 112.58, 122.78, 134.03, 146.61, 160.36, 170.85, 184.11, and 183.63: 100,000, respectively. The number of hospitals providing thrombolytic therapy in the 2009–2018 was 24, 38, 53, 70, 99, 124, 138, 150, 168, and 168, respectively. The rate of receiving thrombolytic therapy in 2009–2018 was 0.53, 1.24, 1.62, 2.19, 3.02, 3.85, 4.26, 4.82, 5.77, and 6.45 %, respectively. The hospital mortality rate of ACI in 2009–2018 was 8.05, 8.33, 7.37, 7.19, 6.44, 6.09, 5.78, 5.06, and 4.76 %, respectively.

**Conclusions:** The incidence of acute stroke patients, especially ACI, has increased considerably. The number of hospitals that provide more thrombolytic therapy throughout the country. Increasing the rate of receiving thrombolytic therapy and reducing the mortality rate of hospital ACI patients.

**Trial registration number:** N/A

**AS12-038****PROSPECTIVE EVALUATION OF QUALITATIVE PARAMETERS IN TREATMENT OF ACUTE ISCHEMIC STROKE IN UMHAT “ST. MARINA”, VARNA, BULGARIA USING THE RES-Q REGISTRY DATABASE**

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**Background and Aims:** In Bulgaria there is no national registry of patients with acute stroke, which requires the use of international registers to improve the quality of treatment. The aim of our study is to observe the dynamics in some qualitative parameters related with the treatment of patients with acute ischemic stroke (AIS) using the Res-Q database.

**Methods:** We conducted a prospective study on the qualitative parameters associated with the treatment of AIS in UMHAT “St. Marina”, Varna, which is the largest center for treatment of stroke in Eastern Bulgaria. We analyzed the data from the Res-Q registry database for our center for two consecutive years -2017 and 2018.

**Results:** There are no significant differences in the distribution of patients by sex, average age is  $74 \pm 9$ , with median NIHSS  $7 \pm 4$ . 100% of the patients with acute stroke are hospitalized in stroke or intensive care unit, assessed using NIHSS scale and rehabilitated. In 2017 only 5.19% of the patients with AIS were treated with thrombolysis and the average door-to-needle time was 45min. One year later 6.98% of the patients have thrombolytic treatment and door-to-needle time is reduced to 25min. In 2017 during the hospitalization 26.42% of the patients received carotid artery imaging and in 2018 – 30.23%.

**Conclusions:** Res-Q registry is a tool capable to change the quality of health care for stroke patients and during the short period of our study, it is clear that the use of this registry led to a significant improvement in the treatment of stroke patients in our center.

**Trial registration number:** N/A

**AS12-082****TIME TRENDS IN STROKE CARE IN GEORGIA:  
AN INTERIM ANALYSIS OF THE ESO-EAST  
RES-Q DATA**

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Brno, Czech Republic

**Background and Aims:** The Registry of Stroke Care Quality (RES-Q) is a potent tool within the ESO-EAST program created for measuring and then improving stroke care quality in Eastern European countries. The purpose of the study was evaluating dynamics of selected stroke quality indicators in Georgia using the RES-Q data.

**Methods:** We used the RES-Q data of consecutive stroke patients admitted to 6 participating centers in Georgia and analyzed temporal trends over 3 years period (2016, 2017 and 2018).

**Results:** Data of 622 patients (median age 72 years, 52% female) was analyzed. Proportion of patients treated in stroke units has increased from 92% (2017) to 100% (2018). All patients in 2018 underwent neuroimaging. Proportion of carotid imaging procedures has increased from 77% (2016) to 81% (2018). There were no cases of intravenous thrombolysis in 2016 while its rate reached 4% (out of 217 patients) in 2018. Prescription of antiplatelets has increased from 82% (2016) to 93% (2018), whereas proportion of patients with AF receiving anticoagulants slightly decreased (86% in 2016 to 82% in 2018). Of ischemic stroke patients, 92% were prescribed antihypertensives and 90% were prescribed statins at discharge in 2018.

**Conclusions:** The results of our study demonstrate some positive trends over last 3 years in terms of improving the quality of stroke care in Georgia. This is especially true for ischemic stroke treatment by intravenous thrombolysis. However important shortcomings still remain urging further implementation of modern evidence-based preventive, diagnostic and therapeutic interventions in order to decrease the growing burden of stroke in the country.

**Trial registration number:** N/A

**AS12-054****COMPLIANCE WITH GUIDELINES IN  
EMERGENCY MEDICAL SERVICE STROKE  
CARE: A NEW ZEALAND  
OBSERVATIONAL STUDY**

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**Background and Aims:** The study measures the quality of care delivered to stroke and transient ischaemic attack (TIA) patients by Emergency Medical Service (EMS) paramedics.

**Methods:** Using population-level data for confirmed cases between February 2011 and March 2012, paramedic care was assessed against indicators identified from local guidelines and the international literature.

**Results:** A summary of the results is shown in the table.

Clinical Quality Indicator	n (%)
Face-Arms-Speech assessment	1,409 (76)
Onset time (any definition)	(86)
Onset time (last known well)	(59)
Blood glucose level	(80)
Blood pressure	(100)
Advance notification (all cases)	1,407 (36)
Advance notification (critical and serious cases only)	859 (58)
On-scene ≤ 20 minutes	1,373 (65)
Total contact time ≤ 60 minutes	(74)

**Conclusions:** Compliance with the guidelines was variable. High rates of documentation for blood pressure and blood glucose reflect the routine nature of these observations. Applying alternative definitions to onset time and advance notification impacted on compliance rates. Recognition of the stroke/TIA by the paramedic was associated with significantly more FAST assessments and fewer on-scene delays but did not affect the total EMS contact time from call pick-up until arrival at hospital (not shown). While acknowledging the stroke/TIA case mix and the complexity of managing patients in the out-of-hospital setting, this study suggests that opportunities may exist to improve the quality of care delivered. Paramedics have a key role in the early management of stroke and TIA. Appropriate indicators and regular auditing that engages with clinical staff may support improvement in the quality of EMS care.

**Trial registration number:** N/A

**AS12-064****PREHOSPITAL TRIAGE STRATEGIES FOR THE  
TRANSPORTATION OF SUSPECTED STROKE  
PATIENTS IN THE UNITED STATES**

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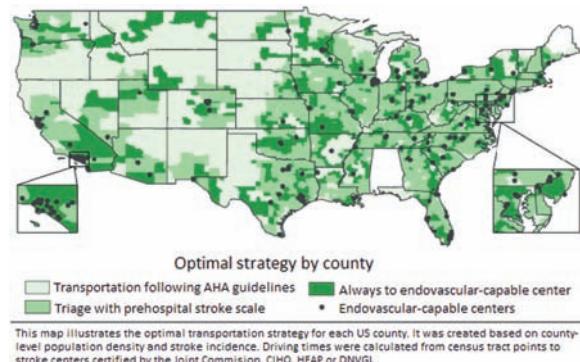
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**Background and Aims:** The optimal prehospital transportation strategy for suspected stroke patients depends on regional characteristics such as the location of stroke centers and population density. We aim to compare the effect of different triage strategies in the US.

**Methods:** We used an existing decision tree model to estimate outcome of patients in the following scenarios: (1) transportation following AHA guidelines (to endovascular-capable center if < 15 minutes further away than the primary stroke center), (2) using the Rapid Arterial Occlusion Evaluation (RACE) prehospital stroke scale (to endovascular-capable center if RACE>4), and (3) transportation of all patients to an endovascular-capable center. Primary outcome was the annual benefit of each strategy in quality-adjusted life years (QALYs) compared to standard transportation to the nearest stroke center.

**Results:** Transportation following AHA guidelines was mostly preferred in rural regions (Figure). Triage with the RACE scale was most favorable in 37/48 states (77%), with a median benefit of 259 QALYs per state (IQR:158-446). Standard transportation to an endovascular-capable center was only preferred in the District of Columbia and Rhode Island (benefit 15–49 QALYs), both small and highly-populated states.

Implementation of the optimal strategy in each state could lead to a total annual benefit of 11,343 QALYs.



**Conclusions:** Regional triage protocols based on local between-center distances and/or a prehospital stroke scale can greatly improve outcomes of ischemic stroke patients in the US.

**Trial registration number:** N/A

## AS12-067

### ADDRESSING PSYHOSOCIAL NEEDS OF PERSONS WITH STROKE IN FOLLOW-UP CARE: EVALUATION OF A NURSE-LED STROKE AFTERCARE CLINIC

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**Background and Aims:** To examine whether a nurse-led stroke aftercare clinic (SAC), extending beyond routine follow-up care, is beneficial for long-term psychosocial and emotional outcome of community-dwelling persons with stroke.

#### Methods:

**Design:** Comparative design in which the prospective SAC study ( $N = 87$ ) was compared to care-as-usual ( $N = 363$ ) at 6 and 12 months post-stroke.

**Intervention:** The SAC is provided at approximately six months post-stroke for all persons who suffered from stroke and were admitted to our university hospital. The clinic focuses on detecting problems in daily life (e.g. cognitive and emotional), psycho-education and referral to specialist care when needed.

**Analyses:** Cognitive and emotional problems, fatigue and caregiver burden were examined using paired t-tests (SAC). Anxiety, depression, social participation and quality of life were examined over time across cohorts using multilevel modelling.

**Results:** Mean age at stroke onset of the SAC cohort was 66.5 ( $SD = 10.0$ ) and the majority suffered from minor (NIHSSmedian = 2.0), ischemic stroke (74.7%); whereas in the care-as-usual cohort, 92.8% suffered from ischemic stroke ( $p \leq .001$ ). No significant effects were observed for most psychosocial outcomes (multilevel and pairwise;  $p > .05$ ). A significant decrease in emotional problems and anxiety levels ( $p < .05$ ) was observed for SAC whereas care-as-usual remained on stable anxiety levels.

**Conclusions:** The SAC did not show beneficial psychosocial effects in comparison to care-as-usual except for emotional well-being. This could indicate (needed) reassurance by the SAC. The SAC enriches routine

follow-up stroke care but could benefit from including more therapeutic elements (e.g. self-management strategies).

**Trial registration number:** N/A

## AS12-030

### THE ICTUSNET PROJECT. A NETWORK OF EXCELLENCE FOR THE DEVELOPMENT AND IMPLEMENTATION OF INNOVATIVE MODELS OF INTEGRATED STROKE CARE IN SOUTHWEST EUROPEAN REGIONS

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**Background and Aims:** Burden of stroke is similar in Southwest European (SUDO) regions. However, development and maturity of Stroke plans in SUDO regions is highly variable leading to unmet needs in terms of availability, accessibility or acceptability of services. ICTUSnet seeks to create a collaboration network between different SUDO regions with participation of stroke patients and professionals to promote research by incorporating innovative data analysis technologies to improve stroke systems of care and reduce its impact.

**Methods:** Developed by a consortium of 10 partners, gathering together healthcare and research institutions from public and private domain, covering a population of 20 M people from 6 regions. The project encompasses 8 work packages where novel benchmarking methods, text mining, natural language processing, deep learning techniques, and the use of innovative data visualization tools are being developed and applied.

The project is funded by the Interreg Sudoe Programme (2018-2021), through the European Regional Development Fund.

**Results:** Project outcomes expected are: 1) development of standardized regional stroke registries and a central integrated platform to perform knowledge-exchange and benchmarking across the SUDO regions; 2) development of software to analyse unstructured text and neuroimaging to enrich the available datasets; 3) analysis and comparison of stroke care pathways and the identification of best practices to eventually develop an action plan for SUDO regions.

**Conclusions:** ICTUSnet is expected to improve quality of stroke care by creating a permanent network that promotes collaborative research, incorporates new technologies for data analysis, and fosters mutual learning across SUDO regions.

**Trial registration number:** N/A

**AS12-057**

**APPLYING INNOVATIVE BUSINESS  
INTELLIGENCE TOOLS TO DATA  
MANAGEMENT AND EXPLOITATION FOR  
EVALUATION OF QUALITY OF STROKE CARE.  
THE EXPERIENCE OF THE STROKE  
PROGRAMME OF CATALONIA**

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**Background and Aims:** European Stroke Action Plan 2018–2030 encourages all countries to establish systems for routine collection of data to evaluate quality of stroke care (QoC). New technologies of data analysis and visualization are available to report on key performance indicators (KPI) openly.

To describe our experience with use of innovative tools of data management and exploitation to assess QoC/KPI and give feedback to stroke agents.

**Methods:** We describe methods used from 2011 to 2018 to report on QoC/KPI and give feedback to stroke agents. We assessed users' satisfaction with the introduction of innovative business intelligence tools for reporting of CICAT registry data through a survey.

**Results:** From 2011 to early 2018, assessment of QoC/KPI and feedback to stroke agents were done through quarterly newsletters. As of June 2018, stroke agents and general population can access weekly-updated information through a fully open interactive tool accessible on a corporate website. Number of viewers raised from 120 to 1076. Scope range from Catalan territory to 13 countries. Quantity of data and quality of data visualization have improved due to interactive reports based on robust, and reusable models.

The most highlighted features of the satisfaction survey were: 1) real-time comparisons; 2) consulting updated data more frequently; and 3) interactivity.

**Conclusions:** Use of innovative business intelligence tools allows for real-time analysis of QoC/KPI, and a better visualization. An open website for benchmarking is a powerful tool to communicate results to different stakeholders, including the general population, in an effective manner.

**Trial registration number:** N/A

**AS12-048**

**EMERGENCY MEDICAL SERVICES USE AND  
ITS ASSOCIATION WITH ACUTE ISCHEMIC  
STROKE EVALUATION AND TREATMENT  
IN SINGAPORE**

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**Background and Aims:** Emergency medical Services (EMS) is a critical link in the chain of stroke survival. While studies in western countries

have demonstrated improved care among EMS transported patients, little is known about EMS use in Asian-pacific countries with large traffic-burdened urban cities.

**Methods:** Using Singapore National Stroke Registry data, we assessed nationwide EMS use in Singapore. Multivariate logistic regressions with the generalized estimating equations were used to examine the association between EMS use and timely stroke evaluation and treatment.

**Results:** Of 3,780 patients with acute ischemic stroke admitted to all 5 public hospitals in Singapore between 2015 and 2016, 66% arrived via EMS. Patients more likely to use EMS were older, self-reported ethnicity as Indian (vs. Chinese), with more severe stroke, and with a history of ischemic heart disease, atrial fibrillation, or peripheral vascular disease. Patients transported by EMS were more likely to receive rapid evaluation (door-to-imaging time  $\leq$ 25 minutes 34% vs. 11%, OR = 3.30 [95% CI 1.68–6.48]) and were more likely to receive intravenous tissue plasminogen activator (tPA 22% vs. 4%, OR = 6.73 [95% CI 4.66–9.72]). Among those who were treated with tPA, patients who arrived via EMS were more likely to receive timely treatment than self-transported patients (door-to-needle time  $\leq$ 60 minutes 53% vs. 29%, OR = 2.57 [95% CI 1.35–4.88]).

	EMS	No EMS	Adjusted OR <sup>a</sup> (95% CI)	P Value
<b>Overall</b>				
tPA treated	553/2,493 (22%)	52/1,287 (4%)	6.73 (4.66 to 9.72)	<0.001
Door to imaging time $\leq$ 25 min	834/2,493 (34%)	136/1,284 (11%)	3.30 (1.68 to 6.48)	<0.001
Door to imaging time in min, mean (SD)	93 (255)	171 (277)	.70 (-81 to -59) <sup>b</sup>	<0.001
<b>Among patients with door-to-imaging time <math>\leq</math> 4.5 hrs and received tPA <math>\leq</math> 4.5 hrs</b>				
DTN $\leq$ 60 min	289/550 (53%)	15/51 (29%)	2.57 (1.35 to 4.88)	0.004
DTN in min, mean (SD)	66 (28)	77 (27)	-11 (-19 to -3) <sup>b</sup>	0.007

<sup>a</sup>tPA, tissue plasminogen activator; DTN, Door to needle.

<sup>b</sup>Adjusted for age, sex, ethnic group, previous stroke/TIA, history of hypertension, diabetes mellitus, ischemic heart disease, atrial fibrillation/flutter, valvular heart disease, peripheral vascular disease, hyperlipidemia, smoker, on-time arrival

<sup>c</sup>Adjusted mean differences

**Conclusions:** EMS use is independently associated with timely stroke evaluation and treatment in Singapore. Seamless EMS-Hospital stroke pathways and targeted public campaigns to advocate for appropriate EMS use for acute stroke are recommended.

**Trial registration number:** N/A

**WITHDRAWN**

**AS27-034****IMAGING MARKERS OF SMALL VESSEL DISEASE AND 'BRAIN FRAILTY' PREDICT WORSE MOOD AND QUALITY OF LIFE SCORES FOLLOWING ACUTE STROKE****J. Appleton<sup>1</sup>, L.J. Woodhouse<sup>1</sup>, Z.K. Law<sup>1</sup>, N. Sprigg<sup>1</sup>,****J.M. Wardlaw<sup>2</sup>, P.M. Bath<sup>1</sup>; for the ENOS investigators**<sup>1</sup>University of Nottingham, Stroke- Division of Clinical Neuroscience, Nottingham, United Kingdom; <sup>2</sup>University of Edinburgh, Centre for Clinical Brain Sciences, Edinburgh, United Kingdom

**Background and Aims:** Cerebral small vessel disease (SVD) manifests as lacunar stroke, cognitive impairment and dementia. We assessed the association of baseline imaging markers of SVD and 'brain frailty' with mood and quality of life using data from the Efficacy of Nitric Oxide in Stroke (ENOS) trial.

**Methods:** ENOS recruited 4011 patients with acute stroke within 48 hours of onset. Mood was assessed using the Zung Depression scale and quality of life using the European quality of life 5-dimensions (EQ-5D) and visual analogue scale (EQ-VAS) at day 90. Brain imaging was adjudicated blinded to clinical information and treatment, and assessed SVD (leukoaraiosis, old lacunar infarcts/lacunes, atrophy [max 3/3]) and 'brain frailty' (leukoaraiosis, atrophy, old vascular lesions [max 3/3]). Data are mean difference (MD) with 95% confidence intervals (CI), adjusted for prognostic variables.

**Results:** Those with 'brain frailty' scores of 3 had worse mood and quality of life scores at day 90 compared to those with no 'brain frailty': Zung MD 5.56, 95%CI 2.48 to 8.64,  $p < 0.001$ ; EQ-5D MD -0.08, 95%CI -0.12 to -0.03,  $p = 0.001$ ; EQ-VAS MD -3.11, 95%CI -6.95 to 0.72,  $p = 0.11$ . Similarly, SVD score was associated with: Zung MD 9.02, 95%CI 4.76 to 13.27,  $p < 0.001$ ; EQ-5D MD -0.06, 95%CI -0.12 to 0.0,  $p = 0.051$ ; EQ-VAS MD -8.57, 95%CI -13.82 to -3.33,  $p = 0.001$ .

**Conclusions:** These easy to detect baseline imaging features are strong predictors of worse mood and quality of life scores following acute stroke. We add to the body of evidence suggesting 'brain frailty' may be a surrogate for clinical frailty.

**Trial registration number:** ISRCTN99414122

**AS27-033****THE ASSOCIATION OF IMAGING MARKERS OF SMALL VESSEL DISEASE AND 'BRAIN FRAILTY' WITH COGNITION FOLLOWING ACUTE STROKE****J. Appleton<sup>1</sup>, L.J. Woodhouse<sup>1</sup>, Z.K. Law<sup>1</sup>, N. Sprigg<sup>1</sup>,****P.M. Bath<sup>1</sup>, J.M. Wardlaw<sup>2</sup>; for the ENOS investigators**<sup>1</sup>University of Nottingham, Stroke- Division of Clinical Neuroscience, Nottingham, United Kingdom; <sup>2</sup>University of Edinburgh, Centre for Clinical Brain Sciences, Edinburgh, United Kingdom

**Background and Aims:** Cerebral small vessel disease (SVD) is a common cause of lacunar stroke, cognitive impairment and dementia. We assessed the association of baseline imaging markers of SVD and 'brain frailty' with cognition 90 days after acute stroke using data from the Efficacy of Nitric Oxide in Stroke (ENOS) trial.

**Methods:** ENOS randomised 4011 patients with acute stroke (<48 hours of onset) to transdermal glyceryl trinitrate (GTN) patch or no GTN for 7 days. Cognitive outcomes were assessed by telephone at day 90: telephone mini-mental state examination (t-MMSE), modified telephone interview for cognition scale (TICS-M) and verbal fluency. Brain imaging was adjudicated blinded to clinical information and treatment, and assessed for SVD (leukoaraiosis, old lacunar infarcts/lacunes, atrophy [max 3/3]) and 'brain frailty' (leukoaraiosis, atrophy, old vascular lesions [max 3/3]). Data are mean difference (MD) with 95% confidence intervals (CI), adjusted for prognostic variables.

**Results:** Those with baseline 'brain frailty' scores of 3 had worse cognitive scores at day 90 compared to those with no evidence of 'brain frailty': t-MMSE MD -1.13, 95% CI -2.37 to 0.11,  $p = 0.07$ ; TICS-M -2.49, 95% CI -4.25 to -0.73,  $p = 0.006$ ; verbal fluency MD -1.72, 95% CI -2.97 to -0.46,  $p = 0.008$ . Increasing SVD score was associated with worse verbal fluency only: MD -2.12, 95% CI -3.66 to -0.58,  $p = 0.007$ .

**Conclusions:** Easy to detect baseline imaging features of SVD and 'brain frailty' predict poor cognition after acute stroke. Imaging signs may have differential relationships with cognition; this emphasises the importance of testing all cognitive domains in future research.

**Trial registration number:** ISRCTN99414122

**AS27-045****IMPROVING DETECTION OF ACUTE LACUNAR STROKE (BECAUSE HOPEFULLY WITH EARLY TREATMENT THERE IS NO INFARCTION!): DATA FROM THE THIRD INTERNATIONAL STROKE TRIAL (IST-3).****F. Arba<sup>1</sup>, G. Mair<sup>2</sup>, S. Phillips<sup>3</sup>, P. Sandercock<sup>4</sup>, J. Wardlaw<sup>2</sup>;****IST-3 Collaborators**<sup>1</sup>AOU Careggi, Stroke Unit, Florence, Italy; <sup>2</sup>University of Edinburgh, Brain Research Imaging Centre, Edinburgh, United Kingdom; <sup>3</sup>Dalhousie University and Nova Scotia Health Authority, Medicine Division of Neurology, Halifax, Canada; <sup>4</sup>University of Edinburgh, Centre for Clinical Brain Sciences, Edinburgh, United Kingdom

**Background and Aims:** We aimed to improve detection of lacunar stroke <6hours from symptoms onset using clinical and radiological characteristics of lacunar infarcts and Oxfordshire Community Stroke Project (OCSP) classification with data from IST-3.

**Methods:** We defined patients more likely to have lacunar stroke as patients with: OCSP lacunar syndrome (LACS); a random sample with National Institutes of Health Stroke Scale (NIHSS) < 7; lacunar infarct assessed by expert panel of IST-3 study. An independent reviewer rated baseline and 24 hours computed tomography (CT) scans, and classified acute visible infarcts according to type, size, location. We calculated

sensitivity and specificity of OCSP in identifying lacunar infarcts, and integrated OCSP with NIHSS < 7.

**Results:** We included 568 patients (330 LACS; 147 with NIHSS < 7; 91 with lacunar infarct from the expert panel, numbers exclude overlaps between groups), mean ( $\pm$  SD) age 73.2 ( $\pm$  13.6) years, 316 (56%) males, and median NIHSS = 5 (IQR = 4–8). On 24 hours CT, 139 (24%) patients had lacunar infarcts [mean ( $\pm$  SD) diameter 12.9 ( $\pm$  3.9) mm], 175 (31%) had other infarct subtypes, 254 (45%) had no visible infarct. Sensitivity and specificity of LACS for detecting lacunar infarction were 58% (95%CI = 49–66) and 45% (95%CI = 40–51), respectively. Adding NIHSS < 7 to LACS did not affect sensitivity (55%, 95%CI = 47–63) but increased specificity (99%, 95%CI = 99–100), with positive and negative predictive values of 97% (95% CI = 90–99), and of 87% (95% CI = 84–89).

**Conclusions:** Adding NIHSS to OCSP classification may increase specificity for lacunar stroke early after stroke onset. Our findings may help select patients for clinical trials of lacunar stroke, but need external validation.

**Trial registration number:** N/A

## AS27-008

### CEREBROSPINAL FLUID BIOMARKERS IN CEREBRAL AMYLOID ANGIOPATHY

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**Background and Aims:** Cerebral amyloid angiopathy (CAA) is associated with lobar intracerebral haemorrhage, but there are no good outcome markers known for early disease. CSF biomarkers hold promise as dynamic and potentially reversible measures, with potential for use in therapeutic trials.

**Methods:** We performed a detailed comparison of CSF markers, comparing patients with CAA, Alzheimer's disease (AD) and healthy volunteers (HV), recruited from the Biomarkers and Outcomes in CAA (BOCAA) study, and a Specialist Cognitive Disorders Service.

**Results:** We included 10 CAA patients, 20 AD patients and 10 HV (mean age  $\pm$  SD  $68.6 \pm 3.0$ ,  $62.5 \pm 4.1$  and  $62.2 \pm 5.4$  years, respectively). Patients with CAA had a distinctive CSF biomarker profile compared with AD and HV groups, with significantly lower ( $p < 0.01$ ) median concentrations of all amyloid components measured, including  $\text{A}\beta_{38}$ ,  $\text{A}\beta_{40}$ ,  $\text{A}\beta_{42}$ , sAPP $\alpha$  and sAPP $\beta$  (Table 1). CAA patients had higher levels of CSF NFL than the HV group, but there were no differences in CSF total tau, phospho-tau, sTREM2 or neurogranin concentrations (Table 1). AD patients had higher total tau, phospho-tau and neurogranin than HV and CAA groups (Table 1). Comparing CAA patients with amyloid-PET positive and negative scans, PET positive individuals had lower concentrations of CSF  $\text{A}\beta_{42}$ , and higher total tau, phospho-tau, NFL and neurogranin concentrations consistent with an "AD-like" profile (Table 2).

Table 1: Comparison of baseline characteristics and biomarkers by group  
p values were obtained using one-way ANOVA (age), chi squared (sex) tests, or Kruskal-Wallis tests (remainder).

	CAA (n=10)	AD (n=20)	HV (n=10)	p value
Age, years, mean (SD)	68.6 (3.0)	62.5 (4.1)	62.2 (5.4)	0.0014
Sex, female, n (%)	2 (20%)	11 (55%)	5 (50%)	0.180
MMSE, median (IQR)	29 (28 to 30)	24 (19.5 to 26)	29 (29 to 30)	0.0001
Biomarkers				
$\text{A}\beta_{38}$ , pg/ml, median (IQR)	1485.5 (1349.0 to 2452.5)	2739.5 (2359.0 to 3264.8)	2839.3 (2148.5 to 3274.5)	0.0019
$\text{A}\beta_{40}$ , pg/ml, median (IQR)	3147.8 (2940.5 to 4136.5)	6465.0 (5761.0 to 7328.0)	6887.0 (5076.0 to 7597.0)	0.0001
$\text{A}\beta_{42}$ , pg/ml, median (IQR)	115.0 (91.35 to 134.0)	322.8 (263.8 to 375.8)	520.3 (279.5 to 813.5)	0.0001
sAPP $\alpha$ , pg/ml, median (IQR)	88.6 (67.9 to 100.0)	115.0 (99.0 to 136.5)	117.0 (105.0 to 136.0)	0.0082
sAPP $\beta$ , pg/ml, median (IQR)	85.8 (66.3 to 104.0)	117.8 (101.7 to 142.0)	123.8 (97.5 to 143.5)	0.0092
T-tau, pg/ml, median (IQR)	316.2 (247.2 to 439.8)	656.9 (497.3 to 869.4)	249.7 (206.4 to 265.9)	0.0001
P-tau, pg/ml, median (IQR)	62.3 (45.8 to 77.1)	92.8 (73.6 to 112.3)	49.5 (42.0 to 52.4)	0.0001
NFL, pg/ml, median (IQR)	2783.7 (2384.5 to 8376.6)	2370.4 (1917.0 to 2727.6)	1466.3 (1148.5 to 1628.2)	0.0003
sTREM2, pg/ml, median (IQR)	7038.4 (642.0 to 9233.0)	6579.4 (5640.5 to 8115.9)	7961.7 (6162.5 to 7984.6)	0.5188
Neurogranin, pg/ml, median (IQR)	432.0 (348.7 to 490.8)	564.9 (454.4 to 702.1)	408.6 (308.5 to 431.0)	0.0118

Table 2: Comparison of PET positive and negative patients with CAA  
p values were obtained using one-way ANOVA (age), chi squared (sex) tests, or Wilcoxon-Mann-Whitney tests (remainder).

	PET positive (n=5)	PET negative (n=5)	p value
Age, years, mean (SD)	69.4 (3.1)	67.8 (2.9)	0.4296
Sex, female, n (%)	1 (20.0)	1 (20.0)	1.000
MMSE, median (IQR)	29 (29 to 29)	29 (28 to 30)	0.8266
$\text{A}\beta_{38}$ , pg/ml, median (IQR)	2452.5 (1349.0 to 2501.0)	1475.5 (1434.5 to 1495.5)	0.4647
$\text{A}\beta_{40}$ , pg/ml, median (IQR)	4136.5 (2798.5 to 4370.0)	3126.5 (3043.5 to 3169.0)	0.6015
$\text{A}\beta_{42}$ , pg/ml, median (IQR)	92.5 (89.4 to 105.0)	134.0 (130.5 to 140.0)	0.0472
sAPP $\alpha$ , pg/ml, median (IQR)	81.0 (67.9 to 96.2)	98.5 (69.4 to 100.0)	0.6015
sAPP $\beta$ , pg/ml, median (IQR)	82.8 (79.0 to 104.0)	88.7 (66.3 to 94.1)	0.7540
T-tau, pg/ml, median (IQR)	439.8 (430.6 to 458.3)	247.2 (221.8 to 258.1)	0.0163
P-tau, pg/ml, median (IQR)	72.1 (70.8 to 87.8)	45.8 (42.1 to 49.1)	0.0090
NFL, pg/ml, median (IQR)	8376.6 (7255.1 to 10362.7)	2384.5 (2228.0 to 2435.7)	0.0163
sTREM2, pg/ml, median (IQR)	8499.4 (7299.2 to 9783.0)	6656.2 (5421.8 to 6777.6)	0.1172
Neurogranin, pg/ml, median (IQR)	490.8 (488.8 to 603.7)	348.7 (334.0 to 373.4)	0.0163

**Conclusions:** Our findings suggest that CAA has a characteristic biomarker profile suggesting a global, rather than selective, accumulation of all amyloid species measured, consistent with the protein elimination failure hypothesis. We also provide evidence of different phenotypes according to amyloid-PET positivity.

**Trial registration number:** N/A

## AS27-049

### FACTORS OF PROGRESSION IN LACUNAR INFARCTS: CAN WE IMPROVE THEIR OUTCOME?

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**Background and Aims:** Although, a priori, lacunar infarcts (LI) have a favourable prognosis, up to 20–30% of patients may progress in the following days, significantly worsening functional prognosis. The objective is to determine factors of progression of LI and to establish whether treatment with intravenous fibrinolysis (tPA) may prevent clinical progression.

**Methods:** Retrospective study of patients with LI admitted to our center. Neurological deterioration was defined as worsening of  $>1$  point in the NIHSS motor item. We compared demographic characteristics, progression factors and prognosis of patients who had a progressive lacunar infarct (PLI) with those who did not. The incidence of PLI was studied in patients who received tPA.

**Results:** N:63 (of which 17 had PLI). Patients with PLI had a statistically significant greater decrease in blood pressure (BP) in the first 24 hours (53 vs 27mmHg, p: 0.003), higher glycemia at 24 hours (191 vs 134mg/dL, p: 0.01) and greater glycemic increase in the first 24 hours (55.7 vs 12.8mg/dL, p: 0.02). There were no differences in BP or glycemia at admission. PLIs were associated with greater functional dependence at

three months (Rankin 3 vs 1, p: 0.01). None of the patients treated with tPA(N: 27) presented clinical progression.

**Conclusions:** PLIs imply a persistent and significant functional worsening. The adequate control of glycemics and BP in the first 24 hours is crucial. Although LI are supposed to have a good prognosis, it may be reasonable to offer an aggressive treatment with tPA even in patients with low NIHSS, since it may prevent the progression of symptoms and offer a better functional outcome.

**Trial registration number:** N/A

## AS27-012

### NEURO-GLIAL-VASCULAR ALTERATIONS IN A NOVEL MODEL OF SMALL VESSEL DISEASE

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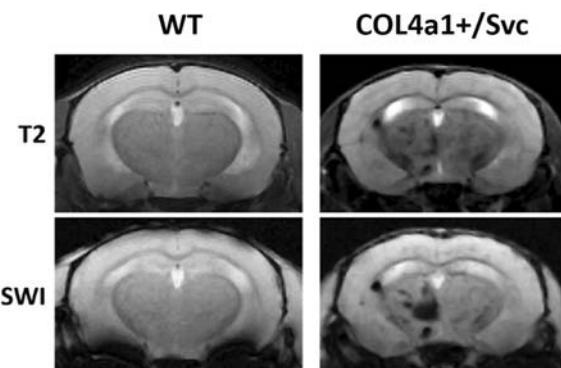
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**Background and Aims:** Cerebral small vessel disease (SVD) is a leading cause of vascular cognitive impairment and dementia. Despite characterisation of disease features (haemorrhage, infarcts and white matter pathology), the underlying molecular basis of these processes remains poorly understood. Central to SVD pathophysiology is the disruption of the finely tuned interplay between the cells of the neuro-glial-vascular unit. Mutations in the genes COL4 A1/A2 are known to cause familial SVD, and polymorphisms in these genes are also associated with sporadic SVD risk. By utilising mouse models relevant to SVD ( $\text{COL4a1}^{+/SvC}$  mutant), we aim to investigate how mutations in the COL4 gene lead to neuro-glial-vascular alterations, SVD pathology and cognitive impairment.

**Methods:** Male and female  $\text{COL4a1}^{+/SvC}$  and wild-type littermates (n=12) aged 3–8 months underwent magnetic resonance imaging (MRI) to assess structural (T2 and T2\*), white matter (diffusion tensor imaging) and perfusion (arterial spin labelling) changes. Subsequently, neurovascular function was assessed by measuring blood flow responses to whisker stimulation by laser speckle contrast imaging in the same mice. Following *in vivo* imaging, mice were sacrificed and brains were extracted for pathological analysis. Histology analysis was used to further assess structural alterations investigated with MRI and characterise SVD-like pathology in the model.

**Results:** Preliminary data from neuroimaging show white matter alterations and subcortical micro haemorrhages. Pathological investigations show increases in vascular collagen deposition and fibrinoid necrosis. A fuller characterisation of the model will be presented at the conference.

**Conclusions:** This work will provide information on NVU, structural, white matter and perfusion changes relevant to familial and sporadic SVD.



**Trial registration number:** N/A

## WITHDRAWN

**AS27-030****RISK OF INCIDENT STROKE AND DEMENTIA IN CADASIL: A SIX-YEAR FOLLOW-UP OF 85 KOREAN PATIENTS**

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**Background and Aims:** Asian CADASIL (cerebral autosomal dominant arteriopathy with subcortical infarcts and leukoencephalopathy) patients have been reported to be different from those of Caucasian. However, little is known for clinical course and long-term prognosis. This study aimed to investigate the risk of incident stroke and dementia in Korean CADASIL patients.

**Methods:** We retrospectively reviewed the medical records of patients who were diagnosed with CADASIL at our institution from March 2012 to February 2015. The patients were selected by the following criteria; (1) aged  $\geq 18$  years, (2) diagnosis of CADASIL by a NOTCH3 gene mutation, (3) followed for at least 36 months. Primary outcomes were (1) any stroke (ischemic or hemorrhagic), (2) dementia, and (3) death of any cause.

**Results:** Of 102 CADASIL patients who were evaluated at baseline, 85 patients met the inclusion criteria (mean age  $68.9 \pm 12.1$  years). Of the 85 patients, 46 patients (54.1%) had a history of ischemic or hemorrhagic stroke, and 17 patients (20.0%) had dementia at baseline examination. Of the 85 patients, 13 patients (15.3%) experienced a new ischemic stroke. The risk of incident ischemic strokes was significantly greater in patients with a history of stroke than in without (23.9% vs. 5.1%,  $P = 0.016$ ). Of 68 patients who had no dementia at baseline, incident dementia developed in 11 patients (16.2%).

**Conclusions:** The risk of incident ischemic stroke or dementia seems to be lower than expected in Korean CADASIL patients. Clinical course and prognosis could be rather benign in Korean patients compared with the Caucasian patients with CADASIL.

**Trial registration number:** N/A

**AS27-022****SYMPTOMS AND RECURRENT DWI LESIONS IN PATIENTS WITH MILD STROKE**

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**Background and Aims:** Small vessel disease (SVD) often presents late with stroke and vascular dementia. Patients, relatives and doctors may overlook subtle neurological and cognitive symptoms. Apparently 'silent' acute lesions on Diffusion Weighted Imaging (DWI) have been described. We aim to determine whether recurrent DWI lesions are actually 'silent'.

**Methods:** We prospectively recruited patients with minor ischaemic stroke, and performed diagnostic MRI. Informants completed a Neuropsychiatric Inventory Questionnaire and Informant Questionnaire for Cognitive Decline in the Elderly (IQCODE). We invited participants to repeat MRI scans at monthly intervals for 3 months, questioning participants about interval symptoms at each visit.

**Results:** We recruited 26 participants (mean age 65 years, range 40–84; 27% female); 10 attended short interval follow-up. Neuropsychiatric symptoms (15/23 informants reported symptoms) and recurrent DWI lesions (6/26; at mean 93.67 days after stroke) were common. Five of the six (83%) recurrent lesions were subcortical. Of the six,  $n = 2$  were truly

asymptomatic,  $n = 2$  reported stroke-like symptoms (worsening left-sided weakness/unsteadiness; physician-diagnosed TIA) and  $n = 2$  reported neuropsychiatric and non-focal symptoms (emotional outbursts/headaches; low mood/dysarthria). Informant-reported neuropsychiatric symptoms in participants with recurrent DWI lesions vs. those without were: apathy [4/5 (80%) vs. 3/18 (16.7%),  $p = 0.033$ ], irritability [4/5 (80%) vs. 5/18 (27.8%),  $p = 0.056$ ] dysphoria [3/5 (60%) vs. 7/18 (38.9%),  $p = 0.089$ ] and cognitive decline [high IQCODE scores in 4/5 (80%) vs. 5/18 (23.5%),  $p = 0.039$ ].

**Conclusions:** Neuropsychiatric and stroke-like symptoms and recurrent DWI lesions are common following minor stroke and commonly co-associate. Recruitment is ongoing to increase data to identify which symptoms might provide useful 'red flags' for progression of SVD.

**Trial registration number:** N/A

**AS27-024****VASCULAR RISK FACTORS AND RECURRENT DWI LESIONS IN PATIENTS WITH MILD STROKE**

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**Background and Aims:** 'Silent' acute Diffusion Weighted Imaging (DWI) lesions may contribute to development of leukoaraiosis, but their vascular risk factors are poorly understood. We aim to identify factors associated with recurrent DWI lesions.

**Methods:** We recruited prospectively patients with minor lacunar and cortical ischaemic stroke, performed diagnostic MRI, and invited participants to repeat MRI scans at monthly to 6-monthly intervals. We recorded vascular risk factors at baseline.

**Results:** We recruited 26 participants (mean age 65 years, range 40–84; 27% female; median mRS = 1) of whom 10 have attended short interval follow-up to 3 months to date. Six (23.1%) had recurrent DWI lesions, at mean 93.67 days (SD 33.26, range 39–139) to identification; 5/6 (83%) of recurrent lesions were subcortical. In those with vs. without recurrent DWI lesions, vascular risk factors were: current/ex-smoker [6/6 (100%) vs. 9/20 (45%),  $p = 0.022$ ]; poorly controlled hypertension [4/6 (66.7%) vs. 2/11 (18.2%),  $p = 0.077$ ]; any history of hypertension [5/6 (83.3%) vs. 11/20 (55%),  $p = 0.225$ ]; diabetes [3/6 (50%) vs. 3/20 (15%),  $p = 0.112$ ]; previous stroke or TIA [2/6 (33%) vs. 5/20 (25%),  $p = 0.529$ ]; atrial fibrillation [1/6 (16.7%) vs. 2/20 (10%),  $p = 0.562$ ]; usually adding salt to food [4/6 (66.7%) vs. 6/20 (30%),  $p = 0.128$ ]; mean systolic BP at index stroke presentation [162mmHg vs. 126mmHg  $p = 0.303$ ], and diastolic BP [98mmHg vs. 62mmHg,  $p = 0.141$ ].

**Conclusions:** Recurrent subcortical DWI lesions are common and early data indicate associations with hypertension control and smoking. Recruitment is ongoing to increase data to identify which risk factors might provide useful 'red flags' for worsening SVD.

**Trial registration number:** N/A

**AS27-017****THE ASSOCIATION BETWEEN CEREBRAL SMALL VESSEL DISEASE AND GAIT DISTURBANCE IN A RURAL CHINESE POPULATION-BASED STUDY**

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**Background and Aims:** Gait disturbance is considered to be significant clinical manifestation of cerebral small vessel diseases (CSVDs). Although their relationship has been claimed in some other research, the accurate damaging characteristics of different CSVDs markers on gait still need to be further confirmed. We aimed to give a new insight into the association between different imaging markers of CSVDs and the parameters of gait disturbance in a rural Han Chinese population.

**Methods:** In the cross-sectional population-based Taizhou Imaging Study, 314 participants free of neurological disorders accepted brain MRI and wearable devices for gait analysis. Cerebral small vessel diseases were diagnosed according to the STRIVE criteria. Walking speed, step height, stride length, swing width and gait cycle was collected through wearable devices. Linear logistic regression was used to estimate the association between different CSVDs markers and gait parameters.

**Results:** In linear regression, after a full adjustment, we found CSVD score was correlated with walking speed positively ( $\beta$ : 0.327; 95% CI 0.010 to 0.643) and stride length negatively ( $\beta$ : -0.047; 95% CI -0.093 to -0.002). White matter hyperintensity volume was positively associated with gait cycle duration ( $\beta$ : 0.009; 95% CI 0.001 to 0.017). Cerebral microbleeds (CMBs), especially deep/mixed CMBs, were positively correlated with stance duration percentage ( $\beta$ : 0.721; 95% CI 0.018 to 1.425).

**Conclusions:** In this study, we found several markers of CSVDs were associated with gait disturbance. Different types of CSVDs might cause gait disturbance through different pathways.

**Trial registration number:** N/A

## AS27-014

### CEREBELLAR INTRACEREBRAL HAEMORRHAGE AND MICROBLEEDS IN PATIENTS WITH HEREDITARY CEREBRAL AMYLOID ANGIOPATHY

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**Background and Aims:** Cerebellar intracerebral haemorrhage (ICH) is mostly associated with hypertension but recent studies suggest that superficially located cerebellar ICH might point towards cerebral amyloid angiopathy (CAA). Sporadic CAA patients, however, often have multiple vascular risk factors related to ageing including hypertension. We investigated prevalence and location of symptomatic cerebellar ICH and asymptomatic macro- and microbleeds in Hereditary-Cerebral-Haemorrhage-with-Amyloidosis-Dutch-Type (HCWA-D), a pure form of CAA.

**Methods:** We included 55 symptomatic (defined as  $\geq 1$  ICH) HCHWA-D-patients and 26 asymptomatic mutation-carriers who had a 1.5 or 3T MRI between 2012–2018. Mean age of the participants was 54 years and 57% were women. MRI sequences (T1/2 and SWI/T2\*GE) were analysed for symptomatic cerebellar ICH, asymptomatic cerebellar macrobleeds and microbleeds according to the STRIVE-criteria. Location was assessed as superficial-cerebellar (cortex, vermis or juxta-cortical) or deep-cerebellar (white matter, pedunculi and grey nuclei).

**Results:** None of the symptomatic ICH in the 55 HCHWA-D-patients was located in the cerebellum. Thirty-two of 79 (41%) patients with T1/2 showed  $\geq 1$  asymptomatic cerebellar located macrobleed (81% strictly superficial, 16% predominately superficial with mean ratio superficial-deep of 5:1 and 3% strictly deep). Cerebellar microbleeds were found in 42 of 75 (56%) patients with SWI/T2\*GE (average  $3.7 \pm SD 7.4$ ), all strictly (69%) or predominantly superficial (31%, mean ratio superficial-deep 7:1).

**Conclusions:** Superficially located asymptomatic cerebellar macrobleeds and microbleeds are markers of cerebral amyloid angiopathy. Symptomatic cerebellar ICH was not observed in HCHWA-D suggesting that cerebellar ICH in sporadic CAA might be more a mixed type small vessel disease than a pure CAA phenomenon..

**Trial registration number:** N/A

## AS27-042

### PREVALANCE AND CLINICO-RADIOLOGICAL CHARACTERISTICS OF ACUTE STROKE PATIENTS RELATED TO SMALL VESSEL DISEASE FROM A SINGLE TERTIARY CARE HOSPITAL FROM EASTERN INDIA

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**Background and Aims:** Cerebral Small vessel disease related strokes remained an important subgroup of stroke patients. They have varied imaging and clinical presentations with limited understanding of pathophysiology. We aimed to look the frequency and clinico-radiological characteristics of small vessel disease related stroke.

**Methods:** We retrospectively surveyed consecutive patients admitted in our stroke centre over the last 6 yrs. We identified the patients admitted with acute stroke related to small vessel disease. Baseline and discharge NIHSS, vascular risk factors, medical & imaging records and patient demographics were recorded.

**Results:** Out of 804 patients admitted with acute stroke, 135 (16.79%) had stroke related to small vessel disease. Out of 135 patients 97(71.85%) were male while 38 (28.14%) were female. Mean age at admission was 58 yrs [21-88]. The commonest associated vascular risk factors were hypertension (79%) followed by smoking (34%) diabetes (21%) and dyslipidemia (17%). The median NIHSS scores at admission and discharge were 8(0-14) and 4(0-10) respectively. Out of 135 patients, 96(71.11%) had anterior while 39(28.88%) had posterior circulation stroke. The commonest location of lacunar infarct was internal capsule followed by corona radiata, thalamus, pons and mid brain. Commonest clinical presentation was pure motor stroke ( 32%) followed by mixed sensory-motor (28%), ataxic hemiparesis (18%), dysarthria clumsy syndrome (16%) and pure sensory stroke (6%). Among 135, 21(15.55%) patients had initial worsening of symptoms but no mortality observed.

**Conclusions:** In our study, pure motor stroke was commonest presentation. Hypertension remained the most common vascular risk factor followed by smoking while internal capsule was the commonest location of lacunar infarct.

**Trial registration number:** N/A

## AS27-023

### RENAL DYSFUNCTION AND FGF-23 IN PATIENTS WITH RECENT SMALL SUBCORTICAL STROKE: A PROSPECTIVE COHORT STUDY.

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**Background and Aims:** Cerebral small vessel disease (CSVD) may be part of a multisystemic small vessel disorder also affecting the kidneys, but most previous data on this topic was retrospective and used limited renal parameters. In this prospective study of stroke patients with CSVD-related recent small subcortical infarction (RSSI), we hypothesized that markers of renal dysfunction were associated with the burden of CSVD on baseline MRI and its progression at follow-up MRI.

**Methods:** We prospectively investigated 101 patients (mean age: 60 ± 11 years, 73% men) with MRI-confirmed RSSI who underwent follow-ups until 15 months poststroke. Renal parameters assessed included eGFR, Albumin-Creatinine Ratio and fibroblast growth factor-23 (FGF-23, an early marker of renal dysfunction). Chronic kidney disease (CKD) was defined according to current guidelines. Baseline CSVD burden and progression were assessed on brain MRI.

**Results:** RSSI patients with CKD (n = 24, 24%) had more severe WMH at baseline (Fazekas 2–3 in 58% vs. 36%, p = 0.04), other MRI markers of chronic CSVD did not differ compared to patients without CKD. CKD did not predict CSVD progression at 15 months. However, patients in the highest FGF-23 quartile more frequently showed CSVD progression (50% vs. 21%, OR 3.89, p = 0.03) and showed increased rates of recurrent vascular events in the observation period (53% vs. 19%, OR 4.93, p = 0.003).

**Conclusions:** Although the severity of WMH was associated with CKD, conventional parameters of renal dysfunction did not predict progression of CSVD. However, our data suggest FGF-23 as a new biomarker of CSVD progression and recurrence of vascular events in RSSI patients, which warrants further studies.

**Trial registration number:** N/A

## WITHDRAWN

**AS27-055**

**JUGULAR VENOUS REFLUX AND BRAIN LESION BURDEN IN CADASIL**

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**Background and Aims:** Previous pathological studies in humans and animal models have shown alterations of small arteries and veins within white matter lesions in cerebral small vessel disease. We aimed to determine if there is an association between the presence of jugular venous reflux (JVR) and brain lesion burden in patients with cerebral autosomal-dominant arteriopathy with subcortical infarcts and leukoencephalopathy (CADASIL).

**Methods:** Between July 2017 and September 2018 we prospectively enrolled 32 CADASIL patients from an outpatient clinic of a tertiary Center in Portugal. Extracranial Doppler-ultrasonography, including internal jugular vein flow before and during Valsalva manoeuvre and 3-T brain MRI with a lesion growth algorithm calculation were obtained. Binary logistic regression (nominal variables) and linear regression (continuous variables) were used when adjustment for confounding variables was needed. Statistical significance was set at two-sided p values < 0.05.

**Results:** In this CADASIL population, the presence of JVR was associated with a non-significant trend to more lesion volume ( $\beta, 11.86$ ; CI 95%, -6.74–30.46; p = 0.153) and a smaller number of lesions ( $\beta, -4.22$ ; CI 95%, -13.36–4.92; p = 0.219). This association was significant in those aged 40 years or older ( $\beta, 21.57$ ; CI 95%, 4.71–38.42; p = 0.014).

**Conclusions:** It appears to be a trend for higher lesion volume in CADASIL patients with JVR, particularly in those aged 40 or more. JVR might be a non-documented risk factor for disease severity.

**Trial registration number:** N/A

**AS27-046**

**FUNCTIONAL CONNECTIVITY CHANGES IN CEREBRAL SMALL VESSEL DISEASE PATIENTS DURING TASK FMRI.**

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**Background and Aims:** Cerebral small vessel disease (cSVD) is a highly prevalent condition associated with brain diffuse ischemic damage which can lead to fronto-subcortical circuits disruption and executive dysfunction (ED). The aim is to evaluate effects of cSVD on functional connectivity in patients with different severity of ED.

**Methods:** 51 patients (60 ± 6.7 years) with cSVD according to STRIVE criteria and 20 healthy volunteers (age and education matched) underwent fMRI on 3T scanner with serial count task. According to TMT B-A

test results all patients were divided into three groups – normal executive functions (EF), mild and severe ED. Pre- and postprocessing of fMRI data were performed using SPM12 and CONN17.a.

**Results:** FMRI analysis showed reduction of interhemispheric functional connections in patients with mild ED and intrahemispheric functional connections in patients with severe ED between the structures of the salience and executive-control networks (fig. 1).

**Conclusions:** Gradually reduction of inter- and intra-hemispheric functional connections between the structures of EF networks in patients with cSVD supposed to be fMRI equivalent of disconnection syndrome. The main cause of the disconnection syndrome in these patients is the white matter tracts disruption caused by cSVD which disturbs communication between crucial neural networks responsible for normal EF. Multimodal structural and functional neuroimaging studies can reveal mechanisms of cognitive impairment in cSVD and explain the clinical variation.

**Trial registration number:** 184

## AS27-053

### DIFFUSION TENSOR IMAGING IN CEREBRAL SMALL VESSEL DISEASE: CORRELATION WITH COGNITIVE FUNCTION.

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**Background and Aims:** Cerebral small vessel disease (cSVD) is a common cause of cognitive impairment (CI). Given the limitations in predicting CI on conventional MRI signs, the study of the brain microstructure in cSVD is of particular interest. In the past decade, diffusion tensor imaging (DTI) has been increasingly used for the evaluation of SVD patients because it is sensitive to tissue damage and can show abnormalities in both areas of white matter hyperintensities (WMH) and in normal appearing WM (NAWM). The aim is to estimate DTI measures in patients with cSVD and to assess its association with cognitive function.

**Methods:** 74 patients ( $61 \pm 7$  years) with cSVD according to STRIVE criteria and 20 healthy volunteers (age and education matched) underwent conventional 3T MRI with DTI to assess fractional anisotropy (FA), mean (MD), axial (AD), and radial diffusivity (RD). Cognitive tests and ADL scale were administered to assess cognitive domains and daily live independence.

**Results:** On region-of-interest-based analysis, FA was significantly reduced, while MD, AD and RD significantly increased in patients with MCI and dementia in the most of evaluated WM tracts ( $p < 0.05$ ). On logistic regression model independent predictors of MCI and dementia were AD in three regions – periventricular NAWM in left frontal lobe, right cingulum and corpus callosum ( $p = 0.001$ ). The high predictive efficiency of the obtained microstructural predictors of CI was shown using ROC analysis.

**Conclusions:** This study provides evidence that DTI measures are sensitive to WM microstructure damage and to CI. AD may be an important predictor of CI in SVD. It supports the use of DTI measures as useful surrogate biomarkers to monitor disease progression and assess therapeutic interventions.

**Trial registration number:** 184

## AS27-006

### TIME-DOMAIN NEAR-INFRARED SPECTROSCOPY IN SUBJECTS WITH CEREBRAL SMALL VESSEL DISEASE

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**Background and Aims:** The microcirculation of the cerebral outer layers and white matter are functionally and anatomically connected. We hypothesized that the presence of cerebral small vessel disease (cSVD) could affect the oxygenation of cerebral outer layers measured with Time-Domain Near-Infrared spectroscopy (TD-NIRS).

**Methods:** We selected subjects with age  $\geq 55$  years, absence of stenosis  $\geq 50\%$  in cervical extra- and intra-cranial arteries, availability of head MRI-scan imaging. According to Fazekas score, we identified 3 groups : subjects with score 0 in both white-matter and periventricular regions (CSVD-0), subjects with score 1–2 in periventricular regions (CSVD-1), and subjects with score 1–2 in both white-matter and periventricular regions (CSVD-2). Resting TD-NIRS measurements from frontal, central, parietal brain regions on each hemisphere provided the average concentration of deoxy-hemoglobin, oxy-hemoglobin, total hemoglobin and tissue oxygen saturation ( $StO_2$ ).

**Results:** We enrolled 26 subjects with mean age  $68 (\pm 9.5)$  yrs, 18 were male. Patients with CSVD-0 were significantly younger ( $58.5 \pm 3.0$  yrs) compared to CSVD-1 ( $74.7 \pm 9.7$  yrs) and CSVD-2 ( $70.5 \pm 7.3$  yrs) ( $p < 0.001$ ).  $StO_2$  was significantly lower in patients with CSVD-2 ( $55.6 \pm 1.0\%$ ) compared to CSVD-0 ( $58.5 \pm 1.4\%$ ) and CSVD-1 ( $59.4 \pm 1.3\%$ ) ( $p = 0.017$ ). The result persisted significant also after controlling for age ( $p = 0.042$ ). A cut-off of  $StO_2 > 58\%$  predicted the absence of CSVD2 with 67% sensitivity and 91% specificity [AUC 81% (CI 95% 65–98%)].

**Conclusions:** These preliminary data suggest that the presence of extensive cSVD affect the oxygenation of cerebral outer layers as measured by TD-NIRS. In particular, lower  $StO_2$  might be a surrogate marker of the presence of extensive white matter-CSVD.

**Trial registration number:** N/A

## AS27-028

### STRUCTURAL BRAIN ALTERATIONS AND COGNITION IN CEREBRAL AMYLOID ANGIOPATHY: A LONGITUDINAL FOLLOW-UP STUDY

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**Background and Aims:** The aim of this study was to assess the longitudinal changes in cortical and white matter atrophy and to evaluate their relationship with longitudinal changes in cognitive scores in Cerebral Amyloid Angiopathy (CAA).

**Methods:** The study included 57 non-demented probable CAA patients, 57 Alzheimer's Disease (AD) and 57 Healthy Controls (HC), all age-matched. All had undergone 2 MRI scans 1 year apart. FreeSurfer was used to calculate cortical thickness (CT) and White Matter Volumes (WMV), expressed as percentage of intracranial volume. Thirty-six CAA patients had cognitive assessments with z scores during baseline and follow up. Percent differences of CT (pdCT), WMV (pdWMV) and cognitive z scores (pd-z) at two time-points were calculated.

**Results:** CAA had lower WMV and CT compared to HC and lower WMV compared to AD both at baseline and follow up. The pdWMV was worse in CAA (-1.54%) as compared to HC (-0.32%,  $p = 0.004$ ) and AD (-0.30%,  $p = 0.018$ ), whereas the pdCT was lower in AD patients compared to CAA and HC (both  $p < 0.05$ ). The reduction in WMV correlated strongly with the worsening z-scores in executive function ( $r = 0.42$ ,  $p = 0.011$ ), but not processing speed ( $p = 0.16$ ) or memory ( $p = 0.11$ ) in CAA. The pdCT in CAA did not correlate with any of the cognitive domains. All these associations remained significant in multivariable models.

**Conclusions:** Progression of white matter atrophy is more prominent in CAA as compared to AD and HC and this progression correlates with worsening of executive function, confirming the importance of white matter changes in CAA-related cognitive impairment.

**Trial registration number:** N/A

## AS27-009

### WHITE MATTER DISEASE AS A CAUSE OF SUSTAINED ORTHOSTATIC HYPOTENSION IN THE IRISH LONGITUDINAL STUDY OF AGEING (TILDA).

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**Background and Aims:** Sustained Orthostatic Hypotension (OH) with delayed recovery of Blood Pressure from orthostatic challenge is associated with increased risk of injurious falls, cognitive impairment and death. We examined a subgroup of community dwelling older adults to determine if an association exists between sustained OH and White Matter Hyperintensities (WMH).

**Methods:** 440 subjects >64 years were randomly selected from the Wave 3 (W3) TILDA population to undergo 3T MR scanning including FLAIR and DWI. All underwent assessment of beat-to-beat and orthostatic BP response at Wave 1 (W1, 4 years previously) and reassessment at W3 using digital photoplethysmography. Scheltens' scoring of FLAIR images were performed by Radiologists blinded to BP status and logistic regression was performed for these scores against cardiovascular risk data (age, sex, smoking history, hypertension, hyperlipidaemia, diabetes) and OH data at intervals from 10–110 seconds for both W1 and W3.

**Results:** Median age of subjects was 72 years (65–92 years) at MR, 228 (51.5%) were female. The range of Scheltens' Scores was 0 – 32 (total achievable 84), mean score 9.72 (SD 5.87). When compared to the W1 data no independent association was found between Scheltens' score and OH for any time interval. When compared to W3 data a significant association was found between WMH and OH at 70 seconds ( $p = 0.002$ . OR 2.5 (1.4–5.5)), 90 seconds ( $p = 0.015$ . OR 2.15 (1.2–4.0) and 110 seconds ( $p = 0.003$ . OR 2.5 (1.4–4.5)).

**Conclusions:** Sustained OH is associated with extent of WMH at time of MR. Prior OH is not associated with later WMH implying WMH may cause sustained OH.

**Trial registration number:** N/A

## AS27-004

### LEUKOARAIOSIS DECREASED THE INCIDENCE OF BRAIN METASTASIS IN PATIENTS WITH LUNG CANCER

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**Background and Aims:** The multi-step metastatic process involves several biological mechanisms, including embolization, survival in

circulation, endothelial invasion, angiogenesis, extravasation, proliferation within the brain parenchyma, and resistance to glial immune surveillance. The aim of this study was to determine whether the presence of leukoaraiosis (LA) would predict the development of brain metastases (BM) in patients with lung cancer.

**Methods:** Between January 2014 and June 2015, 1,007 patients underwent initial magnetic resonance (MR) imaging prior to any treatment and exhibited no evidence of BM. Of these, 189 underwent repeat MR imaging: 56 of 189 patients (30%) developed new BM. LA was retrospectively evaluated according to Fazekas scale on the initial MR images.

**Results:** BM occurred in 15 of 31 patients (48.4%) with grade 0 periventricular hyperintensity (PVH), and in 41 of 158 patients (25.9%) with grade I–3 PVH. The frequency of grade 0 PVH was significantly greater among patients with BM, compared to those without BM ( $p = 0.0156$ ). The median BM-free survival for patients with grade 0 PVH was 22 months (95% CI, 10–41), whereas 51 months for patients with grade I–3 PVH (95% CI, 30–113). The median BM-free survival for patients with grade 0 PVH was significantly shorter than that for patients with grade I–3 PVH ( $p = 0.0196$ ). In a multivariate analysis, patients with grade 0 PVH developed BM at a rate 2.5-fold higher rates than those with grade I–3 (95% CI: 1.1–6.0).

**Conclusions:** Lung cancer patients with LA on initial MR images have a high subsequent incidence of BM.

**Trial registration number:** N/A

## AS27-020

### RATES OF SMALL VESSEL DISEASE AND SILENT BRAIN INFARCTION IN PATIENTS WITH RETINAL ISCHEMIA PRESENTING A TERTIARY REFERRAL CENTRE TIA CLINIC

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**Background and Aims:** We aimed to determine rates of cerebral small vessel disease (SVD) and silent brain infarction (SBI) in ischemic transient and permanent visual loss (TVL and PVL).

**Methods:** We reviewed records for consecutive patients from June 2013–September 2018 in the daily TIA clinic at UCLH, a regional referral centre for north central London and Moorfields Eye Hospital. We rated SVD on CT head (CTH) using the van Swieten scale (vSS). We defined SBI as the presence of lacunes or cortical infarcts without previous TIA/stroke. We compared number of vascular risk factors (No.RFs) for SVD and SBI.

**Results:** Of 485 patients, 356 (73%) had a CTH, 211 (59%) were male, mean age 66.1 years. 223 (63%) had TVL and 133 (37%) had PVL. Rates of SVD and severity were comparable between TVL and PVL (40% vs. 45%,  $p = 0.42$ ; mean vSS = 0.7 vs. 0.8,  $p = 0.32$ ). Rates of SBI lacunes were 13% for TVL and 21% for PVL ( $p = 0.07$ ); rates of SBI cortical infarcts were 4% for both groups ( $p = 1.00$ ). Patients with SVD had more vascular risk factors (mean 2.0 vs. 1.4,  $p = 0.000$ ), as did patients with SBI (1.8 vs. 1.4,  $p = 0.03$ ). Significant RFs for SVD were hypertension (OR 2.7, 95% CI = 1.6–4.4), previous stroke (OR 3.9, 95%CI = 1.3–11.4) and previous TIA (OR 2.9 95%CI = 1.1–8.0).

**Conclusions:** This work represents the first description of rates of SVD and SBI in patients with ischemic visual loss. Rates of SBI in retinal ischemia are comparable to patients with cerebral TIAs and we suggest they are treated on a par with cerebral ischemia.

**Trial registration number:** N/A

**AS27-018****INNOVATIVE MRI MARKERS FOR SPORADIC CEREBRAL AMYLOID ANGIOPATHY AT 7 TESLA MRI: STRIPED OCCIPITAL CORTEX AND INTRAGYRAL HEMORRHAGE**

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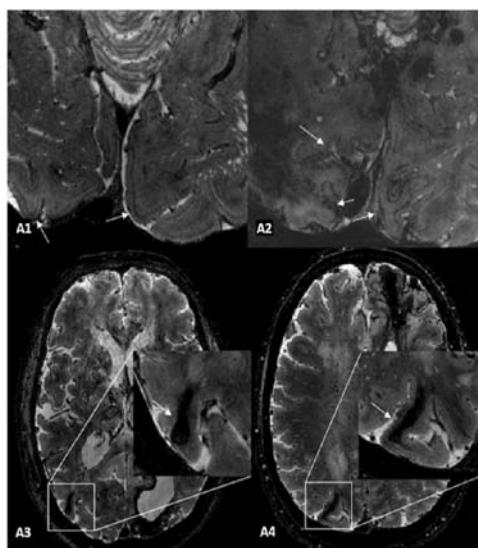
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**Background and Aims:** Recently, a striped pattern of the occipital cortex and intragyrinal hemorrhages were observed in respectively 40% and 47% of patients with Hereditary-Cerebral-Hemorrhage-With-Amyloidosis-Dutch-type (HCHWA-D) at 7T-MRI. We investigated the prevalence of these markers and clinical characteristics of participants with these markers in sporadic Cerebral-Amyloid-Angiopathy (sCAA).

**Methods:** We performed 7T-MRI in patients with probable sCAA according to the Boston criteria. Striped cortex (linear hypointense stripes perpendicular to the cortex) and intragyrinal hemorrhages (hemorrhage restricted to the subcortical white matter of one gyrus) were scored on T<sub>2</sub>\*-weighted gradient echo scans by two independent observers.

**Results:** We included 34 sCAA patients (38% women, mean age 70 years). A striped occipital cortex was detected in 4 (12%) sCAA patients, although the pattern was less pronounced than previously found in HCHWA-D (figure A1/2). Seven intragyrinal hemorrhages were found in 6 (18%) sCAA patients, located in the temporal (29%) and/or occipital (71%) lobe (figure A3/4). Age, sex and number of symptomatic intracerebral hemorrhages did not differ between patients with or without markers. Both markers were associated with lower Montreal Cognitive Assessment scores (median score: 16 (SD3.8) for patients with versus 26 (SD4.3) for patients without striped occipital cortex and 21 (SD5.8) for patients with versus 26 (SD4.8) for patients without intragyrinal hemorrhage).

**Conclusions:** Striped occipital cortex and intragyrinal hemorrhages are present in sCAA, although less frequent than in HCHWA-D.



2D transverse T<sub>2</sub>\*-Weighted gradient echo scan on 7T-MRI showing A1: a striped pattern of the occipital cortex in sCAA and A2 HCHWA-D (data from previous research); A3: intragyrinal hemorrhage in sCAA and A4: HCHWA-D (data from previous research).

Trial registration number: N/A

**AS27-019****BIOMARKERS OF PROGRESSION OF SMALL VESSEL DISEASE (SVD) IN ASYMPTOMATIC PATIENTS**

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**Background and Aims:** Identify biomarkers of progression of SVD using molecules implicated in vascular cognitive impairment: amyloid beta (AB) 1–40; endothelial dysfunction: sTWEAK; and extracellular matrix dysfunction: metalloproteases.

**Methods:** We selected 207 patients with hypertension and/or diabetes mellitus between 60–75 years without previous history of vascular disease, stroke or previous diagnosis of cognitive impairment and they were followed for at least 1 year. MRI brain exam, cognitive evaluation and ELISA test in serum for sTWEAK, AB1-40, TIMP1 and MMP-1, MMP-10, MMP-7, MMP-9, MMP-12, MMP-13 and MMP-3 were performed every year. The main variable was progression of any SVD phenotypes. The second variables were progression of each phenotype: leukoaraiosis, cognitive impairment, lacunar infarcts and microhaemorrhages.

**Results:** 101 patients were included. Mean time of follow up was 24 ± 4,8 months. Progression of any phenotype was detected in 42,6% of cases. Progression of leukoaraiosis in 28,7%, progression of cognitive impairment in 12,9%, new lacunar infarcts in 14,9%, new microhaemorrhages in 14,9%. Higher levels of AB 1–40 was associated with progression of any SVD phenotype OR 1,05 (CI 95% 1,00-1,10) p = 0,038, also with progression of cognitive impairment OR 1,02 (CI 95% 1,00-1,03) p = 0,016, higher levels of sTWEAK was associated with new lacunar infarcts OR 1,11 (CI 95% 1,06-1,17) p < 0,006 and higher levels of MMP-7 and MMP-9 with new microhaemorrhages OR 1,85 (CI 95% 1,03-2,32) p < 0,0001 and OR 1,21 (CI 95% 1,00-3,12) p = 0,019 respectively.

**Conclusions:** Higher levels of AB1-40, sTWEAK, MMP-7 and MMP-9 are associated with progression of different phenotypes of SVD.

Trial registration number: N/A

**WITHDRAWN**

**AS27-047****TITLE: FEASIBILITY OF TRIALS OF TREATMENTS FOR SMALL VESSEL DISEASE**

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**Background and Aims:** Small vessel disease (SVD) on the MRI, in the absence of clinical symptoms increases the risk of stroke and dementia, but there are no known treatments. Proposed treatments including anti-platelet agents and lowering of blood pressure, are often already prescribed for many patients with SVD, therefore it is uncertain if a clinical trial would be feasible.

**Methods:** We examined data from adults in the UK Biobank MRI sub-study (aged 40–70). We defined SVD severe enough to consider a clinical trial as matter hyper-intensity volume (WMHV) in the top quartile of the cohort.

We applied inclusion and exclusion criteria for: aspirin; and any blood pressure (BP) lowering medication, based on previous trials. We then calculated the number of patients who could enter a potential aspirin or anti-hypertensive-medication trial after these criteria had been applied. **Results:** 5794/23179 participants had SVD. 4822 (83.2%, 95% CI: 82.3%, 84.2%) could enter into a trial of aspirin, and 3262 (56.3%, 95% CI: 55.0%, 57.6%) patients would be eligible to enter into a trial of BP lowering medications.

**Conclusions:** The majority of patients with SVD in UK biobank would be eligible to enter a trial of aspirin or BP lowering medication. UK Biobank was established by the Wellcome Trust medical charity, Medical Research Council, Department of Health, Scottish Government and the Northwest Regional Development Agency. It has also had funding from the Welsh Assembly Government and the British Heart Foundation. This project was completed under application 17689.

**Trial registration number:** N/A

**AS27-003****ABNORMAL FINDINGS OF MR PERfusion IN THE PUTAMEN AND CORONA RADIATA PREDICTS MORE SEVERE NEUROLOGICAL IMPAIRMENT IN PATIENTS WITH THE ACUTE ISCHEMIC STROKE**

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**Background and Aims:** The aim of this study was to compare the neurological severity and diffusion lesion size between acute ischemic stroke involving putamen and corona radiata with perfusion abnormality and without that.

**Methods:** We included the patients 1) who were admitted from 2014 to 2018 due to acute ischemic stroke in the putamen and corona radiata, 2) who underwent MR perfusion and MR angiography on admission, 3) whose MR angiography showed neither stenosis nor occlusion of the M1 segment of the middle cerebral artery or the internal carotid artery in the affected side, 4) whose modified Rankin Scale before admission was from 0 to 3. We evaluated patient's baseline characteristics, abnormal findings of MR perfusion, maximum lesion's diameter on admission, NIHSS, upper limb score of NIHSS.

**Results:** Seventy-one patients met our inclusive criteria. Their median age was 75 years. Median MLD on admission was 15mm, median NIHSS on admission was 3 and median NIHSS at discharge was 2, median upper limb score of NIHSS on admission was 1 and median upper limb score of NIHSS at discharge was 0. Thirty (42%) presented abnormalities of MR perfusion (aMRp) in their ischemic lesions. In patients with and without aMRp, median MLD on admission was 20.5 and 14mm ( $p = 0.0002$ ), median NIHSS on admission was 5 and 3( $p = 0.07$ ), median upper limb score of NIHSS at discharge was 0.5 and 0( $p = 0.07$ ), respectively.

**Conclusions:** In patients with abnormal findings of MR perfusion in the putamen and corona radiata on admission, MLD was larger on admission and neurological symptoms were more severe.

**Trial registration number:** N/A

**AS27-015****TGFB LEVELS ARE REDUCED IN SKIN BIOPSIES OF CADASIL PATIENTS**

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Á. March<sup>5</sup>, R. Pujol<sup>5</sup>, C. Soriano<sup>6</sup>, G. Romeral<sup>6</sup>, O. Maisterra<sup>3</sup>,  
J. Krupinski<sup>7</sup>, J. Martí-Fàbregas<sup>8</sup>, J. Montaner<sup>3,9,10</sup>, J. Roquer<sup>6</sup>  
and I. Fernández-Cadenas<sup>1</sup>**

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**Background and Aims:** CADASIL is an inherited small vessel disease (SVD) caused by mutations in NOTCH3 that leads an odd number of cysteines in the receptor, causing protein misfolding and aggregation.

However, the molecular pathways altered by this receptor aggregation need to be further studied.

Transforming growth factor- $\beta$  (TGF $\beta$ ) has been related with sporadic and familial SVD. Moreover, it has been observed a decrease of HTRA1 activity in CADASIL patients, a protein related with TGF $\beta$  pathway activity. Our aim is to study if TGF $\beta$  expression is altered in skin biopsies of CADASIL patients.

**Methods:** Skin biopsies were obtained to conduct a quantitative analysis of immunohistochemistry in 10 genetically confirmed CADASIL patients and 6 healthy controls to study TGF $\beta$  protein levels. Formalin-fixed skin tissues were embedded in paraffin and stained with TGF $\beta$  mouse monoclonal antibody (NBP2-45137, Novus Biologicals), which recognize TGF $\beta$ 1, TGF $\beta$ 2 and TGF $\beta$ 3 expression. We evaluated the expression of TGF $\beta$  in epidermis, fibroblasts, sebaceous glands, sudoriparous glands, inflammatory infiltrate and blood vessels in these skin biopsies. Mann-Whitney test was used to analyse TGF $\beta$  level differences with R software.

**Results:** Immunohistochemistry analysis showed decreased levels of TGF $\beta$  in CADASIL patients compared to controls in fibroblasts ( $p = 0.04$ ) and blood vessels ( $p = 0.03$ ). No differences were observed in epidermis ( $p = 0.34$ ), sebaceous glands ( $p = 0.91$ ), sudoriparous glands ( $p = 0.5$ ) or inflammatory infiltrate ( $p = 0.77$ ).

**Conclusions:** CADASIL patients have lower levels of TGF $\beta$  in fibroblasts and blood vessels. Further studies are needed to understand the repercussion of this finding, analysing TGF $\beta$  transcriptomic regulation and TGF $\beta$  activity.

**Trial registration number:** N/A

## AS27-031

### LEUKOENCEPHALOPATHY WITH CALCIFICATIONS AND CYSTS (LCC): 5 PERSONAL CASES AND LITERATURE REVIEW.

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**Background and Aims:** Leukoencephalopathy with calcifications and cysts (LCC) is a rare autosomal recessive cerebral angiomatics-like microangiopathy characterized by diffuse and asymmetric white-matter lesions associated with multiple calcifications and cysts. The disease is caused by SNORD11B mutations. The entire clinical spectrum of LCC is not yet fully determined. We analyzed data from recently diagnosed personal cases and from the literature.

**Methods:** Both clinical and imaging features from 5 personal LCC cases harboring compound heterozygous SNORD11B mutations were reported and all cases reported in the literature reviewed.

**Results:** Ninety-two LCC cases including our 5 patients were identified. Consanguinity was rare (4%). Age at first clinical manifestations was 16.1 years (1 month-71 years) and was earlier in men (10.3 years) than in women (20.2 years,  $p = 0.02$ ). The main inaugural symptoms were seizures (36%; mean age at onset: 5.2 years) and progressive neurological symptoms including ataxia, dystonia, spasticity (26%; 27.8 years). Intracranial hypertension was less frequently observed (14%), mostly in adults (mean age of 31.5 years). Ischemic or haemorrhagic strokes were inaugural symptoms in 2 adults (2%). During follow up, most patients presented with progressive extrapyramidal, cerebellar and pyramidal signs (79%), cognitive decline (45%), seizures (38%), intracranial hypertension (30 %) or stroke (2%).

**Conclusions:** In LCC, the clinical spectrum is largely heterogeneous and the course of the disease appears highly variable in contrast with other hereditary cerebral small vessel diseases.

**Trial registration number:** N/A

## WITHDRAWN

## AS27-038

### SCREENING FOR COL4A1 AND COL4A2 MUTATIONS IN PATIENTS WITH FAMILIAR MICROANGIOPATHY

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**S. Nannucci**<sup>4</sup>, **A. Poggesi**<sup>2</sup>, **I. Di Donato**<sup>5</sup>, **S. Bianchi**<sup>5</sup>,  
**C. Cereda**<sup>3</sup> and **L. Pantoni**<sup>6</sup>

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**Background and Aims:** Cerebral small vessel disease (CSVD) is hereditary in 5% of patients. Several monogenic hereditary disorders have been identified over the last years. Variations on the type IV collagen coding COL4A1 and COL4A2 genes have been reported in association with a broad spectrum of cerebrovascular diseases. We report our experience in the analysis of COL4A1 and COL4A2 genes.

**Methods:** Analysis was performed in 7 patients for clinical suspicion of familiar CSVD with cerebral hemorrhage and 34 patients enrolled in a

multicenter study. The coding regions of the genes were analyzed by TruSeq Custom Amplicon Low Input (Illumina) assay for targeted-resequencing. Sanger sequencing was used for variant confirmation. Segregation analysis was performed on available relatives. Prediction software (SIFT, Polyphen2, Mutation taster) were used to estimate the pathogenicity of the possible variants.

**Results:** COL4A1 analysis showed a novel variant on exon 31 (NM\_001845.5c.2413G>C; NP\_00183.3p. Gly805Arg), considered pathogenic from prediction software in 1 patient; a variant of unknown clinical significance in another; 4 nonpathogenic variants in 4. Two COL4A2 nonpathogenic variants and 3 variants of unknown clinical significance were found in 2 and 6 patients, respectively. The patient with the novel potentially damaging COL4A1 variant was a 52-year-old woman with recurrent cerebral hemorrhages, muscle cramps, elevated creatine kinase (CK) concentrations, psychiatric disturbances, epilepsy, and diffuse white matter lesions. Symptomatic brother and daughter carried the same variant.

**Conclusions:** In this exploratory study, COLA1/2 variants of unknown clinical significance were found in 19.5% of patients. Among these, a novel variant on COL4A1 was potentially pathogenic.

**Trial registration number:** N/A

## AS27-048

### IMPACT OF SMALL VESSEL DISEASE BURDEN ON COLLATERAL CIRCULATION IN ISCHEMIC STROKES TREATED BY MECHANICAL THROMBECTOMY

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**Background and Aims:** The development of leptomeningeal collateral artery network during acute MCA occlusion is likely associated with changes of the myogenic tone of the arterioles. Small vessel disease burden may account for an increased resistance to blood flow within penetrating arterioles. We sought to determine whether cSVD score may impact collateral status in patients treated by thrombectomy for large vessel occlusion (LVO).

**Methods:** All the patients admitted in our institution for an anterior circulation ischemic stroke related to LVO and who underwent 1) a baseline MRI including T2\*, Flair, DWI, TOF sequences and 2) a mechanical thrombectomy, were included in the study. Small vessel disease (SVD) burden and pial collaterality were respectively assessed by the MRI cerebral SVD (cSVD) score and Higashida's score on digital substracted angiography (DSA).

**Results:** From January 2013 to July 2018 624 patients were screened. Among them, 240 patients ( $69.21 \pm 16.10$  years old; 49.17% female) with relevant analysis of pial collaterals and cSVD score were included in the study. According to multiple regression analysis, cSVD score severity had no significant impact on collateral status (OR 1.11 95CI[0.82-1.50]; p = 0.51).

**Conclusions:** In patients with ischemic strokes related to a LVO, collateral status does not appear to be influenced by SVD burden. However larger studies involving functional assessment of microcirculation might be needed to assess the true impact of this surrogate imaging marker.

**Trial registration number:** N/A

## AS27-044

### SMALL POSTERIOR FOSSA LESIONS OF PRESUMED VASCULAR ORIGIN: NEUROIMAGING DEFINITION AND RELATION WITH SMALL VESSEL DISEASE

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**Background and Aims:** Neuroimaging definitions for posterior fossa lacunar infarcts and lacunes of presumed vascular origin vary widely leading to uncertainty about their significance and relation with supratentorial small vessel disease (SVD).

**Methods:** We aimed to assess small posterior fossa lesions of presumed vascular origin using ad hoc developed scales to examine appearance, risk factors, and associated SVD features, rating 90 MRI scans from two studies including patients with different SVD phenotypes. SVD burden was evaluated by means of the SVD score (ranging from 0 to 4; 1 point each for the presence of:  $\geq 1$  lacunar infarct;  $\geq 1$  microbleeds; moderate to severe deep perivascular spaces; periventricular Fazekas scale 3 and/or deep  $\geq 2$ ).

**Results:** We identified 240 small posterior fossa lesions, 59% in the cerebellum and 41% in the brainstem (96% chronic). The mean number of lesions per patient was  $2.6 \pm 1.7$  SD. 68% were cavitated, 14% non-cavitated, and 18% partially cavitated. On FLAIR sequences, a hyperintense rim was visible in 43%, full hyperintensity in 48%. 5% showed a hemorrhagic component. Patients with small cerebellar lesions in deep locations and patients with paramedian brainstem lesions had higher SVD burden compared to patients without lesions in these locations (mean SVD score respectively:  $2.7 \pm 1.1$  vs.  $2.0 \pm 1.1$ ;  $2.8 \pm 1.0$  vs.  $1.9 \pm 1.2$ , all p < 0.05).

**Conclusions:** Some small posterior fossa lesions might represent an expression of SVD, thus increasing the visible brain vascular burden, possibly contributing to the evaluation of the vascular risk of these patients.

**Trial registration number:** N/A

## AS27-010

### ROLE OF DIASTOLIC ARTERIAL PRESSURE IN MICROSTRUCTURAL CHANGES OF THE BRAIN IN PATIENTS WITH HYPERTENSION-RELATED CEREBRAL SMALL VESSEL DISEASE.

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<sup>3</sup>M.V. Lomonosov Moscow State University, Laboratory of analysis of cell structure imaging, Moscow, Russia

**Background and Aims:** The usage of modern antihypertensive drugs improved the course of arterial hypertension (AH), but did not lead to the expected reduction of small vessel disease (SVD) incidence and its complications. This fact encourages further investigation of the mechanisms of hypertension-related brain damage.

**Aims:** Evaluation of the relation between daily profile of blood pressure (BP) and brain microstructure changes in patients with SVD and AH.

**Methods:** The study included 64 patients (mean age  $59.4 \pm 5.4$  years, 38 (59.4%) female) with SVD and AH. All patients received antihypertensive treatment. Ambulatory blood pressure monitoring (ABPM) and diffusion MRI with region of interest analysis were performed for all participants. The relation between parameters was estimated using multivariate linear regression.

**Results:** A statistically significant relation was found between daily profile of BP according to ABPM and microstructure abnormalities (increased mean diffusivity and radial diffusivity) of the juxtacortical white matter hyperintensities (WMH) of anterior frontal lobe, temporal-parietal area and left posterior cingulate cortex according to MRI data. An increase in diastolic blood pressure (DBP) and its variability were of predominant importance for increasing in mean and radial diffusivity.

**Conclusions:** The results revealed the importance of the DBP increase and variability in brain damage in patients with SVD and AH. Microstructural abnormalities seem to correspond to increase of free water diffusion and myelin damage suggesting an increase in permeability of the blood-brain barrier with further development of vasogenic edema in areas of WMH in patients with SVD and AH.

**Trial registration number:** The study was supported by RFBR grant 18-32-00852.

## AS27-026

### NOT ALL LACUNAR INFARCTS ARE THE SAME – INFLUENCE OF SHAPE ON SIZE AND WHITE MATTER HYPERINTENSITIES

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**Background and Aims:** Lacunar infarcts are common particularly in ethnic Asians. We investigated the relationship between acute lacunar infarct shape, infarct size and grades of white matter hyperintensities (WMH).

**Methods:** This was a retrospective review of MRI data of patients from Asian ethnicity who were admitted for acute ischemic stroke of small vessel aetiology to a single hospital from July 2013 to July 2015. Two physician reviewers performed the imaging analysis with a third adjudicating if there was disagreement. Infarct size was defined as small if  $< 7.0\text{mm}$  or large if  $> 7.0\text{mm}$ . Infarct shape was categorized as ovoid (vertical  $<$  horizontal diameter) and tubular (vertical  $>$  horizontal diameter). WMH were graded using Fazekas scale on FLAIR sequence.

**Results:** Of the 188 lacunar infarcts, 108 (57.4%) were ovoid and 80 (42.6%) were tubular in shape. Patients' demographics, vascular risk factors, and presence of intra- and extracranial disease were similar between ovoid and tubular groups. Ovoid infarcts were more likely to be small  $< 7.0\text{mm}$ , while tubular infarcts were associated with increasing severity of deep WMH and periventricular WMH. Logistic regression analysis revealed infarct size ( $p = 0.06$ ), severity of deep WMH (0.003) and severity of periventricular WMH ( $p = 0.08$ ) were independently associated with infarct shape after age adjustment.

**Conclusions:** The associations found between infarct shape with infarct size and WMH suggest possible differences in pathogenesis and prognosis.

	Ovoid (%)	Tubular (%)	p-value
Size $< 7.0\text{mm}$	31.5	16.2	0.017

## Continued

	Ovoid (%)	Tubular (%)	p-value
7.1-20mm	68.5	83.8	
Deep WMH			
Fazekas 0	20.4	5.0	0.006
Fazekas 1	53.7	53.8	
Fazekas 2	6.5	16.2	
Fazekas 3	19.4	25.0	
Periventricular WMH			
Fazekas 0	16.7	8.8	0.014
Fazekas 1	50.0	36.2	
Fazekas 2	15.7	18.8	
Fazekas 3	17.6	36.2	

**Trial registration number:** N/A

## AS27-043

### AN ATYPICAL CASE OF REVERSIBLE HYPERTENSIVE ENCEPHALOPATHY

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<sup>1</sup>Stroke Unit-Neurology Department IRCCS Foundation Ca' Granda – Ospedale Maggiore Policlinico- Dino Ferrari Centre- University of Milan, Department of Pathophysiology and Transplantation DEPT, Milan, Italy

**Background and Aims:** Hypertensive encephalopathy is characterized by the presence of brain edema along with neurological signs caused by severe hypertension. Usually brain MRI shows a posterior reversible encephalopathy syndrome (PRES) caused by dysfunction of cerebrovascular autoregulation and endothelial damage. We present a case of a patient with malignant hypertension and an atypical pattern of brain damage, not compatible with PRES or other form of hypertensive encephalopathy.

**Methods:** A 54-year-old man came to the Emergency Department for a subacute onset of confusion, acute renal failure and severe hypertension. At clinical evaluation the patient was disoriented, drowsy, confused, and poorly aware of his symptoms.

**Results:** Brain MRI scans disclosed widespread white matter abnormalities involving supratentorial white matter, brainstem and cerebellar hemispheres. The diffuse damage was atypical for PRES, so we considered numerous differential diagnosis including infective encephalitis, leucodystrophy, mitochondrial disease and immune-mediated damage. We performed blood tests, autoimmune screening, eye examination and lumbar puncture with negative results. The patient was treated only with aggressive antihypertensive therapy with a partial regression of symptoms. Serial brain MRI showed a progressive, but not complete, improvement of leukoencephalopathy, especially of the infratentorial damage. The clinical course allowed us to exclude other type of disease such as leukodystrophy and Binswanger disease.

(continued)

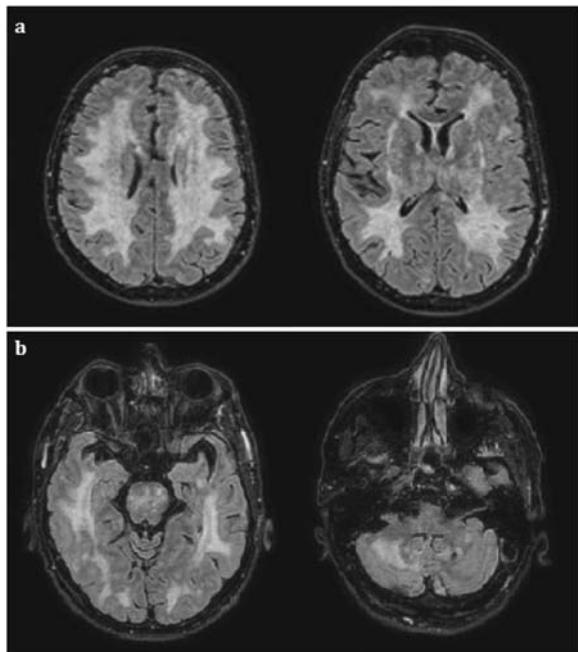


Fig:(a-b) MRI FLAIR sequence showing widespread supra and infratentorial white matter damage.

**Conclusions:** This is an atypical case of reversible hypertensive encephalopathy, since usually the damage has a bilateral parieto-occipital distribution. Cases with such extensive radiological involvement both supra and infratentorial caused by malignant hypertension have been rarely described in literature.

**Trial registration number:** N/A

## AS27-050

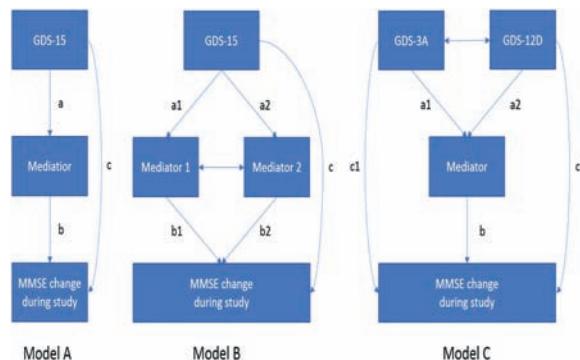
### THE RELATION BETWEEN DEPRESSIVE SYMPTOMS AND COGNITIVE DECLINE IN OLDER PEOPLE WITH HYPERTENSION IS NOT MEDIATED BY MRI MARKERS OF SMALL VESSEL DISEASE

J.W. Van Dalen<sup>1,2</sup>, W. Van Gool Van Gool<sup>2</sup> and E. Richard<sup>1,2</sup>

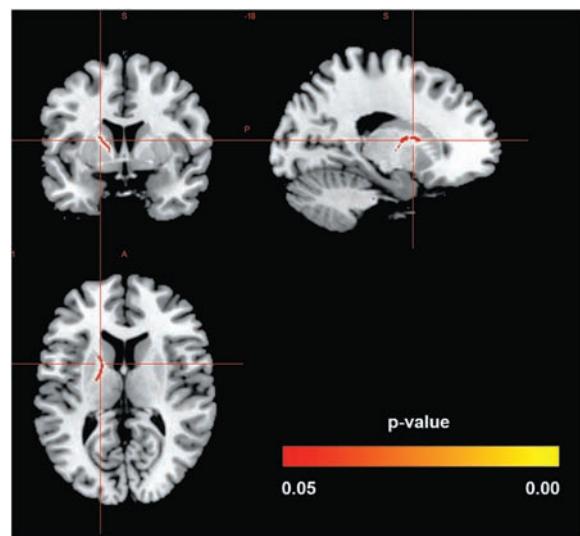
<sup>1</sup>Radboud UMC, Neurology, Nijmegen, The Netherlands; <sup>2</sup>Amsterdam UMC- University of Amsterdam, Neurology, Amsterdam, The Netherlands

**Background and Aims:** Apathy and depressive symptoms in older people are associated with cognitive decline. It has been hypothesized that these relations are due to age related cerebral damage being a common underlying pathology.

**Methods:** We evaluated how the relation between depressive symptoms and cognitive decline over 7 years was mediated by MRI markers of cerebral damage (Fig 1) in a longitudinal cohort of 191 older people (mean age: 76.5 SD: 2.5) with hypertension participating in the Prevention of Dementia by Intensive Vascular Care (preDIVA) study. Cognitive decline was measured using the mini-mental state examination (MMSE) and depressive symptoms, including apathy and non-apathy sub symptoms, using the Geriatric Depression Scale (GDS).



**Results:** Higher GDS scores and GDS non-apathy sub scores were associated with steeper decline in MMSE scores. There was no relation between GDS apathy sub scores and cognitive decline. Structural equation modelling showed no evidence for mediation in the relation between cognitive decline and GDS symptoms by white matter hyperintensity volume, brain parenchymal fraction, fractional anisotropy and/or mean diffusivity. Tract-based spatial statistics (TBSS) found that higher GDS non-apathy sub scores were associated with reduced fractional anisotropy in the right anterior and posterior internal capsule (Fig 2). Our results are limited by inability to adjust for all possible comorbidity. The absence of participants with apathy associated cognitive decline precluded conclusions regarding apathy symptoms.



**Conclusions:** Results suggest that the association between old age depressive symptoms and cognitive decline is not due to brain damage related to MRI markers of cerebral (vascular) damage being a common underlying condition.

**Trial registration number:** NA

**AS27-011****CORTICAL OCCIPITAL CALCIFICATIONS IN PATIENTS WITH HEREDITARY CEREBRAL AMYLOID ANGIOPATHY**

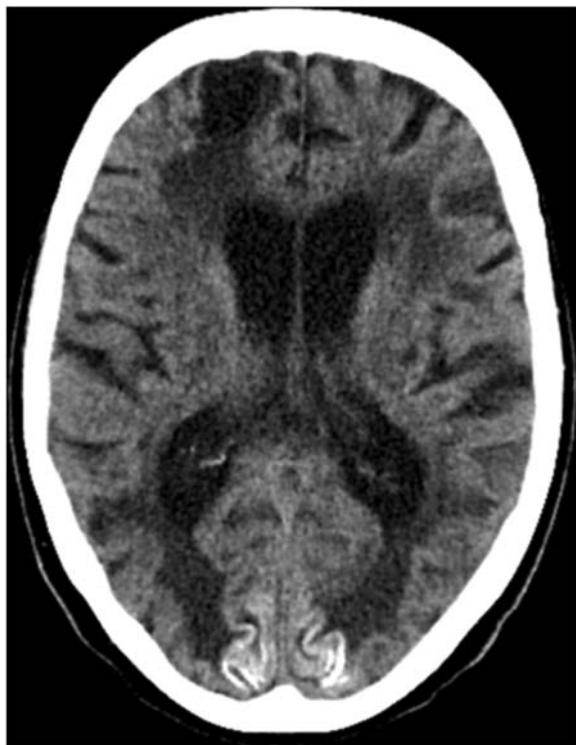
**S. Voigt<sup>1</sup>, I. Rasing<sup>1</sup>, E.A. Koemans<sup>1</sup>, E.S. van Etten<sup>1</sup>, P.C. de Kruijff<sup>1</sup>, S. van Rooden<sup>2</sup>, L. van der Weerd<sup>3</sup>, M.A. van Buchem<sup>3</sup>, M.A.A. van Walderveen<sup>3</sup>, G.M. Terwindt<sup>1</sup> and M.J.H. Wermer<sup>1</sup>**  
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**Background and Aims:** Hereditary forms of cerebral amyloid angiopathy (CAA) caused by specific APP-mutations offer unique insights in CAA pathophysiology. In patients with the Iowa APP-mutation, cortical occipital calcifications are common. We investigated the prevalence of calcifications in patients with Hereditary-Cerebral-Haemorrhage-with-Amyloidosis-Dutch type (HCHWA-D) caused by a mutation of codon 693 in the APP-gene.

**Methods:** We included HCHWA-D-patients who visited the LUMC in whom a CT-scan was performed. HCHWA-D diagnosis was based on the presence of the APP-mutation or a lobar haemorrhage and  $\geq 1$  first-degree family member with HCHWA-D. We assessed presence and location of cortical calcifications on plain CT and related calcifications to the number of previous ICH.

**Results:** We included 73 patients (47% women, 3 presymptomatic) with a mean age of 60 years (range 32–85). Cortical calcifications were found in 10 (14%) of 73 patients, all in symptomatic patients and all located in the occipital cortex. In patients with cortical occipital calcifications (mean age 64, 30% women) the mean number of ICH was 4 (range 1–10) versus 1 (range 0–6) in patients without calcifications (mean age 61, 51% women).

**Conclusions:** Cortical occipital calcifications are a frequent finding in HCHWA-D, especially in patients with multiple ICH. The location aligning the visual cortex might be a result of chronic occipital ischemia or neurodegeneration caused by amyloid deposition but further research is needed to investigate these hypotheses.



Trial registration number: N/A

**AS27-041****DEEP/MIXED CEREBRAL MICROBLEEDS ARE ASSOCIATED WITH COGNITIVE DYSFUNCTION THROUGH THALAMOCORTICAL CONNECTIVITY DISRUPTION: THE TAIZHOU IMAGING STUDY**

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**Background and Aims:** Cerebral microbleeds (CMBs) are considered to be risk factors for cognitive dysfunction. The specific pathology and clinical manifestations of CMBs are different based on their locations. We investigated the association between CMBs at different locations and cognitive dysfunction and explored the potential underlying pathways in a rural Han Chinese population.

**Methods:** We used baseline data from 562 community-dwelling adults (55–65 year-old) in the Taizhou Imaging Study between 2013 and 2015. All individuals underwent multimodal brain magnetic resonance imaging (MRI) and 444 subjects completed neuropsychological measures: the Mini-Mental Status Examination (MMSE) and the Montreal Cognitive Assessment (MoCA). Multinomial logistic regression was used to estimate the association between CMBs and cognitive dysfunction. The volume of brain regions and white matter microstructure were analyzed using Freesurfer and Tract-based spatial statistics (TBSS), respectively.

**Results:** CMBs were detected in 104 individuals (18.5%) in our study. Multinomial logistic regression found deep/mixed CMBs were associated with global cognitive dysfunction (OR 3.52; 95% CI 1.21 to 10.26), whereas lobar CMBs (OR 1.76; 95% CI 0.56 to 5.53) were not. Quantification of multimodal brain MRI showed that deep/mixed CMBs were accompanied by decreased thalamic volume and loss of fractional anisotropy (FA) of bilateral anterior thalamic radiations.

**Conclusions:** Deep/mixed CMBs were associated with cognitive dysfunction in this Chinese cross-sectional study. Disruption of thalamocortical connectivity might be a potential pathway underlying this relationship.

Trial registration number: N/A

**AS27-001****IMAGING MARKER FOR COGNITIVE IMPAIRMENT DUE TO CEREBRAL WHITE MATTER LESIONS BASED ON SKELETONIZATION OF WHITE MATTER TRACTS AND DIFFUSION HISTOGRAMS**

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**Background and Aims:** The peak width of skeletonized mean diffusivity (PSMD) is a new, fully automated, and robust imaging marker for cerebral small vessel disease (SVD). It is considered to be strongly associated with processing speed. However, it has not been applied to cerebral white matter lesions (WMLs) yet. Our study aimed to investigate the correlation between PSMD and cognition in patients with WMLs.

**Methods:** A total of 111 WML patients and 50 healthy controls (HCs) were enrolled, and their demographic information and cardiovascular disease risk factors were recorded. Subjects were divided into three groups: WMLs with normal cognition (WMLs-NC), WMLs with vascular cognitive impairment (WMLs-VCI), and HCs. They underwent conventional head MRI and DTI scans followed by neuropsychological examinations. We analyzed the correlation between PSMD and cognitive function in all subjects.

**Results:** There were no significant differences in demographic characteristics (age, gender, level of education, and cardiovascular disease risk factors) among the three groups ( $P>0.05$ ). However, there were significant differences in global cognition ( $P<0.0001$ ), executive function ( $P<0.0001$ ), and PSMD ( $P<0.0001$ ) among the three groups. There was no correlation between PSMD and cognition in the HC group. PSMD was significantly correlated with MoCA scores ( $r=-0.3785$ ,  $P<0.0001$ ) and executive function ( $r=-0.4744$ ,  $P<0.0001$ ) in the WMLs-NC group and in the WMLs-VCI group ( $r=-0.4448$ ,  $P<0.0001$  and  $r=-0.6279$ ,  $P<0.0001$ , respectively).

**Conclusions:** WML patients have higher PSMD and worse cognitive performance than do healthy controls. PSMD is strongly associated with cognition in WML patients.

**Trial registration number:** N/A

## AS27-037

### BLOOD PRESSURE VARIABILITY INCREASES THE RISK OF DIFFUSION-WEIGHTED IMAGING LESIONS IN INDIVIDUALS WITH SMALL VESSEL DISEASE

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**Background and Aims:** Recent studies have identified a role for diffusion-weighted imaging positive (DWI+) lesions in the origin of small vessel disease (SVD), however their etiology remains largely unknown. As hypertension and blood pressure (BP) variability are known risk factors for SVD, we investigated their role in DWI+ lesion occurrence in individuals with SVD.

**Methods:** 54 individuals with SVD (mean age 70.2 years [SD 6.5], 63% male) underwent 10 monthly 3T MRI scans and parallel BP measurements. DWI+ lesions were visually identified on DWI scans as hyperintense lesions. Variability in BP was defined using the coefficient of variation (CV; SD/mean × 100%). We used Cox proportional hazard regression analysis to investigate the association between BP (mean, variability) and DWI+ lesions.

**Results:** During a median follow-up of 39.5 weeks (interquartile range [IQR] 37.8-40.3), 9 participants (16.7%) had a DWI+ lesion. Individuals with DWI+ lesions had a higher systolic BP (SBP) (157 mmHg [IQR 140-177]) at baseline than individuals without DWI+ lesions (139 mmHg [IQR 128-150],  $p=0.042$ ). However, in Cox regression, baseline SBP was not associated with DWI+ lesion occurrence, whereas high variability in SBP during the study period significantly increased the risk of developing a DWI+ lesion even after adjustment for baseline age (aHR 1.30 per one point increase in CV of SBP, 95% confidence interval [CI] 1.04 -1.64,  $p=0.02$ ).

**Conclusions:** Variability in SBP is associated with the risk of developing DWI+ lesions. Increased SBP variability is a potentially modifiable mechanism for DWI+ lesion occurrence in individuals with SVD.

**Trial registration number:** N/A

## AS27-002

### THE ASSOCIATION OF WHITE MATTER HYPERINTENSITIES WITH INITIAL STROKE SEVERITY AND 3-MONTH FUNCTIONAL OUTCOMES IN MINOR STROKE AND TIA PATIENTS

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**Background and Aims:** The opinions are controversial about the influence of white matter hyperintensities (WMHs) on functional outcome in stroke patients. This issue needs more investigation, especially in Chinese population. We investigated the impact of WMHs on initial stroke severity and 90-day functional outcome in patients with minor stroke and TIA.

**Methods:** We derived data from the Clopidogrel in High-risk Patients with Acute Nondisabling Cerebrovascular Events (CHANCE) trial. 1040 patients undergoing baseline MR examinations with all the required sequences were included in this analysis. WMHs, including periventricular white matter hyperintensities (PVWMHs) and subcortical deep white matter hyperintensities (SDWMHs), were scored by Fazekas scale for each individual. We analyzed the associations between WMHs severities and outcomes using multivariable Logistic models.

**Results:** Among the 1,040 patients in this analysis, there were 491 (47.2%), 349 (33.6%), and 200 (19.2%) patients identified as mild level (0-2), moderate level (3-4), and severe level (5-6) based on Fazekas scores. Severe WMHs (OR 1.75; 95%CI 1.14-2.67;  $P=0.001$ ), as well as severe SDWMHs (OR 1.54; 95%CI 1.12-2.10;  $P=0.007$ ) were associated with higher NIHSS scores. The moderate WMHs group (Fazekas scores 3-4) is slightly associated with higher mRS scores (OR, 1.61; 95% CI 0.98-2.63;  $P=0.058$ ) and tends to have an increased risk of poorer functional outcome than severe group (OR, 1.03; 95%CI 0.56-1.92;  $P=0.919$ ).

**Conclusions:** In patients with minor stroke or TIA, the severity of WMHs and SDWMHs were significantly associated with NIHSS at onset. Compared to severe WMHs, moderate WMHs might predict an increased risk of 3-month functional outcome.

**Trial registration number:** URL: <http://www.clinicaltrials.gov>. Unique identifier: NCT00979589.

## AS27-051

### THE ROLE OF INCREASED BLOOD-BRAIN PERMEABILITY IN THE DEVELOPMENT OF WHITE MATTER HYPERINTENSITIES IN PATIENTS WITH CEREBRAL SMALL VESSEL DISEASE.

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**Background and Aims:** Cerebral small vessel disease (SVD) is the leading cause of vascular dementia and lacunar stroke. White matter hyperintensities (WMH) is the most frequent neuroimaging marker of SVD. Previously was shown that the combination of MRI features of SVD allow to distinguish of two MRI-types of SVD at the Fazekas3. It

is suggested that increased blood-brain barrier permeability (BBB<sub>p</sub>) is important in disease development.

**Aim:** to clarify the association of BBB<sub>p</sub> with early WMH and role of BBB<sub>p</sub> in the different MRI-types of SVD.

**Methods:** 65 patients (45females, 59.9 ± 6.8years) with SVD according to STRIVE criteria and 20 healthy volunteers (age and sex matched) underwent 3T conventional MRI and T1-dynamic contrast-enhanced MRI. In all patients were evaluate BBB<sub>p</sub> (AUC, Ktrans, V<sub>p</sub>) in the grey matter (GM), normal-appearing white matter (NAWM), WMH using pharmacokinetic model Patlak.

**Results:** WMH according to Fazekas scale corresponded to stage F1 in 13, F2 in 21 and F3 in 31 patients. In patients with SVD were increased AUC in GM ( $p=0.03$ ), AUC and V<sub>p</sub> in NAWM( $p=0.009$ ;  $p=0.032$ ). Ktrans between the patient and control groups wasn't statistically differ. There was shown a significant correlation between the AUC and Ktrans ( $R=0.9$ ,  $p < 0.001$ ). A significant association was determined between the increased AUC in WMH( $p=0.002$ ) and V<sub>p</sub> in WMH ( $p=0.005$ ) with the early WMH. AUC in WMH ( $p=0.046$ ), V<sub>p</sub> in NAWM and WMH( $p=0.005$ ,  $p=0.048$ ) were significantly higher in the 2d MRI-type of SVD.

**Conclusions:** Our findings demonstrate the initiating role of increased BBB<sub>p</sub> in the development of the early WMH. The increased BBB<sub>p</sub> of the 2dMRI-type indicates different pathophysiological mechanisms for the formation of different types of SVD.

**Trial registration number:** N/A

## Stroke Complications

### WITHDRAWN

## AS18-058

### ASSOCIATION BETWEEN UNCONSCIOUSNESS AND PNEUMONIA INCIDENT IN ACUTE ISCHEMIC STROKE PATIENTS

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**Background and Aims:** Unconsciousness in acute ischemic stroke patient will decrease the swallowing reflex protection, decrease the function of lower esophageal sphincter resulting in delayed gastric emptying, and also make poorly coordination between breathing and swallowing. The pathomechanism hypothesizes why unconsciousness causes pneumonia. This study aims to determine the association between unconsciousness and the incidence of pneumonia in acute ischemic stroke patients that have required intensive treatment in Stroke Unit dr. Sardjito Hospital, Indonesia.

**Methods:** The method in this study used retrospective cohort study. The population were acute ischemic stroke patients during their comprehensive treatment in Stroke Unit dr. Sardjito Hospital in-between October 1<sup>st</sup>, 2017 until March 31th, 2018. The results were considered statistically significant if  $p < 0.05$ .

**Results:** In this study, 78 patients with acute infarct stroke met eligibility criteria. We used Glasgow Coma Scale (GCS) to asses consciousness level and Centers of Disease and Prevention (CDC) criteria to diagnose pneumonia. The average GCS was 14.10 with SD +2.277. GCS was divided into 2 categories: (1) Conscious patients (GCS 15) were 63 patients (80.8%), (2) Unconsciousness patients (GCS 3–14) were 15 patients (19.2%). Patients with pneumonia were 14 patients (17.9%). The result of Chi-Square Bivariate Analysis showed that unconsciousness significantly affected pneumonia incident ( $p = 0.001$ ). Variables from consciousness level and stroke risk factors that affect pneumonia incident after analized using Logistic Regression Multivariate Analysis were consciousness level ( $p = 0.002$ ; OR = 0.107), and dyslipidemia ( $p = 0.001$ ; OR = 0.080).

**Conclusions:** Unconsciousness affected pneumonia incident during the treatment of acute ischemic stroke patients in Stroke Unit dr. Sardjito Hospital.

**Trial registration number:** N/A

## AS18-040

### CONTRAST-INDUCED ENCEPHALOPATHY POSSIBLY SECONDARY TO ENDOTHELIAL DAMAGE AFTER MECHANICAL THROMBECTOMY

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**Background and Aims:** Increasingly complex stroke patients are receiving endovascular treatment (ET), appearing new clinical scenarios we have to deal with. We aim to present a series of cases of contrast-induced encephalopathy (CE) after ET and compare their characteristics with those patients that did not develop this complication.

**Methods:** Retrospective study of consecutive patients with acute ischemic stroke in middle cerebral artery territory treated with ET in our stroke center who developed CE (defined as neurological deterioration and images of blood-brain-barrier disruption with contrast extravasation in CT and posterior resolution). Their characteristics were compared with treated patients who did not present CE.

**Results:** N=295. 14 patients (4.7%) developed CE: average age: 71.5 (IQR: 65.3-78), 64.3% women, 85.7% hypertension, 42.9% diabetes, 7.1% nephropathy. Mean ASPECTS:8, mean NIHSS:18, primary mechanical thrombectomy: 50%, TICI $\geq$ 2b: 84.7%, mRs  $\leq$ 2 at 3 months: 42.8%. When comparing with treated patients who did not present CE (N=281), the development of CE was associated with diabetes (42.8% vs 15.3%, p < 0.05) and with the number of attempts during the procedure (3.5 vs 2, p 0.05). We didn't find any statistically significant differences between both groups in relation to the rest of variables studied, including 3 months outcome (mRs).

**Conclusions:** Contrast-induced encephalopathy is an infrequent complication in patients who receive ET. It could be related to direct endothelium damage produced during the procedure. In our study, its incidence is significantly higher in diabetic patients and in those with higher number of attempts during ET. Nevertheless, it doesn't seem to affect long-term prognosis.

**Trial registration number:** N/A

## WITHDRAWN

## AS18-005

### PREDICTORS OF EARLY CHEST INFECTION AND THEIR IMPACT ON FUNCTIONAL OUTCOME IN ACUTE ISCHEMIC STROKE

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**Background and Aims:** Pneumonia is the most widespread medical complication after stroke with incidence ranging from 2.4% to 12%. The study to identify its predictors are important to know which patients would be at an increased risk of the infection. The objective of present study is to identify independent risk factors for chest infection after acute stroke and to study their effects on 90 day functional outcome.

**Methods:** It was a prospective, longitudinal, observational study. A total number of 50 subjects of ischemic stroke were enrolled within 48 hours. Modified Rankin score (mRS), National institute of health stroke scale (NIHSS), stroke volume using ABC/2 score, C reactive protein (CRP) and procalcitonin were done at the baseline. At 7 days, patients were tested for pneumonia using Mann Criteria. Follow up was done at 90 days and functional outcome was assessed using mRS and Barthel index and the same was correlated with the various parameters at the time of admission.

**Results:** 34% developed pneumonia during the first 7 days. Patients which larger infarct volume, higher NIHSS, low Barthel index, high procalcitonin and CRP at admission have increased risk of development of pneumonia. NIHSS at admission and poor Barthel index at admission were predictors of poorer outcomes. Patients with mRS category 2 at three months was higher in Non-pneumonia group as compared to patients with pneumonia while death at three months was more common in patients with pneumonia.

**Conclusions:** Our study shows that it is important to identify the markers which may lead the patient to the development of respiratory complications which are the causes of increased mortality in such patients.

**Trial registration number:** N/A

## AS18-031

### IMPROVING IN-HOSPITAL POST-STROKE URINARY CONTINENCE ASSESSMENT AND MANAGEMENT BY IMPLEMENTING THE “STRUCTURED URINARY CONTINENCE ASSESSMENT AND MANAGEMENT PLAN (SCAMP)”- THE STUDY PROTOCOL

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**Background and Aims:** Urinary incontinence is a common, costly but often overlooked stroke complication. We aim to determine if implementing our SCAMP intervention (includes previously-piloted clinically-applicable tools and processes and education, audit and feedback) improves urinary incontinence assessment and management for in-hospital patients following stroke.

**Methods:** Design: pragmatic, before- and after-implementation study at six acute stroke/ medical units, two comprehensive stroke and six rehabilitation services in NSW, Australia. Primary outcome: change in the proportion of incontinent patients who have a continence management plan. Secondary outcomes: change in the proportion of patients who have a urinary continence assessment, recorded diagnosis of incontinence type/s, and receive continence education. We will also determine the intervention effect on clinician knowledge, skills and confidence, and the potential cost-effectiveness from a hospital perspective. Data collection: medical record audits, clinician questionnaires and site-specific teams identifying local barriers and enablers to continence management. Data will be collected for 3 months before and after the 7-month implementation period. To assess sustainability, outcomes will again be measured 16 months after implementation commences. Sample size: Fifteen consecutive medical record audits (incontinent patients) per site per month will provide >80% power to detect a 20% absolute increase (from before intervention) in the proportion of incontinent patients with a continence plan (type I error rate of 5%).

**Results:** Ethics has been approved. Before-implementation data collection is underway. The project will be completed by July 2020.

**Conclusions:** We will translate high-level concepts outlined in clinical guidelines into effective and efficient continence care. SCAMP has the potential to be readily-scaled internationally.

**Trial registration number:** N/A

## AS18-030

### PRONOSTIC FACTORS IN STROKE ACCOMPANIED BY RESPIRATORY INFECTION

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**Background and Aims:** Pneumonia is the most frequent medical complication after stroke. The prevalence is 2–14%, and it is associated with a worse functional prognosis, longer hospital stays, worse recovery in the NIHSS score, and more mortality rate. Our aim is to identify prognostic factors in this kind of patients.

**Methods:** From November 2016 to April 2017, we collected variables of every stroke patients with a respiratory infection during their hospital stay. We used frequencies (percentage), and the average (standard deviation). We used Chi-square and t-Student tests, by SPSS-20.

**Results:** N = 62, 38(61.3%) were men, the average age was 85.52(8.9). 17(27.4%) patients deceased. Charlson index (CI) average was 2.77(1.95). The patients with a CI ≥ 2, presented greater mortality [97%Vs3%, (p = 0.010)]. 24(38.71%) patients presented sepsis, 29,41%(p = 0,020) of them died. All of these patients were prescribed antibioticotherapy: 46 (74,2%) amoxicilline/clavulanic acid, 11(17,7%) levofloxacin and 9(14,5%) piperacillin-tazobactam, with no differences between them. 53(85.5%) suffered an ischemic stroke, 8(12.7%) a hemorrhagic one and 1(1.6%), a transitory ischemic attack. In 12(19%) there was posterior circulation involvement. Greater mortality for the hemorrhagic strokes [29,4% Vs70,6%,(p = 0,019)] and posterior ones [35,3Vs64,7%,(p = 0,049)].

NIHSS average was 14(8.4), the greater NIHSS score, the more mortality rate[CI(0.01-9,28), (p = 0,049)]. 21(33.9%) showed mild and 19(30.6%) moderate dysphagia. In 24(38.7%) patients it was necessary a nasogastric intubation. Moderated dysphagia patients had greater mortality than mild dysphagia patients or those without swallowing difficulties[52,94% Vs47,06% (p = 0,019)].

**Conclusions:** Higher CI, sepsis, hemorrhagic stroke, posterior circulation involvement, greater NIHSS score, and moderate dysphagia were related with greater mortality. Recognizing these variables can help us to asses our patients prognosis and to make better medical decisions.

**Trial registration number:** N/A

## AS18-047

### SUCCESSFUL MANAGEMENT OF CEREBRAL HYPERPERFUSION SYNDROME AFTER BRIDGING INTRAVENOUS-INTRARTERIAL THROMBOLYSIS FOR ACUTE MCA OCCLUSION

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**Background and Aims:** Cerebral hyperperfusion syndrome (CHS) can complicate acute revascularization procedures, especially carotid endarterectomy, carotid angioplasty with stenting and stenting of intracranial vessels [Ho et al, 2000; Lieb et al, 2012]. CHS is caused by impaired cerebral autoregulation, hypertension and ischemia-reperfusion injury resulting in increased regional blood flow and vascular congestion [Adhiyaman et al, 2007; van Mook et al, 2005]. Clinical presentation may include hyperacute as well as delayed onset of headache, seizures and focal motor weakness. MRI features include oedema, hemorrhage or hyperperfusion [Pan et al, 2007; Farooq et al, 2016]. Risk factors include diabetes, older age, hypertensive microangiopathy, poor collaterals. Currently, no specific treatments are available.

**Methods:** Case report

**Results:** Acute onset of aphasia and right hemiplegia in a 69 years-old male, suffering from diabetes and hypertension. CT scan was normal, angio-CT revealed left MCA occlusion. Bridging intravenous-intrarterial thrombolysis produced complete recanalization of left MCA. After the procedure, early neurological deterioration and recurrent partial motor seizures occurred. MRI scan revealed left hemispheric cortical swelling, consistent with EEG theta and delta waves. Severe hypertension, fever and hyperglycemia were noticed; the patient was administered antihypertensives, acetaminophen and insulin. Restoration of normal blood pressure, body temperature and improvement of glycemic control resulted in rapid clinical improvement. Follow-up MRI and EEG normalized.

**Conclusions:** CHS after intracranial endovascular procedures has been rarely reported. Furthermore, an early clinical recovery with subsequent complete reversal of instrumental abnormalities has never been reported. We suggest the role of prompt management of hypertension, hyperthermia and hyperglycemia as a potential remedial strategy.

**Trial registration number:** N/A

**AS18-014****NATURAL HISTORY OF SWALLOW FUNCTION DURING THE 3-MONTHS PERIOD AFTER STROKE**

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**Background and Aims:** Oropharyngeal dysphagia (OD) is a prevalent complication following stroke. Some patients spontaneously recover from swallowing dysfunction through neuroplasticity changes in the unaffected hemisphere. The aim of this study was to describe the natural history of swallowing function between admission and 3-months post-stroke and the factors associated with its prevalence and development. **Methods:** Safety and efficacy of swallow were assessed by using a validated clinical test (volume-viscosity swallow test, V-VST) on admission and at 3-month follow up. Clinical, demographical and neuroanatomical factors were compared between patients with and without spontaneous changes in swallowing function.

**Results:** We analysed 247 post-stroke patients ( $72.3 \pm 11.9$  years, NIHSS  $3.5 \pm 3.8$ ). Prevalence of OD on admission was 39.7% (34.0% impaired safety, 30.8% impaired efficacy). At 3 months, OD prevalence was 41.7% (19.4% impaired safety, 39.3% impaired efficacy). Spontaneous recovery of swallow occurred in 42.4% of post-stroke patients with unsafe swallow and in 29.9% with ineffective swallow mainly associated with young age and optimal functional status. However, 26% of post-stroke patients developed new signs/symptoms of ineffective swallow which were related to poor functional, nutritional and health status, and institutionalization.

**Conclusions:** Prevalence of OD on admission and at three-month follow up was very high in a mild severity stroke population. OD is a dynamic condition with some spontaneous recovery in patients with optimal functional status but also new signs/symptoms appeared in post-stroke patients with poor functional status. Our results suggested that regular OD monitoring is needed to identify those post-stroke patients at high risk of nutritional and respiratory complications.

**Trial registration number:** Protocol code: CEIC17/11.

**AS18-025****DETERMINATION OF THERAPEUTIC VISCOSITY RANGE OF A GUM-BASED THICKENER IN POST STROKE PATIENTS WITH OROPHARYNGEAL DYSPHAGIA**

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**Background and Aims:** Oropharyngeal dysphagia (OD) is highly prevalent following stroke (upto 45.6% in acute phase) and is associated with malnutrition, respiratory infections and increased mortality. Thickening agents are a valid strategy to increase safety of swallowing. However, the therapeutic viscosity range of thickeners in stroke patients is unknown. The therapeutic range of a xanthan gum-based thickener (Nutilis Clear<sup>®</sup>) was defined by testing 6 viscosities compared to thin liquid in post-stroke OD (PSOD).

**Methods:** One hundred-twenty patients with OD were included ( $\geq 28$  days post-stroke) in this reference controlled, multiple dose, fixed order (liquid, 2000, 1400, 800, 450, 250 and 150 mPa.s), single-blind and single-centre study. Boluses (10 mL) were given in duplicate with a stop rule for safety. Each swallow was evaluated with Videofluoroscopy and Penetration Aspiration Scale. Nutritional status was determined with MNA-SF.

**Results:** Only 41.2% of patients swallowed thin liquid safely, and this percentage significantly increased to 71.9% at 150mPa.s ( $p < 0.05$ ) and to maximal therapeutic effect (92.1%) at 800mPa.s. Increasing bolus viscosity further did not significantly increase the swallowing safety. Prevalence of patients with pharyngeal residue at each viscosity (37.7-44.7%) did not significantly differ from thin liquid (41.2%). 54.4% of patients were (at risk of becoming) malnourished.

**Conclusions:** Prevalence of unsafe swallow with thin liquids is very high in PSOD patients. Prevalence of (risk of) malnutrition is also very high and underlines the importance of nutritional screening and management in PSOD. Safe swallowing significantly increased with increasing viscosity with a specific gum-based thickener. The therapeutic effect was between 150-800mPa.s.

**Trial registration number:** NTR5628

**AS18-055****PSYCHOLOGICAL DISTRESS POST STROKE: CAN WE TALK OUR WAY OUT OF THIS ONE?**

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**Background and Aims:** The psychological distress experienced by stroke survivors is often complex and multifaceted. Higher levels of distress are often associated with a poorer outcome. The focus of this study was to assess if a brief psycho-social intervention would decrease the level of subjective psychological distress in this grouping.

**Methods:** A brief psycho-social intervention was offered to the stroke patient on discharge. This was carried out by a qualified psychotherapist who offered client centered and solution focused intervention over a six week period. The CORE Outcome Measure (CORE-OM) was used pre and post intervention. This is a self-reported questionnaire used to indicate the person's level of current psychological distress.

**Results:** Forty stroke survivors were offered the brief intervention service. Fifteen out of the 40 requested and availed of the service. Nine pre and post questionnaires were completed to date which showed a 63% improvement across all 4 dimensions of psychological distress.

Dimensions	Pre - Therapy Mean Scores	Post-Therapy Mean Scores	Improvement Rates
Wellbeing	2.5	1.055	58%
Problems/Symptoms	2.162	0.827	62%
Function	1.515	0.53	65%
Risk	0.277	0	27%
Total Scores	2.047	0.755	63%

**Conclusions:** This demonstrates that a brief psycho-social intervention is a feasible and effective intervention to decrease the global index of

distress post stroke. There is a potential that this approach could be transferred to the greater stroke survivor population. These results highlight the need for further research in this area.

**Trial registration number:** N/A

## AS18-042

### CLINICALLY SILENT SIGNS OF INFECTION ON ADMISSION CHEST CT INCREASE RISK OF PNEUMONIA OR DEATH IN PATIENTS WITH ACUTE ISCHAEMIC STROKE

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**Background and Aims:** In patients with acute stroke, the occurrence of pneumonia has been associated with poor functional outcomes and an increased risk of death. We assessed the presence of very early signs of infection on chest CT prior to the development of clinically overt pneumonia.

**Methods:** In 200 consecutive patients with ischaemic stroke who had CT angiography from skull to diaphragm (including plain CT of the chest) within 24 hours of symptom onset, we assessed whether clinically asymptomatic predefined signs of aspiration or infection on chest CT (consolidation, ground-glass-opacity, tree-in-bud sign, bronchial wall thickening) were associated with the development of clinically overt pneumonia in the first 7 days and 90-day mortality with logistic regression.

**Results:** The median time from stroke onset to CT was 223 minutes (IQR, 91–462 minutes). Thirty five patients (17.5%) had asymptomatic radiological signs of infection on admission and 22 (11.0%) had a clinical diagnosis of pneumonia in the first 7 days. Patients with early radiological signs of infection had a higher risk of developing clinically overt pneumonia (25.7% vs. 7.9%; aOR, 3.6; 95% CI, 1.3–9.7;  $p = 0.01$ ) and had a higher risk of death at 90 days (40.6% vs 18.4%;  $p = 0.01$ ).

**Conclusions:** About one in six patients had clinically silent radiological signs of pneumonia within hours of stroke onset. These patients had a higher risk of clinically overt pneumonia and death. Early administration of antibiotics in these patients may lead to better outcomes.

**Trial registration number:** N/A

## AS18-070

### EARLY RECURRENT EMBOLIC INFARCTION MAY BE AN UNDERRECOGNISED COMPLICATION OF INTRAVENOUS THROMBOLYSIS

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**Background and Aims:** Early recurrent ischemic stroke (ERIS) can occur during or after intravenous (IV) thrombolysis in patients with tPA. ERIS, as one of the reasons of early neurological deterioration, complicates clinical outcomes by inducing new territorial or large hemispheric infarctions.

**Methods:** We retrospectively reviewed 518 consecutive AIS patients treated with IV tPA between January 2016 and June 2018. We defined the ERIS as: Firstly, newly emerged identifiable neurological deficits (with an increment of NIHSS  $\geq$  4-points) during or within 24 hours after intravenous thrombolysis and, secondly ICH excluded and, thirdly new neurological deficit cannot be explained by previously presumed or neuroimaging-shown infarction (s).

**Results:** Of the 518 patients treated with IV tPA in our center, 5 (0.97%) developed ERIS. Median onset time of ERIS cases were 7 hours after the beginning of IV tPA. All the five patients developed neurological deterioration with median NIHSS of 18 points when recurrence. Compared with patients who did not developed ERIS, ERIS patients were associated with prolonged hospital stay, increased neurological severity (NIHSS), functional outcome (mRS) and in-hospital mortality. Surprisingly, none of the patients was with history of AF or was diagnosed with AF during the hospitalisation. Detailed statistical analysis is underway and will be presented.

**Conclusions:** Our case series showed ERIS after IV tPA is associated with significantly greater neurological severity and worse functional outcome in ischemic stroke patients, and due to the nature of high prevalence of intracranial stenosis among Chinese population, the results may warrant future observational study from large-scale Asian registry or cohort.

**Trial registration number:** N/A

## AS18-001

### PREVALENCE OF ANXIETY AFTER STROKE: AN UPDATED SYSTEMATIC REVIEW AND META-ANALYSIS OF OBSERVATIONAL STUDIES

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**Background and Aims:** A 2013 systematic review found a prevalence of post-stroke anxiety of 18% when measured by interview, and 25%, measured by rating scale. We aimed to update the 2013 review and generate an updated measure of prevalence. Secondary aims were to measure prevalence of anxiety subtypes and explore the effect on prevalence of the method of measuring anxiety, time post-stroke, and study setting.

**Methods:** Screening and data extraction used pre-piloted forms. Study quality was assessed using the Newcastle-Ottawa Scale. A second reviewer screened a sample of papers and checked data extraction and quality appraisal for errors. Interrater agreement was moderate to high. Meta-analysis, subgroup, and sensitivity analyses were performed, with results presented as forest plots.

**Results:** 22564 unique records were obtained. 80 publications reporting 51 studies were included in the review; all 51 were included in meta-analyses. Based on 11 studies using clinical interviews, prevalence of anxiety was estimated as 18.0% (95% CI: 13.3–22.6,  $I^2 = 85\%$ ); pooled prevalence from 40 studies using rating scales was 25.1% (95% CI: 21.4–28.9,  $I^2 = 96\%$ ). Community-based studies reported a statistically significant lower prevalence than population-based studies. There was no statistically significant change in prevalence over time. Higher quality studies tended towards lower prevalence. The relative importance of anxiety subtypes was not clear.

**Conclusions:** The prevalence of post-stroke anxiety is significant, in line with the results of the original review. Further research should focus on the prevalences of anxiety subtypes, changes in prevalence over time, and on the effectiveness of treatments for anxiety after stroke.

**Trial registration number:** N/A

**AS18-015****THE CHRONIC POST-STROKE APHASIA SEVERITY: MAGNETIC RESONANCE IMAGING (MRI) STUDY****D. Filatova<sup>1</sup>, G. Portnova<sup>2</sup> and O. Martynova<sup>2</sup>**

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**Background and Aims:** This study aim was to assess the correspondence of volume, localization and cortex thickness of the stroke area to aphasia severity.

**Methods:** A sample of 15 right-handed patients after left hemisphere stroke participated in cognitive and MRI study. The inclusion criteria: stroke at left middle cerebral artery; time 3 to 24 months after stroke; the exclusion criteria: other locations of stroke, neurological or psychical diseases. The Tsvetkova method was used to determine the aphasia degree. The MRIcron, xjView, CIVET and Freesurfer were used to calculate stroke volume and surface area, the cortex thickness and stroke localization. Spearman's coefficient and correlation analysis were used to get the results.

**Results:** The linear regression analysis performed using values of speech test as a dependent variable and the lesion volume, calculated separately for each patient, and the difference in cortex thickness between right and left hemisphere showed significant results. We allocated areas reported as the speech-related and found that the higher aphasia severity was related with the higher amount of injured speech-related Brodmann areas.

**Conclusions:** Our results demonstrated that the involvement in the stroke both Broka and Vernike areas leads to higher aphasia severity. We analyzed the thickness of the impaired cortex to consider the post-stroke plastic changes of the brain tissue. We find the significant correlation of the presumed volume of injury and the aphasia severity.

**Trial registration number:** N/A

**AS18-024****CEREBRAL HYPERPERFUSION-RELATED INHIBITION OF CEREBRAL ISCHEMIC LESIONS DUE TO ARTERY-TO-ARTERY EMBOLI DURING CAROTID EXPOSURE IN ENDARTERECTOMY**

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**Background and Aims:** Artery-to-artery emboli during exposure of the carotid arteries in carotid endarterectomy (CEA) causes development of cerebral ischemic lesions and neurological deficits after CEA. It has been reported that insufficient cerebral flow induces the development. Inversely, too-much flow supply like cerebral hyper perfusion after revascularization may inhibit development of cerebral ischemic lesions due to the artery-to-artery emboli. The purpose of the present study was to determine whether cerebral hyperperfusion after revascularization inhibits development of cerebral ischemic lesions due to artery-to-artery emboli during exposure of the carotid arteries in CEA.

**Methods:** In patients undergoing CEA for internal carotid artery stenosis (>70%), cerebral blood flow (CBF) was measured using single-photon emission computed tomography (SPECT) before and immediately after CEA. Postoperative CBF increase >100% compared with preoperative

values is defined as cerebral hyperperfusion. Microembolic signals (MES) were identified using transcranial Doppler during carotid exposure. Diffusion-weighted magnetic resonance imaging (DWI) was performed within 24 h after surgery for identifying cerebral ischemic lesions.

**Results:** Of 32 patients with a combination of reduced cerebrovascular reactivity to acetazolamide on preoperative SPECT and MES during carotid exposure, 14 (44%) showed, and 16 (50%) developed postoperative cerebral ischemic lesions identified on DWI images. Postoperative cerebral hyperperfusion was significantly associated with the absence of DWI-characterized postoperative cerebral ischemic lesions ( $p = 0.0009$ ).

**Conclusions:** From the present study, blood pressure elevation following carotid declamping would be effective when embolism not accompanied by cerebral hyperperfusion occurs during CEA.

**Trial registration number:** N/A

**AS18-028****ENTERAL NUTRITION IN ACUTE STROKE: WHEN AND HOW**

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**Background and Aims:** Stroke is the most frequent cause of dysphagia. Up to 29% of patients require nasogastric (NG) feeding in the acute phase and there is controversy about when to indicate percutaneous endoscopic gastrostomy (PEG) feeding. We studied the rate of stroke patients requiring NG and PEG in our Stroke Unit (SU), its characteristics and associated complications.

**Methods:** Retrospective analysis of patients with acute stroke admitted to the SU (September-2013 to February-2017). Main objective: percentage of patients with NG, PEG or oral nutrition (ON) at discharge. Secondary objective: 3 month prognosis and feeding-specific complications.

**Results:** Out of 836 patients; 699 (83.6%) were discharged on ON, 70 (8.3%) on NG, 3 on PEG and 64 (7.6%) without feeding (due to limitation of therapeutic effort). The ON-group was younger than the NG-group ( $69.8 \pm 13.49$  vs  $77.1 \pm 11.32$ ), with lower percentage of women (42.3% vs 50.6%), baseline NIHSS (median 3 vs 14), stroke-associated pneumonia (3.4% vs 36.9%) and in-hospital mortality (0.1% vs 15%). At 3 months, 55% of the NG-group presented mRS between 3–5, 39% dementia and 30% more than 4 NG replacements. Median time to withdrawal of NG 43.5 days 20.2–68.2 (RIQ). In 14 patients (19.1%) PEG was indicated ( $138 \pm 136$ -days average until PEG). Complications with NG: 32 (43.8%) mild, none serious; PEG: 4 (28.5%) mild and 3 (21.4%) serious.

**Conclusions:** In our series, only 8% of patients required enteral nutrition at discharge, mainly nasogastric tube. PEG was considered in a low percentage of patients and veri late, it carried a higher chance of serious complications.

**Trial registration number:** N/A

**AS18-022**

**THE APPEARANCE OF LENTICULOSTRIATE ARTERIES AFTER ENDOVASCULAR TREATMENT AS A PREDICTOR OF THE RISK OF SYMPTOMATIC INTRACRANIAL HAEMORRHAGE**

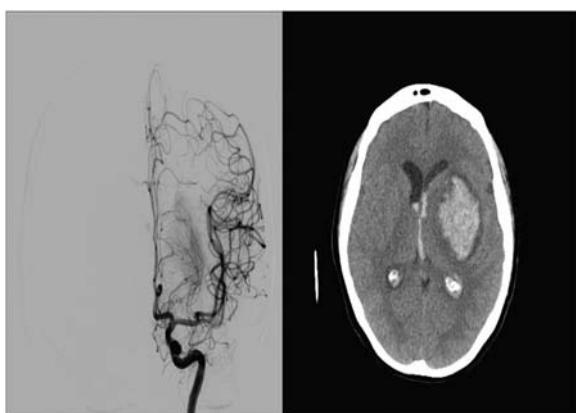
**M. Gutierrez Sanchez De La Fuente<sup>1</sup>, C.I. Gómez-Escalona<sup>1</sup>, M. Moreu<sup>2</sup>, S. Rosati<sup>2</sup>, C. Pérez<sup>2</sup>, P. Simal<sup>1</sup>, J.A. Egido<sup>1</sup> and L. López Ibor<sup>2</sup>**

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**Background and Aims:** Symptomatic intracranial haemorrhage (HICs) is a complication of mechanical thrombectomy that occurs in up to 15% of procedures, with or without previous endovenous fibrinolytic treatment. A postulated pathophysiological mechanism is the loss of brain self-regulation by ischemia. One of the described angiographic patterns associated with HICs is an increased vascular enhancement and distal arterial vasodilatation. The aim of our study is to analyze whether there is a relationship between this angiographic pattern in the lenticulostriate arteries in the last contrast run after arterial revascularization (patent lenticulostriate arteries), with an increased risk of HICs in the basal ganglia.

**Methods:** Retrospective analysis of a prospective cohort of patients undergoing endovascular treatment for occlusion of the proximal segment of the MCA or terminal ICA, with recanalization  $\geq$  TICI2A, performed in our centre between January 2010 and December 2017. We analyzed the presence of patent lenticulostriate arteries in the last angiographic series and the appearance of HICs.

**Results:** We reviewed the cerebral angiographies of 141 patients who met the inclusion criteria of the study. The presence of the patent lenticulostriate artery pattern was observed in 12.1% of the patients, and the total of HICs was 14 (10%). The presence of the patent lenticulostriate artery pattern was significantly associated with the occurrence of HICs, 35.3% vs. 6% ( $p = 0.002$ ).



**Conclusions:** The presence of patent lenticulostriate arteries in the last angiographic series was significantly associated with an increased risk of symptomatic intracranial hemorrhage, which seems to reflect a loss of brain self-regulation in the basal ganglia.

**Trial registration number:** N/A

**AS18-043**

**MACHINE LEARNING PREDICTION FOR POST-STROKE DELIRIUM USING CLINICAL AND BRAIN-REGIONAL CHARACTERISTICS OF ACUTE ISCHEMIC STROKE PATIENTS**

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**Background and Aims:** We developed machine learning models to predict the occurrence of post-stroke delirium using the clinical and brain-regional characteristics of acute ischemic stroke patients.

**Methods:** We screened for delirium using the Confusion Assessment Method and used Diagnostic and Statistical Manual of Mental Disorders (5th edition) to diagnose delirium for the 675 consecutive acute ischemic stroke patients, who were admitted in stroke unit from August 2017 to July 2018. The clinical and brain imaging data of the patients were used to test machine learning algorithms for the prediction of post-stroke delirium. We compared accuracy of machine learning algorithms including Support Vector Machine (SVM), Random Forest (RF) and Tree-based Gradient Boosting (XGBoost) performed with clinical and brain imaging.

**Results:** Post-stroke delirium occurred in 66 (9.8%) of the total patients. On the comparison of the prediction accuracy of delirium occurrence, RF (93%) and XGBoost (92%) showed similar rates, and SVM (81%) was lower than two others. Top linked-variables to be included for the prediction of post-stroke delirium were age (feature importance, 1.50), National Institute of Health Stroke Scale (1.07) and modified Rankin Scale (0.73) at admission, side of old (0.69) and new stroke (0.47), size of new lesion (0.37), male (0.36), old infarction on cognition-related region (0.33).

**Conclusions:** The present study shows the accuracy of the machine learning models to predict post-stroke delirium using the clinical and brain-regional characteristics of acute ischemic stroke patients. The top ranked variables could provide the possibilities to improve the prediction rate of post-stroke delirium.

**Trial registration number:** N/A

**AS18-052**

**FEATURES OF RISK FACTORS OF VASCULAR DEMENTIA AND NEW APPROACHES TO OPTIMIZE THERAPY.**

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**Background and Aims:** The aim – to study the identified characteristics of risk factors and new approaches to optimize therapy

**Methods:** Materials and methods. There were examined 348 patients with post-stroke dementia, 143 (41.1%) males and 205 (58.9%) females. Mean age is  $65 + / - 5.5$  years. To confirm the nature of vascular dementia it was made evaluation using the modified ischemic scale of Hachinsky, each patient has the score of evaluation 7 and higher according to this scale.

**Results:** In studying the frequency of cardiovascular risk factors the duration of arterial hypertension disease was  $15.1 + / - 4.2$  years. Comparative analysis of the frequency of other risk factors showed certain differences. Among the 103 (29.6%) patients suffering from diabetes, dementia was diagnosed in 87 (84.5%) cases; among 93 (26.7%) cases with hyperlipidemia – in 52 (55.9%) patients; among 117 (33.6%) patients with coronary heart disease – in 78 (66.7%) cases. Impairment of daily

activities regulation were different with striking clinical picture. Comparative analysis of focal post-stroke changes showed frontal – temporal – occipital focus localization (there were done computerized tomography of the brain and echoencephaloscopy). Changes in white matter of the brain – leukoaraiosis detected in 297 (85.3%) cases. In order to optimize the processes, the differentiated approach to the treatment of vascular dementia opens new ways in basic therapy.

**Conclusions:** Identified risk factors are potentially correctable, and timely treatment will significantly prevent the progression of cognitive impairment and development of vascular dementia.

**Trial registration number:** N/A

## AS18-069

### COMORBIDITIES AND MEDICATION UTILIZATION AMONG LARGE HEMISPHERIC INFARCTION (LHI) PATIENTS IN LARGE ADMINISTRATIVE DATABASES

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**Background and Aims:** Large hemispheric infarction (LHI) generally encompasses a subset of acute ischemic stroke due to middle cerebral artery (MCA) occlusion or internal carotid artery (ICA) occlusion and is associated with varying levels of cerebral edema. This study aims to provide a general description of LHI in Commercial and Medicare claims databases.

**Methods:** Adult LHI cases were selected from Clininformatics Data Mart Multiplan and Truven Health MarketScan. LHI cases were identified as individuals with  $\geq 1$  ICD-10 code consistent with LHI between 2015 and 2017. For each case, two controls were matched on year of birth, age at index (first LHI ICD-10 code), gender, time in the database, pharmacy benefit eligibility (Truven only), and status of continuous enrollment. Frequencies of comorbidities (Clinical Classification System), medications (Uniform System of Classification), and prevalence ratios are provided.

**Results:** Results were similar across all four datasets which included Clininformatics overall ( $N = 51,772$ ), Truven Commercial ( $N = 33,478$ ), Clininformatics Medicare ( $N = 41,495$ ), and Truven Medicare ( $N = 18,105$ ). Gender distribution within the databases were similar: 49.9%– 55.6% female. The majority of patients were over age 65 years (54.7%– 98.5%). Frequencies of the most common comorbid conditions among LHI patients (e.g. hypertension, heart diseases, and nervous system disorders, etc.) ranged from 1.3 to 2.9 times higher than among non-LHI patients.

**Conclusions:** Overall, there are clear trends in frequencies of comorbidities and medications among patients with  $\geq 1$  LHI diagnosis code in claims data. Further work is needed to refine the definition of LHI in administrative claims for further reliable detailed analyses. All authors are employees and stockholders of Biogen.

**Trial registration number:** N/A

## AS18-037

### RED CELL DISTRIBUTION WIDTH PREDICTS INFECTION IN PATIENTS WITH ACUTE ISCHEMIC STROKE

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**Background and Aims:** The red cell distribution width (RDW) is a rapid, inexpensive laboratory test. Elevated RDW values are associated

with poor outcomes in adult critical illness, especially in cardiovascular disease and infection. We examined the association between RDW and stroke-associated infection.

**Methods:** A consecutive 1,973 patients who were admitted within 7 days after ischemic stroke onset between March 2010 and September 2016 were included for analysis. The patients were categorized into two groups on the basis of RDW( $>14.0\%$ ). We evaluated the stroke-associated infection using a combination of clinical assessment, radiological imaging and appropriate microbiological tests. Logistic regression was used to identify risk factors for stroke-associated infection.

**Results:** The patients were divided into two groups according to RDW scores identified as RDW above group ( $n = 342$ , 17.3%) with mean age  $71 \pm 11.2$  years; 58.8% males and RDW below group ( $n = 1631$ , 81.7%) with mean age  $67 \pm 12.5$  years; 61.2% males. As expected, the patients with stroke-associated infection were older and more likely to have atrial fibrillation, history of dyslipidemia, diabetes mellitus, higher NIHSS on admission and higher RDW (19.0% vs 8.2%,  $p < 0.001$ ). The stroke-associated infection rate was higher in the RDW above groups as compared to RDW below group with odds ratio 2.279; confidence interval 1.637 to 3.173;  $p < 0.001$ , even after adjustment for traditional cardiovascular risk factors.

**Conclusions:** This study demonstrated that higher RDW predicted stroke-associated infection in patients with acute ischemic stroke. This study has shown that RDW provides additive prognostic data for infection of patients with acute ischemic stroke.

**Trial registration number:** N/A

## AS18-010

### GAMMA KNIFE SURGERY-INDUCED ANEURYSM RUPTURE ASSOCIATED WITH TISSUE PLASMINOGEN ACTIVATOR INJECTION: CASE REPORT AND REVIEW OF THE LITERATURE.

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**Background and Aims:** With the increase in the number of patients treated using gamma knife surgery (GKS), cases involving delayed development of intracranial aneurysms related to GKS have been recently reported. Recently, tissue plasminogen activator (t-PA) injection for patients with unruptured aneurysm has been considered safe. Here, we present a rare case of GKS-induced aneurysm rupture after intravenous injection of t-PA for occlusion of the middle cerebral artery (MCA). To our knowledge, this is the first case in which t-PA induced rupture of a GKS-related unruptured aneurysm.

**Methods:** A 74-year-old woman underwent GKS for left trigeminal neuralgia (TN) 18 years ago. She suddenly experienced middle cerebral artery (MCA) occlusion with consciousness disturbance and right hemiparesis. She received an intravenous injection of t-PA and then transferred to our hospital. We confirmed residual thrombus and underwent mechanical thrombectomy successfully.

**Results:** A post-thrombectomy brain computed tomography (CT) scan revealed a subarachnoid hemorrhage with hematoma in the left cerebellar hemisphere. Cerebral angiography revealed a small irregular-shaped aneurysm at the branching site of the left circumflex branch at the distal position of the anterior inferior cerebellar artery which was not detected on the first magnetic resonance angiography (MRA) and CT angiography (CTA). We performed coil embolization.

**Conclusions:** GKS-induced aneurysms have a greater tendency to rupture than intrinsic unruptured aneurysms by previous reports. When performing acute treatment for cerebral infarction in patients with a history of GKS, the presence of aneurysms should be evaluated. If a

GKS-induced aneurysm is noted, t-PA should not be injected to avoid rupture.

**Trial registration number:** N/A

### AS18-036

#### DECOMPRESSIVE HEMICRANIECTOMY FOR MALIGNANT HEMISPHERIC INFARCTION - EXPERIENCES AT A TERTIARY NEUROSCIENCES CENTRE

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**Background and Aims:** National Clinical Guideline for Stroke (UK, 2016) recommends considering decompressive hemicraniectomy (DH) for malignant hemispheric infarctions in suitable patients. However, local practices often differ and are dependent on the treating stroke and neurosurgical team. We aimed to evaluate existing practices at a tertiary neurosciences centre.

**Methods:** A retrospective analysis of data was undertaken using electronic patient records and neurosurgical referral database. All referrals for consideration of DH for malignant hemispheric infarction between 1<sup>st</sup> October 2016 and 31<sup>st</sup> March 2018 were included. Data analysis was undertaken using summary statistics.

**Results:** 45 patients were referred to the neurosurgical services with 7 (15%) patients undergoing DH with a mean age of 58y (range 28y-91y) and majority being males (37 M, 18 F). Of those that underwent the procedure, 57% were referred within 24 hours and 86% underwent DH within 48 hours. The majority (86%) were alive at 3 months although significantly disabled with modified Rankin score (mRs) of 4 or 5. All patients had National Institute Health stroke severity (NIHSS) score >15 and >50% involvement of the middle cerebral artery. Pre-existing co-morbidities and functional baseline status appeared to be the main determinants when considering DH.

**Conclusions:** DH offers a potential lifesaving surgical intervention in malignant hemispheric infarction, which otherwise has an extremely high fatality rate. At our centre DH has led to good survival rates; however a significant proportion of survivors have been left with severe disability. Decision on DH should be made based on appropriate patient selection and frank discussions with patient/family regarding outcomes.

**Trial registration number:** NA

### AS18-019

#### A 4-STEP STANDARD OPERATING PROCEDURE FOR THE TREATMENT OF FEVER IN PATIENTS WITH ACUTE STROKE – FEASIBLE, EFFECTIVE AND COST-EFFICIENT

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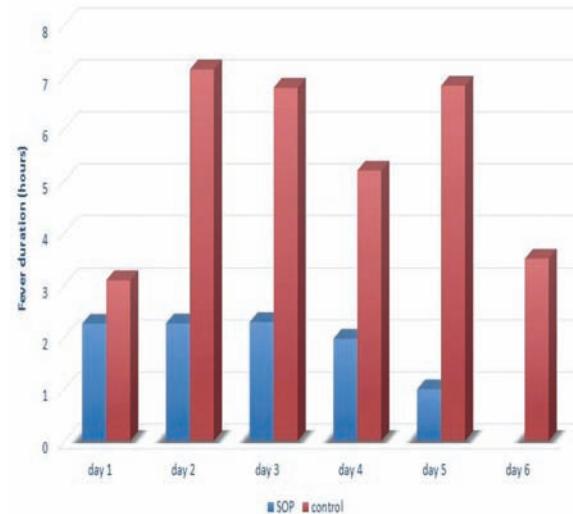
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**Background and Aims:** Fever worsens outcome after acute stroke. However, the effect of antipyretic strategies in terms of reduction of fever burden, feasibility, and neurological outcome is still unclear. Therefore, a 4-step standard operating procedure (SOP: Paracetamol, metamizole, calf packing, Cold infusions) for the treatment of fever was initiated to assess its efficacy and feasibility.

**Methods:** The mentioned SOP was used in patients who developed fever of more than 37.5°C within the first 6 days after stroke onset. Data was recorded and compared to a historical control group before

initiation of the SOP. Moreover, physicians and nurses scored the feasibility of the SOP before and after the first months of initiation of the SOP.

**Results:** We included the first n = 130 patients (mean age 70 ± 14 years) in the SOP Group. Paracetamol (n = 245 applications in total), metamizole (n = 53) and calf packing (n = 15) reduced the body temperature significantly 60min after application. In all patients, who did not respond sufficiently to these interventions, cold infusions led to normothermia. Normothermia could be reached in more than 90% of all treated patients within a period of 120min after the first fever detection. The total fever burden within the first 4 days after stroke was significantly lower in the SOP group compared to the historical control (graph 2). The SOP was considered to be useful and feasible by physicians and nurses.



**Conclusions:** Our SOP is a feasible, easy, cost efficient and effective method for fever treatment in stroke units and requires further investigations in a randomized Fashion.

**Trial registration number:** N/A

### AS18-007

#### A RARE HOARDING BEHAVIOR FOLLOWING LEFT CAUDATE NUCLEUS INFARCTION

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**Background and Aims:** Punding is the term used to describe complex, purposeless abnormal behavior and is characterized by compulsive fascination with excessive, repetitive mechanical tasks. These behaviors are thought to be related to either excessive dopamine stimulation or inhibition. Here, we report a case of punding as a delayed manifestation after cerebral infarction at the body of the caudate nucleus.

**Methods:** N/A

**Results:** A 70-year-old man presented with acute-onset motor aphasia. Upon examination, he showed no other neurological deficit. The CT and MRI taken during admission were consistent with recent infarctions of the left caudate nucleus and multiple scattered areas of multiple cortices. Approximately 6 months after the episode, he gradually became disruptive and ill tempered. He began to buy and collect assorted repair tools, insisting that he would fix any broken machine or instrument, even when he was not asked. He also presented hoarding behavior, acquiring unnecessary goods and stacking them at his house. He was started on 12.5 mg of quetiapine at bedtime to reduce his excessive nighttime activities, and

his sleep pattern improved. He was also prescribed 1 mg of aripiprazole to reduce his remaining punding symptoms, but it worsened his repetitive activities and was therefore discontinued.

**Conclusions:** This is the first case of punding following ischemic stroke at the body of the caudate nucleus. Our case strengthens the hypothetical pathophysiology of punding, which may involve not only direct dopaminergic stimulation but also the dysregulation of the dopamine system via disruption of the cortico-striato-thalamocortical circuits.

**Trial registration number:** N/A

## AS18-021

### THE EFFECTS OF FLUOXETINE ON FRACTURE RISK AFTER STROKE: FURTHER ANALYSES FROM THE FOCUS TRIAL

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**Background and Aims:** The FOCUS trial showed that 20mg of fluoxetine daily, for six months, started 2–15 days post stroke had no effect on the modified Rankin scale (mRS), reduced the risk of new depression (Risk difference 3.8%) but increased the risk of bone fractures (Risk difference 1.4%). Further analyses aimed to explore the factors associated with bone fractures.

**Methods:** Sixty five of the 3127 (2.1%) patients enrolled had a fracture within six months of randomisation. Of these 59 (90.8%) resulted from a fall and 26 (40%) affected the neck of femur. Cox proportional hazards modelling of the risk of fracture showed that only age  $\leq 70$ yr (Hazard Ratio = 0.51 (95%CI 0.29-0.89;  $p = 0.017$ ), female sex (HR = 2.13 (1.29-3.51;  $p = 0.003$ ) and fluoxetine treatment (HR = 2.00 (1.20-3.34;  $p = 0.008$ ) were independent predictors. Stroke pathology, severity, type of deficit, prior fractures, other medication affecting blood pressure, bone density and balance had no significant effect. Furthermore, removing patients with a fracture from the primary analysis did not significantly alter the effect on mRS (Common odds ratio 0.951 with fractures, 0.961 without).

**Results:** Only increasing age, female sex and fluoxetine were independent predictors of fracture risk. Most fractures resulted from falls. Although many of the fractures were serious, and are likely to have impaired patients' function, the increased fracture risk did not explain the lack of observed effect of fluoxetine on mRS.

**Conclusions:** A future individual patient data meta-analysis including the patients from the ongoing AFFINITY and EFFECTS trials may clarify the mechanism of fractures due to fluoxetine.

**Trial registration number:** ISRCTN registry, number ISRCTN83290762.

## AS18-012

### HEALTHCARE ASSOCIATED INFECTIONS IN CRITICALLY ILL NEUROLOGICAL PATIENTS WITH STROKE

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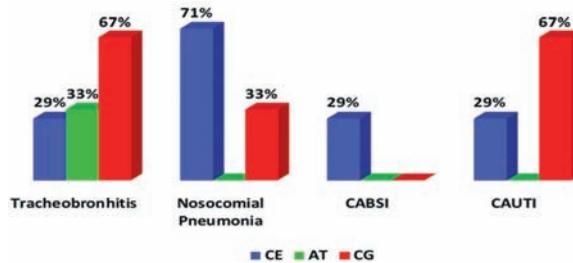
**Background and Aims:** Critically ill neurological patients (CINP) have traditionally been considered as high risk patients for the development of healthcare associated infections (HAI). When infectious complications take place, mortality and length of staying at Intensive Care Units (ICU) are increasing. The objective is to develop a model that considers

the different factors for the development of hospital-acquired infections in CINP admitted to the ICU, including the nosological group, the presence of invasive devices and the type of infectious agent.

**Methods:** We collected all clinical data of 24 patients with stroke, who were admitted to the ICU and stayed there at least 48 hours. Patients were classified in nosological groups and examined daily for signs and symptoms of the infectious complications.

**Results:** 11 patients had hemorrhage; 13 patients had ischemic stroke (IS): 7 (54%) cardioembolic (CE), 3 (23%) atherothrombotic (AT) and 3 cryptogenic (CG 23%). HAIs have been most severe in patients with CE IS. Infectious complications were represented by tracheobronchitis (38%), nosocomial pneumonia (46%) (including ventilator-associated pneumonia), catheter-associated bloodstream infections (15%) and catheter-associated urinary tract infections (31%). 5 patients had more than one infectious complications. 8 patients were ventilated: 50% of CE, 25% of AT, 25% of CG IS. Mortality amounted to 33.3% in patients only with CE ischemic stroke.

#### Infectious complications in stroke



**Conclusions:** This analysis explains the relationship between clinical aspects and HAIs in patients with stroke admitted to the ICU. Infectious complications were mostly associated with invasive ventilation. Patient with CE ischemic stroke had the most severe infectious complications and unfavourable outcomes.

**Trial registration number:** N/A

## AS18-066

### ORGAN DONATION SHOULD BE CONSIDERED PART OF END-OF-LIFE CARE IN STROKE

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**Background and Aims:** There are currently 550 people waiting for an organ or tissue transplant in New Zealand. Transplant surgery offers patients the opportunity to have a quality of life equal to the general population. Over the last few decades, public health initiatives have led to reductions in traffic and stroke fatalities, resulting in a smaller pool of deceased donors. Stroke patients have an important role in organ donation. The pathophysiological processes in rapidly fatal stroke often mean than many organs can be harvested. Patients with fatal stroke accounted for two-thirds of organ donors in New Zealand in 2017.

**Methods:** A case example is a 59 year old woman presented with a right middle cerebral territory infarct. CT angiography demonstrated occlusion of the right internal carotid extending to the right middle cerebral artery.

**Results:** Alteplase was administered, however thrombectomy was not considered feasible. The patient's GCS declined over the next 24 hours and repeat CT head demonstrated features of malignant MCA syndrome. Following discussions, a decision was made for end of life care and referral for organ donation. The patient died 4 days later, and her kidney's harvested for transplant.

**Conclusions:** Organ donation should be considered part of end of life care in stroke patients. Surveys of healthcare professionals show favourable responses to using high dependency settings to facilitate this, provided advanced care plans or family are in agreement. Protocols should be put in place to encourage this practice.

**Trial registration number:** N/A

## AS18-064

### DECOMPRESSIVE CRANIECTOMY IN A DEVELOPING COUNTRY: SAME OUTCOMES AS THE MAJOR TRIALS?

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**Background and Aims:** Decompressive craniectomy (DC) is a life-saving measure for treatment of the malignant infarction of the middle cerebral artery (MIMCA), despite the high disability of the survivors. We performed a study to evaluate the outcomes of DC in a developing country.

**Methods:** A prospective stroke database of a Tertiary Stroke Center was reviewed and all patients treated with DC for MIMCA between January 2014 and December 2017 were included. Functional outcome was measured by the modified Rankin Scale (mRs) at hospital discharge, 3 months and 1 year after stroke.

**Results:** Of 1585 patients with ischemic stroke, 53 (3.3%) that fulfilled inclusion criteria were treated with decompressive hemicraniectomy. Among those, the mean age was  $54 \pm 11$  years with 63% of male. The median NIHSS at admission were 20 [IQR 16–24]. Left hemisphere was the affected site in 39%. The mean time from symptoms to surgery was  $36 \pm 17$  hours. At 3 months after surgery, 5 (11%) patients were mildly or moderately disabled (mRS score 2 or 3), 17 (36%) were moderately-severely disabled (mRS 4), 7 (15%) were severely disabled (mRS 5), and 18 (38%) had died. At one year, these rates were, respectively, 11 (21%), 14 (26%), 7 (13%) and 21 (40%).

**Conclusions:** In our sample of Brazilian stroke patients with MIMCA, DC appears to have lower benefit in reduction of mortality and disability than the results from trials in developed countries. Nevertheless, our results reinforce the massive clinical effect of DC in those patients even in the context of developing countries.

**Trial registration number:** N/A

## AS18-057

### EFFECT OF STROKE-ASSOCIATED PNEUMONIA ON THE OUTCOME OF PATIENTS TREATED WITH MECHANICAL THROMBECTOMY – A SINGLE CENTER EXPERIENCE

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**Background and Aims:** Stroke-associated pneumonia (SAP) frequently affects severity of acute ischemic stroke (AIS). We aimed to evaluate clinical and radiological features connected to the development of SAP and the effect of this condition on the outcome in a population of AIS patients treated with mechanical thrombectomy (MT).

**Methods:** We performed a retrospective analysis of patients with anterior circulation AIS admitted to our center. SAP diagnosis was based on clinical, laboratory and radiological findings. Demographic, vascular risk factors, clinical, imaging and procedural features were compared between SAP and non-SAP patients.

**Results:** 40 SAP patients were compared with 231 non-SAP patients, with no difference in age, vascular risk factors, type of occlusion, rate of dysphagia and symptomatic intracerebral hemorrhage. SAP patients showed a higher NIHSS ( $19.45 \pm 4.94$  vs  $17.8 \pm 1.4$ ;  $p = 0.01$ ) and a lower rate of good collateral flow (47.5% vs 64.5%;  $p = 0.05$ ). Non-SAP group was recanalized earlier ( $320.3 \pm 10.6$  vs  $330.4 \pm 37.5$  min;  $p = 0.04$ ) but no difference was found in successful recanalization nor in the rate of general anesthesia during MT. SAP group showed a lower ASPECT at 24 hours ( $3.3 \pm 4.2$  vs  $4.3 \pm 0.7$ ;  $p = 0.02$ ) and lower rates of mRS 0–2 and mortality at 90 days, although not statistically significant (25% vs 87%;  $p = 0.15$  and 37.5% vs 30.7;  $p = 0.46$  respectively).

**Conclusions:** Our study showed that SAP is associated with higher stroke severity but is not related to most procedural characteristics. SAP seems to be related to a lower chance of functional independence and a higher mortality but further studies on larger populations are warranted.

**Trial registration number:** N/A

## AS18-045

### CEREBROVASCULAR EVENTS AS COMPLICATION OF LEFT VENTRICULAR ASSIST DEVICE: ANALYSIS OF NATIONWIDE INPATIENT SAMPLE (NIS) DATABASE (2005-2014)

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**Background and Aims:** Left ventricular assist device (LVAD) is increasingly used in patients with refractory end stage heart failure to improve survival and quality of life. The rates and outcomes of cerebrovascular events in patients receiving LVAD is poorly understood. The objective of this study was to evaluate these neurological complications in LVAD patients.

**Methods:** All patients receiving LVAD were selected from the Nationwide Inpatient Sample from 2005–2014. The rates and outcomes of cerebrovascular events in terms of acute ischemic stroke (IS), intracranial hemorrhage (ICH), and subarachnoid hemorrhage (SAH) were determined using ICD 9 codes. Outcome variables included discharge status, mortality, length of stay (LOS) and hospitalization costs.

**Results:** Out of 18,292 LVAD patients, 445 (2.43%) suffered the following cerebrovascular events: IS 94 (0.51%), SAH 92 (0.50%), and ICH 277 (1.52%). ICH led to increased rate of discharge to long-term facility (69.6% vs. 58.4%,  $p < 0.0001$ ), higher mortality (60.4% vs. 14.0%,  $p < 0.0001$ ), longer mean LOS (51.9 days vs. 32.6 days,  $p < 0.0001$ ) and higher mean hospital charges (\$950108.40 vs. \$716151.2,  $p < 0.0001$ ). Similarly, SAH patients had longer mean length of stay (58.21 days vs. 32.6 days,  $p < 0.0001$ ). These outcomes did not differ significantly for IS patients.

**Conclusions:** LVAD is associated with higher cerebrovascular events. Given the increasing utilization of LVAD and the poor outcomes associated with hemorrhagic cerebrovascular events, more research is needed to help determine the best way to prevent these sequelae in this patient population

**Trial registration number:** n/a

**AS18-063****IN-HOSPITAL SYSTEMIC COMPLICATIONS FOLLOWING STROKE ADMISSION: ANALYSIS OF NATIONWIDE INPATIENT SAMPLE (NIS) DATABASE (2005 -2014)**

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**Background and Aims:** In-hospital systemic complications following stroke is a topic of extensive research. Our aim is to determine the frequency and prevalence of in-hospital complications among different stroke subtypes.

**Methods:** We identified patients with primary diagnosis of ischemic stroke (IS), subarachnoid hemorrhage (SAH), intracerebral hemorrhage (ICH) with in-hospital complications like myocardial infarction (MI), sepsis, pneumonia, deep venous thrombosis (DVT), pulmonary embolism (PE), and urinary tract infections (UTI) using their respective ICD-9 codes from nationwide inpatient database (2005-2014). We also used hospital characteristics and variable APRDRG severity from NIS data files to assess the clinical severity at admission among various stroke subtypes.

**Results:** Distribution of stroke sub types ( $n = 5282907$ ) is as follows: IS (82.7%), ICH (12.3%) and SAH (4.92%). SAH patients noted higher systemic complications, MI (2.97%), sepsis (3.95%), pneumonia (6.58%), DVT (1.7%), UTI (14.6%) and PE (0.95%) compared to IS and ICH patients ( $p < .0001$ ). In-hospital complications including MI, sepsis, DVT, and PE were higher among the teaching, large bed size and urban hospitals ( $p < .0001$ ). Teaching hospitals had significantly higher rate of admissions for hemorrhagic stroke (ICH & SAH) (22.7% versus 11.6%,  $p < .0001$ ) and significantly higher percentage of extreme loss of function at admission (14.3% versus 8.25%,  $p < .0001$ ).

**Conclusions:** SAH patients experienced more systemic complications compared to other stroke subtypes. Teaching, urban and large bedded hospitals had higher rate of in-hospital complications likely due to higher admission rates of hemorrhagic stroke and higher acuity at admission. Further studies are encouraged to validate our findings.

**Trial registration number:** N/A

**AS18-039****ASSOCIATION BETWEEN CHOLESTEROL LEVELS AND INFECTIONS AFTER ACUTE ISCHEMIC STROKE**

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**Background and Aims:** Multiple studies suggested an immunomodulatory role of cholesterol. We investigated whether cholesterol levels are associated with the risk of infectious complications (IC) in patients with acute ischemic stroke.

**Methods:** Single center prospective cohort study. Total (TOTc), Low Density Lipoprotein (LDLc) and High Density Lipoprotein (HDLc) cholesterol levels were measured within 48 hours from ischemic stroke onset. The outcome of interest was the occurrence of any IC (pneumonia, urinary tract infection, sepsis) during hospitalization. Predictors of IC were investigated with multivariable logistic regression.

**Results:** A total of 544 patients were included (mean age 73, 49.3% males), of whom 90 (16.5%) developed an IC. Subjects with IC had

lower TOTc compared to patients without IC (mean 160 vs 175 mg/dl,  $p = 0.002$ ). When TOTc was stratified in quartiles, we observed a linear decrease in the prevalence of IC with higher TOTc levels (Q1 < 143 mg/dl, 22.1%; Q2 144–168 mg/dl, 19.6%; Q3 169–196 mg/dl, 15.1%; Q4 > 197 mg/dl, 9.6%  $p = 0.031$ ). The inverse relationship between TOTc and IC remained significant after adjustment for confounders in logistic regression [odds ratio (OR) 0.992, 95% confidence interval (CI) 0.986–0.998,  $p = 0.013$ ]. This association was driven by LDLc (OR 0.993, 95% CI 0.986–0.999,  $p = 0.036$ ) whereas HDLc was not an independent predictor of IC (OR 0.989, 95% CI 0.971–1.006,  $p = 0.211$ ).

**Conclusions:** Higher TOTc and LDLc cholesterol levels are independently associated with lower risk of IC in patients with ischemic stroke. Further studies are needed to confirm our findings and characterize the biological mechanisms underlying the inverse association between cholesterol levels and post-stroke infections.

**Trial registration number:** N/A

**AS18-061****ASSESSING INTENSITY DEPENDENCE OF AUDITORY-EVOKED POTENTIALS (IDAP) AS EARLY SURROGATE MARKER FOR POST-STROKE DEPRESSION**

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**Background and Aims:** Post-stroke depression (PSD) is a common complication following stroke and is associated with severe physical and cognitive impairment. Central serotonergic activity is indirectly reflected by the intensity dependence of auditory evoked potentials (IDAP). We investigated the correlation between IDAP and the occurrence of post-stroke depression at different times.

**Methods:** Patients were recruited from our stroke unit. Auditory evoked potentials (AEP) were assessed at day 1–3, 7–10 and >30 after acute stroke onset. Demographic data and NIHSS were collected. Depressive symptoms using the Montgomery-Asberg Depression Rating Scale (MADRS) were assessed at each measurement point. IDAP was calculated as the linear NI-P2 amplitude/stimulus intensity function (ASF) slope. We compared depressive vs non-depressive patients in respect of severity, localization of stroke and MADRS.

**Results:** Out of 63 enrolled patients, 33 completed the follow-up (mean age 67 years/ median NIHSS 1.09 / 11 female / 10 with left hemispheric stroke). Twenty percent of patients had PSD > 30 days after stroke onset (mean MADRS-score 13.6). At all measurement points, there was a statistically significant correlation between depressive symptoms and IDAP ( $p = 0.002$ ). Patients with later diagnosed PSD already showed increased IDAP at the first measurement ( $p = 0.002$ ). No significant differences concerning NIHSS and localization were found between the depressive and non-depressive groups.

**Conclusions:** Our findings suggest that IDAP strongly correlates with PSD. Furthermore, increased IDAP in the first days after stroke seems to be an early surrogate marker for PSD, independently from stroke severity and localization of stroke.

**Trial registration number:** N/A

**AS18-051****FREQUENCY AND IMPACT OF ACUTE KIDNEY FAILURE IN PATIENTS WITH MALIGNANT MIDDLE CEREBRAL ARTERY INFARCTION UNDERGOING OSMOTHERAPY WITH MANNITOL**

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**Background and Aims:** We present a preliminary analysis of a retrospective cohort study to determine kidney safety profile of osmotic diuretic mannitol in patients with malignant middle cerebral artery (MCA) infarction

**Methods:** We analyzed data from patients with malignant MCA infarction (01/2008-12/2017). Malignant MCA infarction was defined according to clinical and radiographic DESTINY criteria. Clinical and laboratory variables were collected for all patients. We compared clinical endpoints including acute kidney failure (AKF; according to KDIGO definition) and hemodialysis between patients who received mannitol and those who did not. Multivariable model was built to explore predictor variables of AKF and in-hospital death.

**Results:** So far, 100 patients with malignant MCA infarction were analyzed: median age 64 years (IQR, 58–74); 63% men; median NIHSS 23 (17–32) points. Of these, 40 (41.7%) received mannitol over 3.4 (1.2–6) days. Total dosage was 700 (225–1025) g. Patients treated with mannitol more frequently suffered from AKF (22.5% vs. 11.3%) and needed hemodialysis (7.5% vs. 1.8%) than patients without mannitol; however, these differences did not achieve significance ( $p>0.05$ ). At discharge, kidney function completely recovered in 66.7% and 33.3%, respectively ( $p=0.315$ ). In multivariable model adjusted for potential confounders, peak osmolality emerged as single predictor of AKF (per unit increase: OR 1.07, 95%CI 1.02–1.12). Neither AKF nor mannitol therapy was associated with in-hospital death ( $p>0.05$ ).

**Conclusions:** We observed a high frequency of AKF in patients with malignant MCA infarction receiving mannitol, the prognostic relevance of which will be assessed in the final data set.

**Trial registration number:** N/A

**AS18-050****MUSCLE SPECIFIC KINASE (MUSK) ANTIBODY POSITIVE MYASTHENIA IN POST STROKE FATIGUE**

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**Background and Aims:** Post-stroke fatigue is a major impediment for full functional recovery in stroke patients. Post stroke fatigue is presumed to be due to multiple mechanisms including post stroke depression and systemic factors like hypothyroidism. Peripheral mechanisms also may contribute to the fatigability after motor recovery from stroke. We report 4 cases of post-stroke fatigue with positive MuSK antibody test.

**Methods:** Follow-up stroke patients visiting stroke clinic with clinical fatigue and high titres of MuSK antibodies were retrospectively identified from electronic patient database and neuroimmunology laboratory data. Patient demographics, clinical characteristics and response to cholinergics were assessed.

**Results:** Out of 910 stroke patients, 132 had significant clinical fatigue after motor recovery, of which 5 patients tested positive for MuSK antibodies. Baseline characteristics of these patients are mentioned in Table I. All patients responded satisfactorily to the cholinergic treatment and improved their quality of living post-stroke.

**Conclusions:** Post-stroke fatigue is a major cause of disability and looking for myasthenic antibodies including acetylcholine receptor antibodies (AChR) and MuSK would help in treating the patients.

**Trial registration number:** N/A

**AS18-011****POST-STROKE INFECTIONS ASSOCIATED WITH SPLEEN VOLUME REDUCTION**

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**Background and Aims:** **Background:** Spleen volume reduction followed by a re-expansion has been described in acute ischemic stroke in both animal and human studies.

**Aims:** To investigate whether spleen volume changes in the first week after stroke are associated with post-stroke infections, changes in lymphocytes count and autonomic dysfunction.

**Methods:** In 32 patients with acute ischemic stroke, spleen sizes were calculated from abdominal CT images on day 1 and day 7. Spleen size reduction was defined as > 10 % spleen size reduction between day 1 and day 7. We assessed the time course of leukocyte subsets and analysed pulse rate variability indices. Post stroke infections were diagnosed during the first 7 days after stroke onset using the modified criteria of the US Centers of Disease Control and Prevention.

**Results:** Post-stroke infections occurred in 6 out of 11 patients with spleen size reduction versus in 3 out of 21 patients without spleen size reduction ( $p=0.016$ ). Spleen size reduction was associated with a drop in lymphocyte and lymphocyte subsets from day 0 to day 2 and with early neurological deterioration ( $p=0.044$ ). No correlations could be found between spleen volume change and PRV parameters.

**Conclusions:** These results suggest an association between post-stroke infections and spleen volume reduction in acute ischemic stroke.

**Trial registration number:** N/A

**AS18-065****RISK FACTORS OF EARLY/SUBACUTE HEMORRHAGIC TRANSFORMATION IN PATIENTS WITH ISCHEMIC STROKE**

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**Background and Aims:** Hemorrhagic Transformation (HT) is a frequent spontaneous complication of ischemic brain lesion. It may significantly worsen the clinical outcome and prognosis. HT is well described especially as acute reperfusion injury after thrombolytic therapy. Less is known about later occurring HT.

**Aim:** To assess a possible role of recanalization treatment, low molecular weight heparin (LMWH), blood pressure, and MRI parameters of the ischemic lesion as responsible factors for HT of ischemic stroke during day 2 to 12 after stroke.

**Methods:** Prospective monocentric analysis of patients with ischemic stroke without HT on admission and 24 hours imaging. All patients had brain MRI done between 7th and 12th day after stroke using SWI, T1 and T2 sequences. Potential HT risk factors collected: complete blood pressure monitoring data, initial recanalization therapy, daily dose and antiXa efficacy of prophylactic low molecular weight heparin (LMWH). Control group was all patients without HT with completed MR volumetric analysis.

**Results:** We have screened MRI of 147 patients, clinically asymptomatic HT was detected in 25 (17%), 47 patients without HT were analyzed as a control group. Mean hemorrhage volume was 5.96 (SD 7.40) ml. HT patients had significantly larger ischemic lesion volume in FLAIR sequence: 33.36 (SD 32.86) vs. 17.13 (SD 37.44), p < 0.01. All other analyzed parameters – mean and maximal systolic and diastolic pressure, LMWH dosage, and antiXa values, recanalization treatment, and age were not statistically different.

**Conclusions:** The only significant predictor of HT occurring from 2 to 12 days after stroke was the volume of ischemic lesion on MRI.

**Trial registration number:** N/A

## AS18-023

### NEUTROPHIL-TO-LYMPHOCYTE RATIO DOES NOT PREDICT POST-STROKE URINARY TRACT INFECTION

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**Background and Aims:** Neutrophil-to-lymphocyte ratio (NLR) is a marker of systemic inflammation and has been associated to both pneumonia and poor outcome after acute ischemic stroke. We aimed to determine whether NLR is a predictor of post-stroke urinary tract infection.

**Methods:** We reviewed the stroke database and included 505 patients with acute ischemic stroke who had routine blood sampling within 24h from stroke onset. We retrieved clinical and laboratory measures (C-reactive protein (CRP), absolute neutrophil count (ANC) and absolute lymphocyte count (ALC)). NLR was defined as ANC/ALC. Patients were divided into two groups: those who developed urinary tract infection within the first week after onset (n=114) and those who didn't (n=391). Logistic regression analysis was used to identify predictors of post-stroke urinary tract infection.

**Results:** Multiple logistic regression analysis showed that female gender (OR 3.96; 95% CI 2.83-6.87), age (OR 1.04; 95% CI 1.02-1.07) and baseline stroke severity (NIHSS) (OR 1.04; 95 % CI 1.00-1.08) but not NLR predict post-stroke urinary tract infection. ROC curve of a prediction model including age > 75, female gender and NIHSS > 7 showed an area under the curve of 0.772 (0.728-0.817).

**Conclusions:** Female gender, age and baseline stroke severity, but not NLR are predictors of post-stroke urine tract infection.

**Trial registration number:** N/A

## AS18-048

### PREDICTING POST-STROKE PNEUMONIA AND POST-STROKE INFECTION: EXTERNAL VALIDATION OF THE PASS SCORES IN AN ITALIAN POPULATION

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**Background and Aims:** Recently, risk scores for predicting post-stroke pneumonia and infection after acute stroke were developed from the Dutch Preventive Antibiotics in Stroke Study (PASS). These could be useful tools for risk stratification in clinical practice or stroke trials. We aimed to externally validate the PASS scores in an Italian acute stroke population.

**Methods:** We prospectively included acute stroke patients who had been admitted to the Stroke Unit of Città di Castello Hospital from January 2015 to December 2017. We assessed discriminatory performance with C statistics and calibration with calibration plots.

**Results:** Among 671 acute stroke patients (mean age 77.5 years; median NIHSS score 5), in-hospital pneumonia was diagnosed in 7%, and infection in 29%. Based on PASS scores, the risks for pneumonia ranged from 1% (low-risk) to 21% (high-risk) and from 11% to 44% for infection. The AUC was 0.80 (95% CI 0.74-0.86) for pneumonia and 0.74 (95% CI 0.70-0.78) for infection, suggesting good discrimination. The score for pneumonia showed good calibration, while the score for infection showed an underestimation of the risk.

**Conclusions:** The PASS scores could reliably predict post-stroke pneumonia in Italian stroke patients, but the risk for infections was largely underestimated. This suggests that the score is useful in general clinical practice to predict the risk of pneumonia in acute stroke patients.

**Trial registration number:** N/A

## AS18-049

### THIRTY DAYS READMISSION RATES AND LONG-TERM PROGNOSIS OF STROKE ASSOCIATED PNEUMONIA

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**Background and Aims:** Stroke associated pneumonia (SAP) is the most relevant infectious complication in the acute phase of stroke, and its influence goes beyond patient discharge. Our aim is to describe SAP long-term prognosis.

**Methods:** Ischemic and hemorrhagic stroke patients admitted to our center were included in a prospective study from October/2014-January/2018 with one year follow-up. SAP was defined by Pneumonia In Stroke Consensus (PISCES) criteria. Long-term prognosis after discharge was evaluated according to 30 days readmission rates (30dRA), modified Rankin scale (mRS) at 3 months and death.

**Results:** Among 119 included patients (61.3% men, mean age of 73 years old), 91.6% (109) had an acute ischemic stroke. Probable and definitive SAP rates were 16% (19) and 6.7% (8) respectively. 30dRA were higher in probable and definitive SAP patients compared with non-SAP-patients (37.8% versus 16.5%, p = 0.001; and 44.4% vs 17.9%, p = 0.001 respectively). 30 days death rates were higher in probable and definitive SAP patients (31.6% vs 3%, p < 0.001 and 50% vs 4.5%, p < 0.001 respectively). Also, SAP presence was related to worse functional outcomes at 90 days (p < 0.001). Finally, SAP was identified as an independent predictor of 30dRA [HR = 3.4, 95% Confidence Interval (CI) (1.2-9.6), p = 0.018] and of bad functional outcome and death (mRS 3-6) at 90 days [OR = 12.7, 95% CI 2.7-58.2), p = 0.001].

**Conclusions:** In our cohort, SAP was associated with early readmission, poor functional outcome and death in patients with acute stroke after discharge.

**Trial registration number:** N/A

**AS18-032****COMPARISON OF TUBE FEEDING IN STROKE PATIENTS: NASOGASTRIC TUBE FEEDING VERSUS OROESOPHAGEAL TUBE FEEDING****K.D. Park<sup>1</sup>, J.W. Lee<sup>2</sup> and T.H. Kim<sup>3</sup>**

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**Background and Aims:** Although the most common complication for stroke patients is known to be aspiration pneumonia, the physiology of aspiration pneumonia associated with tube feeding has not been fully assessed. The goal of this study was to examine appropriate tube feeding with low risk of gastroesophageal reflux by comparing the results of 24-hour pH monitoring study in patients who were administered the two types of feeding sequentially.

**Methods:** 6 stroke patients were examined 24-hour esophageal pH monitoring during NG tube feeding and OE tube feeding, sequentially. The parameters were collected of acid exposure time, the mean esophageal pH, number of reflux episode, time of bolus reflux of both total 24-hour pH study data and postprandial data and deMeester composite score.

**Results:** Total acid reflux time (minutes) decreased when OE tube feeding than NG tube feeding in total 24-hour pH study. Number of reflux episodes decreased in both total and postprandial data when OE tube feeding than NG tube feeding, statistically ( $P < 0.05$ ). There were no significant differences between the two groups for the mean esophageal pH and total time of bolus reflux.

**Conclusions:** This study could not definitively conclude if OE tube feeding decreases the severity of GER compared with NG tube feeding. However, there were significant differences in four out of nine parameters, OE tube can be a possible substitute for NG tube in patients with dysphagia after stroke suffering from GER disease.

**Trial registration number:** N/A

**AS18-017****SYSTOLIC BLOOD PRESSURE COURSE RELATES TO CARDIAC SYMPATHETIC ACTIVITY IN ACUTE ISCHEMIC STROKE: A PILOT STUDY**

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**Background and Aims:** High blood pressure and increased systolic blood pressure variability in acute ischemic stroke are predictors of poor outcome, but the underlying mechanisms are not well understood. We investigated whether there is a relation between these manifestations and the washout rate (WOR) of cardiac <sup>123</sup>I-metiodobenzylguanidine (<sup>123</sup>I-MIBG), reflecting sympathetic activity.

**Methods:** In 20 patients, we performed an MIBG scan within the first week after stroke onset. Blood pressure was measured on admission and every 30 minutes for 24 hours. We measured the first 24 hours urinary norepinephrine and epinephrine levels.

**Results:** Patients with a WOR above the median were more likely to have higher systolic blood pressure on admission ( $p=0.004$ ), larger 24-hour systolic blood pressure variability ( $p=0.046$ ), and a history of

arterial hypertension ( $p=0.017$ ). There was a positive correlation between WOR and systolic blood pressure on admission ( $r=0.760$ ,  $p=0.001$ ), mean 24-hour systolic blood pressure ( $r=0.604$ ,  $p=0.004$ ), and 24-hour urinary norepinephrine levels ( $r=0.527$ ,  $p=0.020$ ).

**Conclusions:** In patients with acute ischemic stroke, both systolic blood pressure and systolic blood pressure variability are related to cardiac sympathetic activity.

**Trial registration number:** N/A

**AS18-068****THE HOW AND WHEN OF EPILEPTIC SEIZURES IN CEREBRAL VENOUS THROMBOSIS**

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**Background and Aims:** Epileptic seizures may occur at onset or after the diagnosis of cerebral venous thrombosis (CVT), with variable incidence and risk factors. Antiepileptic drugs are recommended after the first seizure, but evidence for treatment duration is scarce. We aim to characterize epileptic manifestations associated with CVT, treatment and patient follow-up.

**Methods:** Retrospective cohort study of CVT patients admitted in our center between January 2010 and August 2018. Descriptive analysis of clinical and imaging characteristics was obtained. Frequency estimates with 95% confidence intervals (95% CI) and inferential analysis is presented.

**Results:** 38 patients were included, with female predominance (76.3%), median age of 39 years (minimum 17 and maximum 72) and 2.7 years of mean follow-up. Twelve cases of epileptic seizures (26.3%; 95% CI 18.0% – 48.8%) were documented, 2/3 with acute seizures. All patients with seizures had CVT from the superficial drainage system ( $p=0.055$ ). Seizure occurrence was associated with male gender (50.0% vs. 11.5%,  $p=0.016$ ); cortical veins thrombosis (83.3% vs 26.9%,  $p=0.05$ ); presence of cortical hematoma (66.7% vs 26.9%,  $p=0.03$ ) and lesions in the frontal lobe (33.3% vs 0.0%,  $p=0.01$ ). Thrombophilia diagnosis was associated with late onset seizures ( $p=0.04$ ). Regarding anti-epileptic treatment, it was only suspended in one patient after 14 months.

**Conclusions:** We found an association between epileptic seizures in CVT and cortical vein thrombosis as well as cortical hemorrhage. Proximity to the cortex and local changes in the blood-brain barrier may predispose to epileptogenesis. The duration of secondary prophylaxis is still controversial, and individualized decision prevails.

**Trial registration number:** N/A

**AS18-020****MACHINE LEARNING MODEL OF POST-STROKE PNEUMONIA FROM VISTA-ACUTE**

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**Background and Aims:** Post-stroke pneumonia (PSP) is a frequent complication of stroke and associated with high mortality. Recently we described using decision tree analysis that stroke severity and not dysphagia is key driver of PSP. Previous publications from VISTA-Acute data described associations with beta-blocker and benzodiazepine with PSP.

However, the additional effect of recombinant tissue plasminogen activator (rTPA) on PSP is not known. Using data from VISTA-Acute, we explored the effect of rTPA on development of PSP. Identification of patients at risk of PSP can help in development of preventative strategies.

**Methods:** We used random forest, a supervised machine learning method related to decision tree analysis, which employed random selection of covariates and patients from the dataset to create multiple trees. This form of ensemble learning utilises 'wisdom of the crowd' to create the model. Diagnosis of PSP was based on reports of serious adverse event. The covariates used include: stroke severity (National Institute of Health Stroke Scale/NIHSS), hemisphere involvement, age, sex, atrial fibrillation, heart failure, diabetes, hypertension. The data were partitioned into training (75%) and testing (25%) sets for validation.

**Results:** The data contains 5653 patients: male 3087 (54.6%), age 69.0 (12.6), NIHSS 13.1 (5.4), rTPA use 41.7%. Pneumonia occurred in 614 (10.9%) cases. The variable importance plot shows that baseline stroke severity, age and rTPA involvement made the largest contribution to the model of pneumonia. The model had accuracy of 88.0% in training data, 88.5% in the validation dataset.

**Conclusions:** Machine learning method can be used to develop model of post stroke pneumonia.

**Trial registration number:** N/A

## AS18-016

### POST-STROKE DYSPHAGIA IN A STROKE-UNIT: 1-YEAR REVIEW

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**Background and Aims:** Background: Dysphagia is present in the acute phase of stroke in around 50 to 80% of patients, increasing the risk of aspiration, pneumonia, malnutrition and ultimately death. Both its pathophysiological mechanisms and risk factors are poorly understood.

**Aim:** Describe the population with post-stroke dysphagia. **Methods:** Retrospective analysis of the clinical data of patients admitted in a Stroke Unit between January and December 2017. 301 cases were included, 55.8% females, median age of 79 years (IQR 16).

**Results:** 134 cases (44.5%) demonstrated post-stroke dysphagia, with a median of 12 in the Gugging Swallowing Screen Score (GUSS) (IQR 9), consistent with moderate dysphagia. In addition to the strong negative correlation between the NIHSS admission score and the GUSS score ( $r=-0.715$ ,  $p < 0.001$ ), a TACI was associated with lower GUSS score ( $p < 0.001$ ). These results demonstrate that large infarctions were associated with more severe dysphagia. Moreover, no significant differences were observed between neither right or left hemisphere infarction nor posterior circulation involvement. The study also revealed that dysphagic patients suffered more frequently from pneumonia (43.3% vs 2.4%,  $p < 0.001$ ), had a longer stay at hospital beds (median 14 vs 7,  $p < 0.001$ ) and died more often (35.8% vs 1.2%,  $p < 0.001$ ) when compared to those without dysphagia.

**Conclusions:** The infarct size and severity is strongly associated with the presence of stroke-related dysphagia, regardless of the affected lobe. Dysphagic patients have significant complications and increased short-term mortality, highlighting the need to address this condition as soon as possible in the stroke acute phase.

**Trial registration number:** N/A

## AS18-041

### POST-STROKE SEIZURES: TYPE AND LOCATION IN RELATION TO THE VASCULAR TERRITORY OF STROKE

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**Background and Aims:** Seizures are a known complication of stroke, however there is little evidence regarding predicted onset time and location of the stroke to cause the seizure. The aim of the study was to identify any relationships between type and location of stroke and seizure.

**Methods:** Electroencephalograms (EEGs) of patients referred to the Royal Stoke University Hospital with suspected post-stroke seizures were reviewed between November 2017 and November 2018. The notes and imaging of patients with confirmed seizures were reviewed to identify the vascular territory, type of stroke, and timing of the event.

**Results:** Out of 125 referred patients 20 had confirmed seizures, 75% occurred within three weeks of stroke onset. All haemorrhagic strokes, but only 7/11 (63%) of ischaemic strokes had the first seizure within three weeks of stroke onset. The focus of the seizures on EEG was within the affected brain area in 8/9 of the haemorrhagic strokes. There was no relationship between the territories affected in ischaemic strokes and the origin of the abnormal electrical activity on EEG. Abnormal electrical activity was bilateral in 4/11 (36%) of ischaemic strokes but in none of the haemorrhages. There was also a higher incidence of partial or complete status epileptics 4/11 (36%) in ischemic than in haemorrhagic strokes 3/9.

**Conclusions:** The study suggests that onset of seizures differs between types of stroke and that electrical abnormality is localised after a haemorrhagic stroke but can be seen in other vascular territories in ischaemic strokes.

**Trial registration number:** N/A

## AS18-013

### DETERMINANTS AND OUTCOME OF COMPLICATIONS IN FIRST EVER ACUTE STROKE PATIENTS: AN OBSERVATIONAL STUDY FROM INDIA

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**Background and Aims:** Post stroke complications are frequent and major cause of death in the early phases of acute stroke. Objective of the present study was to explore the predictors of occurrence of complications, among subjects with first ever acute stroke.

**Methods:** Patients with first ever acute stroke were studied for post-stroke complications (predefined with standard criteria) during hospital stay and their association with risk factors, severity of stroke (National Institutes of Health Stroke Scale), length of hospital stay and outcome (Modified Rankin Scale) were assessed.

**Results:** A total of screened 498 patients with first ever acute stroke were recruited. The mean age was 61.02 years (range 23–75 years), the majority being male (n = 307; 61.6%). Post-stroke complications during hospital stay was documented in 270 patients (54.2%). In logistic

regression analysis, multiple risk factors (OR, 1.571; 95% CI, 1.084-2.278; p=0.017), stroke severity (NIHS Score) (OR, 1.425; 95% CI, 1.027-1.976; P<0.034) and length of hospital stay (OR, 3.565; 95% CI, 2.029-6.264; P<0.0001) were the most robust predictors of occurrence of complications. The independent predictors of poor outcome in subjects with complications were- chest infection (OR, 2.07; 95% CI, 1.006-4.26; P=0.048), bedsores (OR, 2.26; 95% CI, 1.03-4.94; P=0.042), and seizure (OR, 5.072; 95% CI, 1.08-23.79; P=0.039).

**Conclusions:** In our study, the most independent predictors of complications were stroke severity and length of hospital stay. This observation might help clinicians in taking appropriate measures towards preventing post-stroke complications and thereby improving stroke outcome.

**Trial registration number:** N/A

### AS18-035

#### RATES OF HEMORRHAGIC COMPLICATIONS OF ACUTE STROKE INTERVENTIONS ARE UNAFFECTED BY RENAL DISEASE AND HEMODIALYSIS

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**Background and Aims:** Chronic Kidney Disease (CKD) may increase risk of hemorrhage due to abnormal platelet function, altered endothelium, and reduction in inhibitors of blood coagulation. This study examined hemorrhagic risk post-thrombolysis and/or endovascular thrombectomy (ET) in Acute Ischemic Stroke (AIS) patients with CKD with or without hemodialysis (HD).

**Methods:** We performed a retrospective review of patients with AIS admitted to our comprehensive stroke center between January 2010 and July 2018. Patients with CKD treated with IV-tPA and/or ET were included. CKD was divided into stages 1 to 5 and use of HD was recorded. Medical records were reviewed, using an increase in the NIHSS of at least 4 to define sICH. 24-hour post-treatment CT images were assessed for hemorrhagic infarction (grades HI-1 and HI-2) and parenchymal hematoma (grades PH-1 and PH-2).

**Results:** Of 137 patients identified, sICH occurred at rates of 6.7%, 5.9% and 11.5%, for the IV-tPA, ET, and combined therapy groups, respectively. Rates of hemorrhage were not significantly different between patients on HD and patients not on HD (19.1% vs 30.6%, p=0.28). There was no relationship between stage of renal disease and hemorrhage type (p=0.75).

**Conclusions:** Rates of sICH and aICH in AIS patients with CKD post-tPA, ET, or combined therapy were comparable to those rates previously reported in major stroke treatment trials, some of which excluded patients with CKD. Though previously theorized, CKD may not confer greater risk of hemorrhage post-tPA, and/or ET. Furthermore, hemodialysis was not associated with increased rates of sICH or aICH.

**Trial registration number:** N/A

### AS18-062

#### INFLUENCE OF NATURALISTIC LIGHT ON COAGULATION PARAMETERS IN STROKE PATIENTS ADMITTED FOR REHABILITATION

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**Background and Aims:** Long term admitted stroke patients are at risk of developing circadian disruption due to lack of stimulation by natural sunlight and exposure to artificial light at inappropriate times. We aimed to investigate if D-Dimer, INR, fibrinogen, and coagulation factors II, VII, X, and liver parameters exhibit a circadian rhythm and if plasma levels are influenced by naturalistic light.

**Methods:** A secondary explorative analysis from a Randomized Controlled Trial. Stroke patients requiring minimum two weeks of rehabilitation were randomized to an intervention unit equipped with naturalistic light or to a control unit with standard indoor lighting. Patients received similar timed meals and individual fitted physiotherapy. Blood was drawn across 24-hours with 4-hours interval at inclusion and discharge. Circadian rhythmicity was estimated using cosinor analysis and variance between time points.

**Results:** 43 patients completed the study. None of the coagulation parameters exhibited significant cosinor rhythmicity at inclusion or discharge and only fibrinogen and D-dimer showed significant variance between time points in both units. Except from ALAT and ferritin, liver parameters exhibited significant cosinor rhythmicity at discharge from both units.

**Conclusions:** Fibrinogen, D-dimer and five of seven liver parameters exhibited circadian rhythmicity. Naturalistic light did not significantly influence the plasma levels. Comparing stroke patients' liver cosinor rhythmicity to known data from healthy subjects, results are remarkably similar, indicating intact peripheral circadian oscillations of endogenously produced parameters, perhaps due to regularly meal and activity times, which further studies are needed to elaborate on.

**Trial registration number:** N/A

### AS18-053

#### SERUM AMYLOID A – A NOVEL PREDICTOR OF STROKE ASSOCIATED INFECTIONS

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**Background and Aims:** Blood biomarkers may help to identify patients at risk of infections in order to guide adequate therapy-decisions in an earlier stage. The aim of this study was to evaluate and independently validate serum amyloid A (SAA), to predict post stroke infections.

**Methods:** In two independent prospective cohort-studies, we measured SAA within 72h of stroke-onset. Primary outcome measure was any post stroke infections occurring within 5 days of hospitalization, defined by the criteria of the U.S. Centers for Disease Control and Prevention. Patients with a history of infection on admission were excluded.

**Results:** Out of 283 stroke patients in the derivation cohort (A), 21% (n=60) developed an infection and among 367 patients in the independent validation cohort (B) 30% (n=111) developed an infection. After

adjusting for all significantly associated predictors of infection in the univariate analysis, SAA remained an independent predictor in study A (adjusted Odds ratio (aOR) 1.36 [95% CI, 1.10 – 1.67],  $P=0.004$ ) and in study B (aOR 1.56 [95%-CI 1.07 – 2.26],  $P=0.019$ ). Adding SAA to the best regression model without the biomarker, the discriminatory accuracy improved from 0.75 [95% CI, 0.67 – 0.82] to 0.78 [95% CI, 0.71 – 0.85] $p < 0.0036$  in study A. Results were validated in study B, with an improvement of the AUC from 0.75 [95% CI, 0.69 – 0.80] to 0.76 [95% CI, 0.71 – 0.81] $p < 0.018$ .

**Conclusions:** SAA measured on admission is a novel independent predictor of post-stroke infection. SAA improved the prediction model of patients who developed an infection in a derivation and validation cohort.

**Trial registration number:** ClinicalTrials.gov.NCT00390962 and PR (AG)157-2011

## AS18-004

### FIRST CASE IN ISRAEL OF INTRAVENOUS THROMBOLYSIS WITH TISSUE PLASMINOGEN ACTIVATOR (TPA) IN ACUTE ISCHEMIC STROKE AFTER DABIGATRAN REVERSAL WITH IDARUCIZUMAB

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**Background and Aims:** Dabigatran is an oral anticoagulant used for stroke prevention in nonvalvular atrial fibrillation. Further indications include treatment and prevention of deep vein thrombosis and pulmonary embolism. FDA recently approved the use of dabigatran antidote (idarucizumab).

**Methods:** We report here the first case in Israel treated with tPA after dabigatran reversal with idarucizumab.

**Results:** An 82-year-old woman who presented an acute ischemic stroke (NIHSS 9) in the anterior circulation with right leg hemiplegia and aphasia was admitted to the ED. Medical history revealed hypertension, hyperlipidemia, hypothyroidism and ischemic heart disease. She was treated with dabigatran for DVT. Brain CT scan demonstrated an old ischemic stroke in the right frontal lobe and left cerebellum with no evidence of acute ischemic stroke. Coagulation parameters were abnormal. Before performing thrombolysis, we neutralized the anticoagulant activity of dabigatran with idarucizumab. A significant improvement in leg weakness was observed and her speech became more fluent. Unfortunately, 4–5 hours after treatment we noticed deterioration in her consciousness. She became drowsy and right hemiplegic with global aphasia. EEG showed slow mild to moderate bi-frontal activity. A lumbar puncture revealed no evidence of CNS infection. Brain MRI demonstrated an acute right MCA infarct and another acute left ACA territory on DWI.

**Conclusions:** This case report suggests that reversing the effect of dabigatran may have predisposed the patient to a hyper-coagulative state, explaining the second stroke in a different territory few hours later. We cannot, however, completely exclude a prothrombotic effect of idarucizumab or a negative impact of idarucizumab on tPA effectiveness.

**Trial registration number:** N/A

## AS18-060

### COPEPTIN KINETICS AND BRAIN EDEMA/HEMORRHAGIC TRANSFORMATION IN ACUTE ISCHEMIC STROKE

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**Background and Aims:** Prognostic value of copeptin in acute ischemic stroke patients has been widely outlined. This study aimed to evaluate copeptin temporal profile according to reperfusion treatments and its potential relationship with the development of brain edema and/or hemorrhagic transformation.

**Methods:** In this prospective cohort study we performed serial assessment of copeptin and brain CT/MRI upon admission (T0), at 24 hours (T1) and between the third and fifth day of hospitalization (T2) in 34 acute ischemic stroke patients. We evaluated copeptin kinetics and the development of brain edema, as well as unfavorable functional outcome and mortality at 3 months and 1 year.

**Results:** Median copeptin concentration was 50.71 pmol/L at T0, 18.31 pmol/L at T1 and 10.92 pmol/L at T2. Copeptin assessed at T1 was higher in patients who had medium/severe brain edema at T2 (32.25 pmol/L medium/severe vs 13.67 pmol/L mild/absent edema;  $p = 0.038$ ) and hemorrhagic transformation at T1 (93.10 pmol/L vs 13.67 pmol/L;  $p < 0.003$ ) and T2 (85.70 pmol/L vs 14.45 pmol/L;  $p = 0.024$ ). Moreover, copeptin levels' drop (T0-T1) was steeper in patients who received reperfusion treatments than conservative approach, particularly in those undergoing combined therapy (-129.34 pmol/L vs -5.43 pmol/L combined therapy vs single reperfusion treatments;  $p = 0.038$ ). Drop in plasma copeptin levels (T0-T1) correlated with the TICI score of patients who underwent mechanical thrombectomy ( $p < 0.0001$ ).

**Conclusions:** Copeptin may predict the development of brain edema and hemorrhagic transformation in acute ischemic stroke patients. Moreover, copeptin levels' drop might mirror the level of reperfusion achieved.

**Trial registration number:** N/A

## AS18-029

### HOSPITAL-LEVEL VARIATIONS IN RATES OF INPATIENT URINARY TRACT INFECTION OCCURRENCE IN STROKE – AN ANGLIA STROKE CLINICAL NETWORK EVALUATION STUDY

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**Background and Aims:** Urinary tract infection (UTI) is one of the most common complications following stroke, and has been associated with a 14-fold increase in odds of poor functional outcome at discharge. UTI rates have been shown to vary between hospitals, although it is

unclear whether this is due to case-mix differences or hospital-level heterogeneity in care.

**Methods:** A prospective multi-centre cohort study of acute stroke patients admitted to eight National Health Service hospital trusts within the Anglia Stroke & Heart Clinical Network between 2009 and 2011 was conducted. We modelled the association between hospital (as a fixed-effect) and inpatient UTI using a multiple logistic regression model adjusting for established patient-level risk factors. We descriptively analysed variations in UTI in relation to heterogeneities in hospital-level characteristics.

**Results:** Out of 2241 stroke admissions, 171 (7.6%) acquired inpatient UTI. UTI rates varied significantly between the eight hospitals, ranging from 3% to 11%. The hospital that had the lowest odds of UTI ( $OR = 0.50(0.22 \text{ to } 1.11)$ ) in adjusted analysis, had the highest number of junior doctors and occupational therapists compared to all other hospitals. The hospital with the highest adjusted UTI rate ( $OR = 2.69(1.56 \text{ to } 4.63)$ ) had the highest stroke volume, lowest number of stroke unit beds per 100 admissions, and the highest number of hospital beds per CT scanner.

**Conclusions:** Our results highlight the potential influence of service characteristics on post-stroke UTI, independently of patient-level factors. This study informs policymakers that modifiable hospital factors, such as staffing and resources, could influence UTI and its associated effect on stroke outcomes.

**Trial registration number:** N/A

## AS18-038

### SERUM ALBUMIN IS NEGATIVELY ASSOCIATED WITH HEMORRHAGIC TRANSFORMATION IN ACUTE ISCHEMIC STROKE PATIENTS

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**Background and Aims:** Hemorrhagic transformation (HT) is a major complication of acute ischemic stroke (AIS). Serum albumin is known for its neuroprotective effects and is a marker of improved AIS patient outcomes. However, it is not known whether there is a relationship between serum albumin and HT.

**Methods:** AIS patients admitted to the Department of Neurology of West China Hospital from 2012 to 2016 were prospectively and consecutively enrolled. Baseline characteristics were collected. HT during hospitalization was diagnosed by brain imaging. Multivariate logistic regression analysis was performed to determine the relationship between serum albumin and HT. Confounding factors were identified by univariate analysis. Stratified logistic regression analysis was performed to identify effect modifiers.

**Results:** A total of 1996 AIS patients were recruited, of whom 135 (6.8%) developed HT. Serum albumin negatively correlated with HT. Patients in the upper serum albumin tertile (42.6-54.1g/L) had a 46% lower risk of HT than patients in the lower tertile (19.3-39.1g/L) after adjustment for potential confounders ( $OR = 0.54, 95\% CI 0.29-0.99, p = 0.04$ ). Risk of HT decreased stepwise with higher serum albumin tertile ( $p$  for trend = 0.04). There was a significant interaction between serum albumin and age ( $p = 0.02$ ), with no significant correlation between serum albumin and HT in patients over 60 years of age.

**Conclusions:** Higher serum albumin is associated with lower HT risk in a dose-dependent manner in AIS patients younger than 60 years.

**Trial registration number:** N/A

## AS18-006

### CLINICAL FEATURES AND PROGNOSIS IN POST-STROKE EPILEPSY PATIENTS WITH LOW mRS SCORE

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**Background and Aims:** Post-stroke epilepsy has a greater disease burden in patients with low mRS scores (mRS < 3). We explored the clinical features and prognosis of post-stroke epilepsy patients with low mRS scores. In addition, we compared the clinical features of epilepsy after ischemic stroke and that after haemorrhagic stroke.

**Methods:** We retrospectively analysed 3200 stroke patients from January 1, 2013 to October 30, 2018 who visited the Chengdu Fifth People's Hospital. A total of 219 patients were diagnosed with epilepsy after stroke. We compared their clinic features, symptoms, and prognosis.

**Results:** There are 172 patients which mRS score less than 3. Of the 172 low mRS score epilepsy cases, in 133, the focus was in the cortex, and in 39 it was under the cortex. 110 patients had early epilepsy and 62 had delayed epilepsy. The difference was statistically significant. In 110 cases of early epilepsy, 92 cases were controlled, including 89 cases without recurrence and 3 cases requiring long-term medication; 8 cases were not controlled very well or even lead to death (1 patient). In 62 cases of delayed epilepsy, 56 were fully controlled, including 3 cases requiring long-term medication; 7 cases were not controlled very well.

**Conclusions:** The clinic features, symptoms, and prognosis of post-stroke epilepsy in low mRS score patients are similar to post-stroke epilepsy patients. A multicenter trial is needed to confirm this result.

**Trial registration number:** N/A

## WITHDRAWN

**AS18-003****EARLY SLEEP APNEA IN ACUTE ISCHEMIC STROKE****C. Yoon<sup>1</sup>**<sup>1</sup>Inha University School of Medicine, Department of Neurology, Incheon, Republic of Korea

**Background and Aims:** Sleep apnea (SA) is emerging as a risk factor of stroke, and stroke itself can also influence the sleep. However, investigation of SA in acute ischemic stroke is scanty. We evaluated the prevalence of SA in early stage of stroke and analyzed the factors associated with SA.

**Methods:** We prospectively performed overnight polysomnography (PSG) in consecutive acute ischemic stroke patients who were admitted to the stroke unit within 72 hours from onset. PSG was performed on the first night, and severe stroke patients who could not stand the PSG were excluded. The apnea-hypopnea index (AHI) was calculated using the total number of apneas and hypopneas per hour sleep, and categorized into mild (AHI 5–14/hour), moderate (15–29), and severe ( $\geq 30$ ). Ordinal logistic regression was performed to predict the factor associated with severity of SA (no, mild, moderate and severe).

**Results:** From November 2014 to March 2018, a total of 305 patients were enrolled: mean age  $63.5 \pm 12.2$  years, 72.5% male, median (IQR) NIHSS 3 (1–5). Among them, 254 (83.3%) patients had SA (AHI  $\geq 5$ /hour) of any degree: 37.4% mild, 19.3% moderate, and 26.6% severe. Advanced age and higher NIH stroke scale were associated with severity of SA ( $p = 0.033$  and  $p = 0.040$ , respectively).

**Conclusions:** SA is frequently found in acute phase of ischemic stroke. Higher degree of SA is associated with older age and severe stroke.

Trial registration number: N/A

**AS18-034****OUTCOMES OF COMMUNITY VERSUS HOSPITAL ACQUIRED INFECTIONS IN ISCHEMIC AND HEMORRHAGIC STROKE PATIENTS.****A. Zha<sup>1</sup>, K. Parsha<sup>1</sup>, S. Reddy<sup>1</sup>, A. Xavier<sup>1</sup> and S. Savitz<sup>1</sup>**<sup>1</sup>University of Texas McGovern Medical School, Neurology, Houston, USA

**Background and Aims:** There are few studies on the rates of hospital acquired infection (HAI) vs community acquired infection (CAI) in stroke. We evaluated outcomes in patients with HAI vs CAI in both ischemic (IS) and hemorrhagic stroke (ICH).

**Methods:** This is a retrospective review of patients presenting within 24hrs of IS or ICH from January-June 2017 at a single comprehensive stroke center. Patients with <48hrs of inpatient data were excluded. Infections were defined as follows: urinary tract infection (UTI) as  $>100,000$  colony forming units per milliliter on urine culture with clinical symptoms; pneumonia (PNA) as a positive chest x-ray or culture with clinical symptoms. CAI was considered any infection diagnosed <48 hours after admission. Primary outcomes were favorable discharge disposition (home/inpatient rehabilitation) and good mRS(0–3) at discharge/7 days after admission.

**Results:** Of 421 patients in this cohort, 155(36%) had infections. More patients with CAI(25.7%) compared to HAI(10.7%) had a good discharge/7day mRS but was not statistically significant. ICH patients with HAI had an increased odds of unfavorable discharge to a nursing facility, hospice, or death ( $p = 0.008$ , 95% CI 2.01, 99.6). Consistent with prior studies,

patients with HAI had longer lengths of hospital stay and poor discharge mRS. Patients with UTIs were more likely to have CAI and patients with PNAs were more likely to be HAI.

**Conclusions:** HAI leads to poor discharge outcomes for patients with ICH; further study on long term outcomes is needed. Patients with PNA are more likely to acquire them in hospital. Quality improvement may be a strategy to prevent pneumonia after stroke.

Trial registration number: N/A

**WITHDRAWN****AS18-002****QUANTITATIVE EEG IS CORRELATED WITH MIDLINE SHIFT IN PATIENTS WITH LARGE HEMISPHERIC INFARCTION****Z. Zhang<sup>1</sup>, D. Liu<sup>1</sup>, Y. Pu<sup>1</sup>, N. Wei<sup>1</sup>, Y. Zhonghua<sup>1</sup>, M. Wen<sup>1</sup> and L. Liping<sup>1</sup>**<sup>1</sup>Beijing Tiantan Hospital, Department of Neurology, Beijing, China

**Background and Aims:** Studies on monitoring the space-occupying edema due to acute large hemispheric infarction remain scarce.

This study aimed to determine the association between quantitative electroencephalography (qEEG) parameters and midline shift in patients with malignant middle cerebral artery (MCA) infarction.

**Methods:** Patients with unilateral acute ischemic lesions that affect two-thirds or more of the territory of the MCA were included. EEG was performed within seven days after the stroke onset. The alpha/delta ratio (ADR) was calculated using the fast Fourier transformation. The midline structures shift was measured based on CT or MRI that was performed within six hours before or after the EEG monitoring. The association between the ADR and the midline shift was analyzed. A receiver operating characteristic (ROC) curve was drawn to figure out the cut-off value of ADR.

**Results:** A total of 24 EEG records from 17 patients were analyzed. The ADR of channels representing the contralateral hemisphere was significantly associated with midline shift ( $P < 0.0001$ ). The mean ADR when midline shift was no more than 5mm was higher than that when more than 5mm ( $1.02 \pm 0.64$  vs.  $0.36 \pm 0.76$  [mean  $\pm$  standard deviation],  $P = 0.0009$ ). The area under the ROC curve was 0.911. ADR  $< 0.27$  could suggest the midline shift  $> 5$ mm with a sensitivity of 88.89% and a specificity of 80.00%.

**Conclusions:** A decrease in the ADR of the contralateral hemisphere was correlated with midline shift. ADR could serve as an excellent marker for monitoring midline structures displacement caused by malignant MCA infarction.

**Trial registration number:** N/A

## Systematic Review and Meta-Analysis

### AS34-013

#### PIOGLITAZONE AND RISK OF FRACTURES: A SYSTEMATIC REVIEW AND META-ANALYSIS OF RANDOMISED CONTROLLED TRIALS

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University of Glasgow, Professor of Stroke Medicine Consultant Physician Clinical Lead Scottish Stroke Research Network / NRS Stroke Research Champion Chair MVLS Research Ethics Committee, Glasgow, United Kingdom

**Background and Aims:** Pioglitazone reduces risk of myocardial infarction and stroke after ischaemic stroke and transient ischemic attack in people with insulin resistance. However, it increases fracture making the overall risk benefit ratio unclear. We performed a systematic review and meta-analysis of all pioglitazone trials to provide greater understanding of the risk of fracture.

**Methods:** A systematic search of 4 databases (Cochrane Register of Controlled Trials, MEDLINE, EMBASE, Web of Science) was performed (from their inception to 36 weeks, 2017). Published and unpublished studies comparing pioglitazone with placebo or other anti-hyperglycemic drugs (AHGs) were included. We extracted data on fracture occurrence. The protocol was published in PROSPERO-CRD 42016038242.

**Results:** From 860 titles, 27 studies were identified. Five studies had high-risk of bias, 4 unclear and 18 low-risk with moderate GRADE quality of evidence. In 14 trials (13,451 participants, 449 fractures) pioglitazone increased fracture versus placebo (risk ratio (RR) 1.21; 95% CI 1.01–1.45;  $P = 0.04$ ;  $I^2 = 32\%$ ). Both non-serious (RR 1.25; 95% CI 1.05–1.49;  $P = 0.01$ ;  $I^2 = 33\%$ ) and serious fractures (RR 1.35; 95% CI 1.02–1.77;  $P = 0.03$ ;  $I^2 = 29\%$ ) were increased. In 13 trials (11,267 participants, 99 fractures) there was no increased risk with pioglitazone vs. AHGs (RR 1.08; 95% CI 0.73–1.59;  $P = 0.70$ ;  $I^2 = 15\%$ ). Risk was

increased for spinal (RR 2.08; 95% CI 1.26–3.44;  $P = 0.004$ ;  $I^2 = 51\%$ ) and lower-limb fracture (RR 1.86; 95% CI 1.35–2.56;  $P = 0.0002$ ;  $I^2 = 0\%$ ). Risk was increased in females (RR 1.56; 95% CI 1.20–2.02;  $P = 0.0008$ ;  $I^2 = 0\%$ ) but not males (RR 1.10; 95% CI 0.84–1.43;  $P = 0.49$ ;  $I^2 = 14\%$ ).

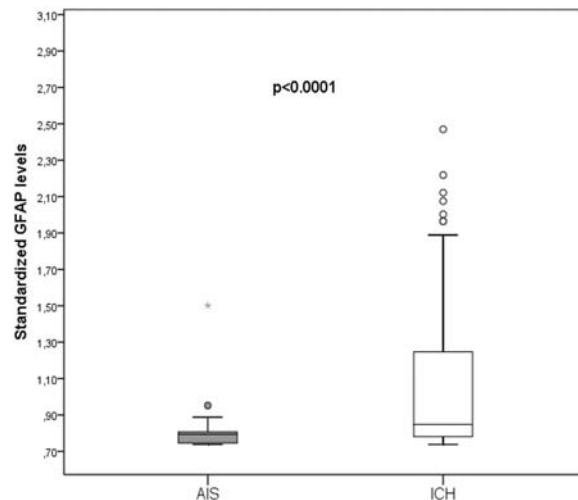
**Conclusions:** Pioglitazone increases fracture risk but this was most apparent in studies vs. placebo and in women. These data may help stroke clinicians decide whether to use pioglitazone in selected patients post-stroke and to guide further trials after stroke.

**Trial registration number:** N/A

## WITHDRAWN

## WITHDRAWN

elevated in ICH patients [0.840 (0.781-1.239), 0.794 (0.741-0.806); median and interquartile range, for ICH and AIS, respectively;  $p < 0.0001$ ; graph 1]. Both stroke types showed a positive correlation between baseline stroke severity and GFAP concentrations (correlation coefficient and  $p$  value: 0.267,  $p < 0.001$ ; 0.302,  $p = 0.004$ ; for ischemic and ICH, respectively). No correlation was found between time to sampling (TTS) and GFAP levels. Others factors associated with GFAP levels were presence of dyslipidemia and hematoma volume, in AIS and ICH patients, respectively.



## AS34-016

### SERUM GFAP FOR DIFFERENTIATING ACUTE ISCHEMIC STROKE AND INTRACEREBRAL HEMORRHAGE: A SYSTEMATIC REVIEW AND INDIVIDUAL PATIENT DATA META-ANALYSIS

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**Background and Aims:** Glial fibrillary acidic protein (GFAP) in serum is a promising biomarker to differentiate between acute ischemic stroke (AIS) versus intracerebral hemorrhage (ICH). We evaluated its diagnostic value through a systematic review and individual patient data (IPD) meta-analysis.

**Methods:** We performed a systematic search in PubMed database until November 2018 for publications that evaluated GFAP to differentiate AIS-ICH within the first 4.5 hours from symptom onset. Due to different assays employed for GFAP measurement, we standardized levels by calculating the Z-score. We used standardized IPD to assess its association with patient and stroke characteristics and factors related with GFAP measurement.

**Results:** IPD were provided from four studies. Overall, 338 patients (236 AIS and 102 ICH) were included. GFAP blood levels were significantly

**Conclusions:** The present IPD confirmed that GFAP serum levels were higher in ICH than AIS patients. Additionally, higher levels were associated with stroke severity regardless stroke subtypes. There was no association with TTS within first 4.5 hours, so GFAP could be a valuable tool in this framework.

**Trial registration number:** N/A

## AS34-012

### FACTORS ASSOCIATED WITH RISK OF STROKE-ASSOCIATED PNEUMONIA IN PATIENTS WITH DYSPHAGIA: A SYSTEMATIC REVIEW

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**Background and Aims:** Dysphagia is associated with increased risk of stroke-associated pneumonia (SAP). However, it is unclear what other factors contribute to that risk or which measures reduce it. This systematic review aimed to provide evidence on interventions and care processes associated with SAP in patients with dysphagia.

**Methods:** Electronic databases (CINAHL, COCHRANE, EMBASE, MEDLINE and SCOPUS) were systematically searched. Studies were screened for inclusion if they included: dysphagia only patients, dysphagia and non-dysphagia patients or unselected patients that included dysphagia patients, and evaluated factors associated with a recorded frequency of

SAP. Eligible studies were critically appraised, data extracted and summarised. Heterogeneity was evaluated using I<sup>2</sup>. The primary outcome was SAP.

**Results:** Data on 3532 patients were included. There was heterogeneity in study design. Measures of immunodepression are associated with SAP in dysphagic patients. There was insufficient evidence to justify screening for aerobic Gram-negative bacteria. Prophylactic antibiotics did not prevent SAP and proton pump inhibitors may increase risk. Treatment with metoclopramide may reduce SAP risk. Evidence that nasogastric tube placement increases risk of SAP was equivocal. A multidisciplinary team approach and instrumental assessment of swallowing may reduce risk of pneumonia. Patients with impaired mobility were associated with increased risk.

**Conclusions:** Several medical interventions and care processes, which may reduce risk of SAP in patients with dysphagia, were identified. Findings should be interpreted with caution given the number of studies, heterogeneity and descriptive analyses. Further research is needed to evaluate the role of these interventions and care processes in clinical practice.

**Trial registration number:** N/A

#### AS34-044

#### A META-ANALYSIS ON THE EFFECTS OF CANNABIDIOL IN EXPERIMENTAL STROKE

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<sup>1</sup>University of Nottingham, Vascular Medicine, Derby, United Kingdom

**Background and Aims:** Multiple *in vivo* studies indicate cannabidiol (CBD) improves outcomes in animal models of ischaemic-reperfusion injury (IRI). Given the accumulating pre-clinical evidence, a meta-analysis was undertaken to assess CBDs effects on *in vivo* models of focal ischaemic stroke.

**Methods:** Studies were systematically identified using Medline, Embase and PubMed. Infarct volume, neurological outcome and quality data were extracted. Data were analysed with Cochrane Review Manager using random effects models; results are expressed as either standardised mean difference (SMD) or mean difference (MD) with 95% confidence intervals [CI]. Publication biased was assessed using STATA.

**Results:** In focal IRI (8 articles, 2 laboratories) induced by middle cerebral artery occlusion, CBD reduced infarct volume by a MD of 29.60mm<sup>3</sup> (CI [34.94, 24.26], p < 0.00001) in mice (n: control 70, CBD 68) and 88.62mm<sup>3</sup>(CI [101.98, 75.26], p < 0.0001) in rats (n: control 81, CBD 81). CBD displayed a bell-shaped dose response curve in both species (range 0.83µg/kg-20mg/kg). Early neuroscore (5 publications) significantly improved in the CBD group (SMD -1.04, CI [-1.43, -0.65], p < 0.00001; n: control 48, CBD 140) but later evaluations (336hrs) in mice only revealed no significant improvement (SMD -0.92, CI [-1.96, -0.11], p = 0.08; n: control 6, CBD 18). Publication bias was evident (Egger's statistic p = 0.004) and median study quality was 2 (range 0-4/10).

**Conclusions:** CBD significantly reduced infarct volume and improved early functional outcome in experimental stroke. Further studies with longer follow up periods in aged, larger and female animal models, with other co-morbidities are required.

**Trial registration number:** N/A

#### AS34-043

#### SYSTEMATIC REVIEW OF QUALITY OF ARTICLES, RELATED TO CEREBROVASCULAR DISEASES, PUBLISHED IN THE LEADING UKRAINIAN NEUROLOGY JOURNAL

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**Background and Aims:** Quality of scientific information is an important factor, defining quality of stroke care in any country. We assessed quality characteristics of articles, related to cerebrovascular diseases, published in one of the leading Ukrainian neurology journals.

**Methods:** All articles, related to cerebrovascular disorders, published in the journal during years 2014–2018 were selected by hand search. The simple methodological and ethical characteristics of the articles were evaluated by both authors, and the ratings were made by consensus.

**Results:** 59 articles (45 original studies, 14 reviews) were included to analysis. The quality of all articles appeared to be rather poor. For original studies the main methodological issues were poor design (absence of clear protocol, blinding and randomization), statistical faults (absence of description of approaches and criteria, using of inappropriate criteria, errors in calculations), etc. The main ethical issues were absence of conflict of interest declaration, even if it was obvious, absence of mentioning of study approval and registration, not mentioning of informed consent. The main shortcomings of review articles were absence of any methodology (all reviews were narrative), selective and possibly biased referring to outdated low-quality sources, mainly published in Russian and Ukrainian languages.

**Conclusions:** The quality of all reviewed articles was poor. Although we have reviewed only one journal, we presume from our experience, that these results may be easily extrapolated at least to some other journals. We kindly advise the leaders of Ukrainian research institutions, professional associations, scientific journals to take care to improve quality of medical research and publications.

**Trial registration number:** N/A

#### WITHDRAWN

**Conclusions:** In acute ischemic stroke patients receiving ET, early anti-platelet use did not lead to a significant difference in recanalization rate and functional outcome. Although there was a trend that antiplatelet agent users had an increased probability of symptomatic intracranial hemorrhage, but no association between antiplatelet agent and mortality was detected.

**Trial registration number:** N/A

## WITHDRAWN

the clinical characteristics of acute stroke patients presenting to EMS and ED who were not identified as such by EMS or ED clinicians.

**Methods:** MEDLINE and EMBASE were searched (1946-October 2018) using key terms including stroke, Emergency Medical Services, emergency medicine and triage. Articles that appeared to meet the inclusion criteria were read in full. Data were extracted from the articles and study quality assessed by two researchers. Risk of bias of included studies was assessed using a pre-specified tool based on Cochrane guidance.

**Results:** Of 3684 studies initially identified, 7, including 3712 patients in total (mean 530) met the inclusion criteria; all were observational. No studies were identified as having a low risk of bias across all the domains assessed. The proportion of false negative diagnoses ranged from 2%-22% (mean 9%). The most commonly reported symptoms were ataxia (25%-71%), visual disturbance (15%-40%), leg weakness (10%-25%) and dizziness (8%-25%). Almost half (49%) of false negative diagnoses related to posterior circulation stroke.

**Conclusions:** Ataxia and visual disturbance were the most commonly reported symptoms in false negative presentation of stroke following application of different identification processes. Addition of these or other symptoms to stroke screening tools would require evaluation of their sensitivity, specificity, associated training needs and impact on resource use.

**Trial registration number:** N/A

## AS34-027

### ROLE OF MOLECULAR BIOMARKERS IN PREDICTING OCCURRENCE OF PAROXYSMAL ATRIAL FIBRILLATION AFTER AN ISCHAEMIC STROKE OR TRANSIENT ISCHAEMIC ATTACK: A SYSTEMATIC REVIEW

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**Background and Aims:** Paroxysmal atrial fibrillation (PAF) is difficult to detect using currently available methods of cardiac monitoring. We sought to identify molecular biomarkers used to predict PAF after ischaemic stroke (IS) or transient ischaemic attack (TIA), and evaluate their performance.

**Methods:** A systematic literature review was undertaken in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement. Studies of patients with IS, TIA, or both, who underwent any cardiac monitoring for a minimum of 12 hours, were included after electronic searches of multiple databases. We pre-specified subgroup analysis of selected (pre-screened or cryptogenic) versus unselected stroke patients and according to duration of monitoring.

**Results:** 21 studies (67% IS, 33% IS and TIA) involving 6327 patients were included. Twelve biomarkers (BNP, NT-proBNP, NT-proANP, MR-proANP, troponin I, troponin T, CRP, ESR, D-Dimer, HbA1c, eGFR, creatinine) were investigated, with cardiac biomarkers utilised in 77% of patients. Among selected cohorts (9 studies), the most commonly used biomarker was NT-proBNP (5 studies; C-statistic 0.65 to 0.91). Among unselected cohorts (12 studies), the most common biomarker was BNP (7 studies; C-statistic 0.63 to 0.88). Only BNP was externally validated with varying biomarker thresholds reported among studies (65-134pg/ml).

**Conclusions:** Analysis was limited due to small, heterogenous study populations and varying methods of patient selection, definitions of PAF and cardiac monitoring strategies. Cardiac biomarkers appear to have modest to good discrimination for predicting PAF. This review supports

## AS34-017

### THE CLINICAL CHARACTERISTICS OF FALSE NEGATIVE STROKE PATIENTS: A SYSTEMATIC REVIEW

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**Background and Aims:** The stroke chain of survival relies heavily on the accuracy with which Emergency Medical Services (EMS) and Emergency Department (ED) clinicians can identify stroke, enabling access to specialist treatment. The aim of this review was to identify

the need to assess the role of biomarkers in larger studies with standardised selection criteria, definition of PAF and laboratory assays.

**Trial registration number:** N/A

### AS34-010

#### ROLE OF GLIAL FIBRILLARY ACIDIC PROTEIN AS A BIOMARKER IN THE DIFFERENTIATION OF ISCHEMIC STROKE AND HEMORRHAGIC STROKE: A META-ANALYSIS

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**Background and Aims:** Stroke is the most common cause of adult disability and leading cause of death worldwide. Studies showed that Glial fibrillary acidic protein (GFAP) can be used as a biomarker to distinguish ischemic stroke (IS) and hemorrhagic stroke (HS). The aim of this meta-analysis was to determine the potential role of GFAP as a biomarker for differentiating IS and HS.

**Methods:** We performed the literature search using various search engines like PubMed, Google scholar, Trip database, Clinicaltrial.gov for the articles reported from 2007 to 2018. The following search terms were used for literature search: ("STROKE" [Mesh] OR "BIOMARKER" [Title/Abstract] OR "GFAP" [Title/Abstract]) OR "SPECIFICITY" OR "SENSTIVITY". Search was restricted to human clinical trials.

**Results:** The literature search retrieved a total of 136 records. Pooled analysis suggested GFAP if used as a biomarker to differentiate between different types of strokes (ICH and IS) had a sensitivity of 80% (95% CI: 73 to 86) and a specificity of 94%, (95% CI: 0.87 to 0.97). Positive likelihood ratio 13 (95% 6.1 to 25.8), negative likelihood ratio 0.21 (95% 0.15 to 0.29) and diagnostic odds ratio 60 (95% CI 27 to 137).

**Conclusions:** Our meta-analysis suggests that GFAP has remarkable diagnostic accuracy with pooled sensitivity 0.80% (95% CI 0.73 to 0.86) and pooled specificity of 0.95 (95% CI 0.87 to 0.97) for the differentiation of both types of stroke.

**Trial registration number:** N/A

### AS34-029

#### C-REACTIVE PROTEIN AND UNFAVORABLE PROGNOSSES IN PATIENTS WITH ACUTE ISCHEMIC STROKE: A SYSTEMATICAL REVIEW AND META-ANALYSIS

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**Background and Aims:** The relationship between C-reactive protein (CRP) and prognoses in patients with acute ischemic stroke (AIS) remains controversial. We systematically reviewed all the literature to assess the role of CRP as a prognostic marker in patients with AIS.

**Methods:** We identified observational studies from Pubmed, Embase, and Cochrane Library in investigating the association between CRP and prognoses up to January 1, 2019. The unfavorable prognoses were defined as poor outcome (modified ranking scale score 3–6), mortality, early neurological deterioration and combined end point of death or new vascular events. We calculated pooled odds ratio (OR) with 95% confidence intervals (CI) of comparing the top thirds to the bottom thirds of baseline CRP levels. Sensitive analysis and subgroup analysis were performed to find the source of the heterogeneity.

**Results:** In total, 41 studies with 22,390 patients were included. When comparing individuals in the top versus bottom thirds of CRP levels, pooled ORs for poor outcome in 14 studies, mortality in 10 studies, early neurological deterioration, and combined end point was 2.28(95% CI 1.79-2.91), 2.43(95%CI 1.52-3.89), 1.47(95% 1.30-2.09), and 2.43(95% CI 1.04-5.69), respectively. The pooled analysis of CRP increment in 1 mg/L and 1-log mg/L also observed similar results. Subgroup analysis revealed that different characteristics of patients and blood sampling time maybe the main source of the heterogeneity.

**Conclusions:** AIS patients with higher CRP appeared to have a greater risk of unfavorable prognoses.

**Trial registration number:** N/A

### AS34-032

#### THE EFFECT OF INTERRUPTING PROLONGED SITTING WITH FREQUENT BOUTS OF PHYSICAL ACTIVITY OR STANDING ON FIRST OR RECURRENT STROKE RISK FACTORS: A SCOPING REVIEW

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**Background and Aims:** Interrupting prolonged sitting with frequent bouts of physical activity shows beneficial effects on cardio-metabolic health. We reviewed all current literature on the effects of interrupting prolonged sitting time with frequent bouts of physical activity on stroke and recurrent stroke risk factors.

**Methods:** Databases Medline, Embase, AMED, CINAHL and Cochrane library were comprehensively searched from inception until 13<sup>th</sup> June 2018. Experimental trials which interrupted sitting time with frequent bouts of physical activity or standing in adults ( $\geq 18$  years) were included. In addition, trials had to include a comparison condition of uninterrupted prolonged sitting, and a measure of at least one first or recurrent stroke risk factor.

**Results:** Overall, 30 trials meet the inclusion criteria. Fifteen trials included participants at an increased risk of having a first stroke, one trial included people with stroke (and therefore at risk of a recurrent stroke), and 14 trials included healthy individuals. Interrupting sitting time with light- to moderate-intensity bouts of physical activity or standing was found to improve outcomes of hypertension and dysglycemia compared to uninterrupted sitting in the majority of trials that involved participants at risk of having a first stroke. In the one trial of stroke survivors, only outcomes of hypertension were significantly improved.

**Conclusions:** The beneficial effects of interrupting sitting time with frequent bouts of physical activity or standing on hypertension is an important finding, given hypertension is the leading risk factor for first and recurrent stroke. However, trials are needed to assess the dose-response effect in these high risk population groups.

**Trial registration number:** N/A

### AS34-028

#### RANDOMISED CONTROLLED TRIALS OF NORMOBARIC OXYGEN THERAPY IN ACUTE STROKE: A SYSTEMATIC REVIEW AND META ANALYSIS

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**Background and Aims:** Normobaric oxygen (NBO) is potentially a readily accessible neuroprotective therapy. We undertook a systematic review to assess the effect of NBO in acute stroke.

**Methods:** Medline, EMBASE and CENTRAL databases were searched from inception to November 2018. Randomised controlled trials of NBO administered < 7 days after stroke to normoxic patients and no other indication for oxygen were identified by two researchers independently. Data on early recovery within 7 days; functional outcome within 9 months; mortality; oxygen saturation and imaging markers were collected.

**Results:** 15 publications involving 12 cohorts were identified. Oxygen regimes ranged from 2 l/min via nasal cannula nocturnally to 45 l/min via facemask for 8 hours from randomisation. The proportion of patients with ischaemic stroke was 82.8% (range 61–100%); 3.5% were stroke mimics (where declared). Median time to treatment starting was 19.3 hours. Meta-analysis demonstrated no significant effect on: modified Rankin scale at follow up (Standardised mean difference (SMD) = -0.015 (-0.060–0.030)); reduction in National Institutes of Health Stroke Scale (NIHSS) at 7 days in all stroke or ischaemic stroke only (Mean difference = -0.16 (-1.11–0.80) and -0.73 (-3.54–2.08) respectively); neurological improvement at week 1 assessed by NIHSS or Scandinavian Stroke Scale (SMD = -0.026 (-0.154–0.103)); improvement in Barthel index (SMD = 0.001 (-0.043–0.045)) or mortality (odds ratio = 1.03 (0.90–1.19)).

**Conclusions:** Studies to date of NBO have shown no significant effect on early recovery, functional outcome or mortality in acute stroke. Study protocols and populations have varied considerably. Populations have included significant numbers of non-ischaemic stroke and stroke mimics. Oxygen has been predominantly low dose commenced in the subacute phase.

**Trial registration number:** N/A

## AS34-031

### INFLUENCE OF BLOOD PRESSURE DURING THROMBECTOMY ON FUNCTIONAL OUTCOME IN ACUTE ISCHEMIC STROKE: A SYSTEMATIC REVIEW

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**Background and Aims:** Evidence for optimal blood pressure (BP) targets during mechanical thrombectomy (MT) for acute ischemic stroke patients with anterior large vessel occlusion are unknown and randomized controlled trials addressing this issue are lacking. We aimed to perform a systematic review of studies evaluating the effect of per-procedural BP on functional outcome after MT.

**Methods:** Studies assessing per-procedural BP effect on functional outcome published since January 1<sup>st</sup> 2012 were included. The systematic review was carried out according to PRISMA requirements.

**Results:** Nine studies were included, for a total of 1037 patients. There was an important heterogeneity regarding BP parameters definition and measurements, precluding a meta-analysis. Mean arterial pressure (MAP) was the most frequently reported parameter to describe BP variability during MT, and systolic blood pressure (SBP) was the main parameter used to define per-procedural BP objectives. Among the nine eligible

studies, five studies showed an association between BP drop during MT and functional outcome at 3 months: >40% fall in MAP compared with baseline (OR = 2.8; [1.09-7.19]; p = 0.032), lowest MAP before recanalization (OR = 1.28; [1.01-1.62] per 10 mmHg drop below 100 mmHg; p = 0.04), and MAP drops (OR = 4.38; [1.53-12.6] for drops >10%). Four studies did not show an association between BP during MT and functional outcome, including 3 studies with strict per-procedural SBP objectives (within a 140–180 mmHg).

**Conclusions:** BP variability during MT is associated with worse functional outcome and is best described by MAP drops during MT. The lack of association between BP and functional outcome when strict SBP targets are achieved needs further evaluation

**Trial registration number:** NA

## AS34-002

### HYPONATREMIA AND MORTALITY IN PATIENTS WITH ACUTE STROKE: A SYSTEMATIC REVIEW AND META-ANALYSIS

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**Background and Aims:** It is well established that hyponatremia, which is frequent in patients with acute stroke, is associated with increased mortality in hospitalized patients and individuals from community. We aimed to assess available data regarding the mortality risk in patients with acute stroke and hyponatremia.

**Methods:** We conducted a meta-analysis of prospective and retrospective trials investigating the impact of hyponatremia on the mortality of patients diagnosed with acute ischemic or hemorrhagic stroke.

**Results:** Nine eligible cohorts (n = 20,826) were published up to November 2018 and included in the present meta-analysis. The pooled analysis showed a significant increase by 71% in the mortality of total stroke in patients with hyponatremia compared with those with higher sodium levels [risk ratio (RR): 1.709 (1.368-2.137), p < 0.001; Q = 53.311, p < 0.001, I<sup>2</sup> = 84.994%]. Similar results were noticed in patients with acute ischemic stroke [RR: 2.235 (1.397-3.577), p < 0.001; Q = 18.588, p < 0.001, I<sup>2</sup> = 78.481%], as well as those with intracerebral hemorrhage [RR: 1.645 (1.147-2.360) p = 0.007; Q = 6.374, p = 0.041, I<sup>2</sup> = 68.621%].

**Conclusions:** Available data from published cohorts support that hyponatremia increases the mortality in patients with acute stroke. However, it is yet unclear whether the appropriate restoration of sodium level improves outcomes in patients with acute stroke. In this context, randomized trials scheduled to compare the available therapeutic options in treating hyponatremic stroke patients are required.

**Trial registration number:** N/A

## AS34-003

### GLUCAGON-LIKE PEPTIDE 1 RECEPTOR AGONISTS PROTECT AGAINST STROKE IN PATIENTS WITH DIABETES: A SYSTEMATIC REVIEW AND META-ANALYSIS OF 5 RANDOMIZED CONTROLLED TRIALS

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**Background and Aims:** Glucagon-like peptide 1 receptor (GLP-1R) agonists, a novel class of antidiabetic agents, have been reported to exert neuroprotective effects in experimental stroke models, especially if treatment starts before stroke. We aimed to assess available data

regarding the risk of stroke in diabetic individuals treated with GLP-IR agonists.

**Methods:** We conducted a meta-analysis of randomized, double blinded, placebo-controlled trials (RCTs) involving GLP-IR agonists with cardiovascular outcomes and/or safety as primary endpoints.

**Results:** Five eligible multicenter ( $n = 42,358$ ) prospective double-blinded RCTs (ELIXA, LEADER, SUSTAIN, EXSCEL and HARMONY) were published up to October 2018 and included in the present meta-analysis. The pooled analysis showed a significant reduction by 13% in the risk of total stroke from treatment with GLP-IR agonists vs. placebo [risk ratio (RR): 0.87, 95% confidence intervals (95% CI): 0.78 – 0.98,  $p = 0.021$ ]. No significant heterogeneity among trials was detected ( $Q$ -value = 4.094,  $p = 0.393$ ,  $I^2 = 2.307\%$ ). When only fatal stroke was included (this applied for ELIXA, LEADER, EXSCEL and HARMONY trials), active treatment resulted in a non-significant reduction by 16% compared with placebo (RR: 0.84, 95% CI: 0.60 – 1.17,  $p = 0.29$ ). Again, no significant heterogeneity was detected ( $Q$  value = 2.12,  $p = 0.548$ ,  $I^2 = 0\%$ ).

**Conclusions:** Available data from RCTs dedicated to cardiovascular safety support the promising findings from previous experimental studies indicating protective effects of treatment with GLP-IR agonists against stroke.

**Trial registration number:** N/A

## WITHDRAWN

### AS34-039

## THE ROLE OF BLOOD-BASED BIOMARKERS IN ISCHAEMIC STROKE PROGNOSIS: A SYSTEMATIC REVIEW

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**Background and Aims:** Prognostication of clinical outcome in ischaemic stroke (IS) patients remains a challenge. Blood-based biomarkers could provide further information regarding individual prognosis on top of clinical and demographical variables.

**Methods:** This work is an update from a previously published systematic review, including publications up to 01/2007. Articles assessing the predictive performance of at least one blood-based biomarker measured up to 7 days after IS and reporting disability or death at least 7 days after stroke were included. The review protocol followed the PRISMA-P statement and was registered (PROSPERO CRD42018094671). A systematic search on MEDLINE (Ovid) and ISI Web of Knowledge from 01/2007 to 08/2018 was performed.

**Results:** The systematic search produced 16,463 results. After exclusion of duplicates, 13,407 publications were screened by two independent raters at the title/abstract level. Of 729 references identified, 692 publications were available for full-text evaluation. Two hundred ninety articles (42%) that included 257 different biomarkers reported a measure of association with outcome. Of them, 72% adjusted for age, 63% for stroke severity and 16% for stroke aetiology. Publications tended to be of medium sample size (median 226, IQR 105.5–416). Few studies provided evidence of sample size calculation (2%) and only 34% assessed any performance measure of the predictive model (e.g. discrimination, calibration or reclassification). Brain natriuretic peptide and copeptin were consistently associated with poor outcome in multivariable models.

**Conclusions:** The number of papers assessing the prognostic role of blood-based biomarkers in IS increased substantially since the previous period. Although sample size has increased, methodological flaws are still common.

**Trial registration number:** N/A

### AS34-033

## IN STROKE PATIENTS, WHAT ARE THE RISK FACTORS AND INTERVENTIONS TO PREVENT WORSENING COGNITION? AN UMBRELLA REVIEW OF SYSTEMATIC REVIEWS.

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**Background and Aims:** A large number of reviews have published on post-stroke cognitive impairment (PSCI) with methodological differences and limitations. This review aims to appraise the existing evidence on

interventions designed to prevent PSCI and summarise risk factors related to PSCI.

**Methods:** Umbrella review of findings across systematic reviews (SRs) and meta-analyses. An electronic and manual search included Medline, PsycINFO, EMBASE, Cochrane and the international prospective register of systematic reviews (PROSPERO), from inception until June 2018. Effect size, Hedges' ( $g$ ), 95% confidence interval (CI), p-value, study-heterogeneity by  $I^2$  and source of excess bias were estimated to examine and grade the evidence. Also, classes from I to V were created to classify the evidence into convincing, highly suggestive, suggestive, weak and non-significant, respectively. The AMSTAR 2 (A MeASurement Tool to Assess Systematic Reviews) checklist was used to assess the overall quality of the reviews.

**Results:** Out of 4093 studies, 19 SRs included. Atrial Fibrillation was strongly associated with PSCI (Class I; the number of cases (NOC)  $>1000$ ,  $p < 10 - 6$ ,  $I^2 < 50\%$ , 95% CI excluding I). Acupuncture intervention had a highly suggestive positive effect (Class II; NOC  $> 300$ ,  $g > 0.8$ ) on PSCI. The majority of the Interventions had a weak positive effect on PSCI (Class IV;  $g < 0.5$ ) including virtual reality, transcranial magnetic stimulation, antihypertension medication withdrawal, Chinese herbal medicine and physical activity. Interventions that included occupational therapy, cognitive rehabilitation, antidepressant medications or dopamine agonists had no significant effect.

**Conclusions:** This umbrella review provides guidance of the effective intervention and risk factors related to PSCI for healthcare workers and decision makers.

Trial registration number: N/A

## AS34-045

### THE PREVALENCE OF FRAILTY IN STROKE, A SYSTEMATIC REVIEW

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**Background and Aims:** Frailty, the clinical syndrome, can be defined by using either the phenotype or the deficit models. Linda Fried proposed the former in 2001. John Rockwood in 1999 proposed the deficit model. There are several instruments that can be used to define frailty. We sought to determine the prevalence of frailty in acute stroke patients.

**Methods:** We searched MEDLINE, EMBASE and CINAHL up to November 2018, using a pre-defined search criteria, in accordance with PRISMA guidance. Studies that used a defined measure of frailty were included. Studies that included transient ischaemic attack patients were excluded.

**Results:** A total of 1981 studies were screened, 9 studies met the inclusion criteria. Six studies were conference abstracts found in the grey literature. 1331 patients were included in total, of which 452 (34%) were defined as frail. Five different methods, for assessing frailty were used; the Clinical Frailty Scale, Rockwood Frailty index, Fried Frailty Criteria, Canadian Study on Health and Ageing Scale and the Reported Edmonton Frailty Scale were used.

**Conclusions:** The review was limited by the small number of studies, this may be because frailty is a relatively new concept. Studies which included pre-morbid function were not included, if there was no measure of frailty. Our study suggests the need for further larger well designed studies that measure the prevalence of frailty in stroke patients and how frailty affects patient outcomes. Further work is also needed into what assessment method for frailty should be used.

Trial registration number: N/A

## AS34-004

### “OUTCOME AFTER STROKE THROMBOLYSIS IN PATIENTS WITH DIABETES MELLITUS AND PRIOR CEREBRAL INFARCTION TREATED WITHIN 3–4.5 HOURS: A SYSTEMATIC REVIEW AND META-ANALYSIS”

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**Background and Aims:** IV alteplase is a proven treatment for acute ischemic stroke however, diabetes mellitus (DM) and previous cerebral infarction (PCI) were considered relative contraindications for thrombolysis. It is also uncertain whether the repeated use of IV-rtPA in patients with recurrent stroke is safe. The study aims to determine the safety and efficacy of giving of IV-rtPA among diabetic patients with PCI presenting with acute ischemic stroke.

**Methods:** Potential studies evaluating the outcome of IV-rtPA in terms of symptomatic intracerebral hemorrhage, functional outcome measured as mRS, and death among diabetic patients with history of PCI ( $>3$  months) presenting with acute ischemic stroke were included in the review. Cochrane-Mantel-Haenszel test of independence and risk ratios (RR) and 95%CI were used for dichotomous outcome measures. The degree of heterogeneity was assessed using the  $I^2$  statistic.

**Results:** Four studies with a total of 18097 patients were included in this meta-analysis. Incidence of symptomatic intracerebral hemorrhage (RR 0.71, CI 0.27, 1.87), mortality (RR 2.16, CI 1.89, 2.46), and functional dependence (RR 1.14, CI 1.02, 1.27) is comparable among patients with or without DM and PCI after IV-rtPA. Good functional outcome is higher among patients with DM and PCI (RR 0.67, CI 0.61, 0.74). Cochrane-Mantel-Haenszel test showed no significant association between history of cerebral infarction and DM in the outcomes measured ( $X^2 = 12.575$ , df 2,  $p = 0.504$ ).

**Conclusions:** DM and previous cerebral infarction does not result to higher incidence of symptomatic intracerebral hemorrhage, death, and functional dependence among patients who were given IV-rtPA thus providing evidence supporting the current guidelines on thrombolysis.

Trial registration number: N/A

## AS34-022

### EFFICACY OF REPETITIVE TRANSCRANIAL MAGNETIC STIMULATION (RTMS) IN FACILITATING LOWER EXTREMITY RECOVERY AND GAIT AMONG STROKE PATIENTS: A META-ANALYSIS

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**Background and Aims:** Repetitive transcranial magnetic stimulation (rTMS) has been shown to facilitate neuroplasticity and recovery post-stroke. This meta-analysis aims to determine the efficacy of supplementing rTMS to conventional rehabilitation in facilitating improvement of lower extremity (LE) function and gait recovery among post-stroke patients.

**Methods:** Literature search was done using PubMed, Cochrane Library and GoogleScholar with keywords repetitive transcranial magnetic stimulation and lower extremity function and gait and stroke. Three randomized placebo-controlled trials were included in the meta-analysis and appraised by three independent reviewers. Review Manager was used to construct Forest plots.

**Results:** The change in Fugl Meyer-LE score in rTMS groups was significant at 6.35 [3.12 to 9.58] points higher. The change in walking cadence in rTMS groups was significant at 8.72 [8.10 to 9.33] steps more per minute. The change in walking speed of 24.35 [-0.61 to 49.30] cm/sec was not significant in the pooled analysis due to heterogeneity.

**Conclusions:** Overall, among post-stroke patients, rTMS is beneficial as a supplement to conventional rehabilitation in facilitating motor recovery of lower extremities. However, this may not translate to improvement in gait.

**Trial registration number:** N/A

### AS34-030

#### ASPIRIN OR ANTICOAGULATION AFTER CRYPTOGENIC STROKE WITH PATENT FORAMEN OVALE: SYSTEMATIC REVIEW AND META-ANALYSIS OF RANDOMIZED CONTROLLED TRIALS

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**Background and Aims:** One in 4 strokes is defined as cryptogenic, with possible embolic unknown sources including paradoxical embolism via patent foramen ovale (PFO). The most effective antithrombotic strategy in patients with cryptogenic stroke and PFO is still debated. We conducted a systematic review and meta-analysis of randomized controlled trials (RCTs) to define risk/benefit profile of anticoagulation compared to antiplatelet treatment in cryptogenic stroke with PFO.

**Methods:** Following PRISMA guidelines, we searched MEDLINE, EMBASE and Cochrane CENTRAL database for RCTs randomly allocating patients with cryptogenic stroke and PFO (ascertained with trans-esophageal echocardiogram) to medical treatment. Risk of bias was assessed with Cochrane RoB tool. Outcomes were stroke recurrence and major bleeding.

**Results:** Overall, 4 RCTs met the inclusion criteria (2 high, 1 fair, 1 poor quality RCTs), for a total of 882 patients (mean age 55.5 years), 432 (48.9%) receiving anticoagulation and 450 (51.1%) receiving antiplatelet treatment. Only one RCTs used direct oral anticoagulants (DOACs). Compared to antiplatelet treatment, anticoagulation was associated with better prevention of recurrent stroke (OR 0.48, 95% CI 0.24-0.96, p = 0.038) but higher risk of major bleeding (OR 2.33, 95% CI 0.94-5.75, p = 0.066).

**Conclusions:** The results of this meta-analysis highlight a probable benefit in term of ischemic stroke prevention with anticoagulants in patients with cryptogenic stroke and PFO. Such results are limited by increased risk of major bleeding. Further studies are needed to investigate the role of DOACs in patients with cryptogenic stroke and PFO.

**Trial registration number:** N/A

### AS34-024

#### INTRAVENOUS THROMBOLYSIS AT THE LARGEST STROKE CENTER IN BULGARIA – TWO-YEARS' FOLLOW-UP

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**Background and Aims:** Reducing the so-called door-to-needle (DTN) time is key point in the treatment of acute ischemic stroke with rTPA. A considerable amount of effort has been made to improve the collaboration between medical units in our hospital and creating a common understanding in all medical personnel of the significance of quick action.

**Methods:** In 2016 IV thrombolysis became the 'gold standard' when treating ischemic strokes at 'St. Anna' Hospital and it contributed to making it the largest stroke center in Bulgaria. Strict intra-hospital organization was established, with the team of professionals at the Department of Neurology leading the way. The diverse strategies applied have proven effective at reducing DTN time.

**Results:** At the beginning of the year 2016 the average DTN time at 'St. Anna' Hospital was estimated at 61 minutes, which was subsequently reduced in 2017 to 47 minutes. In 2018 the volume of IV thrombolysis administered at the Neurology Department increased by 68% reaching 235 patients, which represented 30% of all IV thrombolysis country-wide. Still, in 40% of the cases the DTN time was less than 60 minutes. In 2017 rTPA was administered in 10.5% of all ischemic stroke patients, and for 2018 that percentage has risen to 18% overall, accelerating significantly during the months of November (25.5%) and December (30% overall).

**Conclusions:** There is now a broad understanding of the causes of delay to the emergency stroke treatment and the strategies that can be employed to improve door-to-needle time.

**Trial registration number:** N/A

### AS34-015

#### NEW PREDICTORS OF ATRIAL FIBRILLATION IN ESUS – A SYSTEMATIC REVIEW

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**Background and Aims:** An increasing proportion of ischaemic strokes are classified as embolic stroke of undetermined source (ESUS). It is established that approximately a third of ESUS are due to paroxysmal atrial fibrillation (AF). The diagnosis of AF can be straightforward but often requires invasive and costly cardiac monitoring. We have previously reviewed established risk-predictors of atrial fibrillation, based on an amalgam of variables such as age, sex and cardiovascular risk factors. Since development of the concept of ESUS in 2014, there have been additional and new developments in identifying singular novel predictors. We sought to identify and summarise novel predictors of atrial fibrillation to inform the development of a new clinical tool to assess the risk and perhaps predict atrial fibrillation following ESUS.

**Methods:** A systematic review of the literature was performed to identify studies that examined singular predictors of atrial fibrillation published from 2014 onwards.

**Results:** A total of 29 articles were identified from more than 130 that met our search criteria articles.

**Conclusions:** Newly validated measurements based on electrocardiogram and echocardiogram have been identified to predict AF in stroke patients. In addition we identified biomarkers of AF including several intrinsic cardiac hormones. These new potential markers of AF in stroke should be combined with more traditional risk predictors to develop a new tool to assess the individuals' risk of AF following ESUS. This would guide the need for further cardiac monitoring and aid risk-stratification of patients who might benefit from the use of direct oral anticoagulants.

**Trial registration number:** N/A

**AS34-011**

## META-ANALYSIS OF HAEMATOMA VOLUME, HAEMATOMA EXPANSION AND MORTALITY IN INTRACEREBRAL HAEMORRHAGE ASSOCIATED WITH ORAL ANTICOAGULANT USE

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**Background and Aims:** To compare haematoma volume, secondary haematoma expansion (HE) and mortality between patients with intracerebral haemorrhage (ICH) taking oral anticoagulants (Vitamin K antagonists [VKA-ICH] or non-Vitamin K antagonist oral anticoagulants [NOAC-ICH]) and those not taking oral anticoagulants (non-OAC ICH) at symptom onset.

**Methods:** We conducted a systematic review and meta-analysis of studies comparing VKA-ICH and/or NOAC-ICH with non-OAC ICH. Primary outcomes were haematoma volume (in ml), HE and mortality (in-hospital and 3-month). We calculated odds ratios (OR) using the Mantel-Haenszel random-effects method and corresponding 95% confidence intervals (95% CI) and determined the mean ICH volume difference.

**Results:** We identified 19 studies including data of 16546 patients with VKA-ICH and 12856 patients with non-OAC ICH. Only 2 studies reported data on 4943 patients with NOAC-ICH. Patients with VKA-ICH were significantly older than patients with non-OAC ICH (mean age difference: 5.55 years, 95%CI 4.03-7.07, p < 0.0001, I<sup>2</sup> = 92%, p < 0.001). Haematoma volume was significantly larger in VKA-ICH with a mean difference of 9.66ml (95%CI 6.24-13.07ml, p < 0.00001; I<sup>2</sup> = 42%, p = 0.05). HE was significantly more often in VKA-ICH (OR 2.96, 95%CI 1.74-4.97, p < 0.00001; I<sup>2</sup> = 65%). VKA-ICH was associated with significant increase in in-hospital (VKA-ICH: 32.8% vs. non-OAC ICH: 22.4%; OR 1.83, 95%CI 1.61-2.07, p < 0.00001, I<sup>2</sup> = 20%, p = 0.27) and 3-month mortality (VKA-ICH: 47.1% vs. non-OAC ICH: 25.5%; OR 2.24, 95%CI 1.52-3.31, p < 0.00001, I<sup>2</sup> = 71%, p = 0.001). We did not find sufficient data for a meta-analysis comparing NOAC-ICH and non-OAC-ICH.

**Conclusions:** This meta-analysis confirms, refines and expands findings from prior single centre studies. VKA leads to larger haematoma volume, increased rate of HE and higher mortality. There is insufficient data to determine whether NOAC has the same effects.

**Trial registration number:** N/A

**AS34-042**

## COMPUTER GAME BASED THERAPY FOR POST-STROKE UPPER LIMB IMPAIRMENTS – A SYSTEMATIC REVIEW

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**Background and Aims:** The need for simplified repetitive task oriented rehabilitation program for upper limb motor recovery after stroke has been established. Computer Game Based Therapy (CGBT) is one such mode being researched widely. We aimed to describe the various characteristics of the rehabilitation protocols delivered through CGBT and its effects when compared to conventional therapy alone.

**Methods:** A literature review based on pre-set inclusion-exclusion criteria yielded 763 studies. Fourteen studies evaluating the feasibility and effects of CGBT were accepted. CGBT was defined as a non-immersive virtual reality where a handheld remote was used to navigate through the game. The studies were assessed for: sample size of included patients; type of intervention; control group; duration, intensity, and frequency of intervention; acceptability of and adherence to therapy; primary and secondary outcomes; limitations of the studies.

**Results:** The CGBT was well tolerated among patients, with no related harmful effects reported. Patients generally found CGBT more enjoyable compared to conventional therapy, which led to their higher compliance in home based environment. CGBT was proved to be minimally as effective as conventional rehabilitation. The most important aspects of successful recovery were the intensity, frequency, and duration of the therapy.

**Conclusions:** Adjunctive CGBT for upper limb stroke rehabilitation may improve patient adherence to rehabilitation protocols, fine and gross motor movements, and quality of life. Such rehabilitation strategies can be implemented at a home/community level to improve patient accessibility to and regularity with rehabilitation. Further research on economic aspects of implementation of such protocols is the need of the hour.

**Trial registration number:** N/A

**AS34-006**

## OUTCOMES OF LEFT ATRIAL APPENDAGE OCCLUSION USING THE ATRICLIP DEVICE – THE EVIDENCE TO DATE

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**Background and Aims:** The recent development of occlusion devices such as the Atriclip device (AtriCure, Mason, USA) enables safe and reproducible epicardial clipping of the left atrial appendage (LAA) during both open and thoracoscopic surgery, representing an evolution in the surgical management of atrial fibrillation. This review sought to assess outcomes of (LAA) clipping using the Atriclip device.

**Methods:** A systematic review was performed in May 2018, based on the PRISMA guidelines, using the keyword 'Atriclip'. A total of 68 papers were identified and reviewed; 12 studies met the inclusion criteria. Data was extracted from each study including patient demographics, patient medical history, indication for intervention, and intervention (s) performed. Further data on peri-procedural outcomes and follow-up was assessed and analyzed.

**Results:** 956 patients were identified (69.9% male) with a weighted mean age of 68.2 (62.6 – 74). Complete LAA occlusion was achieved in 936 out of 956 patients (97.9%), as assessed by intra-operative echocardiogram. In 14 patients, a residual LAA stump of >1cm was observed post clip placement (1.5%). No device-related serious adverse events were reported across the studies. The incidence of stroke/TIA post-clip placement was 1 in 165.6 patient-years. No late deaths attributable to the Atriclip device were reported. The 3-month success rate of clip placement was 98.4% (428 of 435 patients) and 399 of 674 patients (59.2%) ceased anticoagulant/ antiplatelet medication.

**Conclusions:** The Atriclip occlusion device is safe and effective in the management of patients with Atrial Fibrillation, either as an adjunct in

patients undergoing cardiac surgery or as a stand-alone thoracoscopic procedure.

**Trial registration number:** N/A

### AS34-026

#### UNDER REPRESENTED GROUPS IN RESEARCH TRIALS, A STUDY OF STROKE RESEARCH PATIENTS IN A SOUTH LONDON HOSPITAL

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**Background and Aims:** The aim of a Randomised Controlled Trial (RCT) is to be able to test hypotheses without bias. However, bias can still be introduced through the enrolment process resulting in an outcome that cannot be generalised. We aim to investigate three commonly under-represented groups in research: women, the elderly and ethnic minorities.

**Methods:** This study used data on patients recruited into research studies by the Stroke Research team at a South London hospital over a period of 12 months. Type of trial, consent and demographic data were recorded where available. For ethnicity comparisons the most recent census data (2011) for the local borough & SNAPP data were used as population and stroke prevalence comparators.

**Results:** 552 patients were recruited to stroke research studies in 2018. Of these, 218 (39.5%) were female, 124 (22.5%) were over 80 years of age, and 60 (10.9%) were of Asian ethnicity. Comparing this with Census & SNAPP data, the research cohort has less female, comparable elderly, and a higher percentage of Asian patients. Of 552 patients, 476 were in observation trials vs 76 in RCT's. There were higher rates of RCT recruitment for the elderly (19.4% vs 22.4%) and Asian population (8.9% vs 14.5%) but even lower recruitment for women (35.1% vs 31.6).

**Conclusions:** We found the research patient cohort to be largely representative aside from gender. There may be some effect of ethnicity across type of study. Further studies are required to assess and control recruitment bias in clinical trials.

**Trial registration number:** N/A

### AS34-038

#### USE OF DIRECT ORAL ANTICOAGULANTS (DOACS) IN PATIENTS WITH CEREBRAL VENOUS SINUS THROMBOSIS: A SYSTEMATIC REVIEW

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**Background and Aims:** Cerebral venous thrombosis (CVT) is rare and accounting 0.5% of stroke cases. The use of direct oral anticoagulants (DOACs) in CVT remains controversial due to paucity of available data. There are some reports of DOACs use in the treatment of CVT, but their efficacy remains unclear. Randomized clinical trial using DOAC for CVT is currently underway and should offer definitive insight into the efficacy and safety profiles of DOACs in these patients. Therefore, we performed a systematic review to investigate published reports of the use of DOACs in the treatment of CVT to explore its efficacy and safety profile.

**Methods:** We reviewed published literature since 2009 to May 2018, investigating the use of DOACs in patients with CVT using combinations of the words, oral anticoagulant, apixaban, dabigatran, edoxaban, rivaroxaban and CVT.

**Results:** Limited clinical reports of DOACs use in the therapy of patient with CVT with sources mainly in retrospective case series and case reports. From the selected articles, we observe a promising outcome and efficacy. An ongoing trial investigating the safety and efficacy of dabigatran versus warfarin in patients with CVT is ongoing.

**Conclusions:** The use of DOACs in patients with CVT appears a promising alternative treatment which offers similar or better efficacy, tolerability and safety profile compared with warfarin but no robust conclusion to be reached. With the result of the ongoing clinical trial comparing warfarin with DOACs in CVT, this will elucidate the role of DOACs for or against their use in this population.

**Trial registration number:** N/A

### AS34-008

#### A SYSTEMATIC REVIEW OF THE METHODS AND NON-IMAGING APPLICATIONS OF MACHINE LEARNING IN STROKE CARE

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**Background and Aims:** In stroke care, there has been much interest in the use of machine learning to automate the processing and interpretation of medical images such as CT and MRI scans. There are however many other potential uses of machine learning outside of medical imaging, such as in providing more accurate estimations of prognosis and outcomes. The aim of this systematic review was to identify how machine learning has been applied to non-imaging applications in stroke care, in order to inform a linked programme of research and describe the opportunities and challenges of using machine learning for non-imaging use cases in stroke care. We aimed to carry out a systematic review of published research on the methods and non-imaging applications of machine learning in stroke care. The objective was to identify, describe and critique the existing literature, focussing on the use of specific machine learning algorithms, validation methods, data sources, and clinical use cases.

**Methods:** We carried out systematic searches (Search terms: stroke, machine learning, clinical prediction models and related synonyms and abbreviations) in Medline and Web of Science to identify potential publications. Published filters were used for searches. Titles and abstracts were screened. Full copies of the final papers were downloaded for review.

**Results:** The review is in progress and identified over 100 papers for final review. The final results will be ready for presentation at ESOC 2019.

**Conclusions:** We will discuss the key findings of the review and discuss the implications for future research and clinical application of machine learning in stroke care.

**Trial registration number:** N/A

### WITHDRAWN

**Thrombolysis – Excluding Clinical Trial Results****WITHDRAWN**

**AS05-070****THROMBOLYSIS IN THE VERY FRAIL ELDERLY WITH MULTIPLE CO-MORBIDITIES****S. Alam<sup>1</sup>, N. Malek<sup>2</sup>, H. AlKermakchi<sup>1</sup> and V. Ceidiene<sup>1</sup>**<sup>1</sup>ESNEFT Ipswich Hospital, Stroke Medicine, IPSWICH, United Kingdom;  
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**Background and Aims:** To assess the effect of thrombolysis with alteplase in the very elderly (i.e. those >90 years) with significant co-morbidities on in-hospital stay, pre and post thrombolysis Modified Rankin Score (mRS).

**Methods:** We reviewed the treatment of stroke patients above the age of 90 years who were treated with alteplase between April 2016 to March 2017. Consideration of patients co-morbidities were taken in place with the main outcome measures being mRS, length of stay and adverse outcomes.

**Results:** A total of 67 patients above the age of 90 years were admitted. 6 out of these 67 patients received Alteplase. Both groups had similar baseline co-morbidities (Table I). The average length of stay was reduced in the Alteplase group (11 days vs 24 days). There were no reported adverse outcomes in either group.

Table 1 shows the comorbidities and outcome measures in those who received Alteplase compared to those who did not.

	Received Alteplase	Standard treatment
Number of patients	6	61
Charlson Co-morbidity index	7	7
Pre-stroke mRS	2	2
Post stroke mRS	4	4
Length of stay in days	11	24

**Conclusions:** Those who received Alteplase had a shorter in-hospital stay compared to those who did not. Alteplase can be safely administered even to those above the age of 90 with multiple co-morbidities. We therefore conclude, age and co-morbidity in the appropriately selected patient should not be a barrier for Alteplase therapy.

**Trial registration number:** N/A

**AS05-066****RETROSPECTIVE COMPARISON OF THE OUTCOME OF PATIENTS, TREATED WITH INTRAVENOUS THROMBOLYSIS WITH UNKNOWN VERSUS KNOWN SYMPTOM ONSET, GUIDED BY CT-IMAGING****E. Ardila Jurado<sup>1</sup>**<sup>1</sup>Kantonsspital St. Gallen KSSG, Neurologie, St. Gallen, Switzerland

**Background and Aims:** The WAKE-UP trial showed a favourable outcome of intravenous thrombolysis with alteplase (iv-tPA) in patients with unknown onset of stroke, selected by DWI/FLAIR mismatch on MRI. In many centres, however, acute stroke patients are evaluated by CT-based imaging methods. We aimed at evaluating the outcome and safety of a multimodal CT-based decision making algorithm for iv-tPA in acute stroke patients with unknown symptom onset.

**Methods:** Retrospective, single centre analysis. Data from iv-tPA treated patients with unknown symptom onset and from those with a defined symptom onset <4.5 hours were retrieved from the Swiss Stroke Registry (SSR). Patients with additional endovascular treatment were

excluded. Primary outcome was excellent outcome (mRS 0–1) after 90 days. Secondary outcomes were the rates of symptomatic intracranial haemorrhages (sICH) according to ECASS definition and death within 90 days after iv-tPA treatment.

**Results:** Both groups (unknown vs. known symptom onset) show comparable baseline characteristics (Age 74.2 (69.4–79.0) vs 72.4 (70.7–74.0), initial NIHSS 7.7 (5.5–9.9) vs 7.5 (6.8–8.2)). A mRS score of 0–1 after 90 days was observed in 16/28 patients with unknown symptom onset (57%). The rate of favourable outcome was comparable to patients treated <4.5 hours after symptom onset ( $p = 0.427$ ). There was no difference between the two groups regarding the rates of sICH and deaths after 3 months.

**Conclusions:** CT-based selection of patients with unknown symptom onset for iv-tPA is feasible and seems to provide comparable efficacy and safety profile as in patients treated within the standard time window for iv-tPA of <4.5 hours after symptom onset.

**Trial registration number:** N/A

**AS05-012****IV THROMBOLYSIS IN ACUTE STROKE PATIENTS WITH HEPARINE INDUCED COAGULATION DISTURBANCES****K. Banaszkiewicz<sup>1</sup>, E. Majcherczyk<sup>1</sup>, M. Ostrowska<sup>1</sup> and M. Michalski<sup>1</sup>**<sup>1</sup>John Paul's Hospital, Department of Neurology with Stroke Unit, Krakow, Poland

**Background and Aims:** Ischemic stroke is caused by sudden occlusion or critical stenosis of a cerebral artery. Alteplase which is an Intravenous Tissue-type Plasminogen activator (IVTPa) is a standard treatment for acute ischemic stroke, but it is contraindicated in coagulation disorders. IVTPa is therefore not used in patients who develop stroke after endovascular procedures which require unfractionated heparin (UFH) administration.

**Methods:** We present four cases of acute ischemic stroke patients treated with IVTPa after reversal of UFH induced coagulation deficit with use of protamine sulphate. There were 2 females and 2 males aged 57–81 years, who underwent an endovascular procedure: cryoablation due to atrial fibrillation, percutaneous coronary intervention due to non-ST-segment elevation myocardial infarction or carotid artery angioplasty and stenting in primary stroke prevention.

**Results:** 5.000–10.000 IU UFH was used during each procedure. The patients developed symptoms of acute stroke during or immediately after the procedure. Initial CT scans were normal. Neurological deficit persisted for more than 30 minutes. APTT level was significantly increased therefore 1mg of protamine sulfate on 100 j.m UFH was administered intravenously to reverse anticoagulation. Normalization of APTT was achieved and then 0.9mg/kg alteplase was administered (onset-to-needle time was to 145–180 minutes). The neurological deficit decreased in all patients and control CT scans showed asymptomatic intracerebral hemorrhage in two patients and ischemic lesion in one patient.

**Conclusions:** IVTPa after protamine sulphate administration in acute stroke patients with increased baseline APTT due to previous use of UFH seems possible, safe and effective.

**Trial registration number:** N/A

**AS05-031****DABIGATRAN REVERSAL WITH IDARUCIZUMAB PRIOR TO STROKE THROMBOLYSIS**

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**Background and Aims:** Idarucizumab is a humanised monoclonal antibody fragment developed to reverse the anticoagulant effects of dabigatran. Case reports and small case series have suggested dabigatran reversal with idarucizumab prior to i.v. thrombolysis is safe.

**Methods:** All New Zealand stroke patients treated with i.v. thrombolysis are required to be entered into an online national database. Clinical leads at each hospital record data that includes patient demographics, complications, 7-day outcomes, and use of idarucizumab prior to thrombolysis.

**Results:** Between 1st January and 31st December 2018, 766 patients were treated with i.v. thrombolysis. Idarucizumab was used prior to thrombolysis in 46 (6%) patients (median 72 years, IQR 62–81), of whom 7 went on to have thrombectomy. Idarucizumab treated patients had slower door-to-needle times (median 59 minutes, IQR 40–85 versus 81 minutes, IQR 54–111; p = 0.0002). Symptomatic intracerebral hemorrhage occurred in one (2.2%) of the idarucizumab treated patients and 35 (4.8%) of the other thrombolyzed patients (p = 0.34). No patient had a myocardial infarction or significant thrombotic complication, but one idarucizumab patient had a cardiac arrest 40 minutes after thrombolysis, with extensive cerebral infarction requiring hemisplenectomy. At seven days, 3 (6.5%) idarucizumab and 57 (7.9%) of the other thrombolyzed patients had died (p = 0.48).

**Conclusions:** Idarucizumab was used to reverse the effects of dabigatran in 6% of all thrombolyzed patients in a national cohort over 12 months. Idarucizumab treatment resulted in a 22-minute door-to-needle time delay but appeared to be safe with similar clinical outcomes to routinely managed patients. Idarucizumab can facilitate thrombolysis in stroke patients taking dabigatran.

**Trial registration number:** N/A

**AS05-055****THROMBOLYSIS IN STROKE MIMICS. A 2-YEAR SINGLE-CENTER RETROSPECTIVE ANALYSIS**

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**Background and Aims:** The urgency of intravenous thrombolysis (IVT) in acute ischemic stroke (AIS) can lead to inadvertent treatment of patients with conditions mimicking stroke, increasing the risk of hemorrhage without potential benefit. Our objective was to characterize stroke mimics (SM) and to determine safety and outcome of IVT in SMs.

**Methods:** We retrospectively analysed all IVT cases of 2017 and 2018. Diagnosis of SM was based on negative neuroimaging and alternative final clinical diagnosis. Demographic attributes, severity of neurological signs on admission, hemorrhagic complications and functional outcome at discharge were compared between thrombolysed AIS and SM patients.

**Results:** 23 out of 188 IVT cases (12%) had a final diagnosis other than stroke. The most common causes of SM were convulsion, complicated migraine and conversion disorder. SM patients were younger and had less severe symptoms and better functional outcome. Majority of SMs were functionally independent at discharge. None of the SMs developed intracerebral hemorrhage (ICH) or major extracranial bleeding (ECB).

	AIS, n = 165	SM, n = 23	p value
Age [years]	68 ± 12	60 ± 18	0.041
Female/Male [n/n]	68/96	12/11	0.375
Mean NIHSS	8 ± 5	5 ± 4	0.005
modified Rankin scale 0 [%]	20	57	0.005
Favorable functional outcome (mRS 0–1) [%]	45	74	0.013
ICH [n (%)]	17(10)	0(0)	0.234
Symptomatic ICH [n (%)]	4(2)	0(0)	1
Minor ECB [n (%)]	10(6)	3(13)	0.201
Major ECB [n (%)]	1(1)	0(0)	1

**Conclusions:** Our data support the safety of IVT in SMs. Our results suggest that patients with stroke symptoms who may represent SM should not be denied IVT on the basis of safety concerns.

**Trial registration number:** N/A

**AS05-049****DOES CEREBRAL REPERFUSION IS EFFICACY IN “REAL WORLD” SCENARIO IN A LOW-MIDDLE-INCOME COUNTRY? 8-YEARS LARGE COHORT RESULTS**

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**Background and Aims:** Worldwide, cerebral reperfusion is a reality and a economic challenge. “Real world” data for intravenous thrombolysis (IVT) and intra-arterial thrombectomy (IAT) from low-middle-income countries is scarce. Objective: We aim to know the survival and functional status one year after a severe ischemic stroke who underwent cerebral reperfusion in Brazil.

**Methods:** We extracted the data of 917 severe IS, who were cared at Hospital São José, from 2010 to 2017, Joinville city. The outcomes were compared between patients who underwent IVT (2010-2011; 4.5 h time-window) or patients who underwent IAT (2012-2017; 6 h time-window) with patients who did not receive cerebral reperfusion (NCR). We performed an adjusted Kaplan Meier survival curve over one year. The 1-y functional status were measured by Rankin scale with an ordinal shift analysis.

**Results:** The cohort had 917 severe IS. One year after stroke ictus, 60 % (372/619) for NCR group died, 42 % (65/155) for IVT group and 35 % (16/46) for IAT group. Compared with NCR group, the 1-year the adjusted probability of death was 50 % lower for those submitted to IAT (HR: 0.5, 95% CI, 0.3-0.8) and 40 % lower for those submitted to IVT (HR: 0.6; 95% CI, 0.5-0.8). Among 464 survivors, the adjusted ordinal relative risk of dependency was 68% lower for IVT group (RR 0.32; 95% CI: 0.20-0.52) and 72 % for IAT group (RR: 0.28; 95%CI: 0.13-0.59).

**Conclusions:** One year after a severe IS, the prognosis of patients who received cerebral reperfusion were clearly better in Joinville, Brazil.

**Trial registration number:** N/A

**AS05-009****ETIOLOGIC DIAGNOSIS OF ACUTE CEREBRAL INFARCT USING CLOT IMAGING AND MACHINE LEARNING TECHNIQUES**

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**Background and Aims:** Clot characteristics can provide information on the cause of cerebral artery occlusion and may guide acute revascularization and secondary prevention strategies. We developed a rapid automated clot analysis system using machine learning (ML) and validated its accuracy in patients undergoing endovascular treatment.

**Methods:** Pre-endovascular treatment gradient echo (GRE) images from consecutive patients with middle cerebral artery occlusion were utilized to develop and validate an ML system to predict whether atrial fibrillation (AF) was the underlying cause of ischemic stroke. The accuracy of the ML algorithm was compared with that of visual inspection by neuroimaging specialists for the presence of blooming artifact. Endovascular procedures and outcomes were compared in patients with and without AF.

**Results:** Of 67 patients, 29 (43.3%) had AF. Of these, 13 had known AF and 16 were newly diagnosed with cardiac monitoring. By visual inspection, interrater correlation for blooming artifact was 0.73 and sensitivity and specificity for AF were 0.79 and 0.63, respectively. For AF classification, the ML algorithms yielded an average accuracy of >75.4% in 5-fold cross-validation with clot signal profiles obtained from 52 patients and an area under the curve >0.87 for the average AF probability from five signal profiles in external validation ( $n = 15$ ). Absence of AF was associated with increased number of passes by stentriever, high reocclusion frequency, and additional use of rescue stenting and/or glycogen IIb/IIIa blocker for recanalization.

**Conclusions:** ML-based rapid clot analysis is feasible and can identify AF with high accuracy, enabling selection of endovascular treatment strategy.

**Trial registration number:** N/A

rates with a temporal resolution down to the minute, supporting a continuous focus on reducing DTN times in clinical practice.

**Trial registration number:** N/A

## WITHDRAWN

### AS05-064

#### THE EFFECT OF DELAYS IN DOOR-TO-NEEDLE TIME ON SURVIVAL, OBSERVATIONS FROM THE NATIONAL SWEDISH STROKE REGISTER

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**Background and Aims:** Intravenous thrombolysis is a well-established treatment for patients with acute ischemic stroke, and shows better outcomes the sooner it is given. Most studies so far have looked at fixed time intervals, such as 3 and 4.5 hours. Our aim was to quantify the effect on survival for each minute delay to thrombolysis.

**Methods:** Our nationwide registry-based study included 15600 adult ( $\geq 18$  years) patients with ischemic stroke receiving thrombolysis from 2010–2017. The exposure was door-to-needle (DTN) time measured as minutes. Outcomes were survival at 7- and 90 days. Analyses of patient characteristics were followed by unadjusted- and adjusted analyses of the outcomes, including a wide array of confounders.

**Results:** Mean DTN time was 55 minutes, mean age 72 years, mean NIHSS 9 and 56% were men. Overall survival was 95% at 7 days and 88% at 90 days. The unadjusted analyses showed a linear relationship between DTN time and survival. The adjusted analyses showed that each minute delay in DTN time on average reduced survival by 0.5% at 7 days (OR 0.995, 95% CI 0.992-0.998), and by 0.4% at 90 days (OR 0.996, 95% CI 0.994-0.998).

**Conclusions:** Our study confirms previous studies by showing that timely thrombolysis is essential in achieving better outcomes for stroke patients. It also brings new knowledge by showing changes in survival

### AS05-022

#### INTRAVENOUS THROMBOLYSIS IN ACUTE ISCHEMIC STROKE IN BAB EL OUED UNIVERSITY HOSPITAL: OBSTACLES AND SOLUTIONS

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**Background and Aims:** Different obstacles are perceived to administer intravenous thrombolysis (IVT) in acute ischemic stroke (AIS). Some of them are specific to Algeria. The rate of IVT in AIS in Bab El Oued University Hospital is < 2%. We aim to identify the causes of this low rate and propose solutions to improve it.

**Methods:** We conducted a prospective observational study at Bab El Oued University Hospital between April 2017 and October 2018. This study included 415 acute stroke patients admitted to the hospital. A standardized questionnaire was administered for all patients. The eligibility of patients with early presentation for IVT was judged according to standard guidelines. We identified causes of delayed presentation of patients and obstacles to IVT.

**Results:** 290 patients (70%) arrived at hospital after 4.5h from onset. The main causes of delayed presentation were: ignorance of patients and their relatives about symptoms of stroke or acute intervention for stroke 184/290 (63%), and misdiagnosis or non-directing to acute intervention by the first physician examining patient 90/290 (31%). 68 patients (16%) arrived within 4.5h from onset, only 23 patients were thrombolysed. Missing the therapeutic window was the main cause of non eligibility of AIS patients for IVT.

**Conclusions:** A comprehensive action plan based on public awareness and training program for hospital staff must be a priority to improve the rates of IVT in AIS patients admitted in the emergency room of Bab El Oued University Hospital.

**Trial registration number:** N/A

## AS05-069

### OBSERVER AGREEMENT ON THROMBOLYSIS TREATMENT DECISION IN PATIENTS WITH PERfusion DEFICIT DETECTED BY CTP

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**Background and Aims:** The role of CTP in thrombolysis treatment decisions is uncertain. We used an online platform to assess observer agreement on thrombolysis decisions in patients with different perfusion deficits.

**Methods:** We selected 24 cases from the IST-3, ATTEST and POSH studies to illustrate various clinical and imaging scenarios. Observers were presented with short clinical vignettes with non-contrast CT, maps of cerebral blood volume and flow, mean transit time, delay time and thresholded maps dichotomised into penumbra and core. A structured questionnaire asked observers to categorise perfusion deficits, and on whether to give thrombolytic therapy. We assessed observer agreement with Krippendorff's-alpha. Univariate predictors of thrombolysis were entered into a multivariate regression analysis.

**Results:** 29 observers contributed 318 treatment decisions. Thrombolysis was recommended in 204 (65%). The most common reason to withhold treatment was perfusion deficit being too extensive (29%). Overall agreement on treatment decisions was low ( $k$ -alpha = 0.10, 95% CI-0.01-0.20). Univariate factors significantly associated with a decision to give IV rtPA included NIHSS between 5 and 15, time to scan < 3 hours, more experience with perfusion imaging and perfusion imaging showing predominantly penumbra[KM2]. In a multivariate model, these factors accounted for 30% of variation in treatment decision (Hosmer and Lemeshow Test = 0.35, Nagelkerke R2 = 0.29) with perfusion deficit being mainly penumbra and more experience with perfusion imaging remaining significant.

**Conclusions:** Agreement on treatment decisions in clinical scenarios with accompanying CTP was low, and while the proportions of core and penumbra were significantly associated with treatment decisions, these factors explained only 30% of variation in decisions

**Trial registration number:** N/A

## AS05-056

### PREDICTORS OF LONG-TERM OUTCOME IN PATIENTS WITH BASILAR ARTERY OCCLUSION – A SINGLE CENTER STUDY

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**Background and Aims:** Basilar artery occlusion (BAO) is a fatal disease despite recanalization techniques and limited data is available of the factors predicting outcome.

**Methods:** Data of 100 patients treated with BAO was collected prospectively between 2004 and 2018. Risk factors, neurological status, outcome (case fatality, 3-months-mRS, one-year-survival); cranial CT (posterior circulation ASPECT score), result of CT angiography; and the treatment modality was given.

**Results:** Average age was  $64.9 \pm 13.7$  years, 54% male. The most remarkable risk factor was previous stroke (29%), 55% of it vertebrobasilar (58% mortality). The onset to treatment time was  $4.23 \pm 2.85$  hours. The pc-ASPECT score was 10 in 67%,  $\leq 7$  points 33%. BAO was in the proximal part in 17%, in half in 20%, total in 21% and only the top in 42%; respectively within its group the mortality was 53%, 45%, 62%, 38%. Intravenous thrombolysis happened in 43%, intraarterial in 27%, combined therapy in 18% and 12% was treated conservatively. Case fatality within the treatment group was respectively: 48.8%, 55.5%, 33.3%, and 66.6% ( $p = 0.8$ ). Symptomatic haemorrhage was not different among the recanalization groups ( $p = 0.83$ ). Total or partial recanalization was achieved in 39%. There was a favourable trend in the recanalization rate of intraarterial and combined groups ( $p = 0.4$ ). At 3 months 23% had mRS 0–2, 3–5 42%, 58% were dead. At one year 26% was alive.

**Conclusions:** The top occlusion of the BA, combined therapy may influence favourably the outcome. Among the risk factors previous VB stroke has a high impact.

**Trial registration number:** N/A

## AS05-059

### CLINICAL FACTORS ASSOCIATED WITH DOOR-TO-NEEDLE TIME $\leq 60$ MINUTES IN REPERFUSION TREATMENT PATIENTS IN PARAGUAY. A MULTICENTER EXPERIENCE.

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**Background and Aims:** Reducing in-hospital delays has been related to increase the chances to achieve a good outcome in reperfusion treatment patients. In Paraguay, stroke is the fourth-leading cause of death. Our aim is determine clinical factors associated with in-hospital interval times in a south-american population

**Methods:** Observational, multicenter study. Data was collected from a stroke reperfusion treatment registry in Paraguay, from January-2015 to November-2018. An univariate and multivariate analysis was performed to determine clinical factors associated with in-hospital interval times in reperfusion treatment patients.

**Results:** From 92 patients treated with iv-tPA, 42% were women, the mean age was 64.4 years-old ( $SD \pm 12.1$ ), the median baseline NIHSS was 17(IQR 10–21). Symptomatic hemorrhagic transformation was observed in 4 cases (4.3%). Interval in-hospital interval times were; Door-to-CT time: mean minutes 34.4( $SD \pm 27.2$ ), Door-to-needle time (DTN): mean minutes 65.1( $SD \pm 39.2$ ). The proportion of patients with a DTN-time  $\leq$  60 minutes was 59.7%. Univariate analysis, non-Atrial Fibrillation status (66.3%Vs.35.4% $p = 0.04$ ), non-cardioembolic source (74.3%Vs.39.2% $p = 0.004$ ), and higher baseline NIHSS (median 17Vs.13  $p = 0.025$ ) was associated with a DTN-time  $\leq$  60 minutes. In a multivariate analysis, adjusted to age, atrial fibrillation status, cardiembolic/non-cardioembolic source, and baseline NIHSS has shown that non-cardioembolic source ( $p = 0.04$ , OR:4.08 CI95%:1.05-15.8) and baseline NIHSS ( $p = 0.03$ , OR:0.902 CI95%:0.821-0.991) as independent variables associated with a DTN-time  $\leq$  60 minutes.

**Conclusions:** In Paraguay, the proportion of patients treated with a DTN-time  $\leq$  60 minutes is according to the guidelines. A higher baseline NIHSS, and curiously, non-cardioembolic source has been independent variables related to DTN-time  $\leq$  60 minutes. These findings related with the stroke source deserve further studies.

**Trial registration number:** N/A

## AS05-048

### CAN A MULTI-COMPONENT MULTIDISCIPLINARY IMPLEMENTATION PACKAGE CHANGE PHYSICIANS' AND NURSES' PERCEPTIONS AND PRACTICES REGARDING THROMBOLYSIS IN STROKE? AN EXPLORATORY ANALYSIS OF A CLUSTER RANDOMIZED TRIAL

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**Background and Aims:** The Thrombolysis ImPlementation in Stroke (TIPS) trial tested the effect of a multi-component, multidisciplinary, collaborative intervention designed to increase the rates of intravenous thrombolysis. This study will investigate the self-reported perceptions and practices of physicians and nurses working in the participating hospitals.

**Methods:** A survey was administered during the pre- and post-intervention periods to staff from 20 Australian hospitals participating in the TIPS trial. An exploratory factors analysis was undertaken to identify the underlying structure and linear mixed modelling was applied to explore the differences between groups' survey responses over time.

**Results:** Eighteen hospitals participated in both surveys with a response rate of 45%. Identified survey domains were: 1. Hospital performance indicators, feedback and training; 2. Personal perceptions about the thrombolysis evidence base and its implementation; 3. Personal stroke skills and hospital stroke care policies 4. Emergency and ambulance procedures. Domain 1 and Domain 2 score showed a significant increase of 0.2149 (95% CI: 0.0863; 0.3435;  $p < 0.01$ ) and 0.2098 (95% CI: 0.0564; 0.3631;  $p < 0.05$ ) respectively from pre- to post-intervention for the intervention hospitals compared to control hospitals. Sub-group analysis showed the improvements were restricted to nurses' responses only.

**Conclusions:** This thrombolysis implementation package resulted in an improved change in the physicians and nurses perceptions towards

hospital performance indicators, feedback and training and perceptions towards intravenous thrombolysis evidence base and its implementation. However, the result is challenged by the nurses' improvements only and therefore, highlights the need for further evaluation to develop a better and sustainable package for the future.

**Trial registration number:** ACTRN12613000939796, UTN: U1111-1145-6762

## AS05-027

### ALCOHOL INTOXICATION AS A STROKE MIMIC AND THE INCIDENCE OF ACUTE ALCOHOL INTOXICATION IN STROKE

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**Background and Aims:** Alcohol intoxication can be a posterior circulation stroke mimic (SM) as they share symptoms such as dysarthria, gait disturbances and nystagmus. We describe alcohol intoxication as a SM and the frequency of acute alcohol intoxication among stroke patients.

**Methods:** Prospective observational single-center study (2014-2017, HagaZiekenhuis, the Hague). In all patients  $>$  16 years presenting as a possible acute stroke within 6 hours of onset, blood ethanol was measured. A level of  $> 0.1$  mmol/L was considered elevated.

**Results:** In total 974 patients were included: 60 (6%) had elevated blood ethanol (mean: 1.3 mmol/L). In 180/974 (18%) a SM was diagnosed: 12 were due to alcohol intoxication (1% of total cohort, 7% of SM, mean ethanol level: 2.2 mmol/L). Half of these patients denied or downplayed their alcohol consumption.

Stroke and concurrent alcohol intoxication occurred in 38/794 strokes (5%, mean ethanol level: 1.1 mmol/L). Compared to other stroke patients, these 38 patients presented more often after working hours (mean 6.38pm versus 2.23pm) and received alteplase and endovascular therapy less often (24% versus 43%,  $p = 0.018$  and 3% versus 10%,  $p = 0.241$ , respectively).

**Conclusions:** Of all patients presenting as a possible acute stroke, 6% also drank alcohol. 18% of the whole cohort was diagnosed with a SM. Acute alcohol intoxication as sole diagnosis was diagnosed in 1% of the total cohort and 7% of SM, half of these patients denied or downplayed their alcohol consumption. 5% of all stroke patients also drank alcohol and they were significantly less likely to receive alteplase or endovascular treatment.

**Trial registration number:** N/A

## AS05-035

### OUTCOME OF THROMBOLYSIS AT 0-3 OR 3-4.5 HOURS AFTER ACUTE ISCHAEMIC STROKE – AN ANALYSIS OF OUTCOMES OVER 6 YEARS IN A REGIONAL NEUROSCIENCE CENTRE

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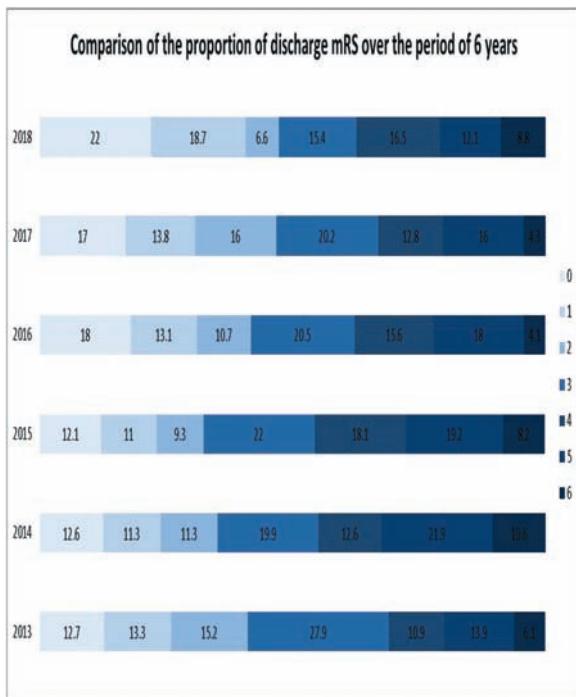
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**Background and Aims:** Intravenous thrombolysis within 4.5 hours from symptom onset for ischaemic stroke is a well-established treatment. We assessed our local performance over six years against published data.

**Methods:** We interrogated our cases submitted to the UK national database (SSNAP) identifying all patients thrombolysed between 01/13 and 02/18. Patients undergoing mechanical thrombectomy were excluded. We compared outcomes between the 0-3 and 3-4.5 hour groups using discharge modified Rankin Scale (mRS), 24 hour significant neurological improvement (National Institutes for Heath Stroke Scale (NIHSS)

improvement  $\geq 8$ , or = 0–1) or rate of symptomatic intracranial haemorrhage (sICH). In addition we compared our outcomes against published data.

**Results:** Over six years, 806 patients received thrombolysis: 618 < 3 hours and 188 between 3–4.5 hours. The two groups were similar in age, gender, baseline mRS, except the 0–3 hour group's baseline NIHSS was higher (9[5,17] vs. 8[5,14];  $p=0.03$  Mann-Whitney-U). Discharge mRS, 24-hour improvement & sICH were similar between groups. Patients >80 fared worse than younger patients in both 0–3 and 3–4.5 hour groups in discharge mRS ( $p=0.003$ , 95%CI [0.16–0.78];  $p=0.051$ , 95%CI [-0.002–1.1] respectively). Over 6 years, the proportion of patients with mRS 0–1 at discharge increased slightly (Figure).



**Conclusions:** In our centre, patients receiving IV thrombolysis within 0–3 hours and 3–4.5 hours from symptom onset had similar outcomes with improvement in our performance over six years. Our outcomes appear inferior to published data, most likely as we used discharge mRS as a marker of outcome and not 3-month mRS, which was not available.

**Trial registration number:** N/A

## AS05-062

### IDARUCIZUMAB IN ACUTE ISCHEMIC STROKE PATIENTS TREATED WITH THROMBOLYSIS: SINGLE CENTER EXPERIENCE

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**Background and Aims:** Patients with acute ischemic stroke anticoagulated with dabigatran may be candidates for intravenous thrombolysis (IV-tPA) after idarucizumab administration followed by normalization of coagulation parameters. We report the case series of acute ischemic stroke patients focusing on laboratory findings.

**Methods:** We identified consecutive idarucizumab-treated patients with acute ischemic stroke and atrial fibrillation. Neurologic deficit was

measured by the National Institutes of Health Stroke Scale (NIHSS) and 90-day modified Rankin Scale (mRS). The anticoagulant effect of dabigatran and its reversal by idarucizumab was assessed by measuring activated partial thromboplastin time (aPTT), thrombin time (TT) and diluted thrombin time (dTt). The safety outcome was symptomatic intracranial hemorrhage (sICH) defined according to ECASS III study.

**Results:** We enrolled 5 IV-tPA-treated patients (40% female, mean age  $70 \pm 9.7$  years, admission median NIHSS 7, IQR 7) after administration of 5g idarucizumab. Treatment with 150mg dabigatran was confirmed in 2 patients (40%). After idarucizumab, laboratory tests in 3 patients (60%) resulted in the immediate reversal of dabigatran anticoagulant activity and 2 patients (40%) had prolonged TT (26s and 25s). In all cases IV-tPA continued. Post-treatment CT in patients with prolonged TT did not reveal any intracranial hemorrhage. 3 patients (60%) had 90-day mRS 0–2, neurologic improvement of  $\geq 4$  in NIHSS score at discharge was confirmed in 3 patients (60%).

**Conclusions:** Our small single center experience supports the eligibility of IV-tPA after idarucizumab even in patients with persistent slight elevation of TT. Safe upper limit of TT has to be determined in larger series.

**Trial registration number:** N/A

## AS05-053

### THE USE OF EX VIVO CLOT LYSIS ASSAY FOR PREDICTING OUTCOMES IN ACUTE ISCHEMIC STROKE PATIENTS WHO UNDERWENT INTRAVENOUS THROMBOLYSIS

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**Background and Aims:** The outcome of intravenous thrombolysis using recombinant tissue plasminogen activator (rtPA) is favorable in only 33–35% of acute ischemic stroke (AIS) patients. We tested whether an ex vivo clot-lysis assay performed before thrombolysis might predict therapy outcomes.

**Methods:** Blood samples of 139 consecutive AIS patients, who underwent intravenous thrombolysis, were taken before thrombolysis. Platelet-poor-plasma was clotted using recombinant tissue factor, then lysis was induced with rtPA. Clot formation and lysis was monitored by turbidimetry in real time. In order to test the impact of neutrophil extracellular traps on lysis, assays were also performed in the presence of cell-free-DNA and histone. Stroke severity was determined by NIHSS on admission. Short- and long-term outcomes were defined at 7 days and 3 months post-event according to the change in NIHSS and by the modified Rankin Scale, respectively.

**Results:** The median time to reach 50% lysis (50%CLT) was 47.3 (IQR:35.0–64.0) min in the total cohort, and became significantly prolonged in the presence of DNA and histone. A dose-response relationship was observed between stroke severity and 50%CLT. Patients with favorable short-term outcome had significantly shorter 50%CLT in the presence of DNA and histone as compared to patients with worse outcomes (median:50.6 (IQR:36.8–70.5) min vs. 62.0 (IQR:45.0–74.7) min;  $p < 0.05$ ). Long-term outcomes and occurrence of post-lysis hemorrhage showed no association with clot-lysis assay results.

**Conclusions:** Clot-lysis assay using plasma of AIS patients taken before thrombolysis might be useful to predict short-term outcomes, but showed no association with hemorrhagic complications and long-term outcomes. Funding: GINOP-2.3.2-15-2016-00043, NKFI-K120042

**Trial registration number:** N/A

## AS05-071

### SAFETY AND OUTCOMES OF IV TENECTEPLASE IN ACUTE ISCHEMIC STROKE : POST APPROVAL EXPERIENCE FROM TERTIARY CARE HOSPITAL IN INDIA

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**Background and Aims:** IV rtPA is currently the only thrombolytic approved for use in acute ischemic stroke (AIS) within 4.5 hours. Ongoing trials are testing efficacy of IV Tenecteplase (TNK). However, TNK has been approved in India for use in AIS within 3 hours (0.2mg/kg-Max 20mg). We describe the experience of TNK following approval in 2016 from a tertiary care center.

**Methods:** AIS patients admitted in PGIMER Emergency from April 2017 to January 2018 and administered IV TNK were included. Patients fulfilled the standard inclusions and exclusions to thrombolysis. Baseline NIHSS, proportion of patients with improvement of >4points at 24 hours, proportion of patients with modified Rankin Scale (mRS) 0–2 at 3 months was calculated. Safety was assessed from symptomatic intracerebral hemorrhage (SICH) rates as per SITS-MOST definition. Secondary efficacy measure was recanalisation rates at 24 hours of treatment.

**Results:** 38 patients with AIS were recruited. Mean age was 55 and 68 % were males. Baseline Median NIHSS was 13, door to CT time and door to needle times were 11 and 50 minutes respectively. Median ASPECT was 7 and 18 (47.3%) had major intracranial artery occlusion. 35% patients had >4 point NIHSS improvement at 24 hours. 3 patients (7.9%) had mRS 0–2 at 1 months while the rest had mRS 3 – 5. 5 patients died (13.1%) and 1 patient had a SICH. 7(18.4%) achieved recanalisation.

**Conclusions:** IV TNK at dose of 0.2mg/kg within 3 hours of AIS although is safe but associated with poor outcomes and recanalisation rates in majority patients. Trial results should be awaited before approval of TNK as an economical alternative.

**Trial registration number:** NA

## AS05-034

### MECHANICAL THROMBECTOMY IN ACUTE ISCHEMIC STROKE PATIENTS WITH A LEFT VENTRICULAR ASSIST DEVICE: A MULTI-CENTER STUDY

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**Background and Aims:** As the number of patients with left ventricular assist device (LVAD) implantation has been increasing, an LVAD-related ischemic stroke is becoming a critical issue. We thought to clarify the features of mechanical thrombectomy in LVAD-related stroke with large vessel occlusion.

**Methods:** In a multi-center, retrospective case-control study, we compared 20 LVAD-related strokes with 33 non-LVAD strokes, all of which had large vessel occlusion in anterior circulation treated with mechanical thrombectomy. A comparative histopathological examination of the retrieved thrombi was also performed.

**Results:** Successful reperfusion was achieved in 75% of LVAD-related strokes and the median National Institutes of Health Stroke Scale score improved from 17 to 6 at 24 hours. Compared with non-LVAD strokes, the time from onset to reperfusion was similar, but total number of device passes required for reperfusion (median, 2.5 vs 1,  $P=0.01$ ), and incidences of post procedural parenchymal and subarachnoid hemorrhage (25% vs 3%,  $P=0.02$  and 55% vs 15%,  $P=0.01$ ) were higher in LVAD-related strokes. A symptomatic intracranial hemorrhage occurred in 4 patients (20%) of the LVAD-related strokes. The histopathological analysis revealed that the ratio of platelet and fibrin component was significantly higher in thrombi retrieved from LVAD-related patients than in those from non LVAD patients ( $75 \pm 7\%$  vs  $52 \pm 4\%$ ,  $P=0.01$ ).

**Conclusions:** Mechanical thrombectomy is feasible in patients with LVAD-related stroke. However, repetitive device passes may be required to achieve successful reperfusion because of the structurally organized thrombi, and the higher risk of hemorrhagic complications should be considered, while offering this therapeutic alternative.

**Trial registration number:** N/A

## AS05-060

### DISPARITIES IN THE USE OF INTRAVENOUS T-PA AMONG ISCHEMIC STROKE PATIENTS: POPULATION-BASED RECENT TEMPORAL TRENDS

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**Background and Aims:** To explore a 5-year comparison of disparities in intravenous t-PA use among acute ischemic stroke (AIS) patients based on race, gender, age, ethnic origin, hospital status, and geographic location.

**Methods:** We extracted patients' demographic information/hospital characteristics for 2010 and 2014 from the population-based New York Statewide Planning and Research Cooperative System (SPARCS). We compared disparities in t-PA use among AIS in 2010 and 2014 to estimate temporal trends. Multiple logistic regression was performed to compare disparities based on demographic variables, hospital stroke center designation, insurance status, and geographic location within New York State (NYS).

**Results:** There was a 1.9% increase in t-PA from 2010 (4.9% in 32,546 stroke-related discharges) to 2014 (6.8% in 33,190 stroke-related discharges),  $p < 0.0001$ . Blacks were 15% less likely to receive t-PA compared to whites in 2014 (OR 0.85, 95%CI 0.75,0.96), without a difference in 2010. Patients aged 62–73 (second quartile) had lower odds of receiving t-PA than those  $\leq 61$  years old in 2010 (OR 0.74 95%CI 0.62,0.87) and 2014 (OR 0.78, 95%CI 0.68,0.89). Designated stroke centers (2010:

88/197; 2014: 94/198) in lower NYS were associated with lower odds of t-PA use in 2010 while those in upper NYS were associated with increased odds of t-PA in 2010 and 2014 compared to non-designated hospitals. Gender, ethnic origin, and insurance status were not associated with t-PA utilization in either year.

**Conclusions:** NYS t-PA utilization increased between 2010 and 2014. Disparities in t-PA use include race, age, hospital geography and stroke designation status. Variables influencing these disparities require study.

**Trial registration number:** N/A

## AS05-010

### EARLY POST-STROKE SEIZURES FOLLOWING THROMBOLYSIS AND/OR THROMBECTOMY FOR ACUTE STROKE: CLINICAL AND STROKE CHARACTERISTICS

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**Background and Aims:** We explored the clinical and stroke characteristics of patients treated with thrombolysis and/or mechanical thrombectomy for an acute stroke and experiencing early post-stroke seizures within 7 days of the cerebrovascular accident.

**Methods:** Patients with prior epilepsy, primary intracerebral hemorrhage or transient ischemic attacks, and taking antiepileptic drugs were excluded.

**Results:** We retrospectively identified 32 patients admitted between 2010 and 2016 (mean age 75 years; range: 49–90; 14 females and 18 males). Most patients did not have a prior history of stroke (18; 56.3%), alcoholism (30; 93.8%) or diabetes (19; 59.4%); did not take statins (19; 59.4%) or anticoagulants (29; 90.6%); had a diagnosis of hypertension (30; 93.8%). Half of them (16; 50%) was treated with antiplatelet agents. 71.9% of strokes (23) had a cortical involvement, 12.5% (4) were subcortical and 15.6% (5) lacunar. Median NIHSS- and Rankin-score on admission were 12 and 4, respectively. 25 patients were treated with intravenous and 7 with intra-arterial thrombolysis, whereas 16 underwent thrombectomy. An hemorrhagic transformation occurred in 7 (21.9%) patients, and an hemorrhage following thrombolysis in 6 (18.8%). Focal-onset aware seizure (not secondarily generalized) was the most frequent seizure type (43.8%), followed by primarily generalized (40.6%), and focal unaware seizure (9.4%). No case of status epilepticus was observed. The median time between stroke and seizure occurrence was 2 days; in 75.9% of cases seizures occurred within the first 3 days.

**Conclusions:** Early post-stroke seizures are associated with cortical stroke involvement, are usually focal without impairment of awareness, and occur mostly within the first 3 days.

**Trial registration number:** N/A

## AS05-011

### INTRAVENOUS THROMBOLYSIS WITH T-PA AND CORTICAL INVOLVEMENT INCREASE THE RISK OF EARLY POST-STROKE SEIZURES: RESULTS OF A CASE-CONTROL STUDY

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**Background and Aims:** Aim of this study was to identify risk factors for early post-stroke seizures (PSS) in patients with acute ischemic stroke.

**Methods:** We undertook a case-control study at a single stroke center. Patients with seizure occurring during the first 7 days following ischemic stroke admitted at our stroke center between 2010 and 2016 were retrospectively identified and matched with controls on age and gender. We included 79 cases and 158

**Results:** Blood sugar levels on admission, stroke localization, NIHSS- and Rankin score, and intravenous (i.v.) thrombolysis with rtPA were statistically associated with early PSS in univariate analysis. Multiple logistic regression after forward and backward variable selection identified cortical stroke localization (OR 2.49; 95% CI 1.35 to 4.59; p = 0.003) and intravenous thrombolysis (OR 2.26; 95% CI 1.16 to 4.43) as being independently associated with occurrence of early PSS. Accordingly, the predicted risk of early PSS in stroke patients with cortical involvement and i.v. thrombolysis is 57%, whereas the risk in subcortical or lacunar stroke not treated with thrombolysis is 19%.

**Conclusions:** Cortical involvement and i.v. thrombolysis are independent risk factors associated with the occurrence of early PSS. This association is not explained by age or gender, concomitant drugs, diabetes or alcoholism, sodium and cholesterol levels, blood pressure on admission, stroke etiology or severity, and hemorrhagic transformation or hemorrhage following i.v. thrombolysis. Our results are consistent with those of a previous case-control study conducted in a smaller population. Further prospective studies are required to fully elucidate the association between i.v. thrombolysis and early PSS.

**Trial registration number:** N/A

## AS05-023

### THROMBOLYSIS FOR ACUTE STROKE ON A LOCAL HOSPITAL IN COLOMBIA

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**Background and Aims:** The access to thrombolytic therapies for ischemic stroke is still very limited in countries such as Colombia, the implementation of specific programs for early reperfusion therapies improves stroke's outcomes in the short and long term.

Nariño is located at south of Colombia and The Hospital Universitario Departamental de Nariño is the main reference institution for predominantly low-income rural 1.7 million inhabitants. The Stroke's reperfusion program started in 2014, and with help of Angels Initiative has been improving the possibility of better stroke care for region.

**Methods:** A retrospective study was conducted with all ischemic stroke patients who received intravenous thrombolysis. Normality distribution was tested with Shapiro-Wilk's test. Descriptive statistics were used; Differences were analyzed with  $\chi^2$  or Fisher's exact test or T student where appropriate. p Values < 0.05 were considered statistically significant. Analyses were done with SPSS V20.0

**Results:** Thirty-five patients were evaluated, 57.1% improved after successful thrombolysis, Three patients required additional thrombectomy. 7 patients had some Haemorrhage Post-Thrombolysis (20%), and 4 died. (table 1 )

Patients with better ambulatory functionality (mRS 0–2) had lower initial NIHSS and improved at least 3 points in NIHSS with rTPA, and patients with worst functionality ( mRS 3–6 ) were more associated with Haemorrhage Post-Thrombolysis ( table 2 )

**Conclusions:** The implementation of stroke care program, a network of attention, as well as ongoing training with medical staff and community, have been improving the possibility of access to reperfusion therapies and better standards of stroke care in developing regions.

**Trial registration number:** N/A

**AS05-047**

## INTRAVENOUS THROMBOLYSIS IN PATIENTS WITH RECENT MYOCARDIAL INFARCTION PRESENTING WITH ACUTE ISCHEMIC STROKE: CASE SERIES AND SYSTEMATIC LITERATURE REVIEW

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**Background and Aims:** The safety of intravenous thrombolysis (iv-rtPA) for acute ischemic stroke (AIS) after recent myocardial infarction (MI) is still a matter of debate. We aimed to study the safety of delivering iv-rtPA to AIS patients with a MI within the preceding 3 months.

**Methods:** Retrospective review of consecutive AIS admitted to two university hospitals' stroke units and systematic literature review (PubMed and EMBASE) for AIS patients treated with iv-rtPA and MI in the previous 3 months. Cardiac complications (cardiac rupture/tamponade, intracardiac thrombus embolization or life-threatening arrhythmias) were assessed by type of MI (non-[NSTEMI] or ST-elevation [STEMI]), MI location and time-elapsed between events.

**Results:** Forty-four patients were included, 28 hospital cases and 16 from the literature review. Twenty-two (50%) patients had concurrent events. In the remaining, MI occurred 1-to-63 days before AIS. Twenty-two (50%) patients had STEMI. In this group, MI location was anterolateral in 14 (63.6%) and inferior in 8 (36.4%). No NSTEMI patients had cardiac complications. All patients with cardiac rupture/tamponade ( $n=4$ ) had an anterolateral STEMI, 1-to-7 days before stroke. Only one patient with inferior STEMI, 2-days before stroke, had thrombus embolization. He also experienced a life-threatening arrhythmia. The other two cases of arrhythmia occurred in patients with anterolateral STEMI.

**Conclusions:** In patients with AIS and recent MI, type and location of MI, and time-elapsed between events should be taken into consideration when deciding to deliver iv-rtPA. While recent NSTEMI or concurrent events seem safe, anterolateral STEMI within the first weeks before stroke should prompt caution.

**Trial registration number:** N/A

**AS05-044**

## OROLINGUAL ANGIOEDEMA AFTER INTRAVENOUS THROMBOLYSIS WITH ALTEPLASE IN ACUTE STROKE: BASELINE FEATURES, MANAGEMENT AND RELATED FACTORS

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**Background and Aims:** Orolingual angioedema (OA) after intravenous thrombolysis with alteplase in acute ischemic stroke is a potentially life-threatening complication. Our objective was to describe the characteristics and management of OA and to identify related factors.

**Methods:** We conducted a retrospective review of patients with ischemic stroke treated with intravenous alteplase in our institution during 8 consecutive years. Patients who developed OA (OA+ group) were recorded. We compared baseline and clinical characteristics of OA+

patients and those who did not develop angioedema (OA-) using bivariate analysis.

**Results:** 512 patients were included. A total number of 7 patients (1,37%) developed OA, which was unilateral in 4 cases (in 3 of them OA was contralateral to an insular ischemic lesion). All OA+ patients had a previous history of hypertension, while in OA- previous hypertension was present in only 58%, [ $p=0.045$ ]. OA was also related with diabetes (OR: 8,98 [CI 95%: 1,72-46,90;  $p=0,008$ ]) and previous treatment with ACE inhibitors (OR: 12,53 [CI 95%: 2,39-65,67;  $p=0,002$ ]). All OA were treated with corticosteroids, antihistamines were used in 3 cases, and icatibant (a novel B2 bradykinin receptor antagonist) was administered to one patient, resulting apparently in a more rapid resolution of the OA. In one case, endotracheal intubation was required due to airway compromise.

**Conclusions:** OA occurred in 1,37% of stroke patients treated with intravenous alteplase in our centre. According to our results, OA seems to be related with previous treatment with ACE inhibitors, history of diabetes and hypertension. Unilateral OA could be associated with contralateral insular involvement.

**Trial registration number:** N/A

**AS05-005**

## ACUTE ISCHEMIC MYELOPATHY TREATED WITH RAPID INTRAVENOUS THROMBOLYSIS: FOUR CASES AND LITERATURE REVIEW

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**Background and Aims:** Intravenous thrombolysis (IVT) is a well-established treatment of ischemic stroke within 4.5 hours. However, its effectiveness in acute ischemic myelopathy (AIM) is unknown.

We describe a series of four AIM patients treated with IVT within 4.5 hours and review the current literature to explore this treatment feasibility, potential safety and efficacy.

**Methods:** We reviewed all routinely collected clinical, radiological and follow-up data of patients with a final AIM diagnosis who received acute IVT in our stroke network. We examined and reviewed thrombolysed AIM patients in the literature.

**Results:** Four patients (3 women) aged 57 to 83 years presented with acute uni- or bilateral extremity paresis, considered initially as cerebral strokes in two of them. After excluding contraindications by brain imaging in three, spinal CT in one and confirmation of AIM on spinal MRI in one patient, IVT was administered at 135, 190, 240 and 245 min. accordingly. Subacute DWI-MRI confirmed AIM in all but one patient who improved most rapidly. Favorable outcome was achieved in two patients rapidly and in three patients at three-month follow-up. We identified five thrombolysed AIM patients in the literature, who showed good recovery and no IVT complications.

**Conclusions:** With appropriate acute imaging, IVT after AIM is feasible and potentially safe within 4.5 hours. Given the likely harm of AIM, thrombolysis seems justifiable and warrants further efficacy and safety studies.

**Trial registration number:** N/A

**AS05-038****THE INFLUENCE OF SEX ON OUTCOMES AFTER INTRAVENOUS THROMBOLYSIS: A QUASI-EXPERIMENTAL STUDY USING THE SOUTH LONDON STROKE REGISTER**

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**Background and Aims:** The influence of gender on outcomes after Intravenous Thrombolysis (IVT) has not yet been established in a real world setting

**Methods:** Data from the population-based South London Stroke Register of first-ever strokes. A quasi-experimental design based on matched propensity scores (PS) was used to assess differences in outcomes between sexes after IVT. PS were estimated with data mining algorithms. Variable ratio matching was performed with an evolutionary search algorithm (GenMatch). Standardised mean differences (<0.25) and variance ratios (0.5-2.0) demonstrated good covariate balance.

**Results:** 311 IVT treated matched to 1,986 controls. Median follow-up 3.1 years. Treated patients were younger ( $68 \pm 15$  vs  $71 \pm 15$ ;  $p = 0.005$ ) and had higher NIHSS (Median [IQR]10 [6 – 18] vs 6 [3 – 12];  $p < 0.001$ ). Multivariable models were adjusted for gender-age interaction, pre-morbid status, stroke severity and risk factors. Female-and-thrombolysis interaction was significant for Barthel Index at five years in proportional logistic regression model (Proportional OR 2.15 [95%CI 1.60-2.90]). Gender-treatment interaction term was significant in Cox regression with robust standard errors adjusted. A Gender-stratified analysis showed HRfemale 0.21 [0.08 – 0.48] and HRmale 0.27 [0.07-0.90]. In an adjusted restricted mean survival time analysis, females gain 1.88 [0.49-3.27] years of life over a ten year period, while males gain 1.70 [0.39-3.00].

**Conclusions:** The results show that women benefit more than men after treatment with IVT. Treatment-sex interactions persist after adjustment for pre-morbid status and stroke severity.

**Trial registration number:** N/A

**WITHDRAWN**

hypertension in 22 patients (61.1%), diabetes in 2(5.6%), dyslipidemia in 5(13.9%), smoking in 11(30.6%), alcohol consumption in 13(36.1%), coronary heart disease in 3(8.3 %), and previous stroke in 5(13.9%). On the basis of NIHSS, 8(22.2%) patients had a mild-stroke, 25(69.4%) had a moderate-stroke, 3(8.3%) had a moderately severe stroke and none had a severe stroke. Sixteen (44.4%) patients had mRS greater than two. Out of 36 thrombolysis cases, 14(38.8%) achieved early major neurological improvement, 4(11.11%) had SICH and there were 3(8.3%) in-hospital mortality.

**Conclusions:** Identification of clinical profile of patients undergoing thrombolysis is important in design of future studies to assess the use of thrombolysis and to identify various prognostic factors.

**Trial registration number:** N/A

**WITHDRAWN****AS05-016****CASE REPORT: IMMEDIATE REVERSAL OF DABIGATRAN WITH IDARUCIZUMAB FOR THE PURPOSE OF SUBSEQUENT INTRAVENOUS THROMBOLYSIS FOR ACUTE ISCHEMIC STROKE.**

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**Background and Aims:** Here reports an immediate reversal of dabigatran with idarucizumab, a humanized monoclonal antibody fragment for dabigatran, for the purpose of subsequent intravenous thrombolysis for acute ischemic stroke led to safe and successful recanalization.

**Methods:**

**Case:** Fifty minutes has passed since 77 year-old woman with hypertension and transient trial fibrillation suddenly fell down. She demonstrated disturbed consciousness, slurred speech, left hemiparesis and unilateral spatial neglect, whose NIHSS scores reached to 12. No early ischemic CT signs provided us clinical diagnosis of cardiogenic embolism in the right frontal lobe, with no other contraindication than her prolonged APTT to 44 seconds and dabigatran 110mg intake 3 hours before. The neutralization of dabigatran by idarucizumab made her APTT returned to 27 sec immediately, when alteplase was started 90 minutes after ictus.

**Results:** A 60-min duration of alteplase infusion mitigated her neurological deficits completely and MRI demonstrated patchy cortical infarcts on the right frontal lobe and patent intracranial vessels. Symptomatic or asymptomatic intracranial hemorrhage was not observed.

**Conclusions:** The latest officially-authorized Japanese clinical guides recommend that thrombolysis can be approved both if the time of the late dose of direct oral anticoagulants exceeds 4 hours and if commonly available anticoagulation markers are normal or subnormal. Even for dabigatran users, if patients does not meet the above criteria, direct mechanical thrombectomy can be considered without idarucizumab or rt-PA, however, alternative option of idarucizumab pretreatment can be applied to the patients who regain eligibility for intravenous thrombolysis, only when thrombectomy cannot be promptly performed. (J Stroke 20;321-331, 2018.)

**Trial registration number:** N/A

**AS05-043**

### NEUTROPHIL-TO-LYMPHOCTYE RATIO AND RESPONSE TO INTRAVENOUS THROMBOLYSIS IN PATIENTS WITH ACUTE ISCHEMIC STROKE

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**Background and Aims:** The Neutrophil-to-Lymphocyte Ratio (NLR) is suggested as a readily available and inexpensive biomarker to predict prognosis of acute stroke. Experience with intravenous (IV) tissue plasminogen activator (tPA) treatment is limited.

**Methods:** 142 (80 female, age:  $69 \pm 13$ yr) consecutive acute stroke patients treated with IV rtPA were enrolled. Admission and 24h lymphocyte, neutrophil and monocyte counts were measured and the NLR was calculated.

**Results:** Average NLR elevated (by  $3.47 \pm 6.75$ ) significantly from admission to 24th hour ( $p < 0.001$ ). 52% of patients exerted good response to IV rtPA, while 27% showed dramatic response. The patients with "thrombolysis resistance" had significantly higher 24h NLR ( $p = 0.001$ ). In the end of 3rd month, 46.5% of patients had favorable (mRS 0–2) and 32.4% had excellent (mRS 0–1) outcome. Patients without favorable/excellent outcome had significantly elevated 24h NLRs. Linear regression analysis indicated that post-tPA NLR, but not admission, was independent negative predictor of excellent ( $b = -0.216$ ,  $p = 0.006$ ) and favorable ( $b = -0.179$ ,  $p = 0.034$ ) outcome after adjustment for age, hypertension and NIHSS. Nine patients developed PH2 had very significantly elevated pre-tPA ( $7.6 \pm 7.39$  vs  $3.33 \pm 3.07$ ,  $p < 0.001$ ) and 24h NLR ( $26.2 \pm 18.6$  vs  $5.78 \pm 4.47$ ,  $p < 0.001$ ). Of note, AUC of ROC curve of NLR failed to detect any reliable threshold for absence of tPA effectiveness/dramatic response, 3rd month good/excellent outcome or any type tPA-induced hemorrhage.

**Conclusions:** As a marker of stroke-associated acute stress response, the NLR, which increases during the first 24 hours, is an epiphomenon of poor prognosis. However, pretreatment NLR values have no importance in predicting IV tPA response.

**Trial registration number:** N/A

**AS05-042**

### PHARMACOLOGICAL MODULATION OF NEUTROPHIL EXTRACELLULAR TRAPS REVERSES THROMBOTIC STROKE T-PA-RESISTANCE

**C. Peña Martínez<sup>1</sup>, V. Durán-Laforet<sup>1</sup>, A. García-Culebras<sup>1</sup>, F. Ostos<sup>2</sup>, A. Pérez-Ruiz<sup>1</sup>, I. Bravo-Ferrer<sup>1</sup>, M. Hernández-Jiménez<sup>1</sup>, F. Ballenilla<sup>3</sup>, J.M. Pradillo<sup>1</sup>, J. Díaz-Juárez<sup>1</sup>, I. Lizasoain<sup>1</sup> and M.A. Moro<sup>1</sup>**

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**Background and Aims:** The obstruction of the blood flow by a thrombus leads to cerebral injury and disability. Therefore, recanalization of the occluded artery is a primary goal in stroke treatment. Unfortunately, endovascular treatment is not always available and t-PA therapy is limited by the narrow therapeutic time window; in addition, the rate of early arterial recanalization after t-PA administration is low especially in the case of platelet-rich thrombi. The exact reasons for this so-called "t-PA resistance" are currently unknown but thrombus composition is believed to play an important role. In this context, neutrophil extracellular traps (NETs) have been implicated in thrombosis, and platelet Toll-like receptor 4 (TLR4) has been related to NETs formation and activation. Therefore, our aim was to study the involvement of NETs on thrombus formation and outcome, and the role of TLR4 in this setting.

**Methods:** To this goal we have used a photothrombotic stroke model in mice, which produces a fibrin-free thrombus composed primarily of aggregated platelets, as well as thrombi obtained from human stroke patients.

**Results:** Our results demonstrate that 1) a late administration of DNase I, that promotes NETs lysis, or a preventive administration of Cl-amidine, that impedes NET formation, reduce infarct volume and improve functional outcome after photothrombotic stroke in mice, 2) platelet TLR4 is implicated in NETs formation after stroke and 3) ex vivo fresh platelet-rich thrombi from ischemic stroke patients are effectively lysed by DNase I.

**Conclusions:** Hence, our data open new avenues for recanalization of platelet-rich thrombi, especially to overcome t-PA resistance.

**Trial registration number:** N/A

**AS05-029**

### INTRAVENOUS TPA AFTER CONE-BEAM CT EVALUATION IN DIRECT TRANSFER TO ANGIO SUITE PATIENTS

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**Background and Aims:** Direct transfer to angio-suite (DTAS) protocols have demonstrated to achieve a significant reduction of in-hospital workflow in patients who undergo endovascular treatment. Applying DTAS protocol implies the indication of intravenous thrombolysis (IVT)

and endovascular treatment based on cone-beam CT. We aimed to assess the safety of IVT following this protocol.

**Methods:** A 1 to 3 case-control study of consecutive DTAS patients treated with IVT after cone-beam CT and matched to 48 IVT treated patients after conventional CT-scan. DTAS protocol included a cone beam CT (X-pert CT Philips) in the angio-suite to rule-out intracerebral hemorrhage or large established infarct. Cases and controls were matched by age, NIHSS score, occlusion location and time from onset to arrival. Primary safety outcome was the rate of intracranial hemorrhage and in-hospital mortality.

**Results:** During 24 months, among 138 DTAS patients, 16 received IVT following a cone-beam CT as only imaging test. There were no differences in age, NIHSS, level of occlusion and time from onset-to-door between cases and controls. The mean door-to-needle time was similar ( $25.6 \pm 13.2$  Vs  $28.5 \pm 18.8$  minutes,  $p = 0.1$ ) and the mean door-to-groin time was shorter ( $19.8 \pm 8.7$  Vs  $83.4 \pm 30.8$  minutes,  $p < 0.01$ ) in the DTAS group. There were no differences in the rate of intracranial hemorrhage (17.0% vs. 18.8%,  $p = 0.8$ ), symptomatical hemorrhage (6.4% vs. 0%,  $p = 0.3$ ) and in-hospital mortality (10.6% vs. 6.25%,  $p = 0.5$ ).

**Conclusions:** DTAS seems to be a safe strategy to reduce in-hospital workflow time in acute stroke patients. Using cone-beam CT to indicate IVT does not increase the rate of complications in our cohort.

Trial registration number: N/A

## AS05-040

### DOES BRIDGING-THERAPY IN MECHANICAL THROMBECTOMY INCREASE RECANALIZATION RATES IN ISCHEMIC STROKE PATIENTS Affected BY ACUTE LARGE VESSEL OCCLUSION?

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**Background and Aims:** Both intravenous thrombolysis with tissue plasminogen activator (IV-rtPA) and mechanical thrombectomy (MT) increase recanalization rates. We assessed if bridging-therapy (the concomitant use of rtPA and MT) could increase the recanalization rates and reduce the number of procedural passes in patients suffering from acute ischemic stroke (AIS) when compared to MT alone. Analysis of type of device used, stentriever or aspiration catheter, is also reported.

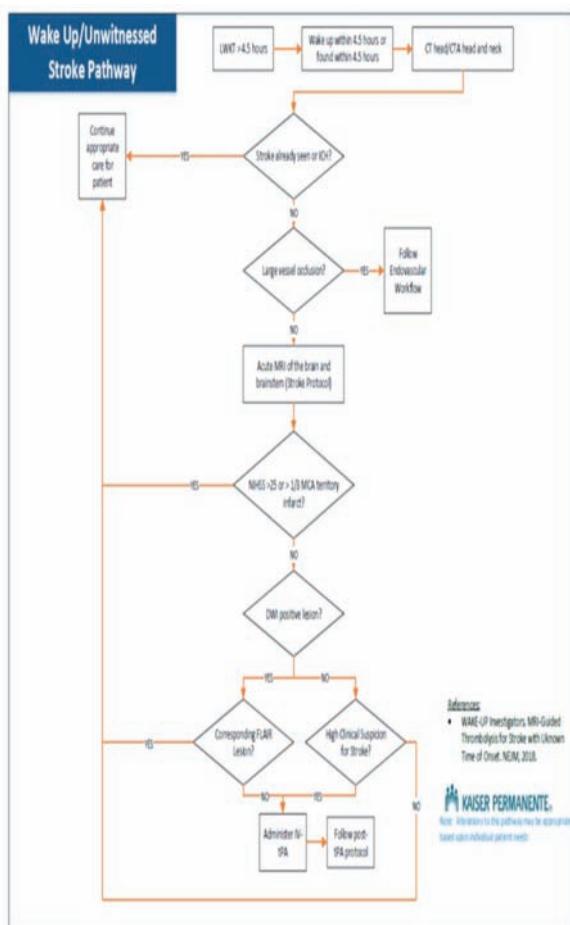
**Methods:** 334 mechanically extracted thrombi were collected from two partner hospitals: Beaumont (Dublin) and Sahlgrenska (Gothenburg). 158 patients (47.3%) were treated with bridging-therapy, while 176 (52.7%) underwent MT alone. Recanalization rate was defined by using the modified Thrombolysis In Cerebral Infarction (mTICI) score. Non-parametric Kruskal-Wallis test was used for statistical analysis.

**Results:** Bridging-therapy reduced the total number of passes to remove the clot (mean for MT+rtPA =  $2.27 \pm 2.10$ , MT alone =  $2.63 \pm 1.88$ , HI =  $4.376$ ,  $p = 0.036^*$ ). Analyzing the device, rtPA lowered the overall number of passes using stentriever devices (mean for MT+rtPA =  $1.57 \pm 1.12$ , MT alone =  $2.36 \pm 1.48$ , HI =  $8.303$ ,  $p = 0.004^*$ ), but not using aspiration (mean for MT+rt-PA =  $1.78 \pm 1.22$ , MT alone =  $2.03 \pm 1.47$ , for HI =  $0.795$ ,  $p = 0.372$ ). Also, when using both devices no significant reduction of number of passes was observed (mean for MT+rtPA =  $3.29 \pm 2.90$ , MT alone =  $3.83 \pm 2.20$ , HI =  $3.027$ ,  $p = 0.082$ ). There was no significant effect on final mTICI score using bridging-therapy when compared to MT alone (HI =  $1.163$ ,  $p = 0.281$ ).

**Conclusions:** This small study suggests that bridging-therapy lowers the number of procedural passes in MT procedures, specifically when using stentriever devices. However, this did not have a significant effect on final mTICI score. Funding: Science Foundation Ireland (Grant Number 13/RC/2073) and Cerenovus.

Trial registration number: N/A

## WITHDRAWN



**Results:** A total of 374 patients received tPA: 34 at CSC, 3 were WU; 340 at TS, 4 were WVU. Median door to needle times (DTN) were longer for WVU vs. NW at both CSC (37 vs. 98 mins;  $p = 0.024$ ) and TS (44 vs. 121 mins;  $p = 0.003$ ). Median DTN for WU was shorter at CSC vs. TS (98 vs 121 mins;  $p = 0.02$ ). Fourteen patients were screened for WU tPA, and 7 received tPA: 3 at CSC, 4 at TS. The most common reason for no tPA was MRI unavailability in 4 patients.

**Conclusions:** Treating WU patients using a CSC Hub and TS model is a feasible. DTN are longer for WVU vs. NW. MRI availability is a barrier to WVU tPA at community hospitals in the United States.

**Trial registration number:** N/A

## AS05-067

### HIGH-RISK PREGNANCY AND THROMBOLYTIC TREATMENT

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**Background and Aims:** Guidelines indicate thrombolysis as one of the treatments for stroke during pregnancy. Actually, few cases are reported in literature, because of highlighted relative contraindications. The major risks are maternal hemorrhagic complications.

**Methods:** A 43-year-old woman, 30 weeks pregnant, presented within 120 minutes of abrupt onset of left-sided hemiparesis. Diffusion-weighted imaging MRI showed an ischemic area and given that her clinical conditions were getting worse, it was decided, with obstetric back-up, to treat

her with IV rTPA (recombinant tissue plasminogen activator). Due to a previous premature delivery (28 weeks), according to recent indications, she was at risk of bleeding and death. Therefore after treatment she was transported to another hospital with a neonatal intensive care unit.

**Results:** The response was excellent and at the end of thrombolysis she was able to move the left side of her body. After 5 days she gave birth to a healthy baby.

**Conclusions:** Given that there are no specific trials, since the angiographic team is not on site, this case confirms once again that acute stroke treatment decision-making is a complex process that must be performed rapidly.

**Trial registration number:** N/A

## AS05-050

### SINGLE-CENTRE, RETROSPECTIVE, CASE-CONTROL STUDY OF LOW-DOSE VS. STANDARD-DOSE THROMBOLYSIS IN ACUTE ISCHEMIC STROKE

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**Background and Aims:** Low-dose intravenous thrombolysis is approved in Asian countries but no clear evidence of benefit is available for Caucasian-descent patients. Our aim was to evaluate safety and efficacy of low-dose thrombolysis in acute stroke patients treated in a tertiary care stroke centre.

**Methods:** From our stroke database we selected consecutive acute ischaemic stroke patients treated with low-dose ( $0.60 \pm 0.15$  mg/kg) alteplase and propensity score-matched stroke patients treated with standard-dose (0.9 mg/kg) alteplase. The primary outcome was 3-months modified Rankin Scale score (mRS) and safety outcome was haemorrhagic transformation rate, including symptomatic ICH defined as NIHSS change  $\geq 4$  points.

**Results:** Overall 120 patients with median age 76 (IQR 11), median baseline NIHSS score 12 (IQR 12) were included; 24/120 (20.0%) subjects received additional endovascular treatment. Clinical-demographic variables were comparable between case and control group. Low-dose group received median 0.66 (IQR 0.14) mg/kg alteplase, while standard-dose group 0.90 (0.01) mg/kg, at a median of 170 (IQR 53) minutes from symptom onset. Good outcome (mRS  $\leq 2$ ) was observed in 21/40 (52.5%) low-dose patients and 42/80 (52.5%) standard-dose patients ( $p = 1.00$ ); median 3-month mRS was 2 (IQR 3) for both groups, with mean utility-weighted mRS of 0.62 (SD 0.34) in low-dose vs. 0.66 (SD 0.30) in standard-dose group ( $p = 0.35$ ). Low-dose and standard-dose alteplase had comparable rate of haemorrhagic transformation (15% vs. 16.3%,  $p = 1.00$ ) of which 2.5% were symptomatic.

**Conclusions:** Patients treated with low-dose thrombolysis had a rate of favourable functional outcome comparable to patients treated with standard-dose thrombolysis without significant reduction in haemorrhagic transformation.

**Trial registration number:** N/A

## AS05-046

### THROMBOLYTIC THERAPY FROM LEARNING-CURVE IN PUBLIC STROKE UNIT BUENOS AIRES CITY

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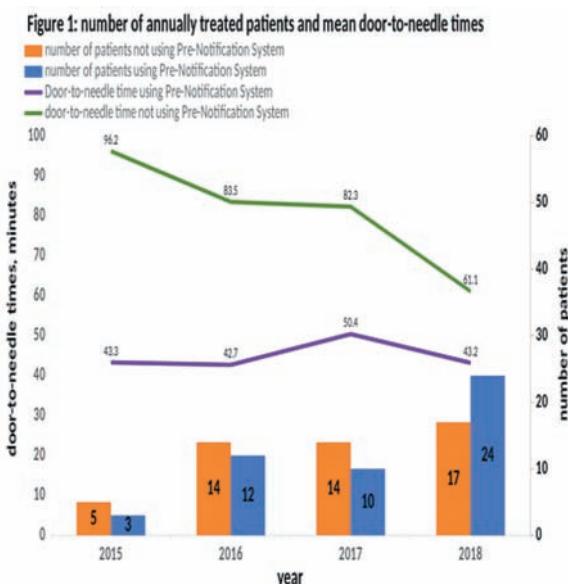
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**Background and Aims:** Buenos Aires City has 3 million inhabitants. Public health system (PHS) consists in 14 General Hospitals with a single

Stroke Unit (SU). The PHS has a network communication using ambulance transfer with Pre-Notification System (PNS). We present the SU of Buenos Aires City experience in the first 4 years.

**Methods:** We conducted a retrospective 4-year longitudinal study involving 332 patients admitted in our SU. We analyzed: Referral from PHS, Stroke Patient's Window (SPW), thrombolytic therapy (TT), onset-to-door time (ODT), door-to-needle time (DNT), and causes of no TT in SPW.

**Results:** 217 out of 332 patients were admitted before 4.5 hours in the PHS, 37% of them was referral using PNS. 189 out of 217 arrived to our SU as SPW and 99 patients received TT. Mean ODT using PNS and not using PNS was 201 and 160 minutes respectively ( $p: 0.02$ ). Mean DNT using PNS and not using PNS was 43.9 and 76.2 minutes respectively ( $p: 0.02$ ). 90 patients did not receive TT. The causes were: 42% mild symptoms, 26% transient symptoms, 8% uncontrolled high blood pressure, 6% SPW (3 to 4.5 hours) with additional warnings and 18% other causes. Mean DNT between 2015 and 2018 were 96.2, 83.5, 82.3, 61.4 minutes (not using PNS) and 43.3, 42.7, 59.4, 43.2 minutes using PNS (figure 1).



**Conclusions:** The patient percentage who received TT was high compared with literature. Worse ODT in patient which use PSN was probably associated with time transfer. We improved our DNT which reflex our learning-curve in stroke management.

**Trial registration number:** N/A

## AS05-039

### EFFECT OF REPORTED CONTRAINDICATIONS FOR INTRAVENOUS THROMBOLYSIS IN PREHOSPITAL SELECTION OF THROMBECTOMY CANDIDATES: SHOULD THEY PLAY A ROLE?

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**Background and Aims:** The Madrid-DIRECT scale has demonstrated high accuracy in prehospital patient selection for direct transfer to thrombectomy-capable centers (EVT-C). However, it is argued whether the existence of contraindications for intravenous thrombolysis (IVT) should be considered as additional criterion for direct transfer. We analysed the influence of IVT contraindications in our previous study.

**Methods:** Prospective observational study of code-stroke patients evaluated by emergency services SUMMA-112 using the Madrid-DIRECT scale from March 2017 to June 2017. We collected reported contraindications for IVT, clinical examination, patient destination according to Madrid-DIRECT score and reperfusion treatments. We analysed the association of IVT contraindications with final diagnosis and treatments.

**Results:** We included 326 patients (mean age  $69 \pm 15.8$  years). 139 patients (42.6%) had a known contraindication for IVT (90 more than 4.5 hours or unknown time from symptom onset, 48 anticoagulation, 17 other contraindications). One hundred patients (30.7%) scored positive in the Madrid-DIRECT scale, 226 (69.3%) scored negative. EVT was performed in 68 (20.9%) patients, 53 (53%) of the Madrid-DIRECT positive and 15 (6.6%) of the Madrid-DIRECT negative. Surprisingly, we found non-significantly lower EVT rates among patients with IVT contraindications: 47.7% vs 57.1% ( $p = .35$ ) for Madrid-DIRECT positive patients, and 4.2% vs 8.4% ( $p = .21$ ) for Madrid-DIRECT negative patients. Anticoagulated patients presented with higher proportions of hemorrhagic stroke (25% vs 11.9%) and lesser stroke mimics (4.2% vs 22.7%),  $p = .02$ .

**Conclusions:** Existence of IVT contraindications does not increase EVT likelihood over existing Madrid-DIRECT prehospital scale, as it depends on the presence of a treatable large vessel occlusion.

**Trial registration number:** N/A

## WITHDRAWN

migration of emboli during the procedure. Final recanalization was successful (mTICI 2b-3) in 16 patients (69.5%). Eleven patients (47.8%) had good functional outcomes at 3 months (modified mRS 0–2). Intracranial hemorrhage occurred in 4 cases. There were 2 mortality cases.

**Conclusions:** Successful rate of emergency CAS (95.6%) and intracranial EVT after IV-tPA (69.5%) were high. The good functional outcome (mRS 0–2) was 46.7% in patients treated with emergency CAS and the overall clinical outcome would be acceptable.

**Trial registration number:** N/A

#### AS05-024

### STROKE ON THE FRONTIER: EXECUTION AND OUTCOMES OF INTRAVENOUS THROMBOLYSIS IN A FINNISH PERIPHERAL PRIMARY STROKE CENTER

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<sup>1</sup>North Karelia Central Hospital, Neurology, Joensuu, Finland

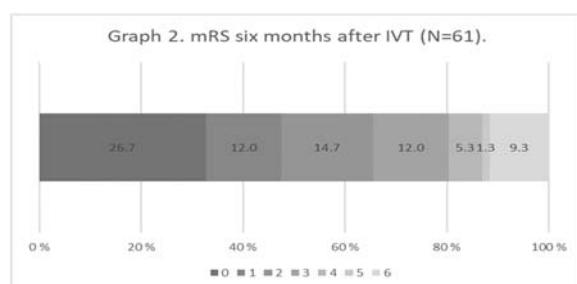
**Background and Aims:** Advances in mechanical thrombectomy (MT) have resulted in uncertainty about the status of primary stroke centers (PSC) where only intravenous thrombolysis (IVT) is available and their outcome was therefore investigated.

**Methods:** Patients treated with IVT at North Karelia Central Hospital (a PSC two hours away from the nearest comprehensive stroke center) were identified out of all the 570 cerebral infarct ward discharges in 2016–2017. Data was retrospectively gathered from electronic patient records.

**Results:** Altogether 75 IVTs (47% women) were identified. Median age was 74 years (IQR 64; 81) with no gender difference ( $p=0.70$ ). Before the stroke, 85% had been totally independent. Median NIHSS (N = 72) was 6 (IQR 4;10, range 0–25) and OTT 125 minutes (N = 67, 95% CI 112–138 min, range 43–270 min, graph 1). Clinical status improved following IVT (table) and the majority were independent at six months (graph 2). LVO was identified in 27% and MT followed IVT in 30% of these. In the LVO patients the mean mRS was 3.0 (1.8 in those alive, 25% had died). Only LVO and pre-IVT NIHSS score predicted the mRS (gender, age and OTT did not) and in a multivariate analysis the NIHSS was the sole predictor ( $B=0.12$ ,  $R^2=0.34$ ,  $p=0.0001$ ).

	Median NIHSS	IQR	NIHSS 0-2	NIHSS >15
Before IVT	6	4;8	5%	11%
24 hours after IVT	2	1;5	54%	5%

Table. Clinical status before and after IVT.



**Conclusions:** This peripheral PSC's IVT results were good, but LVO outcomes need improvement.

**Trial registration number:** N/A

#### AS05-041

### INTRAVENOUS THROMBOLYSIS FOR ACUTE ISCHEMIC STROKE DUE TO INTRACRANIAL ARTERY DISSECTION: A SINGLE-CENTER CASE SERIES

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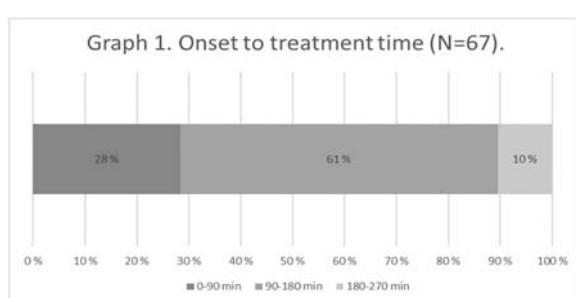
**Background and Aims:** Only case reports of intravenous thrombolysis (IVT) for acute ischemic stroke (AIS) due to intracranial artery dissection (IAD) have been published so far. We present our single-center experience of IAD-related AIS treated with IVT.

**Methods:** We selected all consecutive patients with IAD-related AIS treated with IVT from the Acute STroke Registry and Analysis of Lausanne between 2003 and 2017. We reviewed demographical, clinical and neuroimaging data and also recorded hemorrhagic complications, mortality within 7 days and modified Rankin Scale at three-months.

**Results:** Among 181 AISs related to cervicocephalic dissections, 10 (5.5%) were due to IAD. Five of those patients received IVT and were included in this study. Median age of treated patients was 62 years; hypertension and dyslipidemia were the most frequent vascular risk factors. IAD locations were distal internal carotid artery, middle cerebral artery (M1), anterior cerebral artery (A2), and, in two cases, the basilar artery. All anterior circulation IAD were occlusive or subocclusive, while the two basilar artery IAD caused arterial stenosis. After IVT, there were no subarachnoid or symptomatic intracranial hemorrhage. One patient had an asymptomatic hemorrhagic infarct type I. Two patients died within seven days from ischemic mass effect. The other three patients had a favorable clinical outcome at three-months.

**Conclusions:** In this small, single-center case series of IAD-related AIS, thrombolysis seemed to be relatively safe. However, IVT efficacy and the likelihood of arterial recanalization remain uncertain. Further studies are needed to confirm the safety and assess the efficacy of IVT in these patients.

**Trial registration number:** N/A



**AS05-052**

**EFFECTIVENESS AND SAFETY OF TENECTEPLASE VERSUS ALTEPLASE IN ACUTE ISCHEMIC STROKE: A PROSPECTIVE STUDY FROM A RURAL TERTIARY CARE CENTER IN INDIA**

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<sup>1</sup>M.E.S Medical College, Neurology, Perinthalmanna, India

**Background and Aims:** Stroke incidence among Indians has doubled in the past 40 years and there is a need for research in acute stroke care. Tenecteplase is a recently approved recombinant tissue plasminogen activator (r-TPA) and our study compares its effectiveness and safety with alteplase.

**Methods:** 47 acute ischemic stroke patients receiving r-TPA [alteplase (N=28) and tenecteplase (N=19)] presenting within 6 hours of symptom onset were enrolled in our prospective observational study. Institutional ethics committee approved the study and written informed consent was obtained from all study participants. Evidence of haemorrhagic stroke, age < 18 years, transient ischemic attack and participants with seizures at stroke onset were excluded. NIHSS (baseline, 1 hour, 24 hours and 7 days) and mRS (1 and 3 months) were recorded in structured proforma and were analysed using SPSS. Wilcoxon signed rank test & Friedman test were used as test of significance, p < 0.05 was considered statistically significant.

**Results:** Significantly lower NIHSS at 1 hour compared to baseline was observed among participants receiving alteplase (p < 0.001). Significantly lower NIHSS at 1 hour (p = 0.008), 24 hours (p = 0.01) and at 7 days (p = 0.009) compared to baseline was observed among participants receiving tenecteplase. Significantly lower mRS at 3 months compared to 1 month was observed among participants receiving alteplase (p < 0.001) and tenecteplase (p = 0.005). No significant difference in change in NIHSS (p = 0.3) and mRS (p = 0.5) between alteplase and tenecteplase was detected. 10.7% and 5.3% receiving alteplase and tenecteplase respectively had symptomatic intracranial hemorrhage (sICH).

**Conclusions:** Tenecteplase was non inferior to alteplase in reducing NIHSS and mRS with lower risk of sICH.

Trial registration number: N/A

**AS05-063**

**SAFETY OF THROMBOLYTIC THERAPY FOR ACUTE ISCHEMIC STROKE IN PATIENTS RECEIVING THROMBOEMBOLISM PROPHYLAXIS**

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**Background and Aims:** Treatment with intravenous tissue plasminogen activator (tPA) is recommended for patients with acute ischemic stroke (AIS). Symptomatic intracranial hemorrhage (sICH) constitutes the most devastating complication. The safety of tPA in patients receiving pharmacologic prophylaxis for venous thromboembolism (VTE) is unclear.

**Methods:** We reviewed the medical records of 278 AIS patients treated with tPA. Baseline characteristics and complication rates of patients receiving and not receiving VTE prophylaxis at time of tPA administration were compared. Safety outcome included major bleeding, defined as a decrease in baseline hemoglobin ≥20 g/L or requiring transfusion ≥2 units of blood, and sICH, defined as hemorrhage associated with clinical

worsening of ≥4 points on the NIHSS. Data were compared using univariate analyses (Student t-test or Chi Square tests, where appropriate).

**Results:** Twenty patients (7%) were on VTE prophylaxis (2 on low molecular weight heparin and 18 on unfractionated heparin). Median (interquartile range) age was 81 years (66-86) for the heparinoid group and 63 years (52-79) for the non-heparinoid group (p < 0.0001). Initial NIHSS, time from last known well to tPA bolus infusion, and baseline aPTT were similar between the groups. Major bleeding rates (10%) were also similar between the two groups (p = 0.99). The rates of sICH were 5% in the heparinoid group and 1% in the non-heparinoid group (p = 0.2). Fatal ICH rates were 5% and 2%, respectively (p = 0.13). Gastrointestinal bleeding was seen only in the non-heparinoid group (2%).

**Conclusions:** Use of prophylactic heparinoid products at time of tPA administration is not associated with increased risk of major bleeding or sICH.

Trial registration number: n/a

**AS05-032**

**SIX MINUTES SAVED FROM DOOR-TO-NEEDLE TIME FOR STROKE THROMBOLYSIS ENSUING FROM A CHANGE OF INFORMED CONSENT POLICY IN SINGAPORE**

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**Background and Aims:** Obtaining written consent has been identified as a potential delay in stroke thrombolysis. In 2016, Singapore introduced policy change to encourage stroke centers to adopt practice of using verbal rather than written consent. We report the effect of policy change in reducing door-to-needle (DTN) time.

**Methods:** Using Singapore Stroke Registry, we analysed data of 338 acute ischemic stroke patients who received thrombolysis between January 2015 and December 2016 from two participating hospitals that changed practice from written to verbal consent. There were no other policy changes during this period. Multivariate regression models with generalized estimating equations were used to evaluate association between consent policy changes and DTN times while adjusting for patients' baseline characteristics and within-hospital clustering.

**Results:** Patient demographics, stroke severity, presentation during versus after office hours, or arrival via emergency medical services, were similar between 137 patients in the pre-intervention group and 201 patients in the post-intervention group. Median DTN time decreased from 67 minutes (IQR 54–86) to 57 minutes (IQR 43–71) following the use of verbal consent. After risk adjustment, this policy change was associated with 6.7 minutes reduction (95% CI, 0.6-12.7) in DTN time. The percentage of patients with DTN < 60 and DTN < 45 increased by two-fold (36.8% to 59.1%; OR 2.13; 95% CI, 1.27-3.58) and threefold (10.5% to 31.4%; OR 3.22; 95% CI, 1.52-6.81) respectively.

**Conclusions:** This is the first study to show that timeliness of thrombolysis improved with the change from written to verbal consent, providing direct evidence for this strategy.

Trial registration number: N/A

**AS05-021**

**SHORTER ONSET TO TREATMENT TIME IS ASSOCIATED WITH SWIFTER RECANALIZATION IN ACUTE ISCHEMIC STROKE PATIENTS WITH PROXIMAL INTRACRANIAL OCCLUSIONS TREATED WITH INTRAVENOUS THROMBOLYSIS**

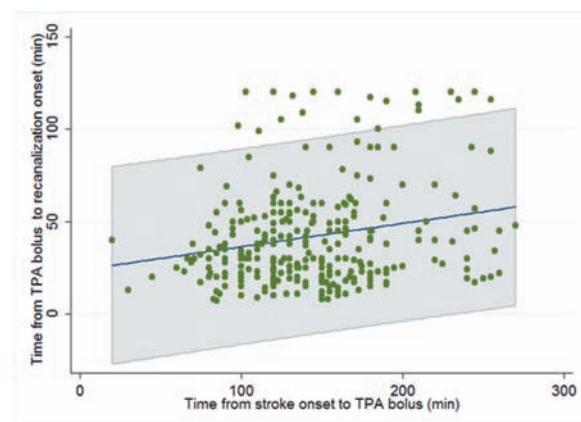
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**Background and Aims:** Although onset-to-treatment time is known to be associated with early clinical recovery in acute ischemic stroke (AIS) patients treated with intravenous tissue plasminogen activator (tPA), the association between the onset-to-treatment time (OTT) and time from tPA bolus-to-recanalization remains obscure.

**Methods:** The aforementioned association was evaluated within the multicenter, prospective cohort study CLOTBUST-PRO, in which tPA-eligible AIS patients with proximal intracranial occlusion underwent continuous, 2-hour, real-time transcranial Doppler (TCD) monitoring. The correlation between OTT and time between tPA-bolus and beginning of recanalization was assessed in multiple regression analyses, adjusting for potential confounders.

**Results:** We enrolled 480 AIS patients (mean age  $66 \pm 15$  years, 60% men, baseline NIHSS score 15). Complete or partial recanalization was detected in 211 (44%) and 90 (19%) patients during the 2-hour TCD-monitoring, respectively. The median OTT and the median tPA bolus-to-recanalization time were 135 min (113-168) and 24 min (IQR: 22-53), respectively. In patients with complete or partial recanalization at 2-hours following tPA-bolus, OTT was independently and positively associated with tPA bolus-to-recanalization time (unstandardized linear regression coefficient = 0.13, 95%CI: 0.06-0.20;  $p < 0.001$ ; Figure) on multiple linear regression model.



**Conclusions:** Earlier tPA treatment after stroke onset is associated with swifter tPA-induced recanalization in AIS patients with proximal intracranial occlusions.

**Trial registration number:** N/A

**AS05-030**

**POSTPARTUM STROKE AND SYSTEMIC THROMBOLYSIS**

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**Background and Aims:** There are very few previously published cases about intravenously applied recombinant tissue plasminogen activator in acute ischemic stroke during puerperium.

**Methods:** Case presentation

We report a 42-year-old woman with postpartum acute ischemic stroke caused by carotid artery dissections treated by systemic thrombolysis. A right-handed woman who was 2 weeks postpartum was admitted to the hospital due to migraine with aura mimic symptoms. In the emergency room, her National Institutes of Health stroke scale was 19 with points received for sudden onset of right-sided weakness and global aphasia. Computed tomography of the brain was negative for hemorrhage and she was given intravenous systemic thrombolysis after fifteen minutes after onset of symptoms. CT angiography of the head and neck showed extracranial left ICA dissection. One day later she was asymptomatic and MRI showed ischemic stroke in the caudate, centrum semiovale and subcortical temporal left hemisphere. She was discharged home without physical therapy.

**Results:** Discussion

There are only limited data regarding thrombolytic treatment in acute stroke during pregnancy and puerperium. Current acute stroke treatment guidelines—while considering pregnancy as a relative exclusion criterion—do not deal with the postpartum state.

**Conclusions:** As the condition is rare, randomized controlled trials are not feasible, therefore further reports on similar cases could eventually help us suggest guidelines or at least propose recommendations for the acute thrombolytic treatment of strokes occurring in pregnancy and puerperium.

**Trial registration number:** N/A

**AS05-068****MOTHERSHIP VERSUS DRIP AND SHIP MODELS IN ACUTE REPERFUSION TREATMENTS FOR ISCHEMIC STROKE: A META-ANALYSIS****S. Vidale<sup>1</sup>, G. Grampa<sup>1</sup> and E. Agostoni<sup>2</sup>**<sup>1</sup>Sant'Anna Hospital, Neurology, Como, Italy; <sup>2</sup>Niguarda Ca' Granda Hospital, Neurology, Milan, Italy

**Background and Aims:** Mechanical thrombectomy (MT) is effective in acute ischemic stroke due to larger vessel occlusion. However, this procedure can be performed only in comprehensive stroke centres and for this reason many patients have to be transferred from primary stroke centers (drip and ship model), instead of a direct treatment (mothership model). In this pooled analysis we compared the outcomes in the organizational models.

**Methods:** A literature search was conducted including PubMed, Embase, and the Cochrane Library databases. Observational studies were included in this pooled analysis. We considered the patients treated directly with MT as interventional group (mothership model). Primary endpoint was represented by good functional outcome at 90 days. We applied a fixed- or random-effects analytical approach to perform the pooled analysis.

**Results:** In this analysis we included 11 studies with a total of 4721 patients. The mothership model was superior than drip and ship in obtaining a good outcome (OR: 1.43; 95%CI: 1.25 – 1.64). In the subgroup of patients receiving the bridging therapy, the good outcome was higher in the mothership group than in the drip and ship group (OR: 1.28; 95%CI: 1.00 – 1.62).

**Conclusions:** In this meta-analysis of observational studies, the mothership model was superior to drip and ship model in achieving a good functional outcome in patients with acute ischemic stroke due to large vessel occlusion. Randomized controlled trials are needed to confirm this observation.

**Trial registration number:** N/A

**AS05-003****SHOULD WE THROMBOLYSE A NORMAL CT BRAIN? ONE IN A MILLION EXPERIENCE:****B. Vincent<sup>1</sup> and U. Mohammed<sup>1</sup>**<sup>1</sup>Worcester General Hospital, Stroke Medicine, Worcester, United Kingdom

**Background and Aims:** 72 years old female presented at Worcester royal hospital with difficulty to speak and right sided neglect. She did not have any vascular risk factors and not on any regular medications. Her exercise tolerance is unlimited

Clinical Examination showed mixed dysphasia, right sensory and visual inattention. NIHSS was 9. Her CT Brain scan did not show any bleed and she was thrombolysed intravenously with Alteplase as per guidelines. She had routine blood test and ECG before thrombolysis.

**Methods:** 50 minutes in to thrombolysis, pathology lab was contacted, as her blood results were not available. The informal result showed platelet count of 19 and was awaiting formal confirmation from haematology consultant. Thrombolysis was immediately stopped but with just 2 mls left.

Immediately after thrombolysis, patient became confused, restless and agitated. Suspecting intra cranial haemorrhage, a repeat CT brain was organised with support of intensive care team and under sedation. It did not show any intra cranial bleed.

**Results:** Meanwhile, the haematology consultant confirmed the diagnosis of Thrombotic Thrombocytopenic Purpura, contacted the regional

tertiary centre and arranged transfer of the patient for plasma exchange. Her ADAMTS 13 was 2%

She did well after plasma exchange. Her neurological symptoms resolved completely and her platelet count improved to 128. Her MRI Brain was normal. She was commenced on RITUXIMAB.

**Conclusions:** Though incidence of Thrombotic Thrombocytopenic Purpura with ADAMTS 13 level below 5%, presenting as stroke, is 1.2 in a million, stroke physicians ought to be aware of this rare condition where thrombolysis is not indicated.

**Trial registration number:** n/a

**AS05-057****INTRAVENOUS THROMBOLYSIS PRIOR TO MECHANICAL THROMBECTOMY IN LARGE VESSEL OCCLUSION STROKE****B. Volbers<sup>1,2</sup>, R. Häußler<sup>1</sup>, M. Heldner<sup>2</sup>, H. Lücking<sup>3</sup>,****M. Schmidt<sup>3</sup>, A. Marsch<sup>1</sup>, K. Macha<sup>1</sup> and B. Kallmünzer<sup>1</sup>**<sup>1</sup>University of Erlangen-Nuremberg, Neurology, Erlangen, Germany;<sup>2</sup>Inselspital- Bern University Hospital- University of Bern, Neurology, Bern, Switzerland; <sup>3</sup>University of Erlangen-Nuremberg, Neuroradiology, Erlangen, Germany

**Background and Aims:** In acute ischemic stroke patients with large vessel occlusion (LVO), mechanical thrombectomy (MT) plus standard of care, including intravenous thrombolysis, has been shown to be superior to medical management alone. However, recent research questions whether additional thrombolysis is needed to maintain the efficacy of MT.

**Methods:** In this retrospective cohort study, we included all patients with LVO who underwent MT between 01/2013 and 12/2016 in our tertiary stroke center. Eligibility for thrombolysis was defined according to the label of recombinant tissue plasminogen activator not accounting for age. Primary endpoint was functional day 90 outcome (dichotomized modified Rankin Scale (mRS) 0–2: favorable, 3–6: poor).

**Results:** 223 patients (17% with vertebral or basilar artery LVO) were included. Median age was 75 (interquartile range 60–80) years, 120 (54%) patients were female. Thirty-two patients had no outcome data available. Fifty-four patients (28%) showed a favorable day 90 outcome. Symptom to groin time did not differ between outcome groups (favorable: 5.2 hours (standard deviation (SD) 3.8), poor: 6.1 hours (SD 7.2) p = 0.352). Multivariable logistic regression revealed a negative association of NIHSS on admission, comorbid hypertension and functional status (mRS) before admission and a positive association of thrombolysis (Odds Ratio (OR) 3.213; 95% CI 1.215–8.494, p = 0.019) with favorable outcome. After adding eligibility for thrombolysis to the model, the association of thrombolysis with outcome could not be shown any more (OR 2.176; 95% CI 0.624–7.592, p = 0.223).

**Conclusions:** Prospective randomized trials should elucidate whether intravenous thrombolysis is beneficial prior to MT in patients with acute LVO stroke eligible for thrombolysis.

**Trial registration number:** N/A

**AS05-026****EFFECTS OF PRESENCE OF OFF-LABEL-CRITERIA ON DOOR-TO-NEEDLE-TIME IN SYSTEMIC THROMBOLYSIS FOR ACUTE STROKE TREATMENT****H. Wiestler<sup>1</sup>, N. Hubert<sup>1</sup>, S. Platen<sup>2</sup>, B. Wiestler<sup>3</sup>, R. Haberl<sup>1</sup> and G. Hubert<sup>1</sup>**<sup>1</sup>TEMPIs Telemedical Stroke Center- Munich Clinic- Academic teaching hospital of the Ludwig-Maximilians-University, Department of Neurology, Munich, Germany; <sup>2</sup>TEMPIs Telemedical Stroke Center- University

Hospital Regensburg, Department of Neurology, Regensburg, Germany;

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**Background and Aims:** Thrombolysis is the only approved pharmacological therapy for acute ischemic stroke. Several contraindications result from the stringent inclusion and exclusion criteria used in landmark RCTs. Nonetheless, off-label-treatment is common in acute stroke care. In previous studies most off-label criteria were not associated with higher risk of symptomatic intracerebral haemorrhage (SICH). The Aim was to analyse, if presence of off-label-criteria influences door-to-needle time.

**Methods:** We analyzed treatment protocols of all patients who received thrombolysis in the TEMPIS telestroke network between 01.01.2015 and 31.12.2017. Off-label criteria were defined according to the European licence of alteplase. Kruskal-Wallis test with Dunn's post-hoc test and linear regression modelling with interaction terms were used for test of significance.

**Results:** Of 2792 patients, 680 (24.4%) had at least one contraindication for thrombolysis (19.3% with one, 3.9%, 0.9%, 0.1% and 0.1% with 2–5 contraindications, respectively). Most common contraindications were history of prior stroke and concomitant diabetes (18.4%), elevated blood pressure (14.9%) and onset >4.5h or unknown (10.3%). Presence of at least one off-label-criterium led to significant delay of door-to-needle-time (47min vs. 41min;  $p < 0.0001$ ) with a tendency to longer delays with more contraindications. Difference was seen irrespective of whether thrombolysis was initiated via telemedicine or onsite (7min vs. 4min difference,  $p = 0.36$ ).

**Conclusions:** Presence of off-label-criteria was associated with longer door-to-needle-time in patients treated with thrombolysis in the TEMPIS-network. Considering the potentially detrimental effect of delayed therapy and recently published data on SICH in off-label thrombolysis, further research evaluating the safety concerns underlying the alteplase licence criteria is needed.

**Trial registration number:** N/A

## AS05-014

### HUMAN ADIPOSE-DERIVED STEM CELLS PARTIALLY RESCUE THE STROKE SYNDROMES BY PROMOTING SPATIAL LEARNING AND MEMORY IN MOUSE MIDDLE CEREBRAL ARTERY OCCLUSION MODEL

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**Background and Aims:** Of all candidate seeding cells, adipose-derived stem cells (ADSCs) are considered as one of the most appropriate for stroke treatment due to their abundance, accessibility without invasive surgery from healthy donors and little immune rejection and no ethical concern.

**Methods:** hADSC were labeled with EGFP expressing FG12 lentivirus and injected into MCAO mouse infarct area by *in situ* way. TTC was carried out to compare the infarct area among groups. Histoimmunostaining was used to track the injected hADSCs for their *in vivo* migration, transdifferentiation and integration with the endogenous neuronal circuitry. To better address the underlying rescuing mechanism, qRT-PCR was performed on neural markers of MBP, MAP2, GFAP, microglia marker of Iba1.

**Results:** GFAP+ cells were significantly ( $P < 0.001$ ) reduced in the hADSC injected MCAO mice compared with both the PBS injected control and the MCAO-Sham mice at brain cortex. Meanwhile, Iba1 positive microglia and GFAP positive astrocyte cells were significantly ( $P < 0.05$ ) suppressed by hADSC injection, which indicated immuno-suppression

role of hADSCs. Moreover, hADSCs could significantly ( $P < 0.001$ ) promote the survival of endogenous neuron cells (MAP2+) compared with the PBS injected mice.

**Conclusions:** hADSCs could transdifferentiate into neuron like cells (MAP2+) *in vivo* and probably used as replacement based therapy cell source for stroke. Significant immunomodulation was found due to their suppression of GFAP and Iba1 positive cells. Meanwhile hADSCs could significantly protect the endogenous neuron survival. The study demonstrated that hADSC intervention with MCAO mice could apparently ameliorate stroke symptoms by direct cell replacement, enhanced immunosuppression and increasing the viability of endogenous neurons.

**Trial registration number:** N/A

## WITHDRAWN

score	Sample size	components	Receiver Operating Characteristic Curve (C Statistics)	Dose of rt-PA
HAT	/	NIHSS score, diabetes mellitus - or glucose, early CT hypodensity - (0-5 points) -	0.59-0.79 -	rt-PA 0.9 mg/kg -
MSS	1205	Age, NIHSS score, glucose, - platelets (0-4 points) -	0.59-0.86 -	rt-PA 0.9 mg/kg -
SEDAH	828	Age, NIHSS score, glucose, - hyperdense middle cerebral - artery sign, early CT hypodensity - (0-5 points) -	0.50-0.70 -	rt-PA 0.9 mg/kg -
SIST-ICH	13908	Age, NIHSS score, glucose, - weight, hypertension, antiplatelet - therapy (none, aspirin, - aspirin/cllodipogrel), systolic - blood pressure, onset-to-treatment - time (0-12 points) -	0.58-0.76 -	rt-PA 0.9 mg/kg -
GRAPS GWIG	7171	Age, NIHSS score, glucose, - systolic blood pressure, Asian vs - non-Asian ethnicity, sex (0-101 - points) -	0.61-0.83 -	rt-PA 0.9 mg/kg -
SPAN-100	624	Age, NIHSS score (0-1 points) -	0.55-0.57 -	rt-PA 0.9 mg/kg -
Iscore	8223	Age, CNS score, blood glucose, stroke subtype, self-care before admission, risk factors (atrial fibrillation, heart failure, etc.), comorbid disease (cancer, renal failure) -	0.782-0.851 -	rt-PA 0.9 mg/kg -
SICH	1146	Heart valve disease, use of aspirin, systolic blood pressure before thrombolysis, NIHSS score, platelet count, whether antihypertensive drugs are used during thrombolysis (0-10 points) -	0.75 -	rt-PA 0.9 mg/kg -

**Conclusions:** The results of studies of hemorrhagic transformation after intravenous thrombolysis are not satisfactory. The risk factors in risk assessment are not able to evaluate their absolute risk values individually. At the same time, it is urgent to study more accurate prediction models to meet clinical needs. There is no specific treatment yet. Comprehensive consideration and individualized treatment are needed.

**Trial registration number:** N/A

## AS05-008

### OUTCOME PREDICTORS AFTER MECHANICAL THROMBOLYSIS IN SLOVENIAN TELESTROKE SYSTEM TELEKAP

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**Background and Aims:** The Slovenian telestroke network – TeleKap enhances the rate of mechanical recanalizations (MeR). Thus, appropriate recognition of the candidates for MeR in spokes should be critical for outcome. The TeleKap is consisted of different types of spokes regarding neurologist availability. Therefore, we suppose that full time expertise is associated with better clinical outcome of MeR in TeleKap.

**Methods:** We analysed data from beginning of TeleKap from 2014. We included 83 cases aged  $68.3 \pm 11.1$  years from 10 spokes. The technical equipment in the TeleKap Centre consists of a dedicated stationary workstation with an HD video camera enabling two-way teleconsultations, with high quality microphone (Polycom Real Presence). Good outcome at discharged was defined as Rankin (mRS) 0-2. Linear and logistic regression analysis were used to determine the relationships between variables in spoke centres

**Results:** We found good outcome in 12.9% of patients. mRS at admission on was associated with good outcome ( $p=0.014$ ,  $OR=0.38$   $95CI=0.17-0.82$ ) as well as NIHSS at admission ( $p=0.01$ ,  $R=0.80$ ,

$CI95=0.70-0.92$ ). Full time neurologic expertise (24/8) was related to good outcome ( $p=0.049$ ,  $OR=8.38$ ,  $95CI=1.00-68.92$ ). In addition, the door to groin time appeared to be associated with good outcome ( $P=0.05$ ,  $OR=0.95$ ,  $95CI=0.91-1.00$ ). The mRS after 90 days correlated with mRS at discharge ( $p=0.016$ ,  $OR=0.37$ ,  $95CI=0.16-0.83$ ).

**Conclusions:** We have concluded that full time clinical expertise at spoke can be beneficial for outcome after MeR in patients managed by telestroke system. The mRS and door to groin time seem to be predictor of good outcome after MeR

**Trial registration number:** N/A

## AS05-037

### EFFECT OF ALTEPLASE ON FUNCTIONAL OUTCOME FOR ACUTE ISCHEMIC STROKE PATIENTS WITH LARGE VESSEL SEVERE STENOSIS OR OCCLUSION AND MINOR NONDISABLING NEUROLOGIC DEFICITS

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**Background and Aims:** Recent trial demonstrated that alteplase did not increase the favorable outcome ratio among patients with minor nondisabling acute ischemic stroke (AIS). However, more than 20% of these patients cannot achieve excellent outcome. As severe stenosis or occlusion of large vessels leading to bad outcome, we tested the hypothesis minor nondisabling AIS patients with severe stenosis or occlusion of large vessels might benefit from alteplase treatment.

**Methods:** We used a prospectively collected cohort of AIS patients being assessed for thrombolysis in our center. Three neurologists categorized the degree of stenosis or occlusion of large vessels on CT or MR angiography. Excellent outcome was defined as 90-day modified Rankin Scale 0 to 1.

**Results:** Of 1857 patients, 326 had a National Institutes of Health Stroke Scale score of 0-5 and were clinically eligible for thrombolysis (194 being treated). Alteplase-treatment was not an independent factor for excellent outcome (alteplase-treated 80.4% vs untreated 84.1%; odds ratio (OR), 1.340;  $p=0.399$ ). For patients with severe stenosis or occlusion of large vessels, alteplase-treatment was an independent favorable factor for excellent outcome (alteplase-treated 77.6% vs untreated 42.9%; OR, 7.027;  $p=0.008$ ). Among patients without severe stenosis or occlusion of large vessels, alteplase-treatment was not an independent factor for excellent outcome (alteplase-treated 81.6% vs untreated 88.7%; OR, 0.878;  $p=0.749$ ).

**Conclusions:** Among patients with minor nondisabling AIS, only patients with severe stenosis or occlusion of large vessels might benefit from alteplase treatment, which needs to be confirmed in future prospective studies.

**Trial registration number:** N/A

## AS05-028

### INTRAVENOUS THROMBOLYSIS IN EMBOLIC STROKE OF UNDETERMINED SOURCE

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**Background and Aims:** It is assumed that the most cases of embolic stroke of undetermined source (ESUS) have cardioembolic origin. The data about outcome after the treatment with intravenous thrombolysis

(IVT) for this type of acute ischemic stroke (AIS) is limited. This study compared the clinical characteristics and outcomes between IVT treated AIS patients with ESUS and cardioembolic stroke (CE).

**Methods:** The data were obtained from our hospital database of IVT treated AIS patients. In total of 416 patients, 113 have CE stroke according TOAST classification. From a 88 patients with undetermined stroke subtype, 62 met the criteria for ESUS. ANOVA and general linear model were used to assess the differences between two groups.

**Results:** Patients with ESUS were younger (63.7 versus 69.7 years,  $p=0.001$ ), had a lower NIHSS score on admission (12.8 versus 15.1,  $p=0.002$ ) and lower prevalence of antiplatelets use (27.4% versus 42.5%,  $p=0.04$ ) compared with CE stroke patients. Hemorrhagic transformation was less frequent (17.7% versus 33.6%,  $p=0.03$ ), while a favorable outcome (mRS 0–2) was more often in ESUS group, either on discharge (48.4% versus 24%,  $p=0.002$ ) or after three months (71.0% versus 37.2%,  $p<0.001$ ). Predictors of a favorable 3-months outcome were ESUS ( $p=0.001$ ; OR 5.22; 95% CI 1.98–13.78), age < 70 years ( $p=0.001$ ; OR 4.26; 95% CI 1.83–9.90) and the absence of diabetes ( $p=0.019$ ; OR 5.88; 95% CI 1.34–25.86).

**Conclusions:** Patients with ESUS had better outcome after IVT than patients with CE stroke. This difference is attributable to younger age and milder stroke severity on admission. IVT was safe and effective in ESUS.

**Trial registration number:** N/A

## TIA

### AS29-008

#### CEREBRAL VASOREACTIVITY AND RISK OF RECURRENT CEREBROVASCULAR EVENTS IN TRANSIENT ISCHEMIC ATTACK PATIENTS

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**Background and Aims:** Compromised cerebral vasoreactivity has been related to risk of stroke, but it is uncertain its relation with transient ischemic attack as predisposing factor for recurrence. The aim of our study was to evaluate the relationship between cerebral vasoreactivity and 3-months recurrent stroke/TIA.

**Methods:** The study included prospective TIA patients, classified as acute cryptogenic-TIA (15 days of the index event). Clinical, demographic and imaging studies were collected. Transcranial doppler was performed in order to assess breath-holding index (BHI) at the middle cerebral artery. Cerebral vasoreactivity test was classified as normal, insufficient and critic and BHI as normal/abnormal and was compared according to ABCD2 categories of TIA. Recurrent stroke/TIA was assessed at 3 months.

**Results:** 99 TIA patients were collected. Hypertension (79.8%), Dyslipidemia (33.9%) and diabetes (23.7%) were the most common risk factors. High (5.1%), moderate (49.2%) and low risk TIA (44.1%) were found at the sample, with 5.1% of recurrence. Mean BHI was  $0.4 \pm 0.4$  (abnormal) and mean percentage variability on vasoreactivity test was insufficient ( $13.4 \pm 11.2\%$ ). No significant differences were found among BHI and vasoreactivity variability among ABCD2 categories. Recurrence was higher in diabetic (OR = 1.2, IC95% 0.9–1.6;  $p=0.001$ ) and high-risk TIA (OR = 1.2, IC95% 3.3–874;  $p<0.001$ ), but no significant association was found among the different categories of vasoreactivity variability and BHI.

**Conclusions:** Our findings suggest a link between impaired cerebrovascular reactivity and cryptogenic-TIA, but we found no association on recurrent cerebrovascular events and the degree of vasoreactivity variability at 3-months.

**Trial registration number:** N/A

### AS29-019

#### FRAILTY SYNDROME IN TIA PATIENTS

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**Background and Aims:** The frailty syndrome (FS), characterized by an increased vulnerability to external stressors, is positively associated with disability, morbidity and mortality. Whether FS is linked to neurovascular diseases and particularly to TIA is actually unknown. We aimed to study frailty in geriatric TIA patients.

**Methods:** TIA patients, hospitalized in the Paris Saint-Joseph Hospital stroke unit and older than 70 were prospectively recruited. Patients with significant disability (Rankin > 2) before TIA were excluded. Primary objective was to assess the FS frequency. Secondary objective was to compare groups with or without frailty. FS was present if 3 out of 5 were present among unintentional weight loss, self-reported exhaustion, low levels of activity, decreased handgrip strength and slow walking speed (Fried et al, 2001). Following patients and TIA characteristics were screened : main vascular risk factors, atrial fibrillation, body mass index, recent stroke on MRI, Mini Mental State Examination, Rankin scale before TIA, depression, ABCD<sup>2</sup> score, hospitalization's duration.

**Results:** 95 patients (median age 79 y.o.) were included. 26 patients (27%) were assessed positively for FS. As expected, FS patients were older (84 vs 79 y.o.). They significantly differed from patients without FS for ABCD2 score (4.1 vs 3.4,  $p=0.01$ ). In addition, positive MRI was more frequent in FS patients (26% vs 16%).

**Conclusions:** FS seems to be frequent in the geriatric TIA population, and associated with high ABCD2 score and positive MRI, known to increase the risk of subsequent stroke. Looking for FS in old TIA patients could be useful for clinical management.

**Trial registration number:** N/A

### AS29-020

#### INCIDENCE AND LONG-TERM PROGNOSIS OF TRANSIENT ISCHEMIC ATTACK IN A POPULATION-BASED SETTING

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**Background and Aims:** We investigated incidence, characteristics, and prognosis of transient ischemic attacks (TIA) in a prospective population-based setting.

**Methods:** We included all cases of first-ever TIA according to the time-based definition occurring in residents in 2011–2013 and followed up to 2018 recording any outcome event including new TIA, non-fatal and fatal stroke, non-fatal and fatal myocardial infarction, and all-cause mortality. Patients with minor stroke were not included.

**Results:** Out of 1,127 screened patients, we excluded 31 non-resident patients with a first-ever TIA and 880 patients with transient symptoms other than TIA (no-TIA). We finally included 316 TIA patients. Overall crude annual incidence rate was 35.3 per 100,000 (95% CI, 31.5–39.4); the corresponding rate standardized to the 2011 European population was 27.8/100,000 (95% CI, 23.3–32.8). At the Kaplan-Meier survival analysis, the cumulative probability of survival for TIA patients was 98.7% at 30 days, 98.1% at 90 days, 95.9% at 1 year, and 85.8% at 5 years of follow-up. As a matter of comparison, no-TIA patients had higher mean age, lower ABCD2 scores, and lower proportions of vascular risk factors compared to TIA patients. Besides, the 5-year cumulative probability of

survival was lower in TIA compared to no-TIA patients (Log-Rank  $p = 0.02$ ).

**Conclusions:** Our study showed the short- and long-term risk of vascular events in TIA patients, suggesting that secondary prevention measures for TIA patients still need to be improved. Besides, we found that patients with TIA and no-TIA patients had different long-term prognoses, supporting the diversity of these two populations.

**Trial registration number:** N/A

## AS29-015

### RATES OF INTRACRANIAL STENOSIS CORRELATED WITH CAROTID STENOSIS AND VASCULAR RISK FACTORS IN PATIENTS WITH RETINAL ISCHEMIA PRESENTING TO A TERTIARY REFERRAL CENTRE TIA CLINIC

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**Background and Aims:** We aimed to determine the rates of intracranial atherosclerotic stenosis (ICAS) in patients with ischaemic transient (TVL) and permanent visual loss (PVL).

**Methods:** We reviewed the records for consecutive patients from June 2013-September 2018 presenting to the daily TIA clinic at UCLH, a regional referral centre for north central London and Moorfields Eye Hospital. We reviewed the CT angiograms (CTA) for TVL and PVL and rated ICAS proximal to the ophthalmic artery on the affected side using a modified version of a previously published rating score: 1 = small flecks of calcification, 2 = circumferential wall calcification without luminal stenosis, 3 = < 50% stenosis, 4 = > 50% stenosis. We compared ICAS with doppler measured carotid stenosis (CS), and number of vascular risk factors (No.RFs): hypertension, diabetes, atrial fibrillation, stroke, TIA, hypercholesterolaemia, smoking.

**Results:** Of 485 patients, 256 (53%) had a CTA, 159 (62%) male, mean age 63.1 years. 155 (61%) had TVL and 101 (39%) had PVL. 251 CTAs were of diagnostic quality and were assessed. Rates of significant ICAS were: 9.4% ICAS = 3, 2.7% ICAS = 4. Mean ICAS score was 0.8 for TVL and 1.3 for PVL ( $p = 0.005$ ). Mean No.RFs was 1.4 for ICAS 0–2 and 2.3 for ICAS >2 ( $p = 0.003$ ). There was moderate correlation between CS and ICAS ( $r = 0.352$ ,  $p = 0.000$ ). 10% CS < 50% and 23% CS > 50% had ICAS >2 ( $p = 0.02$ ; OR 2.6, 95%CI 1.1–6.1,  $p = 0.02$ ).

**Conclusions:** This is the first description of ICAS in retinal ischemia. 12% have some degree of ICAS, ICAS is more severe in PVL and CS > 50%, and patients with ICAS have more risk factors.

**Trial registration number:** N/A

## AS29-016

### PREDICTIVE VALUE OF ABCD2 AND ABCD3-I SCORES IN TRANSIENT ISCHEMIC ATTACK IN A NORWEGIAN PROSPECTIVE COHORT

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**Background and Aims:** Several clinical risk prediction scores have been developed to predict stroke risk after transient ischemic attack (TIA). We aimed to compare the ABCD2 and ABCD3-I scores in short and long-term risk prediction after stroke in our post TIA stroke risk study, MIDNOR TIA.

**Methods:** From October, 2012, to July, 2015, we performed a prospective, multicenter study in Central Norway, enrolling 577 patients with a TIA. In a subset of patients, we calculated the c statistics (which indicate discrimination better than chance at  $>0.5$ ) of the ABCD3-I score and compared this with the ABCD2 score at 1 week, 3 months and 1 year. We used data obtained by telephone follow-up and registry data from the Norwegian Stroke Register to assess stroke occurrences.

**Results:** Three hundred and five patients had complete data for both ABCD3-I and ABCD2 scores. Within 1 week, 3 months and 1 year, 1% ( $n = 3$ ), 3.3% ( $n = 10$ ) and 5.2% ( $n = 16$ ) suffered stroke, respectively. C statistics for the ABCD3-I score were 0.72 at 1 week (compared with ABCD2 score  $p = 0.019$ ), 0.66 at 3 months ( $p = 0.11$ ), and 0.68 at 1 year ( $p = 0.32$ ).

**Conclusions:** ABCD3-I score was superior to ABCD2 score in short-term risk prediction. Neither of the scores reliably discriminated between low and high-risk patients in long-term follow-up. Our study suggests that the ABCD3-I score can be a valuable short-term prediction tool for TIA patients in secondary care settings, also in populations with a low risk of stroke after TIA.

**Trial registration number:** NCT02038725

## AS29-012

### PREDICTIVE VALUE OF BRAIN MRA COMBINED WITH ABCD2 SCALE SCORE FOR PATIENTS WITH TRANSIENT ISCHEMIC ATTACK

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**Background and Aims:** The ABCD2 scale score can accurately predict the early development from transient ischemic attack (TIA) to cerebral infarction. The aims of this article is to evaluate the predictive value of brain magnetic resonance angiography (MRA) combined with ABCD2 score scale for TIA.

**Methods:** Among 105 patients (mean age  $60.5 \pm 3.5$  years) who were admitted to outpatient of neurology from January 2017 to June 2018 included in the study. Patients with clinically defined TIA were enrolled, assessed clinically and by MRA within 3 days. MRA combined with ABCD2 score and ABCD2 score were assessed.

**Results:** The incidence of cerebral infarction was highest in the high-risk group and related to the degree of stenosis in brain MRA. It was highest in the severe stenosis group, followed by the moderate stenosis group and mild stenosis group ( $P < 0.05$ ). A total of 12 patients (11.4%) experienced subsequent stroke by 90 days.

**Conclusions:** A new MRA combined ABCD2 scale score instead of ABCD2 score scale may improve risk stratification for early stroke risk after TIA. MRA combined ABCD2 scale score independently predicted future stroke in patients with TIA. It is a feasible method to improve the accuracy of prediction of the development from TIA to cerebral infarction.

**Trial registration number:** N/A

**AS29-018****A QUALITY AND ACCESSIBILITY ASSESSMENT OF INTERNET-BASED HEALTH INFORMATION FOR TRANSIENT ISCHEMIC ATTACKS.**

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**Background and Aims:** This study aimed to assess the quality and accessibility of internet-based information pertaining to transient ischemic attacks.

**Methods:** The three most popular English based search web engines (Google, Yahoo and Bing) were searched using the terms 'transient ischemic attack', 'TIA' and 'mini-stroke'. Quality was assessed using validated tools; JAMA benchmark assessment, the DISCERN tool, and the presence of the HON code. The Flesch Reading Ease Score (FRES) and the Flesch-Kincaid grade level (FKGL) tool assessed readability.

**Results:** The top 25 websites for each search term and engine were included for review.

The JAMA benchmark assesses quality of information, (max score of four). The average JAMA score was 1.33, indicating low quality.

The Health On the Net (HON) organization provides an HON certificate to websites which measure up to their quality standards. HON code certification was present in 21.5% of website (n = 14).

The DISCERN code assesses consumer health information. A higher code indicates better quality (max score of 80). Those websites with an HON code had a higher DISCERN score (52.2 vs 42.6, p = 0.0043).

The mean FRES score was 52, which is classified as fairly difficult to read. The mean FKGL score was 11, correlating with a grade 11 standard of reading in the USA. This indicates that the information online would largely be difficult for patients to understand.

**Conclusions:** The quality of the websites was poor across the indicators studied. Websites that had the HON code performed better in the assessment of their quality. Information online is difficult for patients to navigate.

**Trial registration number:** N/A

**AS29-009****LONG-TERM RECURRENCE AFTER TIA IN PATIENTS WITHOUT KNOWN ATHEROSCLEROTIC VASCULAR DISEASE.**

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**Background and Aims:** The aim of our study was to determine long-term recurrence stroke risk (SR) after transient ischemic attack (TIA) in patients without cardiovascular antecedents (known stroke/coronary/peripheral vascular disease) to identify the factors associated with increased risk.

**Methods:** Prospective observational registry of patients admitted to Stroke unit of our tertiary stroke center from June 2006 to January 2016 and identified first SR until January 2017. we analyzed stroke etiology subtype according to the evidence-based causative classification system (CSS) and demographic, vascular risk, and clinical factors.

**Results:** A total of 552 patients with a mean follow-up of  $54.2 \pm 37.8$  months were included in the analysis. The mean age was  $70.8 \pm 14.5$  years. A SR was detected in 96 patients (17.4%). Multivariable Cox regression associated SR with unclassified subgroup (more than one

apparent cause) [HR: 3.12 (95%CI:1.04-9.33), male sex [HR: 1.63 (95% CI:1.03-2.58), ABCD2 punctuation (moderate risk [HR: 2.26 (95% CI:1.24-4.09) and high risk [HR: 4.37 (95%CI:2.08-9.16)), new TIA whiting 72 hours after admission [HR: 2.54 (95%CI:1.39-4.64) and acute infarction [HR: 2.88 (95%CI:1.82-4.55).

**Conclusions:** We confirm that habitual predictors of recurrence after TIA are valid in patients with first-ever TIA and without cardiovascular antecedents.

**Trial registration number:** N/A

**AS29-002****READMISSION OF TRANSIENT ISCHEMIC ATTACKS IN THE UNITED STATES**

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**Background and Aims:** Transient ischemia is a temporary loss of neurological function lasting less than 24-hours, associated with obstruction of vasculature that perfuses the brain. Our study analyzes trends in hospital readmissions for patients diagnosed with transient ischemic attacks between 2009–2014.

**Methods:** Using the Healthcare Cost and Utilization Project database, we performed a retrospective cohort study to determine the trends in 7-day and 30-day readmissions for transient ischemic attacks between 2009–2014.

**Results:** We found that readmissions for patients diagnosed with transient ischemia decreased from 2009 to 2014 in the 7-day and 30-day categories ( $p < .001$ ). Between 2009–2014, the total number of readmissions decreased from 6,438 (4%) in 2009 to 4,476 (3.6%) in 2014 ( $p < 0.001$ ) in the 7-day category. In the 30-day demographic, readmissions dropped from 16,787 (10.4%) in 2009 to 11,567 (9.3%) in 2014 ( $p < 0.001$ ). We also determined that the trend of the cost of stay for readmission has increased from 2009 to 2014 in both the 7-day and 30-day categories ( $p < 0.001$ ). In the 7-day readmission category, we saw an increase from \$9,294 in 2009 to \$10,852 in 2014. The mean cost of stay in 30-day readmissions increased from \$10,264 in 2009 to \$11,267 in 2014.

**Conclusions:** Readmission rates within 7 and 30 days of initial discharge for patients diagnosed with transient ischemia decreased from 2009 to 2014, while the mean cost of stay for readmission increased. Further research is warranted to continue the improvements made in transient ischemic attack readmission statistics and to better understand factors driving the rising cost of readmission treatment.

**Trial registration number:** N/A

**AS29-001****SERUM PROPROTEIN CONVERTASE SUBTILISIN/KEXIN TYPE 9 LEVELS ARE INCREASED IN PATIENTS WITH TRANSIENT ISCHEMIC ATTACK.**

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**Background and Aims:** Proprotein convertase subtilisin / kexin type 9 (PCSK9) is associated with hypercholesterolemia and atherosclerotic disease while its inhibition reduces cardiovascular risk. There is some evidence that serum PCSK9 concentrations are higher in patients with acute coronary syndromes compared with those with stable coronary artery disease, which has been attributed to a proatherogenic and prothrombotic state. Our objective was to investigate the potential associations of PCSK9 in patients with transient ischemic attack (TIA).

**Methods:** A total of 20 patients with a first-ever atherosclerotic non-cardioembolic TIA and 20 controls of similar age and sex were enrolled. Clinical characteristics, metabolic parameters, including serum PCSK9 within 24 hours from the onset of TIA symptoms were recorded.

**Results:** Serum PCSK9 concentration was higher in TIA patients vs. controls (mean values, 248 ng/mL vs. 196 ng/mL,  $p=0.02$ ). In patients with TIA, serum PCSK9 correlated with age ( $r=0.603$ ,  $p=0.03$ ), history of coronary artery disease ( $r=0.515$ ,  $p=0.020$ ) and ABCD2 (Age, Blood pressure, Clinical features, symptom Duration, Diabetes) score (a future stroke prediction tool) ( $r=0.512$ ,  $p=0.021$ ). In multivariate analysis, serum PCSK9 was independently associated with higher odds of TIA (1.16 per 10 ng/mL increase, 95% CI 1.01-1.34,  $p=0.035$ ).

**Conclusions:** Our findings indicate that serum PCSK9 levels are independently associated with atherosclerotic TIA and the risk of future stroke. Further investigation is needed to confirm these findings or to assess the use of PCSK9 as a target for early treatment as well as for secondary stroke prevention.

**Trial registration number:** N/A

## AS29-010

### TIA MIMICS IN A REGIONAL HOSPITAL EMERGENCY DEPARTMENT

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**Background and Aims:** Early diagnosis of transient ischemic attack (TIA) is crucial to allow commencement of secondary prevention and reduction of future stroke risk. This is challenging in emergency departments (EDs) as TIA presentations are heterogeneous and brief. 20–40% of TIA referrals have a revised diagnosis of 'TIA mimic' following neurologist review. However, it is unknown if mimics occur with the same frequency in a regional setting. In order to optimize our TIA management pathway, we aimed to determine the frequency and types of mimics presenting to a large regional hospital ED.

**Methods:** We conducted a 3-year retrospective cohort study of all suspected TIA presentations to the ED of Ballarat Health Services, a regional hospital in Victoria, Australia. Data were extracted from the medical record for all patients with an ICD-10 TIA code (G45.8, G45.9, G45.3). Documented diagnoses were reviewed by a Neurologist.

**Results:** We identified 388 TIA presentations to our centre in the Victorian Emergency Minimum Dataset with 243 cases (62.6%) confirmed as true TIA or minor stroke. The 145 (37.4%) mimics included migraine ( $n=19$ , 4.9%), transient global amnesia ( $n=12$ , 3.1%), seizure ( $n=8$ , 2.1%) and peripheral neuropathy ( $n=7$ , 1.8%). Non-neurological mimics included delirium ( $n=18$ , 4.6%), pre-syncope ( $n=17$ , 3.5%) and hypoglycaemia ( $n=4$ , 1.0%).

**Conclusions:** Our results are similar to mimic frequency and type seen in metropolitan centres. Identifying more mimics at a point of referral may reduce the need of unwarranted investigation, medication and referrals. Our data will be used towards this aim.

**Trial registration number:** N/A

## AS29-011

### DELIRIUM AS A TIA MIMIC – ARE THERE CLINICAL INDICATORS?

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**Background and Aims:** Delirium is a recognized stroke mimic, however, there is little data on delirium as a mimic of transient ischemic attack (TIA). Delirium is prevalent in the same population at risk of TIA and is a well-documented independent predictor of mortality, especially if not recognized and managed properly. Differentiating between TIA and delirium disguised as TIA would assist in proper use of resources.

**Methods:** We conducted a 3-year retrospective cohort study of all suspected TIA presentations to the ED of Ballarat Health Services (BHS). We compared symptomatology and other on-presentation features of neurologist-confirmed TIA cases and re-diagnosed delirium cases.

**Results:** A total of 388 patients were identified as suspected TIA. In the group of TIA mimics on neurologist review, we identified 18 (4.6%) with delirium. We were unable to differentiate between delirium and true TIA on symptomatology alone. However, we did identify certain features more frequently in patients with delirium, namely – older age ( $p=0.004$ ), history of recent infection ( $p=0.017$ ), premorbid cognitive deficit ( $p=0.006$ ), previous delirium ( $p=0.018$ ). The categorization of patients with delirium was based on patient records as analyses were retrospective. This is a possible confounder as the actual prevalence of delirium may have been underestimated.

**Conclusions:** Our results indicate that there are potential features in delirium that would allow differentiation from TIA or even stroke. This would require a cross-sectional analysis targeting TIA/stroke admissions to determine if the variables identified are sensitive enough to be used as discriminators. Our project is ongoing.

**Trial registration number:** N/A

## AS29-003

### RATE AND ASSOCIATED FACTORS OF TRANSIENT ISCHEMIC ATTACK MISDIAGNOSIS

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**Background and Aims:** Lack of biomarkers for transient ischemic attack create a diagnosis obstacle. We investigated the rate and associated factors of TIA misdiagnosis.

**Methods:** We analyzed consecutive patients with TIA-like symptoms who presented to our emergency departments during a 9-month period. All TIA patients were evaluated by a neurologist within 24 hours and had at least one follow-up visit within 3 months. Baseline characteristics of patients and clinical data were reviewed. The final diagnosis was independently made by stroke neurologists.

**Results:** Out of 276 patients with the initial diagnosis of TIA, 254 patients (mean age  $68.7 \pm 15.4$  years, 40.9% male, 25.2% final diagnosis of definite TIA) were included in analysis. Twenty-four patients (9.4%) were referred to our TIA clinic. The rate of TIA misdiagnosis among referred patients was 45.8%. Among 230 patients who were evaluated in

inpatient setting, the rate of TIA misdiagnosis was 60.0%. A discharge diagnosis of definite TIA was observed in 54.3% of patients; however, only 24.8% had the final diagnosis of definite TIA. The univariate analysis suggests a significant difference ( $P < 0.05$ ) between two groups (correctly diagnosed vs. misdiagnosed patients) in terms of hospital discharge diagnosis, final diagnosis, history of diabetes mellitus, and coronary artery disease. In regression model three variables including hospital discharge diagnosis ( $P < 0.001$ ), final diagnosis ( $P < 0.001$ ), and diabetes mellitus ( $P = 0.018$ ) retained their independent association with TIA misdiagnosis.

**Conclusions:** Study indicated a high rate of TIA misdiagnosis in the emergency department, hospital, and outpatient clinics. Nothing about the nature of the initial symptoms distinguished true from misdiagnosed TIA.

**Trial registration number:** N/A

#### AS29-004

#### SIX-MONTH OUTCOME OF TRANSIENT ISCHEMIC ATTACK AND ITS MIMICS

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**Background and Aims:** The goal of this study is to compare the 6-month outcome of patients with TIA, TIA mimics, and minor stroke.

**Methods:** We prospectively studied consecutive patients with an initial diagnosis of TIA in a two-year period. Included patients had an initial brain magnetic resonance imaging (MRI) and one-month, three, and six-month follow-ups. Primary outcome was the composition of intracerebral hemorrhage, ischemic stroke, TIA, coronary artery disease, and death.

**Results:** Out of 269 patients with the initial diagnosis of TIA, 259 patients (mean age  $70.5 \pm 15.0$  [30-100] years old, 56.8% men) were included in the analysis. 21 (8.1%, 95% confidence interval [CI] 5.1-12.1%) patients had a composite outcome event within the 6-month follow-up. Five (23.8%) and 13 (61.9%) composite outcomes occurred in the first 30 and 90 days, respectively. Among patients with TIA, the one-month and six-month ischemic stroke rate was 1.5% and 4.6%, respectively. The incidence proportion of composite outcome was significantly higher among patients who had TIA compared with those who had TIA mimics (12.2% vs. 2.1% – relative risk 5.9; 95% CI, 1.4 – 25.2). In univariable analysis among patients with TIA and minor stroke, age ( $P = 0.017$ ) was the factor that was significantly associated with the occurrence of the composite outcome.

**Conclusions:** Our study indicated that the overall six-month rate of the composite outcome among patients with TIA, minor stroke, and TIA mimics were 12.2%, 9.7%, and 2.1%, respectively. Age was the only factor that was significantly associated with the occurrence of the composite outcome.

**Trial registration number:** N/A

#### Women and Stroke

#### AS30-037

#### SEX DIFFERENCES IN PRESENTATION OF STROKE: A SYSTEMATIC REVIEW AND META-ANALYSIS

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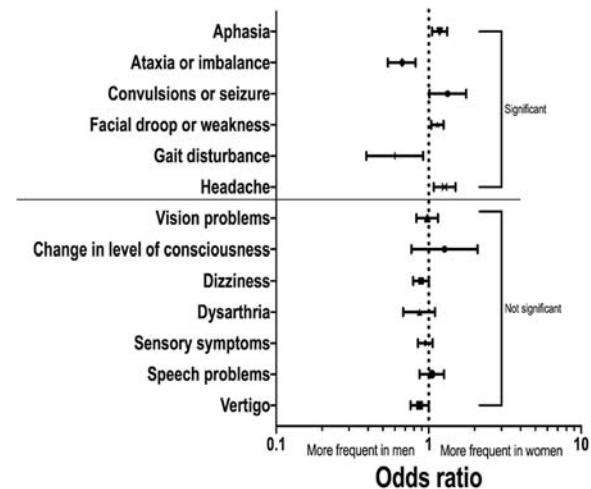
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**Background and Aims:** Previous studies have reported sex differences in the presentation of acute myocardial infarction; atypical symptoms are

observed more often in women. We aimed to investigate gender differences in acute stroke symptoms, especially whether women present more often with atypical symptoms.

**Methods:** A comprehensive literature search was performed to identify articles on sex differences in presenting symptoms in patients with a confirmed stroke. Reference lists from these articles were screened to extract additional articles. Forest plots were produced to investigate traditional symptoms (aphasia, ataxia or imbalance, dysarthria, facial droop or weakness, gait disturbance, sensory, speech or vision problems) and atypical symptoms (change in level of consciousness, convulsions or seizure, dizziness, vertigo and headache).

**Results:** Twenty studies involving 86907 patients ( $n = 44317$ ; 51.0% women) were identified for analysis. Women present more often with aphasia (OR = 1.18; 95% CI = 1.05-1.32; I<sup>2</sup> = 45%) and facial droop or weakness (OR = 1.14; 95% CI = 1.04-1.25; I<sup>2</sup> = 0%), while men present significantly more often with ataxia (OR = 0.67; 95% CI = 0.54-0.82; I<sup>2</sup> = 42%) and gait disturbance (OR = 0.60; 95% CI = 0.39-0.92; I<sup>2</sup> = 73%). In addition, women have more often nonspecific symptoms including headache (OR = 1.27; 95% CI = 1.08-1.50; I<sup>2</sup> = 78%) and convulsions or seizure (OR = 1.33; 95% CI = 1.01-1.76; I<sup>2</sup> = 0%).



**Conclusions:** We found minor sex differences in presentation of stroke symptoms, suggesting that current public awareness campaigns of stroke warning signs are appropriate. However, women are slightly more likely to present with diffuse symptoms such as headache which could affect delay in recognizing stroke and seeking treatment.

**Trial registration number:** N/A

#### AS30-022

#### SEX DIFFERENCES IN HEALTH-RELATED QUALITY OF LIFE (HRQOL) 10 YEARS AFTER STROKE

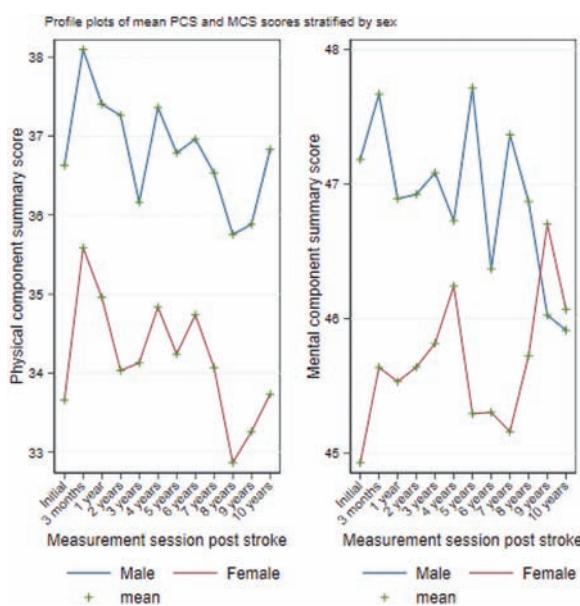
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**Background and Aims:** The James Lind Alliance deems Quality of life after stroke among the top 10 research priorities. Several studies have identified sex differences, however inconsistent findings have been reported. This study investigates the HRQoL 10 years after stroke using the South London Stroke Register (SLSR).

**Methods:** Data from 2,462 SLSR patients (1995–2018) were utilised, 45% were female and mean age (Standard deviation) 68 (15) years. Sociodemographic; stroke severity and health status information were obtained at time of first ever stroke, 3 months and annually thereafter. The primary outcomes were the mental component summary (MCS) and physical component summary (PCS) scores of the Short Form Health Survey 12 (SF-12). Separate mixed effects models were applied for the MCS; PCS and SF-12 items using the statistical software Stata (15.1).

**Results:** The mean MCS (-1.82, 95% Confidence Interval [CI] -2.54 to -1.10,  $p < 0.001$ ) and PCS (-1.91, 95% CI -2.66 to -1.17,  $p < 0.001$ ) scores for women were significantly lower than for men respectively, after adjustment for sociodemographic factors and stroke severity. The profiles of PCS and MCS revealed a decline in HRQOL and a persistent gap between women and men up to 10 years after stroke. (Figure 1)



**Conclusions:** Calculation of minimum clinically important differences and causes of this difference necessitate further work. Interventions to lessen declines in HRQoL should be considered.

**Trial registration number:** N/A

## AS30-025

### GENDER DIFFERENCES IN DOOR-TO-NEEDLE TIMES FOR ACUTE ISCHEMIC STROKE – NEED TO IMPROVE?

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**Background and Aims:** There is little data on gender differences regarding door-to-needle (DTN) times in ischemic stroke (IS) patients. We aimed to compare the DTN times between genders and to test the impact of an implemented strategy to uniform possible differences.

**Methods:** Retrospective analysis of a single-center cohort of consecutive IS patients treated with intravenous thrombolysis from 2015 to 2018. During the second semester of 2018 a strategy was implemented to alert medical staff to the possible gender gap in DTN times. We divided two periods: the pre-intervention (from 2015 to first semester of 2018)

and the post-intervention (second semester of 2018). DTN times between genders in two periods were compared using t-student test and the impact of this strategy was evaluated by Two-Way ANOVA test.

**Results:** We identified 308 patients, 148 (48.1%) were female. In the pre-intervention period, women had longer DTN times ( $50.56 \pm 29.72$  min versus men:  $45.17 \pm 24.12$  min in man), but not statistically significant ( $p = 0.098$ ). This trend continued after the implementation of an awareness strategy (women:  $48.21 \pm 40.01$  min versus men:  $44.92 \pm 23.91$  min,  $p = 0.160$ ), although not statistically significant. The comparison of DTN times between genders in pre and post-intervention periods showed no statistically significant differences (mean value of 4.338,  $p = 0.410$  and mean value of 1.297,  $p = 0.805$ , respectively).

**Conclusions:** Women with stroke appear to have a tendency for slightly longer DTN times, but without clear statistical significance. The implemented strategy did not change the times. Further studies are needed to clarify this trend.

**Trial registration number:** N/A

## AS30-012

### TRENDS IN RECRUITMENT OF WOMEN AND REPORTING OF SEX DIFFERENCES IN LARGE-SCALE PUBLISHED RANDOMISED CONTROLLED TRIALS IN STROKE

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**Background and Aims:** Whether sex differences are regularly reported and discussed in publications from stroke randomised controlled trials (RCTs), and whether this is becoming more usual, is unknown. We aimed to examine the percentage of female participants included, and the reporting of sex and gender related results in large-scale stroke RCTs from 1990 to 2018.

**Methods:** RCTs from 1990 to 2018 were identified from ClinicalTrials.gov, using keywords “stroke” and “cerebrovascular accidents”. Studies were selected if they enrolled  $\geq 100$  participants, included both sexes and were published trials (identified using PubMed, Google Scholar, and Scopus).

**Results:** Of 1700 stroke RCTs identified, 277 were eligible for analyses. Overall, these RCTs enrolled only 40% females, and in the past 10 years this percentage barely changed, peaking at 41% in 2008–2009 and 2012–2013. North American RCTs recruited the most women, at 43%, and Asia the lowest, at 40%. Amongst the 277 RCTs, 101 (36%) reported results according to sex, of which 91 (33%) were pre-specified analyses. The increasing trend in the number of studies reporting sex-differentiated results from 2008–2018 merely paralleled the increase in the number of papers published during the same time period. North American RCTs most often reported sex specific results (42%), and Australia and Europe least often (31%).

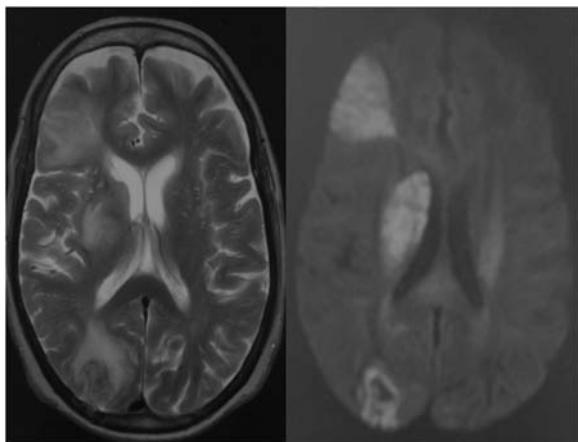
**Conclusions:** Little progress has been made in the inclusion of females and the reporting of sex in stroke RCTs. This highlights the need for key stakeholders to provide clear guidance and effective implementation strategies to researchers in the scientific reporting of sex.

**Trial registration number:** N/A

**AS30-029****ANTIPHOSPHOLIPID ANTIBODY SYNDROME PRESENTING AS STROKE – SIGNIFICANCE OF APTT****D. Chaudhari<sup>1</sup>, P. Renjen Nath<sup>2</sup>, K. Ahmad<sup>2</sup> and A. Kumar<sup>2</sup>**<sup>1</sup>Dr., Department of Neurosciences, New Delhi, India; <sup>2</sup>Indraprastha Apollo Hospital- New Delhi, Department of Neurosciences, New Delhi, India

**Background and Aims:** The antiphospholipid syndrome is a systemic autoimmune disease defined by thrombotic or obstetrical events that occur in patients with persistent antiphospholipid antibodies. Anti-phospholipid antibodies (APLA) are a part of heterogeneous group of circulating serum polyclonal immunoglobulins (IgG, IgM, IgA or mixed) that bind negatively charged or neutral phospholipid component of cell membranes and cause increased tendency to venous or arterial thrombosis. Persistently positive APS requires that laboratory tests be conducted at least 12 weeks apart.

**Methods:** A 67 years old pleasant lady presented with sudden onset dizziness, left sided weakness and right facial deviation for 2 days. Neurological examination revealed left hemi-neglect, left UMN facial palsy and left hemiparesis (2/5). MRI Brain revealed multiple acute infarcts in right frontal, parieto-occipital and basal ganglia regions (Fig-1). Her routine blood tests and cardiac work up (including 2D ECHO) were within normal limits, except for the deranged isolated APTT. Tests for ANA and dsDNA were negative.



**Results:** In view of deranged APTT and high clinical suspicion, Lupus anticoagulation tests were done using DRVVT which was prolonged. Tests were repeated after 12 weeks and Lupus anticoagulant remained positive. The aCL and anti-β2GPL antibodies (IgG, IgM, or IgA) titers were significantly high ( $>40$ GPL). She was started on oral anticoagulation (INR:2.5-3.5). She responded well and didn't have stroke in long term follow-up.

**Conclusions:** Routine APTT detects upto 30% of APLAS, but DRVVT and Antibodies must be considered in such cases. This is a treatable condition, and can be prevented with long term anticoagulation.

**Trial registration number:** N/A

**AS30-030****SEX DIFFERENCES IN POST-STROKE DEMENTIA****L. Dong<sup>1</sup>, E. Briceno<sup>2</sup>, L. Morgenstern<sup>3</sup> and L. Lisabeth<sup>1</sup>**<sup>1</sup>University of Michigan School of Public Health, Epidemiology, Ann Arbor, USA; <sup>2</sup>University of Michigan Medical School, Physical Medicine & Rehabilitation, Ann Arbor, USA; <sup>3</sup>University of Michigan Medical School, Neurology, Ann Arbor, USA

**Background and Aims:** Little is known about sex differences in cognitive impairment after stroke. This study investigated sex differences in prevalence of dementia at 90 days after first-ever stroke in a population-based sample.

**Methods:** The study sample consisted of 1231 participants from the Brain Attack Surveillance in Corpus Christi Project (south Texas, USA) who had first-ever stroke between 2009 and 2016. Post-stroke cognitive function was assessed by the Modified Mini-Mental State Examination (3MSE). Pre-stroke cognitive function was measured using the Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE). Inverse probability weighting and multiple imputation were used to deal with differential attrition. Weighted logistic regression was used to examine the association between sex and post-stroke dementia.

**Results:** The study sample was evenly distributed by sex. Approximately three-fifths were Mexican American, and one-third were non-Hispanic White. Among participants who were dementia-free before stroke (IQCODE < 3.45), prevalence of dementia at 90 days post-stroke (3MSE < 78) was 20.8% for men (95% Confidence Interval [CI] = 16.8%-24.7%), and 27.6% for women (95% CI = 23.1%-32.0%); the unadjusted odds ratio (OR) comparing women to men was 1.45 (95% CI = 1.08-1.96). The association was attenuated after age adjustment (OR = 1.14, 95% CI = 0.82-1.59), and further attenuated after adjustment for sociodemographic, pre-stroke and stroke characteristics (OR = 0.89, 95% CI = 0.59-1.35).

**Conclusions:** The prevalence of dementia at 90 days post-stroke was high among stroke survivors without previous history of stroke and dementia. The higher prevalence in women compared to men was attributable to sociodemographic characteristics and stroke severity. The unique care needs of stroke survivors with dementia warrant further investigation as stroke survivorship improves.

**Trial registration number:** N/A

**AS30-020****ARE GENDER DISPARITIES CORRELATED WITH ONSET SYMPTOMS LAND USE TYPE AMONG PATIENTS TREATED WITH R-TPA?****J. Freyssenge<sup>1</sup>, L. Fraticelli<sup>2</sup>, C. Claustre<sup>2</sup>, M. Bischoff<sup>2</sup>, L. Derex<sup>3</sup>, N. Noghoghsian<sup>3</sup> and C. El Khoury<sup>2</sup>**<sup>1</sup>Université Claude Bernard Lyon 1, EA 7425 HESPER, LYON, France;<sup>2</sup>Lucien Hussel Hospital, RESCUe network, Vienne, France; <sup>3</sup>Hospices Civils de Lyon, Stroke Center – Department of Neurology, Bron, France

**Background and Aims:** Proportion of stroke patients treated with tissue plasminogen activator (r-tPA) is higher in urban than in rural hospitals. In addition, literature reveals a different management by gender. Does the land use type play a role in the management of treated patients according to gender? Our study evaluates if a disparity in management and functional prognosis between thrombolyzed women and men depends on the onset symptoms land use type.

**Methods:** Patients treated with r-tPA between 2010 and 2016 in Primary Stroke Centers (PSC) of RESUVal network were included. Age-adjusted analyses and multivariate models were performed. Multivariate analysis determines whether the place of occurrence (rural/urban) had an impact

on mortality and disability at 3 months (mRS), depending on the patient gender.

**Results:** 2790 patients were thrombolyzed, with 45.7% of women. Women who experienced stroke in an urban area were more likely to be admitted directly to PSC (34.28% vs 29.58%,  $p = 0.0169$ ). With age adjusted analysis this finding was less pronounced (33.83% vs 29.68%,  $p = 0.0546$ ), explained by the higher proportion of elderly women. In multivariate models, the territory type did not influence patient mortality. However, rural areas' symptoms were a risk factor for women (RR 1.26 [1.03;1.55],  $p = 0.0219$ ), with lower mRS at 3 months.

**Conclusions:** Rural areas are an explanatory factor for poorer direct access to PSC and poorer functional recovery at 3 months for women. An explication could be the higher proportion of single women and longer travel times to the nearest PSC.

**Trial registration number:** N/A

## AS30-004

### FACTORS CONTRIBUTING TO SEX DIFFERENCES IN HEALTH-RELATED QUALITY OF LIFE (HRQOL) AFTER ISCHEMIC STROKE: THE BRAIN ATTACK SURVEILLANCE IN CORPUS CHRISTI (BASIC) PROJECT

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**Background and Aims:** Women have been reported to have worse HRQoL post-stroke than men but uncertainty exists over the reasons for the sex difference.

**Methods:** We included first-ever ischemic strokes registered with the BASIC project (2010 – 2012) – a population-based stroke study – who completed their 90-day outcome interview. Information on baseline characteristics were obtained from medical records and in-person interviews. HRQoL was measured by the 12-item short-form Stroke Specific Quality of Life Scale. Multivariable Tobit regression was used to estimate the mean differences (MD) in overall HRQoL scores (range 0–5; higher scores indicate better HRQoL) between sexes and to identify contributing factors to the difference.

**Results:** A total of 290 cases completed the HRQoL assessment (median age: 66; 53.3% being females). In unadjusted analyses, women had poorer HRQoL than men (MD -0.201, 95% CI -0.465, 0.063). Significant contributors included sociodemographics/pre-stroke factors (age, ethnicity, marital status, pre-stroke function and cognition), health behaviours/comorbidities (history of ever-smoking, dementia, heart failure, myocardial infarction, stroke/TIA), and initial stroke severity (NIHSS). Pre-stroke factors explained 40% of the sex difference (MD -0.113, -0.362, 0.136) while further adjustment for comorbidities accounted for a further 16% (MD -0.084, -0.329, 0.161). In a fully-adjusted model that included adjustment for stroke severity, the sex difference was eliminated (MD -0.014, -0.247, 0.218).

**Conclusions:** Poorer HRQoL in women was explained by the combination of sociodemographics, pre-stroke factors, comorbidities, and stroke severity. The finding highlights a need for better management of general health and modifiable factors related to stroke severity to reduce sex differences in wellbeing after stroke.

**Trial registration number:** N/A

## AS30-010

### ARE THERE SEX DIFFERENCES IN PROCESSES OF STROKE CARE AND OUTCOMES AT DISCHARGE IN VIETNAM?

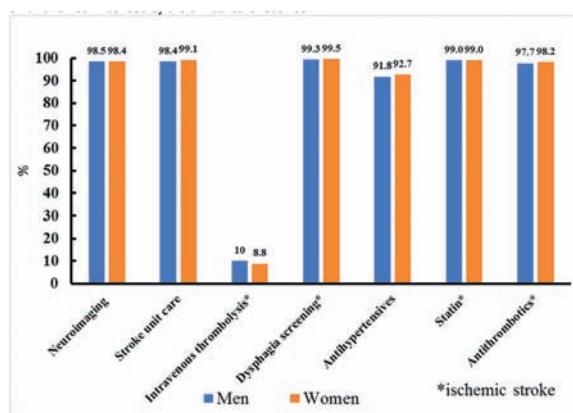
H. Phan Ph, D student<sup>1</sup>, T. Nguyen<sup>2</sup>, D. Cadilac<sup>3</sup>, H. Nguyen<sup>4</sup>, D. Terry<sup>5</sup>, B. Pham<sup>2</sup>, D. Nha<sup>2</sup>, H. Nguyen Nguyen<sup>2</sup>, C. Do<sup>2</sup>, A. Truong<sup>2</sup>, L. Dam<sup>2</sup>, L. Le<sup>2</sup>, B. Phan<sup>2</sup> and S. Gall<sup>1</sup>

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**Background and Aims:** In developed countries, women appear to receive evidence-based care less often than men. Whether there are sex differences in stroke care and outcomes in developing countries is uncertain.

**Methods:** We included consecutive strokes admitted to the 115 People's Hospital – a major metropolitan public hospital in Vietnam during Jun 2017-Mar 2018. The data were collected using the REgistry of Stroke Care Quality (RES-Q). Baseline characteristics, clinical care provided in hospital (e.g. stroke unit access, thrombolysis), and outcomes at discharge (mortality and functional outcome assessed by the ability to walk without assistance) were compared between sexes.

**Results:** Data were available for 6,601 strokes (44% women, 81% ischemic stroke). Compared to men, women were older (mean age 65 vs 60 years), less often current smokers (16% vs 63%) and had more atrial fibrillation detected by screening (12% vs men 8%; all  $p$  values < 0.001). More women had assessment for rehabilitation needs  $\leq$  72 hours (35% vs 31%,  $p = 0.022$ ) or carotid investigation  $\leq$  7 days after hospital admission (4% vs 6%,  $p = 0.041$ ). There were no differences in receipt of other clinical care between sexes (Figure). Women had somewhat greater in-hospital mortality 3.4% vs 2.7% ( $p = 0.139$ ) and lesser ability to walk on discharge (47% vs 44%;  $p = 0.031$ ) than men, but the differences were small and not influenced by the clinical care received.



**Conclusions:** Generally, men and women with acute stroke received equivalent hospital care. Outcomes at discharge did not differ by sex. Nonetheless, uncertainty exists over the sex differences in long-term outcomes, requiring longer-term follow-ups.

**Trial registration number:** N/A

**AS30-040**
**SEX DIFFERENCES IN ISCHEMIC STROKE:  
IMPACT OF COLLATERAL CIRCULATION AND  
CLOT LENGTH ON OUTCOME AFTER  
MECHANICAL THROMBECTOMY**
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**Background and Aims:** The influence of sex on outcome after stroke has been the focus of much research in recent years. However, sex differences in the impact of clot length and collateral circulation on outcome have not been studied. The purpose of this study was to investigate sex differences in collateral circulation and clot length and their impact on outcome after mechanical thrombectomy.

**Methods:** Single center retrospective observational study of 210 patients (110 women, 100 men) treated with mechanical thrombectomy for anterior ischemic stroke during the years 2014–2016. Analysis of CT and CTA (clot length, collateral circulation), patient characteristics (sex, age, time windows, NIHSS) and outcome (TICI, 90-day mRS).

**Results:** Women were older, (median 74 years vs 70), NIHSS, localization of occlusion, clot length and time to recanalization were comparable between men and women. Clot length did not correlate to outcome. A larger percentage of men were functionally independent at 90-day follow-up (mRS 0–2), 46% vs 40%. No collateral circulation lead to poor outcomes (mRS 3–6) in 93% of cases. A larger proportion of women had good/moderate collateral circulation, 71% vs 61% ( $p=0.1$ ). Men with good/moderate collateral circulation were independent at 90-day follow-up to a higher extent, 56% vs 45% ( $p=0.18$ ).

**Conclusions:** Clot length did not differ between men and women and had no impact on outcome. The absence of collateral circulation was highly associated with poor outcome regardless of sex. Although not statistically significant men with good/moderate collateral circulation had better outcomes. Further research is needed to elucidate this difference.

**Trial registration number:** N/A
**AS30-021**
**DIFFERENCES BETWEEN WOMEN AND MEN  
IN EFFECT OF TENECTEPLACE VERSUS  
ALTEPLASE IN ACUTE STROKE (NOR-TEST) –  
A RANDOMIZED, CONTROLLED TRIAL**
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B. Thommessen<sup>4</sup>, O.M. Rønning<sup>4</sup>, C. Kvistad<sup>5</sup>, V. Novotny<sup>5</sup>,  
U. Waje-Andreasen<sup>5</sup>, L. Thomassen<sup>5</sup>, H. Næss<sup>5</sup> and L. Nicola<sup>5</sup>**
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<sup>3</sup>Oslo Universitetssykehus HF, Department of Neurology, 0424 Oslo, Norway; <sup>4</sup>Akershus University Hospital, Department of Neurology, Lørenskog, Norway; <sup>5</sup>Haukeland University Hospital, Center for Neurovascular Disease, Bergen, Norway

**Background and Aims:** In the Norwegian Tenecteplase Trial (NOR-TEST), patients with acute ischemic stroke were randomized to either tenecteplase or alteplase. We aimed to compare the proportions in the two treatment groups reaching good clinical outcome according to sex.

**Methods:** NOR-TEST investigated the safety and efficacy of tenecteplase versus alteplase in acute stroke patients eligible for intravenous thrombolysis. Good clinical outcome was defined as modified Rankin Scale 0–1 at three months follow-up (analysed using unadjusted logistic regression).

**Results:** 1100 patients were randomised; 440 (40%) were women. Mean age was the same in women and men ( $67.8 \pm 15.2$  years). Median NIHSS at admission was 4 (IQR 2–8) in women and 3.5 (2–7) in men. There were no differences in good clinical outcome between tenecteplase and alteplase in women or in men (OR 1.13, 95% CI 0.77 – 1.67, and OR 1.08, 95% CI 0.77 – 1.49, respectively). There was no heterogeneity in treatment effect (interaction p-value = 0.84).

**Conclusions:** Tenecteplase was not superior to alteplase in the subgroups according to sex.

**Trial registration number:** Clinicaltrials.gov, number NCT01949948
**WITHDRAWN**

**WITHDRAWN**

**AS30-028****A SYSTEMATIC REVIEW AND META-ANALYSIS  
ON THE SEX DIFFERENCES IN STROKE RISK  
IN PATIENTS WITH MIGRAINE**

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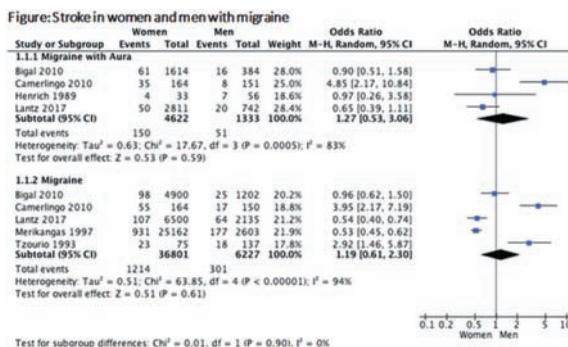
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**Background and Aims:** The association between migraine and the incidence of stroke varies in different subgroups of patients. The role of sex in affecting the outcomes in patients with migraine has not been clearly elucidated. A systematic review and meta-analysis was conducted to evaluate the effect of sex (women and men with migraine or migraine with aura) on stroke.

**Methods:** A comprehensive search of Medline, EMBASE, SCOPUS was performed. From 306 articles eight observational studies were selected. The incidence of stroke, both ischemic and hemorrhagic, was considered the main outcome.

**Results:** The meta-analyses showed no significant differences in the risk of stroke between women and men with migraine or migraine with aura (Fig 1). Of note, in one study (Peng et al, 2017), in a subgroup analysis by age and sex, a higher risk for stroke was found in women with migraine with aura aged  $\leq 45$  years (aHR: 4.58, 95% CI: 2.45–8.56,  $p < 0.001$ ) compared to control. Kuo et al (2013) reported a significantly lower hemorrhagic stroke incidence in women compared to men with migraine (0.40% vs 0.85%,  $p < 0.001$ ).

**Conclusions:** Overall, our data indicate that there are no significant difference in the incidence of stroke (both ischemic and hemorrhagic) between men and women with migraine or migraine with aura. Age could play an important synergistic role with sex. These findings underscore the importance of identifying high-risk migraineurs with other modifiable stroke risk factors. Hemorrhagic stroke risk is significantly greater in men compared to women with migraine.



Trial registration number: N/A

## AS30-032

### DIFFERENT MANIFESTATIONS OF VASCULAR BRAIN INJURY IN WOMEN AND MEN WITH VASCULAR COGNITIVE IMPAIRMENT

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**Background and Aims:** While knowledge about differences in the manifestations of cardiovascular diseases between women and men is increasing, the influence of sex on vascular cognitive impairment (VCI) is marginally studied. Better understanding of potential differences between sexes may improve diagnosis and personalized management of VCI. We aimed to investigate differences in cardiovascular risk factors, cognitive functioning and vascular brain injury on MRI between women and men with VCI.

**Methods:** 160 patients (38% women) with VCI from the Heart-Brain Study were included. These patients had cognitive complaints, were independent in daily living and had vascular brain injury on MRI. Differences between women and men were assessed using independent t-tests,  $\chi^2$ -tests, non-parametric statistics and regression analyses. Additionally, regression analyses adjusted for age and cardiovascular risk factors were used to estimate odds ratio's (OR) for women vs. men. White matter hyperintensity (WMH) volumes were expressed as percentage of the total intracranial volume.

**Results:** Age, education and cognitive functioning did not differ between women and men. Women tended to have larger WMH volumes than men (median [IQR] 0.6% [0.3–1.3] vs. 0.5% [0.1–1.4]; age adjusted  $p = 0.08$ ). In contrast, women had less (sub) cortical infarcts (OR 0.48, 95%CI 0.23–0.97), less lacunar infarcts (OR 0.48, 95%CI 0.24–0.97) and less lobar microbleeds (OR 0.38, 95%CI 0.17–0.82) than men.

**Conclusions:** We found different MRI manifestations of vascular brain injury in women and men with VCI, which suggests different underlying etiologies of VCI in both sexes. Further research is needed to find out if management of patients with VCI should be adapted according to sex.

Trial registration number: N/A

## AS30-033

### SAFETY OF REPERFUSION THERAPY FOR ACUTE ISCHEMIC STROKE IN PREGNANT AND POSTPARTUM WOMEN – A SYSTEMATIC REVIEW

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**Background and Aims:** During pregnancy and the postpartum period, women have an increased risk of acute ischemic stroke (AIS). Due to lack of data, safety of reperfusion therapy in these patients is not well established.

**Methods:** We conducted a systematic review of PubMed and EMBASE databases. We included studies on pregnant/postpartum women with AIS who underwent reperfusion therapy according to current guidelines (IV rtPA 0.9 mg/kg [IVT] and/or endovascular treatment with a stent retriever/aspiration device [EVT]). Outcomes were maternal/fetal death, major bleeding according to ISTH criteria, and severe infant morbidity.

**Results:** Out of 560 search results, we included 26 case reports and 4 cohort studies, with data of 169 women in total. Of these, 163 underwent IVT and 13 EVT (7 both). 149 women were pregnant and 5 were postpartum (15 not reported). Among IVT treated patients, 5 women (3%) and 6 fetuses (4%) died. Two fetal deaths involved voluntary terminations of pregnancy. After IVT, there was one reported case of preterm birth (32 weeks of gestation), and one woman developed a symptomatic intracerebral hemorrhage (0.6%). No complications were reported in women who were treated with EVT.

**Conclusions:** Reported complication rates of reperfusion therapy in pregnant/postpartum women with AIS appear slightly lower than in the general stroke population, although there is a high risk of publication bias.

Based on these data, reperfusion therapy can be considered in pregnant/postpartum women with AIS.

**Trial registration number:** N/A

### AS30-03I

#### GENDER DIFFERENCES IN STROKES IN KYRGYZSTAN: FIRST GENDER COMPARATIVE STUDY, LEAD ON THE HOSPITAL-BASED STROKE REGISTRY SITS-KYRGYZSTAN.

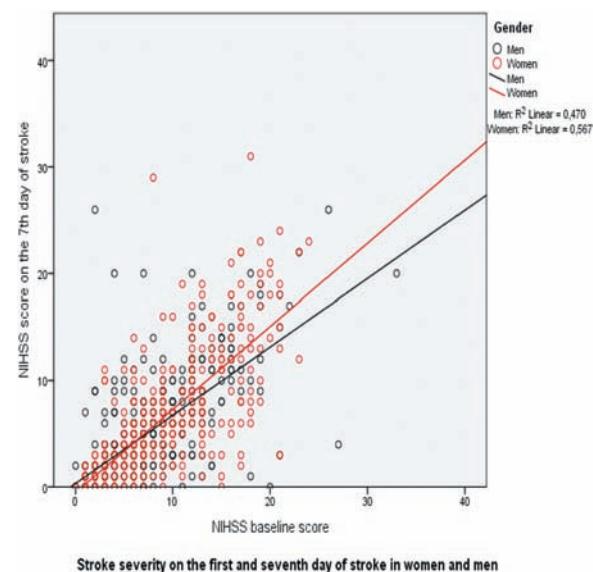
I. Lutsenko<sup>1</sup>, A. Sultanova<sup>1</sup>, A. Ismailova<sup>1</sup>, A. Orunbaeva<sup>1</sup>, D. Nazhmudivanova<sup>1</sup> and S. Omurbekov<sup>1</sup>

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**Background and Aims:** Gender dependent studies in stroke in Kyrgyzstan were never made, despite of growing attention to differences in cardiovascular disease and stroke. We aimed to describe gender differences in acute stroke between males and females in Kyrgyzstan.

**Methods:** We used the data from SITS-Kyrgyzstan, starting from 2015. Demographic parameters, severity of stroke: NIHSS baseline and on the 7th day were evaluated. Etiopathogenetic classification TOAST was used in ischemic stroke.

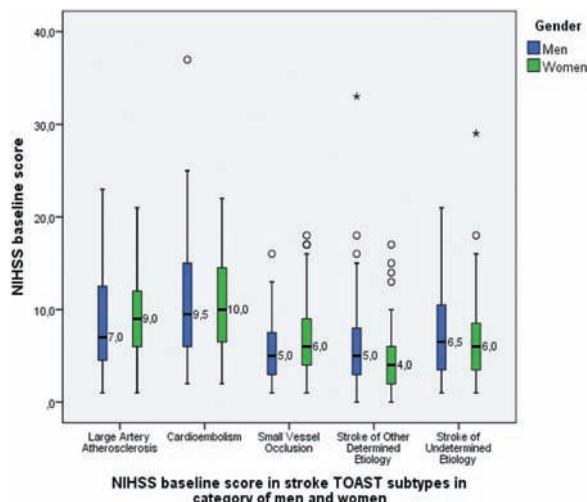
**Results:** A total of 1018 stroke patients were analyzed: 742 (72.9%) ischemic and 204 (21.1%) haemorrhagic strokes, with 481 (47.2%) women and 537 (52.8%) in sample. Females were significantly older than males: median age in women was 66 (57;77) and in men 60 (53;68) years,  $p = 0.0001$ . Stroke severity was not significantly different: median baseline NIHSS in females was 7 (4;12) versus 6 (3;10) in males, but in cardioembolic IS (CIS) median NIHSS were 9.5 versus 10, leaving CIS the most severe in sample. In both genders we found strong positive correlation between the NIHSS severity on the 1st and the 7th days of stroke,  $p = 0.0001$ . No significant difference in NIHSS score between men and women was found on the 7th day of admission, but stroke severity decreased: median NIHSS 4 (2;8). There was no sex differences in "onset-to-door" time in our study with the median time 6.58 (2.8;28.25) hours.



**Conclusions:** Gender differences seen in this study were mostly explained by women's older age, greater comorbidity. Etiologically the severity of stroke dependent on TOAST subtype was similar.

**Trial registration number:** n/a

### WITHDRAWN



**WITHDRAWN**

between women and men in control (55% vs. 53%,  $p = 0.78$ ) or intervention group (41% vs 37%,  $p = 0.59$ ). The EA did not result in significant change in rate of OAC in women (OR 0.57,  $p = 0.11$  95% CI 0.29-1.13). For men, the EA resulted in decreased likelihood of OAC (OR 0.53,  $p = 0.04$ , 95% CI 0.29-0.96).

**Table 1.** Patient characteristics by sex

Variables	Sex		p-value
	Male (n = 179)	Female (n = 137)	
Age, mean (SD)	68.6 (11.9)	72.8 (12.2)	0.002
Race, n (%)			0.052
White	147 (82.1)	107 (78.1)	
Black	26 (14.5)	15 (11.0)	
Hispanic	2 (1.1)	4 (2.9)	
Prior Stroke, n (%)	15 (8.4)	8 (5.8)	0.39
Prior TIA	8 (4.5)	4 (2.9)	0.48
Coronary Artery Disease	86 (48.0)	45 (32.9)	0.01
Peripheral Arterial Disease	11 (6.2)	9 (6.6)	0.68
Congestive Heart Failure	52 (29.1)	38 (27.7)	0.80
Diabetes mellitus	60 (33.7)	37 (27.0)	0.20
Hypertension	145 (81.0)	94 (68.6)	0.01
Mean CHA <sub>2</sub> DS <sub>2</sub> -VASc, mean (SD)	2.9 (1.6)	3.8 (1.6)	<0.001
Median CHA <sub>2</sub> DS <sub>2</sub> -VASc, median (IQR)	3 (2, 4)	4 (3, 5)	<0.001*

\*Values were determined using the Chi Square or Student's t-test

\*P-values for median CHA<sub>2</sub>DS<sub>2</sub>-VASc score were calculated with both the Wilcoxon Rank-Sum Test and the Nonparametric equality-of-medians test. Both resulted in a value of <0.001.

**AS30-006**

### CAN ELECTRONIC DECISION SUPPORT INCREASE ORAL ANTI-COAGULANT USE IN WOMEN WITH ATRIAL FIBRILLATION?

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Rochester, USA; <sup>7</sup>University of Maryland School of Medicine, Neurology, Baltimore, USA

**Background and Aims:** Women represent a large proportion of patients with non-valvular atrial fibrillation (AF) but are less likely to receive oral anti-coagulation (OAC) than men are for stroke prevention. We aim to assess the effect of an electronic alert (EA) decision support tool on rate of OAC use in women compared to men.

**Methods:** An EA in the form of an AF risk stratification tool using CHA<sub>2</sub>DS<sub>2</sub>-VASc was implemented in 2 sites and compared to usual care in another site. We analyzed 137 women (70 intervention) and 179 men (94 intervention). Primary Endpoint was OAC use at time of hospital discharge or follow up.

**Results:** Women were older (73 vs. 69,  $p = 0.002$ ) and had a higher median CHA<sub>2</sub>DS<sub>2</sub>-VASc (4 vs. 3,  $p < 0.001$ ). Overall, there was no difference between women and men in OAC use at most recent visit (48% vs. 45%,  $p = 0.54$ ). There was no significant difference in OAC use

**Table 2.** Medications by sex

Variables, n (%)	Sex		Chi <sup>2</sup> p-value	Fisher's Exact p-value
	Male (n = 179)	Female (n = 137)		
Most Recent Visit (Discharge or Follow-Up)				
Aspirin	88 (53.0)	60 (45.1)	0.18	0.20
Clopidogrel	13 (7.8)	9 (6.8)	0.73	0.83
Aspirin + Clopidogrel	6 (6.0)	5 (5.6)	0.91	<b>1.00</b>
On Different Antiplatelet Regimen	4 (2.4)	3 (2.3)	0.67	<b>1.00</b>
On No Antithrombotic Agent	4 (4.7)	6 (9.1)	0.28	<b>0.33</b>
Warfarin	24 (14.5)	25 (18.8)	0.31	0.35
All OAC <sup>a</sup>	80 (44.7)	66 (48.2)	0.54	<b>0.57</b>

\*Values were determined using both Chi Square and Fisher's Exact tests (bolded when more appropriate to use Fisher's).

<sup>a</sup>Warfarin, dabigatran, rivaroxaban, apixaban, and edoxaban

**Table 3.** Medications by sex by site, univariate analysis

Variables, n (%)	Site					
	Control (n=152)		Intervention (n=164)		Fisher's Exact p-value	
	Male (n=85)	Female (n=67)	Male (n=94)	Female (n=70)	Chi <sup>2</sup> p-value	
At Most Recent Visit (Discharge or Follow-Up)						
Aspirin	46 (56.8)	32 (49.2)	0.36	0.41	42 (49.4)	28 (41.2)
Clopidogrel	7 (8.6)	7 (10.8)	0.66	0.78	6 (7.1)	2 (2.9)
Aspirin + Clopidogrel	5 (6.2)	4 (6.2)	1.00	<b>1.00</b>	1 (5.3)	1 (4.2)
On Diff. Antiplatelet Regimen	3 (3.7)	3 (4.6)	0.78	<b>1.00</b>	1 (1.2)	0 (0.0)
On No Antithrombotic Agent	2 (2.5)	6 (9.2)	0.07	<b>0.14</b>	2 (5.0)	0 (0.0)
All OAC <sup>a</sup>	45 (52.9)	37 (55.2)	0.78	0.87	35 (37.2)	29 (41.4)

\*Values were determined using the Chi Square and Fisher's Exact test (bolded when more appropriate to use Fisher's).

<sup>a</sup>Warfarin, dabigatran, rivaroxaban, apixaban, and edoxaban

**Conclusions:** Electronic decision support was not sufficient to increase anticoagulant use in this study group in men or women. A larger sample would be beneficial. More targeted interventions are needed to reduce barriers to anti-coagulation, with a specific focus on women, given that they are known to be an under-treated group

**Trial registration number:** N/A

**AS30-043****STROKE IN PREGNANCY AND Puerperium: FREQUENCY AND CASE CHARACTERISTICS FROM OBSTETRIC HOSPITAL IN 2015–2018**

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<sup>2</sup>Federal Center of Cerebrovascular Pathology and Stroke, Radiology, Moscow, Russia; <sup>3</sup>Perinatal Medical Center, Treatment of miscarriag, Moscow, Russia; <sup>4</sup>Perinatal Medical Center, Radiology, Moscow, Russia;

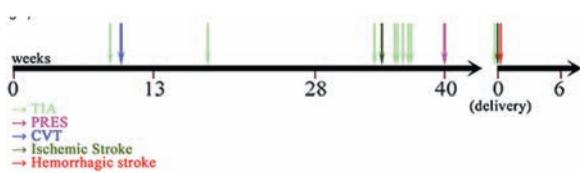
<sup>5</sup>Federal Center of Cerebrovascular Pathology and Stroke, Neurology, Moscow, Russia

**Background and Aims:** Pregnancy and puerperium period impact cerebrovascular homeostasis, coagulation system and are associated with an increased risk of strokes and vascular changes. Other causes of stroke in young adults should be also considered during this period. Thus diagnostic of cerebrovascular complications become challenging problem. In this study we evaluated frequency, risk factors and causes of pregnancy-related strokes in obstetric hospital on the basis of 4-years of observation.

**Methods:** Prospective analysis of women who gave birth between 2015–2018 in obstetric hospital in Russia was conducted. Etiology, risk factors, time of onset for all cases of cerebrovascular complications were characterized.

**Results:** Among 11335 deliveries the total number of 14 cerebrovascular disorders were identified. The frequency of ischemic stroke was 15% (2 patients with severe preeclampsia); for hemorrhagic stroke – 7% (1 patient with AVM), for CVT – 7% (1 case associated with hereditary thrombophilia); TIA was observed in 64% (9 cases associated with different risk factors for young stroke); 7% for PRES (see fig.1). Most events presented in the third trimester of pregnancy (more detailed data is shown in the fig.2).

		Total number of birth in 2015-2018					11335				
		TIA					Ischemic stroke				
		Hemorrhagic stroke					CVT				
		Cerebral venous thrombosis					PRES				
		Total number of cerebrovascular disorders					14				
Pregnancy-related risk factors		TIA	Ischemic Stroke	Hemorrhagic stroke	CVT	PRES					
		1	1	-	-	1					
		Gestational arterial hypertension	-	1	-	-	-	-			
Other stroke risk factors in young adults		Recurrent miscarriage/Antiphospholipid syndrome	1	1	-	-	-	-			
		Arterial hypertension	1	-	-	-	-	-			
		Inherited thrombophilia	9	1	-	1	-	-			
		Patent foramen ovale	1	-	-	-	-	-			
		Arteriovenous malformation	-	-	1	-	-	-			
		Sickle cell disease	1	-	-	-	-	-			



**Conclusions:** Observed cases of ischemic stroke and PRES were associated with pregnancy related complications, while TIA, hemorrhage and SVT were associated with hematological or cardiovascular disorders and vascular abnormalities.

**Trial registration number:** N/A

**AS30-023****GENDER DIFFERENCES IN PERFORMANCE AND OUTCOME OF ENDOVASCULAR TREATMENT FOR ACUTE ISCHEMIC STROKE**

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<sup>2</sup>Hospital Universitario Virgen del Rocío, Interventional Neuroradiology, Sevilla, Spain; <sup>3</sup>Instituto de Biomedicina de Sevilla, Neurovascular Laboratory, Sevilla, Spain; <sup>4</sup>Hospital Universitario Virgen del Rocío, Neurology, Sevilla, Spain; <sup>5</sup>Hospital Universitario Virgen de Valme, Public Health Department, Sevilla, Spain

**Background and Aims:** The course of ischemic stroke varies according to sex, being the first cause of death among women. Whether outcome differences are due to gender dimorphism or to a disparity in medical care remains unknown. The purpose of this work is to explore sex differences in the application of endovascular treatment.

**Methods:** A prospective registry of ischemic strokes treated by endovascular procedures at a comprehensive stroke center was analyzed. Demographic and neuroimaging data, clinical characteristics, treatment intervals and angiographic and clinical results were collected. Results regarding referral centers with or without stroke units (SU) are shown.

**Results:** 271 patients were included [111 being women (41.1%)]. Both door-to-CT time ( $30.9 \pm 28.4$  vs  $44.4 \pm 58.1$  minutes in women,  $p = 0.01$ ) and door-to-needle time ( $52.0 \pm 28.9$  vs  $69.5 \pm 44.4$  minutes in women,  $p = 0.007$ ) were significantly prolonged in women. Women from hospitals without SU have longer delays in door-to-needle time than men ( $92.83$  vs  $59.9$ ,  $p = 0.014$ ). Door-to-arterial puncture and puncture-to-recanalization times were similar in both groups. There were no differences in terms of the thrombectomy system used according to gender and neither in the degree of recanalization. At 90 days, mRS scores trend to be higher in women ( $p = 0.057$ ).

**Conclusions:** Some disparities in terms of rapid access to stroke reperfusion therapies; mainly due to medical tPA therapy initiation delays among women were identified. Those differences could explain in part the trend to worse stroke prognosis among women. Strict adherence to protocols would be a good strategy to prevent these disparities.

**Trial registration number:** N/A

**AS30-015****SEX DIFFERENCES IN ILLNESS SEVERITY AMONG ACUTE ISCHEMIC STROKE WITH DIABETES: RESULTS FROM A HOSPITAL-BASED STROKE REGISTRY OF A DEVELOPING COUNTRY**

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**Background and Aims:** Few recent studies have investigated sex differences in illness severity among strokes with a specific risk factors such as diabetes. Diabetes-related stroke was apparent by its congruence with other cardiovascular risk factors. Even when treated similarly, diabetes women remain less likely than men to achieve target cardiovascular risk reduction. We hypothesized that diabetes stroke women had more illness severely than men.

**Methods:** The medical records of 3,135 acute ischemic strokes admitted to a tertiary care hospital in southern Thailand, from October 2011, to February, 2016, were reviewed. There were 735 (97.61%) of 753 known diabetes had completed data. Illness severity was determined by using Glasgow Coma Scale (GCS), National Institutes of Health Stroke Scale (NIHSS), modified Rankin Scale (mRS), and Barthel Index (BI) on admission. Independent t-test was used to compare illness severity scores.

**Results:** There were 368 stroke women (50.1%), and 367 men (49.9%) with diabetes. Women had more illness severely compared with men, as determined by all four clinical tools. They had lower scores on GCS ( $13.93 \pm 2.28$  vs  $14.28 \pm 2.05$ ,  $p = 0.021$ ), and BI ( $67.11 \pm 23.66$  vs  $72.19 \pm 23.65$ ,  $p = 0.004$ ). Higher scores of NIHSS ( $7.36 \pm 6.07$  vs  $6.27 \pm 5.27$ ,  $p = 0.009$ ), and mRS ( $1.97 \pm 1.78$  vs  $1.59 \pm 1.73$ ,  $p = 0.010$ ) were found in women than men.

**Conclusions:** We provided convincing evidence that women with diabetes have more illness severity than their men counterparts. More illness severity on admission could contribute to an increased risk of poor stroke outcomes. This finding warrants further research explored the causes and consequence of sex differences in stroke with diabetes.

**Trial registration number:** N/A

## AS30-014

### ETIOLOGIC SUBTYPES, PREVALENCE AND PROGNOSIS OF ACUTE ISCHEMIC STROKE IN FEMALE

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<sup>1</sup>Ankara University Medical School, Neurology, Ankara, Turkey

**Background and Aims:** The aim of this study was to determine the etiologic subtypes, risk factors, prevalence and prognosis of acute ischemic stroke in female.

**Methods:** We reviewed the charts of 957 patients who were admitted with acute ischemic stroke between the dates January 2011 and May 2017. The demographic data, NIHSS scores at admission and mRS in follow-up period were recorded. We determined etiologic stroke subtypes using the automated Causative Classification System (CCS).

**Results:** A total of 432 (45.1%) patients with female (mean age  $71.2 \pm 14.7$  [21-100] years) and 525 (54.9%) patients with male (mean age  $67.2 \pm 12.9$  [25-103] years) were included in the study. Females were older than males ( $p < 0.001$ ). AF and CHF were more common in female ( $p < 0.001$ ). Otherwise, CAD was more common in male ( $p < 0.001$ ). There were 75 (17.4%) patients with large-artery atherosclerosis, 209 (48.4%) patients with cardioaortic embolism, 23 (5.3%) patients with small artery occlusion and 31 (7.2%) patients with other causes, according to the CCS. Ninety-four (21.8%) patients remained undetermined. Admission NIHSS and follow up mRS were higher in patients with female than others ( $p < 0.05$ ). On logistic regression analysis, AF and CAD were significantly associated with patients with female ( $p < 0.05$ ).

**Conclusions:** Acute ischemic stroke in female was 45.1 % in our registry. AF was more common in female. It was concluded that female gender was not an independent factor for poor outcome.

**Trial registration number:** N/A

## AS30-013

### STROKE WOMEN AND MEN WITH DIABETES HAD DIFFERENCES RISK FOR DEVELOPING RECURRENCE: RESULTS FROM ONE TERTIARY CARE HOSPITAL IN SOUTHEAST ASIA

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**Background and Aims:** Diabetes is a known risk of stroke. In Southeast Asia, men had higher rates of stroke than women, but little is known if diabetes stroke men and women had differences risk for recurrence. We examined whether sex differences in risk for developing stroke recurrence in diabetes.

**Methods:** The medical records of 3,135 acute ischemic strokes admitted to a tertiary care, and referral hospital in southern Thailand, from October 2011, to February, 2016, were reviewed. There were 753 diabetes (24.02%), a half of women ( $n = 380$ , 50.5%) and men ( $n = 373$ , 49.5%). The Essen Stroke Risk Score (ESRS) was used to assess risk for stroke recurrence. Score of 3 or above indicated a high-risk level.

**Results:** Women had less score on total ESRS ( $p = 0.000$ ). Women had higher score on age ( $p = 0.000$ ), but less score on smoking ( $p = 0.000$ ) indexes, compared with men. Scores on hypertension, myocardial infarction, others cardiovascular disease, peripheral artery disease, and stroke indexes were not differences. On logistic regression, men had higher risk level for recurrence (OR 1.65, 95%CI 1.36-1.99) than did women. Women were more numbers of older adults (OR 1.44, 95%CI 1.25-1.57), but less smokers (OR 0.13, 95%CI 0.09-0.19), compared with men.

**Conclusions:** We provided clinical evidences and gained the knowledge that women and men had differences risk for developing recurrence stroke. Although women had lower risk, but in fact, they were older and less smoker. Secondary stroke prevention in women should be considered age-related risk, and in men should be focused on stop smoking.

**Trial registration number:** N/A

## AS30-001

### SEX DIFFERENCES IN SHORT-TERM OUTCOME AMONG ISCHEMIC STROKE PATIENTS WITH DIABETES: WOMEN HAD POORER FUNCTIONAL RECOVERY

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**Background and Aims:** There are a number studies examined sex differences in stroke outcomes in general, but not in a population of strokes with diabetes. Immediate functional outcome, and a short-term within one month after stroke was not known. We examined whether ischemic stroke women and men with diabetes had differences functional outcome at one-month post stroke.

**Methods:** All patients with acute ischemic stroke ( $N = 3,135$ ) admitted to a tertiary care, teaching, and referral hospital the south of Thailand, from October, 2011 to February, 2016, were reviewed. There were 753 known diabetes (50.1% women,  $n = 368$  vs 49.9% men,  $n = 49.9\%$ ). Functional outcome was assessed by using modified Rankin Scale (mRS). Score of 3 and above indicated poor functional outcome.

Independent t-test, Chi-square, and odds ratio (95%CI) were employed to compare sex differences.

**Results:** Women had higher mRS score at discharge ( $1.97 \pm 1.78$  vs  $1.59 \pm 1.73$ ,  $p=0.004$ ), and at one-month follow up ( $1.52 \pm 1.87$  vs  $1.02 \pm 1.45$ ,  $p=0.003$ ) compared with men. More women than men had higher score on mRS at discharge (Chi-square 18.31,  $p=0.003$ ), and at one-month (Chi-square 17.09,  $p=0.009$ ). Poor recovery rates were more tend in women at discharge (54% vs 46.0%, OR 1.12, 95%CI 0.97-1.30), and at one-month (57.7% vs 42.3%, OR 1.22, 95%CI 0.98-1.49) compared with men. One-month mortality rates in women was slightly higher than men (11.7% vs 6.8%, OR 1.30, 95%CI 0.99-1.69).

**Conclusions:** Women were more likely had poor functional outcome during one-month post stroke. This finding warrants further research explored diabetes-related factors on sex differences in function outcome after strokes.

**Trial registration number:** N/A

### AS30-018

#### SEX DIFFERENCES IN ATHEROSCLEROSIS LOCATION IN THE POSTERIOR CIRCULATION IN PATIENTS WITH ACUTE ISCHEMIC STROKE

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**Background and Aims:** Population based studies and studies in Asian stroke patients suggest that women have less intracranial atherosclerosis in the posterior circulation than men. We investigated sex differences in presence and location of atherosclerosis in the posterior circulation in Dutch patients with acute ischemic stroke.

**Methods:** Participants were included from the Dutch acute stroke study (DUST), a large prospective multicentre cohort study. All patients received CT/CT-angiography within 9 hours of onset of stroke symptoms. We assessed presence of atherosclerosis (non-calcified and calcified plaque) in the intra- and extracranial posterior circulation (vertebrobasilar artery [VBA]) irrespective of infarct location. In addition, we determined the burden of intracranial atherosclerosis by quantifying VBA calcified plaque, resulting in calcium volumes. We analyzed large (upper tertile) versus small (middle and lower two tertiles) burden. Prevalence ratios (PR) between women and men were calculated with Poisson regression analysis and adjusted (aPR) for potential confounders.

**Results:** We included 1360 patients (43% women) with a mean age of 67 years. Presence of atherosclerosis in intracranial posterior circulation was found as frequently in women as in men (14% vs. 14%, aPR 0.78; 95%CI:0.59-1.04). In addition, intracranial VBA calcification volume did not differ between women and men (large burden 26% vs. 40%, aPR 0.69; 95%CI:0.41-1.12). Extracranial posterior circulation atherosclerosis was less common in women than in men (34% vs. 40%, aPR 0.77; 95%CI:0.66-0.89).

**Conclusions:** In patients with acute ischemic stroke the prevalence of intracranial atherosclerosis in the posterior circulation does not differ between women and men, whereas extracranial posterior circulation atherosclerosis is less prevalent in women than men.

**Trial registration number:** N/A

### AS30-011

#### SEX DIFFERENCES IN DISEASE PROFILES, MANAGEMENT, AND OUTCOMES AMONG PEOPLE WITH ATRIAL FIBRILLATION AFTER ISCHEMIC STROKE: A META-ANALYSIS OF INDIVIDUAL PARTICIPANT DATA

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**Background and Aims:** We aimed to examine sex differences in disease profiles, management, and survival at 1 and 5 years after ischemic stroke (IS) among people with atrial fibrillation (AF).

**Methods:** Individual participant data on covariates and survival were obtained from 9 population-based stroke incidence studies conducted in Australasia, Europe, and South America (1993-2014). The presence of AF at the time of stroke onset was self-reported (2 studies) or confirmed by ECG/medical records (7 studies). The mortality rate ratio (MRR) between women and men was estimated using Poisson modelling. Study-specific unadjusted and adjusted MRRs were combined using random-effects meta-analysis.

**Results:** There were 8645 participants (mean age: 72.6; 51.8% women). The pooled AF prevalence was 26.6% in women and 20.8% in men. Among the 1862 IS patients with AF, women were older than men. There were no significant sex differences in prescription of antihypertensive, antiplatelet and anticoagulation agents at admission. Crude pooled 1-year mortality was greater for women (30.4%) than men (24.5%) (1-year MRR 1.24; 95% CI, 1.01-1.51; 5-year MRR 1.28; 0.98-1.66). However, the sex difference was greatly attenuated after accounting for age, pre-stroke function and stroke severity (1-year MRR 1.09; 95% CI 0.97-1.22; 5-year MRR 0.81; 0.60-1.09).

**Conclusions:** AF was more prevalent after IS among women than men. Among those with AF and IS, stroke management was similar irrespective of sex. Greater mortality in women with AF after IS was mostly attributable to pre-stroke factors. The data are very encouraging in that sex differences in management and outcomes were absent.

**Trial registration number:** N/A

## **Young Stroke Physicians and Researchers: Research Design Workshop For Studies In Development**

### **AS3I-002**

#### **IMAGING CHARACTERISTICS CORRELATION WITH HISTOLOGIC ANALYSIS OF RETRIEVED CLOTS IN ACUTE ISCHEMIC STROKE**

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**Background and Aims:** The cornerstone of acute ischemic stroke (AIS) treatment has long been lysis or, more recently, mechanical extraction of the occlusive thrombus. Yet, these thrombi remain one of the more poorly understood aspects of stroke etiology and prognosis. There is increasing evidence suggesting the ability of non-invasive imaging, including CT and MRI, to reveal information about the composition of stroke thrombi. As imaging becomes an increasingly crucial tool in the triage and outcome prognostication of AIS, a broader understanding of clot imaging characteristics is crucial to the development of more refined patient treatment selection paradigms and risk stratification measures.

**Methods:** This study will build on an IRB-approved, prospectively enrolled endovascular stroke therapy registry, which includes baseline characteristics imaging, therapy and outcomes data for more than 1,500 patients. Patients with retrieved thrombi that underwent histopathological analysis as part of our ongoing collaborative STRIP registry will be included. Clot density, length, perviousness, Clot burden Score as well as CTA collateral flow and CT Perfusion maps will be assessed. The relationship between these parameters and clot histological composition as well as procedural and clinical outcomes will be studied.

**Results:** The study is currently in development. A total of 238 patients have thrombi histopathological analysis completed.

**Conclusions:** Enhanced understanding of imaging clot characteristics will help refine patient triage, device selection, prognostication and secondary prevention for endovascularly treated AIS patients.

**Trial registration number:** N/A

### **AS3I-007**

#### **UNAWARENESS RISK FOR STROKE AND CARDIOVASCULAR DISEASE AMONG NORMAL WEIGHT HYPERTENSION WITH AND WITHOUT METABOLIC SYNDROME: RESULTS FROM PRIMARY CARE SETTINGS OF A DEVELOPING COUNTRY**

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**Background and Aims:** In Thai health care context, a term “abdominal obesity” has been used interchangeably metabolic syndrome (MetS). In fact, MetS can be found in both obese and normal weight. Normal weight hypertension are seemly less recognized their risk. However, none of the previous studies address this issue. Thus, we explored whether normal weight hypertension ( $BMI < 23.0 \text{ kg/m}^2$ ) with and without MetS had differences awareness of stroke and cardiovascular disease (CVD).

**Methods:** We analyzed data from 571 normal weight hypertension treated at 11 primary care units in Thailand. MetS was defined according to modified NCEP-ATP III criteria for Asian. Patients were asked “how would you say about your risk for developing stroke?” (DM, CKD, CHD, and CVD). Respondent was 4-rating scales from very low, to very high

risk. Score on each item was classified into less and high awareness by using median values.

**Results:** Over a half had MetS (54.8%). MetS, MetS were more likely had higher score on stroke ( $p = 0.007$ ), and CVD ( $p = 0.074$ ) awareness. Only one-third (27-30%) had high awareness in stroke, CKD, DM, CHD, and CVD. On logistic regression, risk awareness levels in patients with and without MetS were not differences, for DM (OR 1.17, 95%CI 0.65-2.10), stroke (OR 1.42, 95%CI 0.79-2.56), CKD (OR 1.28, 95%CI 0.71-2.32), CHD (OR 1.29, 95%CI 0.71-2.37), and CVD (OR 1.33, 95%CI 0.78-2.27).

**Conclusions:** Normal weight hypertension with MetS had less awareness of stroke and CVD. Unawareness may lead to inappropriate treatment and high magnitude adverse outcomes because of its high prevalence MetS.

**Trial registration number:** N/A

### **AS3I-008**

#### **COMPARISON RISK LEVELS FOR DEVELOPING RECURRENT STROKE AMONG WOMEN AND MEN: A FIVE-YEAR OBSERVATION FROM A HOSPITAL-BASED STROKE REGISTRY IN SOUTHEAST ASIA**

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**Background and Aims:** Sex-differences in risk of ischemic stroke has been reported worldwide. These risks remained post-stroke and causes of recurrent. Stratifying risk for recurrent, based on sex differences, by using a clinical valid tool provide a tailor for appropriate prevention. We examined whether stroke women and men had differences risk score and risk levels for developing recurrent.

**Methods:** We identified risk for recurrent stroke by using the Essen Stroke Risk Score (ESRS) among 3,135 ischemic strokes admitted at a tertiary care hospital in Southern Thailand. Approximately 40% were women ( $n = 1,260$ ). The ESRS scoring system was calculation based on seven indexes including age, hypertension, diabetes, previous myocardial infarction (MI), peripheral arterial disease (PAD), other cardiovascular diseases (CVD) except MI and atrial fibrillation (AF), and previous stroke/TIA. Risk levels were identified as low (score 0-2), and high (score 3-9).

**Results:** Thirty-seven percent of women, and 40% of men were at the high-risk level. Rates of high-risk for recurrent among women and men were not differences (OR 0.93, 95%CI 0.85-1.02). Although women were more likely had less score on total ESRS ( $p = 0.000$ ), they had higher score on three indexes included age ( $p = 0.000$ ), hypertension ( $p = 0.000$ ), and diabetes ( $p = 0.000$ ). In contrast, they had less score on smoking index ( $p = 0.000$ ). Scores on MI, other CVD, PAD, and previous stroke/TIA were not differences.

**Conclusions:** Women had high-risk levels for recurrent stroke as similar to men. Women were older, had hypertension, and diabetes, but less smoker. We noted that a greater score on total ESRS in men was extremely attributed by smoking.

**Trial registration number:** N/A

**AS3I-013****TYPICAL AND ATYPICAL FEATURES OF INSULAR STROKE**

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**Background and Aims:** The insula has been the object of few studies and case reports, but the incidence of insular strokes (IS) is not well defined, due to its rarity. Symptoms from IS appear heterogeneous and consist of sensory-motor deficits, aphasia/dysarthria and further unusual presentations, including psychiatric symptoms, dizziness, autonomic dysfunction, gustatory and auditory disturbances. The aim of our study is to characterize the clinical presentation of acute ischemic IS with specific attention to unusual symptoms.

**Methods:** IS patients were enrolled from the Stroke Unit of the "SS. Annunziata" Hospital of Chieti and "SS. Salvatore" Hospital of L'Aquila, among 1252 with a first-event acute stroke in a period of 4 years. IS patients presented lesions restricted to the insular region on neuroimaging.

**Results:** We identified 38 patients, 18 with right IS and 20 with left IS. IS patients presented at onset with one or a combination of the following behavioral symptoms: sleepiness, hypersomnolence, confusion space-time disorientation, auditory, gustatory disturbances, appetite modifications and accompanying symptoms consisting of transient dysphagia, autonomic disturbance, vestibular-like syndrome, and space-time disorientation.

**Conclusions:** Sensory-motor deficits, aphasia, dysarthria and transient dysphagia are the most typical presentations of IS among described symptoms; in addition, we observed many unusual clinical presentations, such as dizziness, autonomic dysfunction, gustatory and auditory disturbances. These symptoms give a minimum score to the common severity and disability scales used in stroke units (NIHSS, mRS); on the other hand, atypical symptoms do not take any points on NIHSS, thus contributing to the underestimation of the IS.

**Trial registration number:** N/A

**AS3I-012****STROKE RISK ASSESSMENT IN SYMPTOMATIC INTERNAL CAROTID ARTERY STENOSIS**

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**Background and Aims:** Standard of care in symptomatic internal carotid artery (ICA) stenosis is carotid revascularisation. A proportion of patients may not be candidates for revascularisation either due to contraindications, delay in procedure or failure to consent. Although previous trials compared best medical therapy with revascularisation procedures, optimal medical therapy (OMT) has not been evaluated.

To stratify risk of ipsilateral stroke in symptomatic ICA stenosis patients on OMT who did not undergo revascularisation.

**Methods:** Patients having symptomatic ICA stenosis were recruited after a fully informed written consent. Inclusion criteria: age>18 years, TIA/ Stroke<6 months, patients having normal vasomotor reactivity (VMR)/ refusing revascularisation/ >6 weeks delay in revascularisation. Patients were administered OMT (dual therapy with aspirin plus clopidogrel, therapy for vascular risk factors and lifestyle modifications). Other parameters: contralateral carotid stenosis, intracranial atherosclerosis, collateral status, (VMR) and emboli monitoring were assessed. Follow up for at least 12 months and endpoints were any TIA/Stroke and composite of any vascular event including death.

**Results:** 65 patients with symptomatic severe carotid atherosclerotic disease (CAD) were recruited (Table 1). Cox regression showed diabetes mellitus and impaired VMR to be associated with poor outcome (Table 2).

**Table 1: Risk factors and followup characteristics of included patients**

**Demographics**

Total patients recruited (n): 65  
Mean symptom onset to recruitment time: 48.26 days (Range 0-173)  
Gender (M:F): 6.2:1  
Age (mean±SD) in years: 61.8±10

**Stroke risk factors**

Hypertension: 33 (50.8%)  
Diabetes mellitus: 28 (43.1%)  
Dyslipidemia: 29 (44.6%)  
Smoker: 26 (40%)  
Intracranial atherosclerosis present: 10 (15.4%)  
Ipsilateral Collateral status (bad): 39 (60%)  
Contralateral stenosis: 19 (29.2%)  
Impaired ipsilateral VMR: 26 (40%)  
HITS +: 11 (16.9%)

**Follow up (median followup duration 19 months; IQR 17-26)**

Composite endpoint (%): 11 (16.9%)  
Transient ischemic attacks/ Strokes: 10 (15.4%)  
Vascular death: 1 (1.5%)

**Endpoint recurrence time points**

3 months: 5 (7.7%)  
3-6 months: 4 (6.2%)  
6-12 months: 2 (3.1%)

**Table 2: Variables (stroke risk predictors) in the equation**

	Significance	Hazard Ratio (HR)	95.0% CI for HR	
			Lower	Upper
Age	0.333	0.962	0.890	1.040
Hypertension	0.389	1.955	0.425	8.983
Diabetes Mellitus	0.037	8.028	1.133	56.885
Contralateral significant carotid stenosis	0.600	1.542	0.305	7.789
Intracranial atherosclerosis	0.065	3.583	0.925	13.873
Collateral status	0.543	1.771	0.280	11.190
VMR of symptomatic side	0.036	7.267	1.134	46.570
Emboli monitoring	0.820	1.276	0.157	10.366

**Conclusions:** Risk stratification in severe CAD is possible to identify patients with high risk of stroke recurrence. OMT is efficacious in most patients of severe symptomatic CAD. We propose to develop a risk stratification score to identify high risk patients. Larger cohorts are needed to test OMT versus carotid revascularisation.

**Trial registration number:** N/A

## AS3I-019

### ENDOVASCULAR TREATMENT IN PATIENTS WITH ACUTE STROKE AND COMORBID CANCER: ANALYSIS OF THE ITALIAN REGISTRY OF ENDOVASCULAR TREATMENT IN ACUTE STROKE

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**Background and Aims:** Acute stroke patients with comorbid cancer are more preferably addressed to endovascular recanalization treatment (EVT) than thrombolytic therapy, due to the presumed potential risk of hemorrhagic transformation and systemic bleedings. This study aims to evaluate clinical and procedural outcomes of acute stroke patients with comorbid cancer receiving EVT.

**Methods:** Using the Italian Registry of Endovascular Treatment in Acute Stroke, we retrospectively reviewed patients with ischemic stroke and comorbid cancer (CC), treated with EVT from 2011 to 2017. Outcome measures were TICI score, occurrence of symptomatic intracerebral hemorrhage and 3-month modified Rankin score. We compared CC patients with a control group of acute ischemic stroke patients without cancer (noCC) receiving EVT.

**Results:** Out of 4642 stroke patients treated with EVT, 255 (5.5%) had a comorbid cancer. Vascular risk factors were not significantly different and admission NIHSS was 18 (IQR 13–21) in both groups. TICI 2b-3 was obtained in 72.9% of CC and 74.4% of noCC patients ( $p=0.6$ ), while post-treatment symptomatic intracerebral hemorrhage rate was 8.2% in both groups. Three-month mortality was 35.6% in CC and 18.6% in noCC ( $p < 0.001$ ) patients and mRS 0–2 was reached respectively by 34.3% and 46.7% of patients ( $p < 0.001$ ).

**Conclusions:** Although 3-month mortality was significantly higher in CC than in noCC patients, successful recanalization was comparable in both

groups with a same hemorrhagic transformation rate. Further investigation of leading causes of death in CC patients are warranted to clarify prognosis of stroke patients with malignancy.

**Trial registration number:** N/A

## AS3I-015

### PERCEPTION OF STROKE IN PATIENTS WITH STROKE AND OTHER NEUROLOGICAL DISEASES IN KYRGYZSTAN: A QUALITATIVE STUDY

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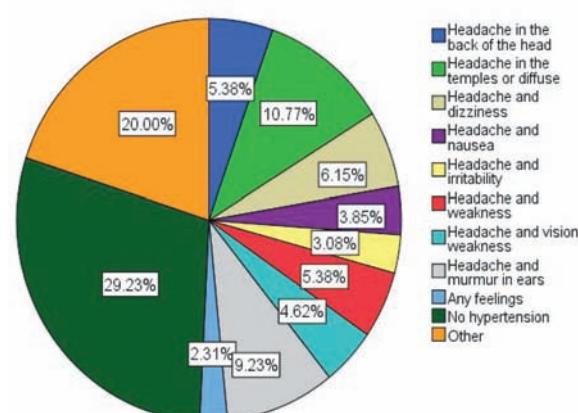
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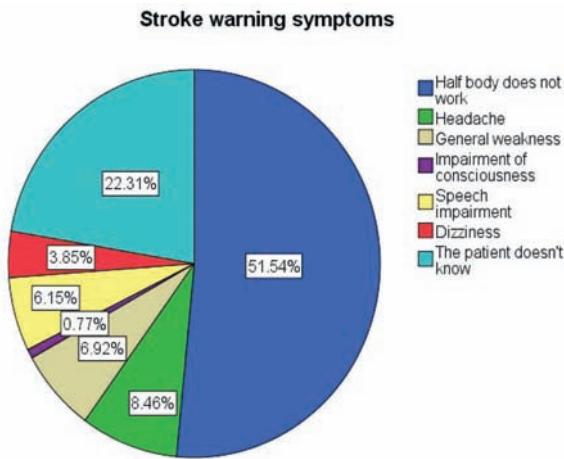
**Background and Aims:** In Kyrgyzstan, almost one in five (17.4%) adults were identified as being at high cardiovascular risk, that is, the probability of a cardiovascular event or death in the next 10 years was 30% or more, partially due to low stroke awareness. The aim of our study was to study stroke awareness in patients with cerebrovascular risk factors.

**Methods:** Our study is the qualitative study with semi structured interviews, which was conducted for the first time in Kyrgyzstan. 130 patients with stroke ( $n = 46$ ) and cerebrovascular diseases ( $n = 84$ ) were interviewed, using the questions about the perceiving of their high blood pressure, stroke prevention beliefs, stroke warning symptoms, government participation in stroke campaigns.

**Results:** 130 patients participated in our study and 60.8% were males. Among sample, 71% of patients would not recognize stroke. Patients defined their high blood pressure as headache in temples (11%) and tinnitus (9%) and connected stroke like symptoms only with arm and leg weakness (51.54%). Stroke patients admitted that they could have prevented stroke if they lead healthy lifestyle, avoided carbohydrates and animal fat intake. Patients believed that stroke prevalence is also influenced by the low level of country economy and the absence of surveillance of stroke-risk population.

Perceiving high blood pressure





**Conclusions:** More educational campaigns are needed in low income countries mostly with bringing attention to stroke symptoms and preventive measures. Informing population about serious illness and encouraging patients to lead a healthy lifestyle are required.

**Trial registration number:** N/A

#### AS3I-014

#### RELATIONSHIP THE EFFECTIVENESS OF STROKE EVALUATION TO PRE-AND INTRAHOSPITAL CARE IN HUNGARY

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**Background and Aims:** In our research, we aimed at following the stroke patient's journey, depending on which we examined the development of care times, the determination of preliminary diagnoses, and stroke time windows from a pre-and intrahospital aspect.

**Methods:** Retrospective, quantitative study was performed in 2 phases. Initially, data for the prehospital phase were collected from case report forms of 2016, then patients from these case report forms were followed up in the intrahospital phase. In the hospital phase, we analyzed necessary data from the medical records of the given patient followed up. 137 patients were gathered at the Ambulance Service and 133 followed up at the Emergency Department (ED).

**Results:** 49.62% of the patients thought to have stroke by prehospital providers had indeed this condition. We found that the time window had no effect on prehospital times ( $p = 0.184$ ), and higher-level ambulance units spent more time than lower-level ones from arrival on site to transfer to the ED ( $p = 0.029$ ). Patients having received a preliminary stroke diagnosis at the ED spent less time in emergency treatment than non-stroke patients ( $p = 0.001$ ). In the case of left hemispheric stroke, the time elapsed from ambulance treatment to CT examination is less than for strokes of different localization ( $p = 0.008$ ).

**Conclusions:** As they cannot reject stroke due to their emergency approach, prehospital providers establish the latter as the most severe preliminary diagnosis. Higher level units spend more time on site. It is a good practice to reserve priority slots for stroke patients in CT examination rooms.

**Trial registration number:** N/A

#### AS3I-010

#### IDENTIFYING THE SIZE OF ISCHEMIC PENUMBRA BY BLOOD-BASED BIOMARKERS: IS IT POSSIBLE?

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**Background and Aims:** Selecting patients for recanalization procedures by assessing the size of salvageable brain tissue is playing an increasing role in stroke care, although currently it is based mainly on imaging methods. There is no validated biomarker for patient selection. However, several articles have reported on proteins that appear only in the penumbra during ischemic stroke, some of which also appear in the peripheral blood during the acute phase.

Our aim is to find blood-based biomarkers which can predict the amount of the salvageable brain tissue and can be potential candidates for extensive clinical usage.

**Methods:** In our department stroke patients are enrolled to a comprehensive Stroke-Registry since November 2017. Our database contains detailed data on medical history, symptoms, management and therapy, aetiology, follow-up data and outcomes of 200 patients so far. Blood samples are collected three times (on admission, at 24h and at 72h after stroke onset) from all included patients and stored in our Stroke-Biobank for later analysis. All patients who meet the eligibility criteria undergo CT-perfusion imaging, which is assessed manually and automatically by the Olea Sphere® software.

**Results:** N/A

**Conclusions:** Our Stroke-Registry and our Stroke-Biobank gives us the chance to investigate multiple biomarkers in a notable number of cases. Currently we are examining the clinical utility of Heat Shock Protein 70 (HSP70) and S100 calcium-binding protein B (S100B). We will examine whether the serum levels of these biomarkers are correlating with the approximation of core infarct (S100B) and region of penumbra (HSP70) on the CT-perfusion scan.

**Trial registration number:** N/A

#### AS3I-005

#### HEAD DOWN TILT 15° IN THE ACUTE PHASE OF EXPERIMENTAL INTRACEREBRAL HEMORRHAGE: A RANDOMIZED NON-INFERIORITY SAFETY TRIAL

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**Background and Aims:** Head down tilt 15° (HDT15°), applied before recanalization, is a safe and effective collateral therapeutic in experimental ischemic stroke due to large vessel occlusion. Safety of HDT15° in the acute phase of experimental intracerebral hemorrhage is unknown and needs to be investigated, with a view to develop of HDT15° for pre-hospital emergency treatment in human stroke.

**Methods:** Intracerebral haemorrhage was produced by stereotaxic injection of collagenase in the left putamen of adult male Wistar rats. A randomized non-inferiority trial design ( $n = 64$ ; non-inferiority limit 15%) was used to assign rats to HDT15° or flat body position. HDT15° was applied for 1 hour during the time window of hematoma expansion.

**Results:** HDT15° achieved the specified criteria of non-inferiority for hematoma volume at 24 hours (HDT15° 97+/-17 mm<sup>3</sup> versus flat position 116+/-23 mm<sup>3</sup>). Mortality at 24 hours was identical in the two groups (12.5%). Functional deficit at 24 hours, assessed with Garcia sensorimotor neuroscore and corner turning test, showed no difference between HDT15° and flat position. Intracranial pressure was measured in a separate set of randomized animals (n = 22) and showed a minimal increase during HDT15° application, compared to flat position.

**Conclusions:** Our findings indicate that application of HDT15° in the hyperacute phase of experimental intracerebral haemorrhage does not worsen early outcome. Further research is needed to translate HDT15° into an emergency collateral therapeutic in acute stroke.

**Trial registration number:** N/A

## AS3 I-001

### SUPPORTING PATIENTS AND RELATIVES IN MAKING TREATMENT DECISIONS AFTER SEVERE STROKE

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United Kingdom

**Background and Aims:** Many treatments after a severe stroke (e.g. tube feeding) improve the likelihood of survival, but with disability. Doctors should support patients and relatives in weighing these trade-offs when making decisions.

**Aim:** To deliver information to aid decision-making regarding treatments that prolong survival with disability.

**Methods:** A mixed-methods study with follow-up to six months:

a) To provide prognostic information:

1. Using large trial data to build statistical models to predict recovery of specific functions (e.g. mobility) (n = 13117)
2. Validating these predictions in a cohort of severe stroke patients (n = 403). I have collected data on survival, functional recovery, quality of health and cognition.

b) To deliver tailored information:

1. Qualitative interviews involving severe stroke patients (n = 15) and relatives (n = 24). I explored their information needs and views on survival and disability over time.

**Results:** We can predict recovery of functions with reasonable accuracy (AUROC 0.7-0.8). I will externally validate this.

Patients and relatives had different views. Patients looked for hope. They were often not aware of treatment goals and accepted all treatments hoping to achieve functional recovery.

Relatives wanted prognostic information. They often decided that treatments that prolonged survival with disability were not appropriate for the patient.

Six months later, patients wished they had been better informed of their prognosis. Most valued survival regardless of disability. Relatives were content with the treatment decisions made and outcome.

**Conclusions:** A tool with information in various accessible formats will aid doctors in tailoring prognostic information to individuals.

I am developing this, and will test it in a step-wedge trial.

**Trial registration number:** N/A