

SESSION 16: BASIC EP

16_1

16_2

ENDOCARDIAL BOTULINUM TOXIN INJECTION IN GANGLIONATED PLEXI FOR PREVENTION RECURRENCES OF ATRIAL FIBRILLATION

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Background. Prior animal studies suggest that botulinum toxin injection into the epicardial fat pads can suppress atrial fibrillation (AF) inducibility. The aim of this study was to assess the efficacy and safety of botulinum toxin injection into atrial ganglionated plexi (GP) by endocardial injection for preventing AF.

Methods and Results. In 20 dogs, transvenous catheters were passed into the left atrium. Sites selected for injection were tagged on the CARTO system when vagal reflexes were evoked by high-frequency stimulation (HFS). Endocardial injection was accomplished using the MyoStar catheter (Biosense-Webster). A mean number of 5.8 ± 0.3 intramyocardial injections (Xeomin, Germany; 10 U/0.2 mL at each) of botulinum toxin were administered into each site exhibiting a positive vagal response. In addition, two empiric injections were made into the fat pads containing the anterior right and inferior right GP (50 U/1 mL at each). The vagal reflexes by HFS and AF inducibility were evaluated before injections and then every 2 weeks until the return of all changes to baseline by precise catheter reposition and stimulation over the GP sites marked on the CARTO map.

At 2 weeks after procedure, all dogs demonstrated complete elimination of the vagal response. First signs of recovery of vagal response occurred at 9.0 ± 0.6 weeks ($p<0.001$), and full recovery to baseline values at 14.0 ± 1.1 weeks. The threshold of stimulation that induced AF increased from 4.9 ± 0.5 V at baseline to 12.1 ± 1.1 V at 2 weeks ($P<0.001$). The effects of AF suppression was complete eliminated at 18 ± 0.9 week. No procedure-related complications occurred.

Conclusion. Endocardial botulinum toxin injection into intramyocardial GPs and epicardial fat pads was feasible and safe, and provided complete abolition of cardiac vagal responses and significant AF suppression. This approach holds promise as a novel therapeutic option for AF.

BOTULINUM TOXIN INJECTION IN EPICARDIAL FAT PADS CAN PREVENT RECURRENCES OF ATRIAL FIBRILLATION AFTER CARDIAC SURGERY: RESULTS OF A RANDOMIZED PILOT STUDY

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Background. Animal models suggest that botulinum toxin injection into the epicardial fat pads suppressed atrial fibrillation (AF) inducibility. The aim of this prospective randomized double-blind study was to compare the efficacy and safety of botulinum toxin injection into epicardial fat pads for preventing atrial tachyarrhythmias in patients with paroxysmal atrial fibrillation undergoing CABG surgery.

Methods and Results. Patients were randomized to botulinum toxin (Xeomin, Germany; n=30) or 0.9% normal saline (control; n=30) injection into epicardial fat pads. Patients were followed for 30 days to assess maintenance of sinus rhythm. There were no significant differences between the groups in the median time until extubation, or intervals from end of surgery to eligibility for and to actual discharge from the ICU (all $P > 0.05$). There were no significant differences in CK-MB levels in the postoperative period. Postoperative AF occurred in 2 (7%) of 30 patients in the botulinum toxin group and in 9 (30%) of 30 patients in the placebo group (log-rank test $P=0.024$).

There was no significant difference in the postoperative hospital length of stay between groups ($P=0.12$), with a median (25th–75th percentile) length of stay of 6 (5–8) days in the botulinum toxin group versus 6 (4–8) days in the placebo group. Other postoperative complications, including death, were similar between groups (all $P > 0.05$).

Conclusion. Botulinum toxin injection in epicardial fat pads provided atrial tachyarrhythmia suppression after cardiac surgery without any serious adverse events.

16_3

COMMON VARIANTS AT SCN5A, SCN10A, AND HEY2 ARE ASSOCIATED WITH PROLONGED PR INTERVAL AND QRS DURATION IN PATIENTS WITH BRUGADA SYNDROME

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Background: Recent genome-wide association study showed that several single nucleotide polymorphisms (SNPs) are associated with susceptibility of Brugada syndrome. However, association between SNPs and electrocardiographic characteristics or clinical course has not well investigated in Japanese patients with Brugada syndrome.

Methods: 51 Japanese patients (mean age: \pm years, % men) diagnosed with Brugada syndrome were included in this study. The PR interval and the QRS duration were measured on a standard 12-leads ECG at diagnosis. Three SNPs, rs1170899 located in the SCN5A gene, rs1042813 located in the SCN10A gene, and rs9388451 near the HEY2 gene, were genotyped by using direct sequence, and the numbers of risk alleles at three SNPs were counted. **Results:** The PR interval and the QRS duration were significantly prolonged with increasing number of carried risk alleles. The number of risk alleles was also associated with increased risk of incidence of cardiac events (spontaneous occurrence of ventricular fibrillation and syncope) with the estimated odds ratio of 2.5 in the presence of more than 2 risk alleles versus less than 1.

Conclusions: Three SNPs at SCN5A, SCN10A, and HEY2 genes are associated with the prolongation of the PR interval and the QRS duration, and an increased risk of cardiac events in patients with Brugada syndrome.

16_4

**WITHDRAWN
BY THE AUTHOR**

CELL-TO-CELL VARIABILITY OF Na^+ CURRENT DENSITY AND CELL CAPACITANCE CONTRIBUTES TO THE VARIABILITY OF THE RATE OF RISE AND THE AMPLITUDE OF THE ACTION POTENTIAL DURING PROPAGATION IN ATRIAL TISSUE

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Purpose Ongoing work in a previously described rat model of heart failure after myocardial infarction (MI) model showed that atrial cells exhibit a large variability of cell capacitance and ion current densities in both sham and MI animals. Measurements in atria also revealed a large variability of the maximal action potential (AP) upstroke velocity (dV/dt_{max}), AP amplitude (APA), AP duration (APD) and resting membrane potential (RMP). We investigated whether the variability of cellular properties can account for the variability of AP parameters at the macroscopic scale.

Methods APs were recorded in atrial tissue. Ion currents and cell capacitances were measured in isolated atrial cells. The variability of measured parameters was quantified by their coefficient of variation (Cvar: ratio of standard deviation/mean). Computer simulations were run in atrial tissue sheets using the Courtemanche et al. model and variability of cell capacitance and Na^+ current conductance was incorporated according to the Cvar observed experimentally in isolated myocytes.

Results In atria, mean dV/dt_{max} was 152 V/s with a Cvar of 18%. APA was 81 mV with Cvar amounting to 7%. In isolated cells, cell capacitance was 82 pF with a large Cvar of 33% (n=67) and Na^+ current density (at -20 mV) was 67 pA/pF with a Cvar of 49% (n=17). In simulations, the introduction of 30% of cell capacitance variability resulted in a Cvar of dV/dt_{max} of 10% and a Cvar of APA of 0.9%. The introduction 50% of Na^+ current variability resulted in a Cvar of dV/dt_{max} of 22% and a Cvar of APA of 2.4%. The combination of both cell capacitance and Na^+ current variability resulted in a Cvar of dV/dt_{max} of 24% and a Cvar of APA of 2.6%.

Conclusions The large variability of AP parameters in cardiac tissue is partially explained by the heterogeneous electrophysiological properties of cardiac cells. Since this heterogeneity may be arrhythmogenic, it is important to consider in the future not only mean electrophysiological properties but also their variability.

SESSION 16: NONINVASIVE ELECTROCARDIOLOGY

ANALYSIS OF CHANGES OF BARORECEPTOR SENSITIVITY DURING THE TREATMENT OF WITH VASOVAGAL SYNCOPES WITH TILT TRAINING

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The aim of study was an analysis of baroreceptor sensitivity Changes of baroreceptor sensitivity during the treatment with vasovagal syncope with tilt training.

Study population: we observed 100 pts. (32 men, 68 women) aged 17-42 yrs (median of age: 22 yrs) with vasovagal syncope (VVS) confirmed by head-up tilt test (HUTT) and referred to non-pharmacological treatment by tilt training.

Methods: All pts underwent HUTT performed according Italian protocol. After positive HUTT result patient were referred to classical tilt training proposed by Ector – repeated tilting until achieving two consecutive negative responses. Continuous non-invasive monitoring of heart rate (HR) and blood pressure (beat-to-beat) was performed using NEXFIN analyser. Based on registered HR and blood pressure values the baroreceptor sensitivity index (iBRS) was calculated separately for supine and for tilting during the following training sessions.

Results: Significant reduction of iBRS during tilt across the training cycle was observed in all patients (2.5 vs. 9.8 ms/mmHg $p<0.01$), whereas there was no changes regarding supine values of iBRS through the training.

Conclusions:

1. Modification of baroreceptor sensitivity during the tilting seems to be important mechanism responsible for antysynusal effect of tilt training.
2. The monitoring of tilt related baroreceptor sensitivity may be marker of effectiveness of treatment of vasovagal syncope by tilt training.

SYMPATHOVAGAL INTERACTION ON HEART RATE AND VENTRICULAR FIBRILLATION INDUCIBILITY

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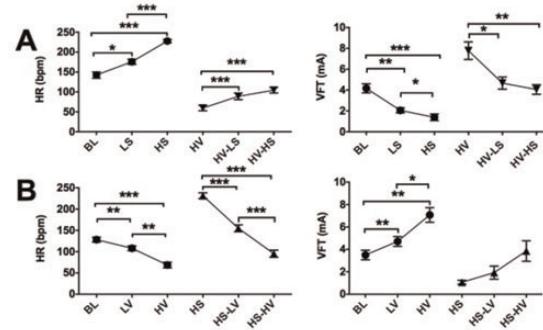
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Purpose Vagal dominance on heart rate (HR) control is well known. This study examines interaction of vagus (VS) and sympathetic stimulation (SS) on HR and ventricular fibrillation threshold (VFT).

Method Dual-innervated Langendorff rabbit hearts (n=9) were used. Right vagus nerve was stimulated at 3Hz (LV) & 10Hz (HV). Spinal cord was stimulated for bilateral SS at 2Hz (LS) & 9Hz (HS). VFT was determined by burst pacing. HR was measured during steady state. Two protocols were carried out - A) LS and HS at baseline (BL) vs. background HV; B) LV and HV ± background HS.

Results A) HR increased in frequency dependent manner by 44 ± 6 bpm (LS) and 97 ± 5 bpm (HS). Background HV blunted this frequency response. SS reduced VFT in a frequency dependent manner. With background HV, SS reduced VFT with preserve frequency response. B) HR reduced in frequency dependent manner by 25.6 ± 5 bpm (LV) and 57 ± 8 bpm (HV). Background HS enhanced this HR reduction in a frequency-dependent manner. At BL, VS increased VFT with a frequency dependent response. With background HS, VS had no significant effect on VFT and its frequency response.

Conclusion The dominance of VS over SS in heart rate changes is absent in the effects on VFT, suggesting a unique interaction on ventricular electrophysiology compared to that at the atrial level.



CHARACTERIZATION OF REPOLARIZATION ABNORMALITIES IN PATIENTS WITH ARRHYTHMOGENIC RIGHT VENTRICULAR CARDIOMYOPATHY, APPLYING VECTORCARDIOGRAPHY.

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Background: Arrhythmogenic right ventricular cardiomyopathy (ARVC) is associated with characteristic de- and repolarization abnormalities in right precordial leads. Abnormalities of ventricular repolarization (VR) are either primary (associated with increased repolarization heterogeneity) or secondary (resulting from abnormal depolarization) or a combination. The cause of the typical VR abnormalities in ARVC is unknown.

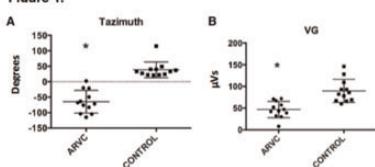
Aim: The aim of the study was to characterize VR abnormalities in ARVC patients compared to controls, using 3-dimensional vectorcardiography (VCG).

Methods: VCG was recorded during 5 minutes of rest using 8 electrodes positioned according to a modified Frank orthogonal lead system in 12 ARVC patients and 12 healthy, sex- and age matched control subjects. The T-vector direction in the horizontal plane was measured as Tazimuth (Taz) and VR abnormality as the ventricular gradient (VG), reflecting dispersion of action potential morphology, and Tarea, a measure of VR dispersion.

Results: In the ARVC patients (9 males, age: 52±12 yrs, ICD, n=9) the T-vector, deviated posteriorly (Fig. 1 A) compared to the control group ($p<0.002$) while the VG was significantly lower (Fig. 1B). Similarly, Tarea was significantly smaller in ARVC patients ($34 \pm 19 \mu\text{Vs}$) compared to controls ($69 \pm 23 \mu\text{Vs}$, $p<0.001$). Slower conduction in the ARVC group was evident as prolonged QRS duration ($113 \pm 19 \text{ ms}$ vs. $100 \pm 9 \text{ ms}$ in controls, $p=0.06$). The results were consistent after correcting for use of antiarrhythmic drugs in the ARVC group.

Conclusion: While patients with ARVC displayed a marked alteration of the T-vector direction in the horizontal plane no increase in VR heterogeneity or dispersion was detected. Together, these data suggest that VR abnormalities in ARVC is primarily secondary and resulting from slow ventricular conduction, and that superimposition of primary repolarization abnormalities is not likely to be present.

Figure 1.



GENETIC SCREENING RESULTS OF INHERITED ARRHYTHMIAS IN CHILDREN: A SINGLE CENTER EXPERIENCE

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Background: Long-QT syndrome (LQTS), Brugada syndrome (BrS) and Catecholaminergic polymorphic ventricular tachycardia (CPVT) are the most important inherited cardiac arrhythmia syndromes which are associated with sudden cardiac death in individuals with structurally normal heart. Due to autosomal dominant transmission, not only the probands but also their asymptomatic family members are under the risk of SCD. In this study, we aimed to assess our patients and their relatives who underwent genetic screening for inherited arrhythmias.

Methods and Results: Data of patients and their family members who underwent for genetic screening of inherited arrhythmias between March 2013 and January 2014 were retrospectively reviewed. Among the completed mutation analysis, disease related gene mutations were identified in 74 individuals. Of these, 26 were probands (age 10.2 ± 6.6 years), the remaining patients were family members (age 24.5 ± 15.4 years). DNA testing started with probands. The choice of which gene to test was based on the patients medical history, symptoms and cardiac assessments. Out of 26 probands, 21 (%80.7) were symptomatic and rest of them were asymptomatic. The mean QT interval was 499.1 ± 65.1 msec in the LQTS group. QT interval was significantly longer (531.8 ± 81.6 msec) in probands compared to the family members (474 ± 32.5 msec, $p = 0.002$). Among the 74 patients, 46 (%62.2, 20 families) LQTS, 13 (%17.5, 1 family) overlap syndrome (related to SCN5A mutation), 5 (%6.7, 1 family) JET, 4 (%5.4, 1 family) CPVT, 1 (%1.5, 1 family) ARVD, and 5 (%6.7, 2 families) BrS mutations were identified. Novel previously undetermined genetic mutations (3 mutations in LQTS, 1 mutation in JET, 1 mutation in BrS) were found in 5 families. One family with 13 family members had overlap syndrome (LQT3-BrS mixed phenotype). ICD was implanted in 19 of the patients (12 probands, 7 family members).

Conclusion: Genetic testing has critical significance in the determination of inherited arrhythmia syndromes in children. Asymptomatic family members without manifest disease significantly benefit from the testing. Novel mutations continue to be discovered; therefore genetic assessment should take that into account for improved identification of disease carriers.

Ivabradine in the paediatric population: Preliminary findings

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Introduction and Objectives: Ivabradine is a selective and specific inhibitor of the If current in the sino-atrial node. It decreases the heart rate and myocardial consumption at rest and during exercise. It is used in the adult population for management of heart failure and angina but promising results have been obtained in postural orthostatic tachycardia syndrome (POTS). There is little experience of Ivabradine in the paediatric population although it is being used, mainly for POTS, on a compassionate basis. We have evaluated retrospectively patients in whom Ivabradine has been prescribed in order to assess efficacy and safety.

Methods: We evaluated all patients less than 18 years in our institution in whom Ivabradine had been prescribed from February 2008 to September 2013.

Results: Thirteen patients were identified (9 females and 4 males). The median age at commencement was 14 years (min 12 years, max 17 years). The indications for Ivabradine were: POTS in 11 patients (84%), chronic angina in 1 patient and Duchenne muscular dystrophy in another. Mean (SD) Ivabradine dose after up titration was 4.8 (1.9) mg corresponding to 0.1 mg/kg per dose. During a mean follow up of 122.2 (94.3) days, six (46%) patients were up-titrated. Ivabradine was suspended in 1 patient for worsening of symptoms (syncope and palpitation). In 7 of 11 patients (63%) symptoms improved. ECGs on Ivabradine were available for analysis in 8 patients. There was a reduction in the heart rate from a mean of 88.8 (13.8) bpm to a mean of 75.1 (19.5) bpm ($p=0.018$). None of the patients had increased duration of QTc above the normal limit (from 398.9 (22.1) to 404.9 (34.9)). None of the patients experienced side-effects (e.g. symptomatic bradycardia or phosphenes).

Conclusions: From our limited preliminary experience, Ivabradine is safe in patients under 18 years. There was improvement of symptoms in 63% of our patients and none had any adverse effect. Further studies are needed to assess the efficacy and the safety of this drug.

DO ECTOPIC SUPRAVENTRICULAR PREMATURE BEATS PREDICT EARLY NEW-ONSET ATRIAL FIBRILLATION AFTER CORONARY ARTERY BYPASS SURGERY?

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Introduction: Early new-onset postoperative atrial fibrillation (PoAF) occurs frequently after CABG, but the exact mechanism is unknown. In the general population, frequent single ectopic supraventricular premature beats (SVPBs) are associated with AF. Whether SVPBs also play a role in development of PoAF is unknown. The goal of this study is to examine 1) frequency and burden of postoperative SVPBs in patients with coronary artery disease, 2) relation between SVPBs characteristics and PoAF.

Methods: Patients (N=105, 83 male, 66±9 years) undergoing elective coronary artery bypass grafting (CABG) were included. Postoperative continuous rhythms were recorded, processed and semi-automatically analysed in a multichannel Holter scanning software SynapseTM (Sorin Group). SVPBs were defined as singles (>25% shortening of SVPB's cycle length (CL) compared to the average CL of the two preceding beats), couplets or runs (containing ≥3 beats and during <30 sec). PoAF was defined as episodes lasting ≥30 sec. Single SVPBs prematurity index (PI%) was determined by dividing its CL to the averaged CL of the 2 preceding beats. Single SVPBs burden per patient was assessed by dividing the sum of all SVPBs by the total number of beats. The burden of couplets and runs was defined as the total duration of all couplets/runs divided by the recording time. SVPBs cut-off values predicting AF in general population, defined as the top 25th percentile, were used to predict PoAF.

Result: 42583846 beats recorded in 9091 hours were analysed. Single SVPBs (N=173263), couplets (N=11795) and runs (N=4031) were observed in respectively in 100%, 91% and 81% of the patients. PoAF developed in 29 (28%) patients. Patients with PoAF had a significantly higher frequency and burden of single SVPBs/couplets/runs compared to patients without PoAF ($p<0.05$). Similar results were demonstrated for single SVPBs PI. Using the SVPBs cut-off values PoAF could be predicted by single SVPB >15/hour and burden >0.03%, couplet burden >0.01%, runs >0.6/hour and burden >0.2%.

Conclusion: After CABG, SVPBs occur in the majority of the patients. The frequency and burden of SVPBs above a specific threshold is associated with development of PoAF.

CLASS III DRUGS IN HUMAN ISCHEMIC VENTRICLES: ANTI- OR PRO-ARRHYTHMIC ACTION?

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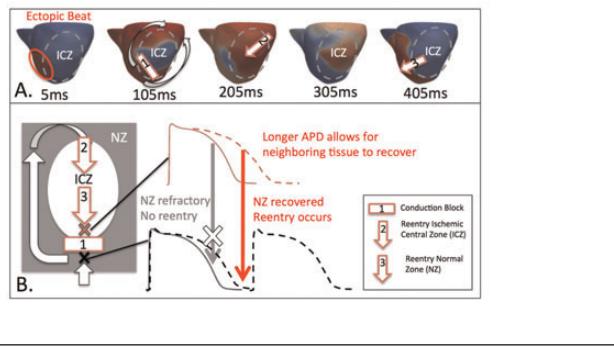
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Background: Class III antiarrhythmic agents (potassium channel blockers) act by prolonging action potential duration (APD). In patients with ischemia, administration has been associated with an increased risk of arrhythmias. The underlying mechanisms remain unclear. The aim of this study was to investigate arrhythmic mechanisms of class III agents during ischemia.

Methods: We performed simulations using a computational model of whole human ventricles with regional ischemia in the LV, with and without hERG block (0, 30, and 50% reduction). Vulnerability window (VW) was calculated as the time within which ectopy resulted in reentry.

Results: In regional ischemia, figure of eight reentry was triggered by ectopy close to the ischemic region during the VW (Panel A). hERG block decreased VW (~24% for 30% block and ~6% for 50% block). With moderate block, the concomitant increase in APD (+5% for 30% block) and refractoriness was protective by preventing reentry (Panel B solid lines and gray arrow). However, with increased block, further APD prolongation (+9% for 50% block) and dispersion allowed for recovery of neighboring tissue and resumed reentry (Panel B dashed lines and red arrow).

Conclusion: Our results demonstrate both anti- and pro-arrhythmic effects of a drug-induced increase and dispersion in APD during regional ischemia. This suggests the need for dose-dependent studies of class III agents in ischemic patients.



Omega-3 fatty acid supplementation does not reduce atrial fibrillation burden in Patients with Implanted Pacemaker

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Introduction: Atrial fibrillation (AF) is the most common sustained atrial arrhythmia associated with high morbidity and mortality. Omega-3 polyunsaturated fatty acids (n3-PUFAs) might have antiarrhythmic properties. Alfa-linoleic acid (ALA) is a plant origin PUFAs. Atrial fibrillation occurred frequently in patients with pacemakers and associated with increased risk of ischemic stroke. Pacemakers can quantify and qualify atrial fibrillation occurrence. We hypothesized that ALA-PUFAs would reduce AF burden.

Methods: Forty eight patients with pacemaker (PM), were enrolled, and randomized to 1 gram of ALA (n=25) or a matched placebo (n=23) for 6 months. There were 31 men and 17 women, with an average of 70.25 ± 2.3 years. Gas chromatography was used to assess plasma fatty acid composition of samples collected on the day of randomization and at six months. We monitored the patients for 6 months to detect and quantify atrial fibrillation.

Results: The ALA dosing increased plasma ALA from 0.5% to 3.5% in the treatment group without change in the placebo group ($P<0.001$). The number of AF episodes and the AF burden were similar in both groups (30% n3-PUFAs versus 33% placebo, $P=0.67$).

Conclusion: Oral plant PUFA (ALA) supplementation for six month did not reduce AF burden in patients with implanted pacemaker.

PA-TDI INTERVAL SUGGESTS REVERSE ATRIAL REMODELING AFTER SUCCESSFUL ELECTRICAL CARDIOVERSION OF ATRIAL FIBRILLATION.

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Background and Objectives Previously we identified total atrial conduction time (TACT) assessed via PA-TDI interval as a non-invasive marker to reflect the degree of atrial remodeling. The aim of this study was to determine whether PA-TDI interval is an independent predictor of recurrent atrial fibrillation (AF) and if it reflects reverse atrial remodeling after successful electrical cardioversion (CV).

Methods 51 patients (mean \pm SD 66 ± 10.6 years; 35% women) with persistent AF and successful CV were prospectively enrolled. TACT was measured six hours/ 90 days after successful CV by tissue Doppler imaging (PA-TDI interval). AF relapse was determined via Holter-ECG (7 day) immediately after CV and after 90 days.

Results Early recurrent AF (within 7 days after CV) occurred in 21 patients (41.2%), whereas after 3-month 26 patients (51%) developed AF relapse. PA-TDI interval was longer in patients where AF recurred after 90 days compared to patients who remained in sinus rhythm (SR) (159 ± 13.2 ms vs. 129.8 ± 10.9 ms, $p<0.0001$). Optimal cut-off values for recurrent AF after 7 days or 90 days from ROC analysis were 142 ms and 143 ms, respectively. Moreover, PA-TDI interval decreased significantly in those who remained in SR (129.8 ± 10.9 ms vs. 125.8 ± 10 ms, $p<0.0001$), whereas PA-TDI interval increased in patients who developed AF after 3-month (149.1 ± 8.3 ms vs. 152 ± 9 ms, $p<0.0001$).

Conclusions PA-TDI interval is a non-invasive predictor of AF recurrence after electrical CV. It may help to reflect the changing degree of atrial remodeling after electrical CV.

CLINICAL PROFILE OF YOUNG-ONSET ATRIAL FIBRILLATION

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Purpose: Atrial fibrillation (AF) is mostly observed in elderly in the presence of underlying disease. However AF more and more starts at younger age (<60 years, 'young onset AF'), even at an age <40 years. Data on this group of patients is sparse.

Methods: This is a single-center observational prospective study performed in a tertiary referral center. Consecutive patients who had developed AF <60 years were included. Detailed information on underlying disease, old and new risk factors for AF and family history was collected. Familial AF was defined as AF occurring in at least one first-degree family member before the age of 60 years. Patients with very young onset of AF (age <40 years) were compared to patients with AF onset at an age 40-60 years.

Summary: Included were 446 patients, 97 (22%) <40 years and 349 (78%) 40-60 years (Table). Mean age at AF onset was 46 ± 10 years, 26% were women. The majority had paroxysmal AF. Familial AF was present in 27%. Underlying heart disease and obesity was often observed albeit less frequently in patients with AF starting <40 years. Lone AF occurred in 11% at an age <40 years, and in 2% at an age 40-60 years.

Conclusion: Young onset AF is associated with a high prevalence of comorbidities, including hypertension, vascular disease and obesity, even in patients with AF onset <40 years. Lone AF is rare.

	Total	AF <40 years	AF 40-60 years	P-value
Age of AF onset (years, mean \pm SD)	46 \pm 10	31 \pm 7	50 \pm 5	<0.001
Female sex - no. (%)	114 (26)	21 (22)	93 (27)	0.32
Paroxysmal AF - no. (%)	289 (65)	62 (64)	227 (65)	0.84
Familial AF - no. (%)	119 (27)	29 (30)	90 (26)	0.42
Hypertension - no. (%)	227 (51)	29 (30)	198 (57)	<0.001
Vascular disease - no. (%)	123 (28)	20 (21)	103 (30)	0.08
Coronary artery disease - no. (%)	78 (17)	10 (10)	68 (19)	0.04
Percutaneous coronary intervention - no. (%)	34 (8)	2 (2)	32 (9)	0.02
Diabetes mellitus - no. (%)	38 (9)	4 (4)	34 (10)	0.10
Heart failure - no. (%)	66 (15)	12 (12)	54 (15)	0.45
Body mass index ≥ 30 kg/m 2 - no. (%)	117 (26)	18 (19)	99 (28)	0.051
Excessive exercise - no. (%)	94 (21)	20 (21)	74 (21)	0.82
Number of comorbidities (mean \pm SD)	2.7 \pm 1.7	2.1 \pm 1.5	2.8 \pm 1.7	<0.001
Lone AF - no. (%)	19 (4)	11 (11)	8 (2)	<0.001
LVEF (% median, range)	58 (13-76)	58 (13-68)	58 (15-76)	0.45
LA volume index (ml/m 2 , median, range)	33 (14-97)	31 (14-97)	33 (14-84)	0.12

16_17

16_18

A CASE WITH DRUG INDUCED EARLY REPOLARIZATION SYNDROME
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We experienced a case with drug induced early depolarization syndrome (ERS), which encountered ventricular fibrillation (VF). A 49-years-old men with paroxysmal atrial fibrillation experienced ventricular fibrillation after taking pilsicainide and verapamil for the second time. After resuscitated, his electrocardiogram showed significant J wave elevation before the ventricular premature contraction in lead I, aVL, and V4-6. Bolus infusion of 50mg lidocaine exaggerated these J waves and increased the frequency of VPC that consequently resulted in VF. Isoproterenol infusion attenuated these J waves and inhibited VPC and VF. While a drug test with pilsicainide alone didn't induce J wave elevation, pilsicainide and verapamil infusion in a vagal condition (pretreated with beta-blocker and cholinesterase inhibitor) induced all the J wave elevation, VPC and VF. He underwent pulmonary vein isolation and was prohibited to take any antiarrhythmic drug. Since then, he is free from any cardiac event. This case remind us the existence of latent drug induced ERS and the importance of the drug test method to reproduce J wave elevation in ERS.

WITHDRAWN
BY THE AUTHOR

SESSION 16: ABLATION TECHNIQUES/EP

16_19

16_20

MUSIC THERAPY DURING EP PROCEDURES MINIMIZES ANXIETY AND PAIN

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PURPOSE: Invasive electrophysiological procedures (IEPP) are usually performed under local anesthesia without any sedation and are associated with significant anxiety(A) and pain(P). The aim of the study was to evaluate the effects of music therapy during IEPP on P and A.

METHODS: 120 patients(82 male,38 female,mean age 66 years) undergoing IEPP (devices 87, eps/ablation 33) performed entirely under local anesthesia were randomized to a music listening group(MG) or to a non-music listening group(nMG). Preselected relaxing instrumental music was delivered from an MP3 player via earphones to the MG throughout the procedure. The level of anxiety was assessed using the State Anxiety Inventory Questionnaire(STAI), which was filled by all the patients. Also the level of P and A involved with the procedure was evaluated using a visual analog scale (VAS) which was completed by the patients following the IEPP; P-VAS and A-VAS.

RESULTS: There were no differences between the 2 groups in reference to age, sex, duration or type of IEPP. Both measures of A-VAS and P-VAS were significantly reduced in the MG compared to the nMG: 0.5 versus 8.0 and 1.0 versus 6.0 respectively (p<0.001 for both). STAI was significantly lower in the MG:26.0 versus 43.0 (p<0.001)

CONCLUSIONS: Music therapy during IEPP performed under local anesthesia can effectively reduce the distress involved with the procedure. It seems it is a simple but valuable tool to help patients undergo IEPP with less pain and anxiety.

SAFETY OF CARDIOLOGIST GUIDED SEDATION DURING ABLATION PROCEDURES.

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Purpose:

To investigate safety and feasibility of cardiologist guided unconscious sedation during catheter ablation in a specialized unit.

Method:

Ablation procedures performed between May 2010 and May 2013 were retrospectively but randomly identified from our database; then procedures were prospectively analyzed (Jun 2013-Jan 2014). Unconscious sedation was performed using boluses of midazolam and fentanyl along with continuous propofol infusion. Three groups were defined (**group I:** AF, **group II:** SVT, **group III:** VT/VES, divided in two subgroups according to the presence or not of structural heart disease, HD). Each group was screened for systolic blood pressure <90mmHg for 5min, SpO₂ <90% for 3min and sedation related complications.

Summary:

808 procedures were analyzed (**group I:** 525 pts, 67±11 years, 19% HD; **group II:** 196 pts, 61±16 years, 22% HD; **group III:** 87 pts, 64±16 years, 38% HD). Mean procedural and fluoroscopy times were significantly longer for group I and III (**group I:** 109±38min and 13±7min, **group II:** 66±34min and 8±7min, **group III:** 111±44min and 9±7min). Mean sedation's amount was significantly lower in group III (**group I:** midazolam 3.6±1.8mg, fentanyl 68±22mmg, propofol 767±324mg; **group II:** midazolam 3.5±1.8mg, fentanyl 57±20mmg, propofol 511±272mg; **group III:** midazolam 1.6±1.6mg, fentanyl 46±28mmg, propofol 401±353mg). No significant differences in sedation related adverse events were observed (SpO₂<90%: **group I** 0%, **group II** 1%, **group III** 1%; transient blood pressure <90 mmHg: 4%, 3%, 1%, respectively). No differences were found between HD and non-HD group III pts. Only one pt underwent AF ablation under elective intubation because of haemodynamic instability. No other pts required switch to intubation or anesthesiologic assistance, no procedures were terminated because of sedation effects.

Conclusion:

Unconscious sedation during catheter ablation is safe and feasible in a specialized unit.

ASSOCIATION OF ATRIAL FLUTTER AND RELATIONSHIP WITH SINUS NODE DYSFUNCTION IN PATIENTS WITH CAVOTRICUSPID ISTHMUS ABLATION

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Background:

Atrial Flutter (AFL) coexists with Sinus node dysfunction (SND). This is observed when the AFL is ablated and the patient requires pacemaker. We investigated the presence of any predictive factor to identify the coexistence of AFL with SND.

Methods. Were studied successfully ablated patients with persistent AFL. Electrophysiology variables included: flutter cycle length (FCL) before the ablation, presence of 2:1 conduction and another clinical features were assessed.

Results. Twenty-one patients (10%) required a permanent pacemaker implantation (PMI) for significant SND after AFL termination. Patient without conduction 2:1 and longer FCL were related with SND (table). The receiver-operating characteristic (ROC) curve analyses showed that the FCL significantly discriminated between patients with and without SND. An FCL of 270 ms was identified as the optimal cut-off values to predict SND requiring a PMI.

Conclusion. The results suggest that FCL and lack of 2:1 conduction are predictive for SND in patients with AFL termination.

Variable	PMI(-) (n=188)	PMI(+) (n=21)	p
Age (yrs)	55±2	57±4	0.56
Diabetes Mellitus	17(9)	5 (24)	0.08
Flutter cycle length	241±35	277±42	0.005
Conduction 2:1	122 (64)	4(19)	0.001

RFA OUTCOMES IN AVNRT AND AVRT IN TERMS OF DISEASE SPECIFIC SYMPTOMS AND HEALTH RELATED QUALITY OF LIFE RESULTS FROM PPRA STUDY.

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The aim of this study was to assess the outcomes of RFA of AVNRT and AVRT in terms of disease specific symptoms (DSS) and health related quality of life (HRQoL).

Methods

PPRA Study was a single-center, prospective, cohort study enrolling patients scheduled for RFA of AVNRT or AVRT. At baseline, all patients received a clinical assessment and completed questionnaires concerning: socio-economic status, disease specific symptoms (PPAQ) and HRQoL (EQ-5D-3L). Two months after RFA, the clinical assessment was repeated and subjects completed PPAQ and EQ-5D-3L.

Results

Out of 82 patients enrolled, 64 patients returned complete questionnaires and were included in this analysis. Baseline characteristics: 41 (64%) women, median age 47, 40 (62.5%) AVNRT, 24 (37.5%) AVRT, median time from onset of symptoms to RFA 10 years, hypertension 15 (23%), any co-arrhythmia 11 (17%), preexcitation 14 (22%). During follow-up there were six (9%) clinically confirmed recurrences but only two patients decided to repeat RFA. There was significant improvement in general HRQoL from baseline after RFA: EQ-5D-3L index improved from 0.86 to 1 and EQ-5D-3L VAS from 70 to 90 (both p<0.0001). There was significant improvement in DSS on all domains of PPAQ: frequency and length of SVT episodes, number of symptoms and average bothersomeness of symptoms (p<0.001 for all, p for frequency 0.02). Influence of arrhythmia on everyday activities significantly decreased from 21 to 1.5 points and absence at work/in school decreased by two days. Most common symptoms reported before RFA were: heart fluttering (81%), heart racing (77%) and fatigue (67%). After RFA, patients reported most commonly: heart skipping (39%), fatigue (36%) and chest pressure (28%).

Conclusions

RFA significantly improves HRQoL of patients and alleviates DSS of AVNRT and AVRT. Still, a group of patients may experience similar but less expressed symptoms after RFA and this should be discussed before discharge to avoid unnecessarily confusion and additional tests.

WOMEN WITH ATRIAL FIBRILLATION ARE MORE HESITANT THAN MEN TO UNDERGO CURATIVE ABLATION THERAPY DESPITE MORE SEVERE SYMPTOMS

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Background: Pulmonary vein isolation often combined with substrate modification is recommended treatment in patients with drug-refractory atrial fibrillation (AF). In most reports, proportionally fewer women undergo this treatment. The objective of the study was to investigate symptoms self-reported measures of HRQL and referral patterns in this cohort and analyze gender differences.

Methods: 115 consecutive patients (39 women; mean age 61 (range 38-76) years, and 76 men; mean age 60 (range 27-75) years) with paroxysmal (82 patients) or persistent (33 patients) AF were studied. They assessed their burden of symptom with the Symptom Checklist: Frequency and Severity (SCL) and evaluated the Health Related Quality of Life (HRQL) with Short Form 36 (SF-36). A detailed questionnaire regarding referral patterns and the patients' own experience was used.

Results: There were no differences in age, comorbidity, proportion of paroxysmal/persistent AF or duration av AF before ablation between men and women. In HRQL, women scored lower than men in several components such as bodily pain, p= 0.007, social functioning, p= 0.008, and physical functioning, p= 0.017. Women scored higher than men in SCL both for frequency and severity (24 vs. 16, p<0.001, and 13 vs. 20; p<0.001). However, women were less inclined than men to accept referral for ablation of AF when first offered and more often demanded expectancy or second opinion (64% vs. 80%, p=0.04). There was a trend that more men than women would have preferred to have been ablated much earlier (34% vs. 7%; p=0.08). Men had undergone more cardioversions than women before ablation.

Conclusion: Women with atrial fibrillation are more symptomatic, reported poorer HRQL than men but are more hesitant to accept ablation therapy. This may be one reason that proportionally less women than men undergo ablation therapy for atrial fibrillation.

WOMEN WITH SUPRAVENTRICULAR TACHYCARDIA ARE MORE SYMPTOMATIC BUT ARE STILL REFERRED FOR ABLATION LATER THAN MEN

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Background: Early retrospective studies showed that women with paroxysmal supraventricular tachycardia (PSVT) although more symptomatic nevertheless were referred later for curative ablation. Since the use of ablation of PSVT has now been recommended treatment of choice since more than 10 years we wanted to evaluate if referral patterns have changed in regard to sex in these patients.

Methods: We studied 135 consecutive patients referred for ablation due to PSVT (98 AV nodal reentrant tachycardia, 29 atrioventricular reentrant tachycardia, and 8 atrial tachycardia). There were 63 men (mean age 52 (range 18-84) years) and 72 women (mean age 51 (range 20-81) years). Symptom burden was evaluated with the Symptom Checklist: Frequency and Severity (SCL) and the Health Related Quality of Life (HRQL) with Short Form 36 (SF-36). Socioeconomic data, symptom duration and referral patterns were evaluated with a separate questionnaire.

Results: Women had a mean of 17 years of symptomatic PSVT before ablation compared to 10 years for men, p=0.03. There was no difference in HRQL but women scored higher in SCL Frequency (20 vs. 15, p=0.005) though not in SCL Severity (12 vs. 16, p=0.15). 26% of the women compared to 8% of the men would have preferred to have been ablated much earlier, p<0.0001. 27% of the men compared to 7% of the women were referred for ablation at their first consultation, p<0.0001. There were no differences between men and women in regard to level of education, income or comorbidities.

Conclusion: Women with PSVT are more symptomatic but are still referred for ablation later than men. The reason is a doctor's delay, not a patient's delay. It is unclear why physicians seem to be more reluctant to advise ablation therapy in women with PSVT than in men.

16_25

COMMON ATRIAL FLUTTER ABLATION IN REAL LIFE. THE FRENCH ELECTRA SURVEY

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INTRODUCTION: Radiofrequency ablation has a well-established indication in the treatment of symptomatic junctional tachycardia. However, ablation procedure modalities are not uniform. We undertook this survey to analyze different managements of patients undergoing this procedure in French Electrophysiology centres. **MATERIAL AND METHODS:** The survey was e-mailed to 140 French electrophysiologists in November 2012. Participants were interviewed on their own strategy in the centre. Answers had to relate to the most frequent routine attitude. When appropriate, physicians could answer « no standardized attitude » or « other ». **RESULTS:** Among the 103 physicians who answered, 31% practice in a university hospital, 34% in a non-university hospital and 30% in a private institution. The rate of annual ablations of all types per physician is <50, 50-100 and >100 in 18%, 24% and 57% of the cases respectively. Atrial fibrillation ablation was performed routinely in 79% of the centres. AFI ablation is performed after the first episode by 95% of physicians. Cavotricuspid isthmus (CTI) resection is validated by 68% of them before ablation. The preferred method for validation is post-pacing interval in 25%, activation mapping via multi-electrode catheter in 14% and both in 29% of the cases. An 8mm and 4 mm irrigated ablation catheter is used by 80% and 14% of physicians respectively for a first procedure, 56% and 36% in case of redo. A long sheath is used first-line in only 3% for a first procedure and 12% for redo. ICT block is confirmed systematically after ablation by 77% of participants. Patients are discharged on the day of ablation by 5%, next day by 77% and 2 days later by 16% of participants. Ablation is systematically performed under general anaesthesia by 7% of them. In case of anticoagulation with Vitamin K antagonist, 92% do not interrupt it, 5% switch to an unfractionated heparin and 3% switch to a low weight heparin. In case of New Oral Anticoagulation, 42% do not, while 14% interrupt it before procedure. In patients with sinus rhythm at admission time and no long-term anticoagulation, 76% do not perform transesophageal echocardiogram. After AFI successful ablation without documented AF but CHADS-VASC >3, anticoagulation is prescribed for 1 month by 35%, lifetime 23%, non standardized 28% of participants. **CONCLUSION:** Most French electrophysiologists ablate after the first episode of AFI, validate CTI responsibility before ablation and its blocking after ablation. They ablate under local anaesthesia, use an 8 mm catheter rather than an irrigated tip catheter especially for the first procedure and do not interrupt VKA. Most frequently, patients are discharged the day following ablation.

DAYCASE CATHETER ABLATION IS SAFE AND COST-EFFECTIVE

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Purpose: Catheter ablation (CA) is curative for common arrhythmias. Many centres admit patients overnight. Daycase CA could provide potential benefits for both patients and healthcare providers. We evaluated our daycase CA practice.

Method: A 3 year retrospective analysis of consecutive daycase CA (February 2010 – 2013). Data were collected on baseline parameters, procedure details/outcomes, complications (immediate [<24 hrs], short term [>24 hrs-4months]) and 1 year mortality. We excluded cases where overnight stay was pre-planned (e.g. left atrial/VT ablations). We performed a cost saving analysis of adopting this policy.

Results: A total of 437 ablations were performed (426 patients; mean age \pm standard error: 56yrs \pm 0.85, range 17- 96 years, 218 males) via the right femoral vein alone (99.8%) or left femoral vein alone (0.2%). Table 1 shows procedure performed, success rate and immediate complications. There were 44 (10.3%) unplanned overnight admissions: 15 for unforeseen concealed pathways needing trans-septal puncture, 9 for immediate complications and 20 admitted at operators discretion but no complication (e.g. prolonged case, late finish, social reasons). All patients underwent immediate targeted echocardiography post procedure; none had significant pericardial effusion. During follow up 1 patient developed DVT in the same leg as vascular access (1 month later) and 2 had died (unrelated to procedure). Overnight stay at our centre costs €350; daycase ablation over this period saved €133,700.

Conclusion: Daycase CA is safe, cost effective and has significant benefits for patients and healthcare systems.

Table 1

Ablation Procedure	Number (n)	Complete Success (n)	Immediate Complications
Concealed accessory pathway	29	28	
Overt accessory pathway	29	25	4 haematomas, 1 intermittent complete heart block (spontaneously resolved)
AV node ablation	17	17	
Atrial flutter (CTI) ablation	146	129	1 haematoma, 1 pulmonary oedema
Slow pathway modification for AVNRT	204	199	2 complete heart block requiring pacing
Right atrial tachycardia ablation	12	10	
Total	437	408	9

16_27

MANAGEMENT OF PAROXYSMAL ATRIAL FIBRILLATION IN THE ELDERLY

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Aims:

The purpose of this study was to investigate the long term efficacy and safety of catheter ablation for elderly patients with paroxysmal atrial fibrillation (PAF).

Background:

Methods and Results:

This study was a single center, retrospective observational study.

We analyzed the single-session procedural outcome of 941 consecutive patients with drug refractory PAF from October 2004 to August 2012.

All patients were divided into 2 groups according to age < 75 years (group-Y; n=840), 75 years (group-O; n=101).

Baseline clinical parameters were similar between group-Y and group-O except for gender ratio and CHADS2 score (72.6% vs 54.5%, p<0.001 and 0.55±0.03 vs 1.71±0.09, p<0.001).

There were no significant differences in the left atrial diameter, volume, and left ventricular ejection fraction.

Major perioperative complications (cardiac tamponade, stroke, anaphylaxis, phrenic nerve palsy) rates were comparable (2.14% in group-Y, 1.98% in group-O, p=0.91) and percentage of minor complications were no significant differences between two groups (1.19% vs 2.97%, p=0.15).

Multivariate logistic regression analysis demonstrated that age was not predictor of perioperative complication (odds ratio, 1.02; 95% confidence interval, 0.99-1.06, p=0.22).

During 27 months follow-up, there was no significant difference in AF free survival between two groups (Log-rank=0.17).

Conclusions:

Catheter ablation should be considered as a first-line therapy in symptomatic elderly patients with PAF.

16_28

ATRIAL FLUTTER ABLATION: INITIAL TUNISIAN EXPERIENCE

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Introduction:

Right atrial flutter has a relatively high incidence. It is often symptomatic and can have a poor outcome particularly in case of thrombo-embolic events.

Aim of study:

We evaluate the results of radiofrequency catheter ablation for right atrial flutter since the introduction of this technique in the Military hospital of Tunis.

Methods:

The 76 first patients referred in our institution for atrial flutter and relevant for cavo-tricuspid isthmus ablation were enrolled. Ablation used a 8 mm tip electrode catheter and one or two conventional diagnostic catheters. The goal of ablation was complete bidirectional isthmus block.

Results:

The first-line success rate was 94, 7 percent. The mean duration of radiofrequency current applications was 717±334 seconds. Only one procedure was complicated by a femoral vein thrombosis. 70 patients were followed up for 28±11 months. The recurrence rate of flutter is 8.5%. Left ventricular dysfunction is the only predictor of recurrence.

Conclusion:

This results are comparable with the published data and encourage the development of basic ablation procedures in general hospital.

EXERCISE TOLERANCE CAN IMPROVE WITH SINUS RHYTHM RESTORATION BY CATHETER ABLATION FOR PERSISTENT ATRIAL FIBRILLATION WITH HIGH BNP

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Introduction Although atrial fibrillation (AF) has a negative hemodynamic effect which leads to decreased exercise tolerance and fatigability on exertion, it is unclear whether restoration of sinus rhythm by catheter ablation for AF improves exercise tolerance. The purpose of this study was to investigate exercise tolerance quantitatively prior to and after catheter ablation for AF.

Methods This study included 46 consecutive patients who underwent catheter ablation for persistent AF (57.5 ± 1.2 y/o, 43 males, AF duration 19.3 ± 2.0 months). The exercise tolerance by the cardiopulmonary exercise test was performed prior to and 3 months after the catheter ablation.

Results Sinus rhythm was maintained in 38 patients (82%) over a 3-month follow-up (SR patients), including 5 patients on oral antiarrhythmic drugs. In the SR patients, the baseline peak oxygen uptake (peak VO₂) were 26.3 ± 0.8 mL/kg/min. The baseline peak VO₂ showed negative correlation with BNP ($R = -0.47$, $P = 0.018$) and UA ($R = -0.55$, $P = 0.025$), but didn't correlate with the duration of AF, CHADS score, the rest heart rate, and the left atrial (LA) volume. The peak VO₂ at 3 months increased significantly in the SR patients (28.5 ± 1.0 mL/kg/min ($P < 0.001$)). And the improvement rate of the peak VO₂ in these patients exhibited positive correlation with the baseline BNP ($R = 0.42$, $P = 0.008$). Furthermore, when the responder was defined as the patients whose peak VO₂ improved over the average improvement rate, the LA volume and the duration of AF-adjusted logistic regression analysis revealed the baseline BNP as an independent predictor of the responder (odds ratio 1.016; 95% confidence interval 1.001–1.031; $P = 0.016$). These favorable changes were not observed in the remaining 8 patients with persisted AF after catheter ablation.

Conclusion Elimination of persistent AF by catheter ablation was associated with improvement of exercise tolerance especially in patients with high BNP, which could be shown in 3 months after the catheter ablation.

RESULTS OF MAZE-SURGERY FOR ATRIAL FIBRILLATION IN RELATION TO GENDER

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Purpose: Maze surgery is an effective treatment for patients with atrial fibrillation (AF). The aim of this retrospective single centre study was to determine if there was a difference in arrhythmia recurrence and/or all-cause mortality between women and men.

Method: Patients with symptomatic therapy resistant AF were selected to undergo the cut-and-sew maze III procedure without modifications. Patients were to have little or no underlying heart disease, but if the preoperative investigation revealed coronary artery disease, significant valve disease or an atrial septal defect, concomitant surgery was allowed. Patients with congestive heart failure class III-IV (not due to AF) and previous heart surgery were excluded.

Summary: A total of 232 consecutive patients with paroxysmal or persistent AF underwent cut-and-sew maze surgery. Forty-seven (20%) were women. The age was 58 ± 8 years in women, 56 ± 8 years in men. Women had more often paroxysmal AF, 62% vs. 40%, $p = 0.009$, of 8.4 ± 6.1 vs. 9.0 ± 6.7 years duration, respectively. Persistent AF was of 7.1 ± 6.5 and 7.3 ± 6.8 years duration in women and men. More women were in NYHA class I and fewer women in class II–III than men, although not statistically significant, $p = 0.09$. The LVEF was $59 \pm 8\%$ vs. $57 \pm 8\%$, $p = 0.053$, while there was no difference in the left and right atrial area. There was no difference between men and women in the use of anticoagulants or other medications or the peri- and postoperative course. The all-cause mortality at 10 years and at the end of the follow-up was 8.7% in women and 9.6% in men, $p = 0.63$. Fewer women remained in SR at 10 years, 58.2% vs. 68.4%, $p = 0.06$, and women had a higher hazard ratio for documented AF/atrial flutter/atrial tachycardia during follow-up, HR 2.0 (1.0; 4.1), $p = 0.04$.

Conclusion: Women selected for maze surgery were not older than men, had more often paroxysmal AF and had a trend towards a better functional class than men. The risk of all-cause mortality was not increased vs. men. Nevertheless women had a higher risk of recurrence of AF/AFI/AT and a somewhat smaller proportion of women than men maintained SR at the end of follow-up.

PREDICTORS OF ALL-CAUSE 90-DAY READMISSION AFTER CATHETER ABLATION FOR ATRIAL FIBRILLATION 2010-2012

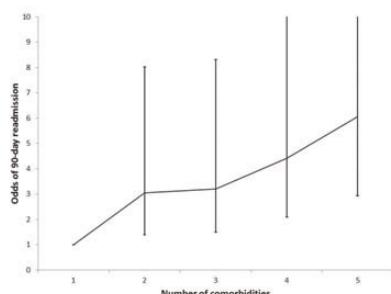
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Purpose: As the number of catheter ablation procedures for atrial fibrillation increases, there is growing focus on reduction in medical costs. Readmission is a major driver of expenditure related to ablation. We sought to identify predictors of all-cause readmission after catheter ablation.

Methods: Using a large, national US health plan administrative claims database we identified all atrial fibrillation (AF) patients aged 64 years or less who underwent catheter ablation between January 2010 and December 2012 (6,339 ablation cases). We examined odds of all-cause 90-day readmission based on place of service (outpatient vs. inpatient), age group (by decade), sex, and number of comorbidities.

Summary of Results: A total of 809 (12.8%) patients were readmitted within 90 days of ablation for any cause. The odds of all-cause 90-day readmission were higher for inpatient procedures (OR 1.72 [95% CI 1.49–2.01]), female sex (OR 1.29 [95% CI 1.10–1.52]), and number of comorbidities (Figure). Chronic renal failure was the strongest individual comorbidity predictor of readmission (OR 2.54 [95% CI 1.74–3.62]). Age group was not associated with odds of readmission.

Conclusion: Identifying patients at high risk for readmission after catheter ablation for AF may offer an opportunity for early intervention and, ultimately, reduction in procedural morbidity and medical costs.



PREDICTORS OF NEW OR AGGRAVATED HEART FAILURE AND OF ALL-CAUSE MORTALITY AFTER ATRIOVENTRICULAR NODAL ABLATION FOR ATRIAL FIBRILLATION

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Purpose: Atrioventricular junction ablation (AVJA) is a highly effective treatment in patients with atrial fibrillation (AF) in who pharmacological rate control or rhythm control with drugs and LA catheter ablation has failed, but renders the patient pacemaker dependent. We aimed to analyse the incidence of new or aggravated heart failure (HF) and all-cause mortality in patients who had undergone AVJA because of AF and to determine predictors for HF and mortality.

Methods: We retrospectively enrolled 186 consecutive patients, mean age 67 ± 9 years, 43% women, who underwent AVJA. At AVJA 103 (55%) patients had paroxysmal and 83 (45%) non-paroxysmal AF. Fifty-seven patients (31%) had known clinical HF before AVJA and 12 had cardiac resynchronization therapy (CRT) before AVJA.

Results: During a follow-up of 61 ± 37 months, new symptoms of HF occurred in 12% of patients without previously known HF, while 9% showed a deterioration of HF, four out of five patients with CRT. Twenty-three percent of the patients died during follow-up at a mean time of 46 ± 31 months after AVJA. The cumulative probability of aggravated or new HF over the first two years after AVJA was estimated to be 5.5%. QRS prolongation ≥ 120 ms and age over 65 years were independent predictors of these conditions. The cumulative probability of mortality over the same time was 6.2%. Age, hypertension, diabetes, HF and QRS duration ≥ 120 ms were independent predictors of death.

Conclusion: The incidence of new or aggravated HF or all-cause mortality was low, which implies that long-term ventricular pacing was not harmful in this patient population.

Impact of Female Gender on Atrial Fibrillation Ablation Outcome

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Background

Despite the fact that male gender is a known risk factor for developing Atrial Fibrillation (AF) and that female gender is a risk factor for thromboembolism in the setting of AF, whether there is any difference in outcome between the two genders after AF ablation still unclear.

Methods

We completed a retrospective review of 481 consecutive patients undergoing AF ablation. Baseline demographics, echocardiography, type of AF, ablation technique, peri-procedure complications and freedom from AF at one year follow up were assessed.

Results

Twice as many AF ablations were performed in men as for women 321 (66.7%) vs 160 (33.3%), women were older at the time of the ablation 62.8 ± 10.2 vs 59.5 ± 10.3 year ($p=0.001$), had lower body weight 89.6 ± 23 vs 105.1 ± 22 Kg ($p<0.001$), higher LVEF 55.8 ± 5.2 vs 52.6 ± 5.0 ($p=0.001$) and were more likely to have paroxysmal AF 70.3% vs 53.5% ($p=0.0005$). Women were more likely to have a history of stroke or TIA 11.9% vs 4.7% ($p=0.0037$), and Hypothyroidism 20% vs 8.4% ($p=0.0003$).

There was no difference between the two genders in peri-procedure complications with the exception of pericardial effusions that required drainage which occurred in 4 (2.5%) women vs 1 (0.3%) man ($p=0.026$).

At a follow up of 249.7 ± 130.6 days there was no significant difference in freedom from AF between the two genders.

Conclusion

Men are referred for AF ablation more frequently than women, but women undergoing ablation tend to be older, have more paroxysmal AF and a greater history of thromboembolic events than men. Although there was no difference in overall complication rates between men and women with AF ablation, women appear to be at greater risk of developing significant pericardial effusion requiring intervention.

PACEMAKERS IMPLANTATION AND RADIOFREQUENCY CATHETER ABLATION PROCEDURES IN THE CONTEXT OF MEDICAL MISSIONS IN MOROCCO : A 6-YEAR EXPERIENCE FROM THE MONACO HOSPITAL

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Introduction : Radiofrequency catheter ablation (RFCA) for arrhythmias in the context of short-term medical missions (MM) in a developing country has not been reported so far. We describe here our experience with pacemakers implantation and RFCA in Morocco with a full portable electrophysiological (EP) system under the auspice of the Monaco-Morocco Association.

Methods : Between october 2008 and december 2013, all patients who benefited from pacemakers implantation and RFCA were included in this study. Two MM (mean duration 4 d) per year were conducted by a team including two physicians and one nurse from Monaco; and were located alternately in Marrakech, Fes, Agadir, Casablanca, Rabat, Essaouira, and Oujda. All patients files were sent by local teams and/or referring Moroccan cardiologists before MM. Each case was discussed with the Monaco EP team before the MM. Pacemakers and leads were donated by companies (Sorin Group, Medtronic, Saint-Jude Medical). The EP system (EP Tracer, CardioTek) as well as diagnostic/ablation catheters were brought for RFCA procedures. After the procedures, follow-up was organized by local teams.

Results : Procedures took place in gynecologic or orthopedic room, or interventional cardiology cathlab. 21 RFCA were performed during 9 MM (Atrioventricular node reentrant tachycardia = 10; Atrioventricular reentrant tachycardia/Mahaim fiber = 9; atrial flutter = 1; ventricular ectopy = 1). RFCA acute success was 90 %. One major RFCA-related complication occurred (stroke with full recovery), and one transient complete AV block with complete resolution. No complication was related to pacemakers implantations ($n = 40$; mean 4 pacemakers per mission). Each MM also included an educational program with lectures concerning rhythm disorders and/or devices programmation. Since the beginning of this experience, two Moroccan EP fellows were trained in Monaco Hospital.

Conclusion : RFCA for arrhythmias in developing countries is technically challenging but feasible. At the end, it represents a wonderful experience and favours strong exchanges and collaboration with local teams.

SESSION 16: PACING

AGE AND QUALITY OF LIFE IN CATHETER ABLATION OF ATRIAL FIBRILLATION

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Background

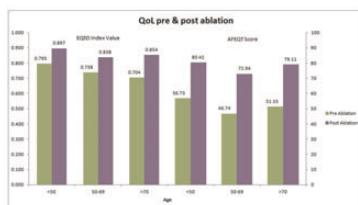
Catheter ablation (CA) has been shown to improve quality of life (QoL) in patients with atrial fibrillation (AF). However, there are concerns that CA may be less beneficial in elderly patients, as competing comorbidities may negate any potential improvement in QoL. We hypothesised that the magnitude of improvement in QoL with CA is same regardless of patient age.

Methods

We assessed QoL in 131 consecutive patients undergoing CA for AF at baseline, and at 6 months following CA. All patients were administered a disease-specific questionnaire, Atrial Fibrillation Effect on QualTy of life (AFEQT), and a general health questionnaire, the EQ5D at both time points. Of 131 patients, 18 patients were <50 yrs of age (Group A), 88 patients were 50 to 69 yrs (Group B), and 25 were older than 70 yrs at time of ablation (Group C).

Results

Baseline QoL of older patients was comparable with younger patients. There was a significant improvement in QoL at 6 months post CA for AFEQT scores across all three age groups. EQ5D scores showed significant improvement in Groups B and C but not in Group A. Improvement in QoL was most marked in patients in Group C, for both AFEQT score (27.79) and EQ5D score (0.150) as compared to groups A and B, $p<0.001$.



Conclusion

Catheter ablation for AF is associated with a significant improvement in QoL, as assessed by both disease-specific and generic tools. The greatest improvements in QoL scores are seen in patients older than 70 years of age. Denial of ablation to older patients with AF cannot be justified on age alone. The magnitude of improvement in health utility (EQ5D score) seen in older patients would be in keeping with a highly cost effective procedure if the benefits are maintained long term.

CURRENT USE OF IMPLANTABLE ELECTRICAL DEVICES IN SWEDEN: DATA FROM THE SWEDISH PACEMAKER AND ICD REGISTRY

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Background: The National Swedish Pacemaker and Implantable Cardioverter-Defibrillator (ICD) Registry collects prospective data on all pacemaker and ICD implants in Sweden.

Aims: To report the 2012 findings of the Registry concerning implantation rates of electrical devices, complications, device longevity and patient survival, and to compare regional differences as well as changes in implantation rates over time.

Methods: Forty-four Swedish implanting centres continuously contribute implantation of pacemakers and ICDs to the Registry by direct data entry on a specific website. Clinical and technical information on 2012 first implants and post-operative complications were analysed. Patient survival data were obtained from the Swedish population register database.

Results: In 2012 the mean pacemaker and ICD implantation rates were 697 and 136 per million inhabitants, respectively. The number of Cardiac Resynchronization Therapy (CRT) implantations/million capita was 41 (CRT pacemakers) and 55 (CRT defibrillators) with only a slight increase in implant rates compared to 2011. Regional differences were observed, with the highest implant rates in the northern region. Most device implantations were performed in men. Complication rates for pacemaker and ICD procedures were 5.3 and 10.1%, respectively. Device and lead longevity differed among manufacturers. Pacemaker patients had generally worse survival rate than ICD patients (63 vs. 82% after 5 years), and were older at the time of the first implant.

Conclusion: Pacemaker and ICD implantation rates seem to have reached a level phase in Sweden, with persistent discrepancies between regions. ICD and CRT implantation rates are very low and don't reflect guidelines indications. Gender differences are pronounced. Device and patient survival rates are variable, and should be considered when deciding device type to improve cost-effectiveness of pacing and ICD therapy.

Optimized Pacing for hyperTrophic Cardiomyopathy to Unravel de Mechanisms. The OPTIMUM pilot study.

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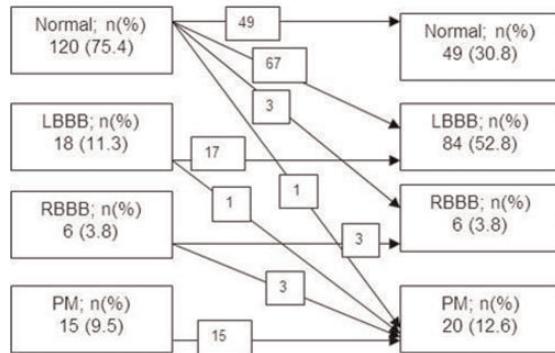
Introduction: Biventricular pacing (BiVP) has shown that could be more effective than right ventricular (RV) pacing for the reduction of left ventricular outflow tract gradient (LVOTG) in severe symptomatic patients with hypertrophic obstructive cardiomyopathy (HOCM). ECG-fusion with intrinsic QRS could reduce the benefit of pacing.**Methods:** Surface ECG studies in 20 symptomatic HOCM patients with severe LVOTG, implanted with an atrial-synchronous (AS) BiVP (AS-BiVP) device, were evaluated for the presence of fusion and its effect on LVOTG reduction and outcomes. The evaluation was retrospective in the first 12 patients, after which 8 patients were included in a prospective study and received atrio-ventricular node ablation (AVNA) immediately after the implant if fusion was present.**Results:** Seven (58%) of the first 12 patients had ECG-fusion. After 54±24 months of BiVP, the presence of fusion was associated with lower values for reduction of resting LVOTG (30±31% vs 58±26%, p=0.117), dynamic LVOTG (39±27% vs 74±26%, p=0.03), and NYHA class (0.7±0.75 vs 1.2±1.3, p=0.64). Table 1 shows the changes in LVOTG, heart failure parameters, and QoL in the 8 patients prospectively evaluated, 5 (63%) of whom needed AVNA that further decreased LVOTG, from 114±47 baseline to 86±29 before to 49±14 mmHg after AVNA (p=0.08). Overall, patients with ECG-fusion (n=7) had lower LVOTG reduction than those without (n=13, including patients with AVNA): 30±31% vs 58±37% (p=0.09).**Conclusions:** ECG-fusion is present in about 60% of patients with AS-BiVP and nullifies the benefit of pacing. In patients with ECG-fusion, AVNA further reduces LVOTG. These acute benefits are associated with better outcomes than patients with ECG-fusion and comparable to those without.

	Baseline	6 Months	P-value
Resting LVOT gradient (mmHg)	98±44	41±24	0.017
NYHA class	2.7±0.48	1.5±0.53	0.023
6-minute walking test (meters)	402±129	438±107	0.06
Cardiopulmonary Exercise Test (meters)	410±158	523±179	0.08
Quality of Life (points)	50±23	21±19	0.04
BNP (pg/mL)	339±255	180±160	0.27

PROSPECTIVE EVALUATION OF A STANDARDISED PROTOCOL TO MANAGE CONDUCTION DISORDERS IN HYPERTROPHIC OBSTRUCTIVE CARDIOMYOPATHY PATIENTS UNDERGOING EXTENDED MYECTOMY.

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Purpose: In patients with Hypertrophic Obstructive Cardiomyopathy, undergoing extended septal myectomy, conduction defects are commonly in the postoperative period. We aimed to assess the clinical outcome related to postoperative conduction impairment and to prospectively evaluate a protocol to standardized pacemaker (PM) implantation criteria. **Methods:** This prospective study enrolled 159 consecutive pts underwent an extensive septal myectomy. Based on pre-defined protocol pts were implanted in case of: persistent/transient 3° or advanced 2° AV block or alternating bundle branch block (BBB) lasting > 5 days post-op, bifascicular or trifascicular block and one of the follow condition: 1 Any episode of advanced 2° or 3° AV block regardless of duration, 2 Alternating BBB regardless of duration, 3 Markedly prolonged HV interval (>100 ms). **Results:** Mean age was 57±16 years. Mean follow up was 2.6±1.2 years. QRS duration before and after surgery was 113.8±24.2 ms and 145.5±24.5 ms (p<0.0001). A pre-existing right BBB is a major risk factor for developing a complete heart block after surgery (RR 34.5, p<0.001). Figure 1 summarizes the effect of myectomy on atrio-ventricular conduction. **Conclusion:** A damage to infra-nodal conduction system is very commonly associated with surgical myectomy. A pre-existing right BBB is a major risk factor for developing a complete heart block after surgery. The risk of developing a late complete AV block in pts without complete block or a high risk trifascicular block at discharge appears very low irrespective of QRS duration. Application of a standardized postoperative decisional algorithm demonstrated to be safe and led to a more rationale PM implantation



LONGTERM PACEMAKER DEPENDENCE IN PATIENTS WITH AV BLOCK FOLLOWING AORTIC VALVE REPLACEMENT

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Purpose: We sought to evaluate the ongoing ventricular pacing dependence in patients who had a pacemaker (PPM) implanted immediately post aortic valve replacement (AVR) for complete heart block (CHB).

Method: We reviewed the pacing dependence of 67 patients (21 female, median age 76 (42-91) years) who underwent post-operative PPM implantation between 2005-2010. PPM dependency at 1 year after AVR and at the patient's most recent follow-up attendance was analysed by ECG and pacemaker check.

Summary: A total of 18 patients (27%) died during a mean follow-up time of 3.9±1.4 years. 2 patients were upgraded to a biventricular device, and 4 were lost to follow up. At one year post AVR survival was 87%, and 38 of 53 patients (72%) were pacemaker dependent. At the end of the study 34 of the surviving 44 patients (77%) were pacemaker dependent.

Conclusion: Most patients with AV block after AVR do not recover conduction. When CHB occurs after AVR it is reasonable to expedite PPM implantation, as this study demonstrates such patients are likely to require lifelong pacing.

CONDUCTION ABNORMALITIES IN ARRHYTHMOGENIC RIGHT VENTRICULAR CARDIOMYOPATHY

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According to an article of Tabib et al., published in 2003, in more than 60% of cases fibrosis was found within structures of the conduction system of 200 autopsy cases with arrhythmogenic (right ventricular) cardiomyopathy-dysplasia (ARVC-D). The question is whether conduction abnormalities belong to the electrocardiographic spectrum of ARVC/D.

Method: The very first ECG without medication was analysed with regard to conduction abnormalities (AV block I° or II° or III°), right bundle branch block or need for pacemaker implantation of 376 patients with modified ISFC/ESC criteria of ARVC-D (210 males, mean age 46.4 ± 11.7 years).

Results: Symptomatic AV block II° and III° were present in 6 patients and in additional 3 patients with provable electrocardiographic Brugada pattern. A complete right bundle branch block as the initial electrocardiographic finding was found in 5 patients. Only nine patients presented with AV-block I°. The incidence of conduction abnormalities and complete right bundle branch block was only 6 %.

Conclusions: The rate of fibrosis of the conduction system as described in the paper of Tabib cannot be confirmed, as the incidence of conduction abnormalities is only 6%. Fibrofatty changes of the conduction system were found in 7% of cases which correspond to the rate of conduction abnormalities. This finding can be seen in the light of rare non-desmosomal gene mutations encoding lamin A/C, titin, TMEM protein 43 and possibly cardiac sarcoidosis mimicking ARVC/D. Complete right bundle branch block is possibly the result of rare desmin gene mutations.

AV block I° is more prevalent in Brugada syndrome and belongs to the electrocardiographic spectrum of this syndrome in SCN5A mutations.

SEX DIFFERENCES IN PATIENTS QUALIFIED TO THE AND AFTER PACEMAKER IMPLANTATION

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Implantation of cardiac pacemaker significantly improve the quality of life (QoL). The question – do sex differences in patients qualified to and after pacemaker implantation exist? – is still valid, mostly due to psychological differences between men and women. Important is also fact that in most of previous research women were discriminated group (sometimes even absent) if compare to the men. METHODS: 98 patients with AV blocks (AVB) and 100 patients with Sinus Node Dysfunction (SND) qualified for pacemaker implantation in classes of recommendation I, IIa and IIb (ESC) were included. In each patient a DDD-type pacemaker with bipolar screw-in leads was implanted. Patients with chronotropic incompetence were excluded. QoL was evaluated twice: 3-5 days before implantation and 6 months later. MLWHF questionnaire was used to evaluate QoL. No special pacemaker function which can influence QoL results were activated during follow-up period. Wilcoxon test was used to compare QoL groups before and after implantation. Mann-Whitney test was used to analyze differences between sex groups. RESULTS: In general score and in all its components significant improvement 6 months after pacemaker implantation was found ($p=0.0000$ in all) both in men and women. Differences in MLWHFq between men and women before and independently after pacemaker implantation are presented in the table below.

	WOMEN before	MEN before	P	WOMEN after	MEN after	P
Global score	41,96 ± 9,56	42,22 ± 9,29	0,9671	25,29 ± 6,70	25,83 ± 7,05	0,6853
Emotional components	10,17 ± 4,10	9,18 ± 4,14	0,0899	7,78 ± 3,71	7,69 ± 3,09	0,7185
Physical components	18,54 ± 4,75	19,41 ± 4,50	0,1647	9,78 ± 3,68	10,39 ± 3,29	0,1917

There were no statistical differences between men and women in QoL global score as well as its components. Statistical trend ($p=0.0899$) was only observed in emotional components before PM implantation, where men had better QoL. This observation was still actual 6 months after pacemaker implantation, however we did not observe a statistical trend in this case. Differences in MLWHFq between men and women according to the classes of recommendation were also not statistical. CONCLUSIONS: We did not find sex differences before and after cardiac pacemaker implantation.

NOVEL CAUSE OF FAMILIAL SICK SINUS SYNDROME?

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Purpose of the study: In our practice we have a family in which five of nine siblings and a son in the next generation, have a pacemaker because of sinus node failure. Such a high incidence of sinus node disease is exceptional, and investigations were performed to reveal a possible cause.

Methods: We examined 31 family members in three generations. In the second generation, five of nine siblings have pacemaker because of intrinsic sinus node disease and serious loss of physical capacity with bradycardia both in rest and exercise, but no sinus arrest or syncope. The last generation is still relatively young, but one of the 24 members has received a pacemaker. Initially, the genes encoding SCN5A and HCN4 were DNA sequenced in all members of the second generation ($n = 9$). These analyses revealed no mutations. The whole group was examined clinically, with blood samples, standard 12-lead ECG, Holter ECG and exercise testing. The heart rate was defined as bradycardia when the lowest heart rate during Holter was lower than the average for the whole group minus two standard errors.

Summary: Average heart rate of the study population did not differ substantially from previously published normal values. There were no pathological findings in blood tests or by clinical examination. The subjects performed, and had a chronotropic response, as expected in the exercise test. There was a clear correlation between the tendency to bradycardia and the duration of the QRS complexes (OR = 1.20 with CI between 1.06 and 1.36 and $p < 0.0001$). 10 family members (32%) had a QRS width greater than the 98 percentile previously reported in healthy subjects.

Conclusion: This family has a high incidence of sinus node disease but the phenotypically healthy subjects did not differ from a normal population in any other aspect than the QRS duration. The most common genetic mutations involved in sinus node disease were excluded. We are currently performing exome sequencing searching for novel mutation(s) responsible for the high incidence of pacemakers in the family.

PERMANENT PACEMAKER IMPLANTATION AFTER HEART TRANSPLANTATION: A SPETRUM OF CLINICAL INDICATIONS.

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Background: Heart transplantation (HTX) has significantly modified the treatment paradigm for end stage heart disease. However, cardiac graft is exposed to various deleterious influences. Sympathetic denervation, ischemic injury to the sinus node, graft ischemia, and drug effects are the common underlying causes of posttransplantation bradycardia. Permanent pacemakers (PM) are generally indicated only for bradycardia that does not resolve and is associated with symptoms. PM implantation is required after orthotopic HTX in 4-29% of transplant recipients. The aim of this study is to describe our spectrum of clinical indications for posttransplant PM placement.

Methods: The HTX database, medical records and pacing database/records were reviewed for all patients undergoing de novo orthotopic HTX ($n=934$) at our institution between January 1984 and December 2013. Bivtrial surgical technique of HTX was used until 1993. Since 1993 bicalaval technique has been employed.

Results: A total of 48 patients (5.3%) received a PM after HTX. Mean age was 54±8 years, 10 patients were females. Clinical indication for PM was sick sinus syndrome in 9 cases (19%), in all 4 pts with bicalaval technique. Atrioventricular block was an indication for PM in 37 pts (77%). In 30 of them, PM was implanted early after HTX (7-49 days). In remaining 2 pts (4%), the reason for PM implant was syncope and bundle branch block. Bicalaval surgical technique was used in 89 pts, 4 of them (4.5%) received PM, all of them for clinical indication of sick sinus syndrome.

Conclusions: In our study, PM was implanted after HTX in 5.3% pts. Introduction of bicalaval surgical technique did not influence the need for pacing after HTX, but in the spectrum of clinical indications for posttransplant PM placement atrioventricular block has become predominant.

PREDICTORS OF LEFT VENTRICULAR REMODELING IN PATIENTS WITH CHAGAS' CARDIOMYOPATHY AND PACEMAKER

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Introduction: Chagas' cardiomyopathy is often associated with permanent pacing due to bradycardia. The aim of this study is to identify predictors of left ventricular (LV) remodeling (LVR) after pacemaker (PM) implantation.

Methods: This study consist of a dynamic cohort including retrospective and prospective follow-up data of 136 patients with positive serology for Chagas' disease, left ventricular ejection fraction (LVEF) ≥ 55% at PM implantation (initial echocardiogram between 6 months before or after implantation) and a final echocardiogram assessment done at least 12 months after the initial. Patients with associated cardiomyopathies were excluded. LVR was defined as a reduction in the LVEF to 35% or less.

Results: The median time between echocardiographic evaluations was 9.28 years (ranging from 1.1 to 25.5). LVR was observed in fifteen patients (11.0%). Univariate analysis identified ten variables associated with LVR: male gender paced QRS duration, echocardiogram parameters at the initial assessment (LVEF, LV end-diastolic and end-systolic diameter, LV end-systolic volume and LV end-systolic volume index), cumulative burden of atrial and ventricular pacing and time between echocardiographic evaluations. The Cox regression model identified the following independent variables of LVR: male gender (Hazard Ratio [HR] 4.376; 95% Confidence Interval [CI] 1.283-14.924; $P=0.018$) and initial LVEF (HR 0.909; 95% CI 0.830-0.995; $P=0.039$). A LVEF cutoff value of 65% yielded a sensitivity, specificity, positive predictive value and negative predictive value of 66.7%, 66.9%, 19.9% and 94.2% respectively.

Conclusions: Patients with Chagas' cardiomyopathy and normal LVEF at the time of PM implantation, in a long-term follow-up, presented a low annual rate of LVR (0.84%). Despite of the association between LVR with paced QRS duration and cumulative burden of atrial and ventricular pacing, only male gender and initial LVEF were predictors of LVR.

PACING WITH RECYCLED PACEMAKERS. REUSE, RECYCLE, RE...PACE.

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Purpose

Temporary cardiac stimulation (TCS) has been associated with bedridden patients, infections, high cost and device malfunction, however it is unavoidable at times. TCS with a "permanent" pacemaker (TPPM) has proven to be safe, effective, and cheaper than the use of conventional temporary devices.

Batteries used by temporary pacemakers are not as reliable as the ones in "permanent" devices. Temporary leads are thicker, rougher, stiffer - with higher risk of perforation-, and more likely to dislodge/dysfunction. These leads can only be used with the temporary external generators.

Effectiveness of "permanent devices" with IS1 connector leads is beyond question.

Furthermore, reused pacemakers can help developing economies and saving the use of critical metals.

Method

We analyze a cohort of 363 patients who underwent TPPM in Mexico's General Hospital from January 2007 to August 2013. We used a new introducer and lead. The device was sutured externally to the skin, and was removed only after the permanent device was implanted.

Summary of results

Among the 363 patients involved, 187 were female and 176 male. Mean age was 73±13.4.

Patients had the TCS for a mean of 13.07 days (1.66 ±10.5). Symptoms were syncope and dizziness in 53.4%. Others (5.8%) reported dyspnea and 5% had a Stokes Adams crisis. No infection nor dislodgement was registered.

Conclusion:

TCS can be successfully achieved with recycled generators. Batteries insure a reliable stimulation, and can be used with soft flexible leads that warranty safety and not likely to perforate heart cavities. Although externally sutured to the skin, we did not register any infection caused by the procedure. TPPM is not only a feasible option for TCS, but a safe and cheaper solution.

GETTING BY WITH LESS - THE FRUGAL TIE

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Purpose

The ability to tie surgical knots efficiently and effectively is an essential skill for medical procedures especially pacemaker implantation. Device generators and their leads need to be safely anchored with sutures during implantation to prevent dislodgement and inadequate packaging in the pacemaker pocket. There are many ways to tie a suture during a surgical procedure with the one-handed or surgeon's knot techniques being most common. With most knot tying techniques, a generous amount of suture slack is required. We introduce a new technique that will allow one to finish or tie a knot when left with little slack.

Method

We describe and illustrate with clear figures a simple step-by-step approach to execute this new knot tying technique that we term the "Frugal Tie". Depending on the finger size of the surgeon, with this new technique a knot can be made with as little as few centimeters or less of suture slack obviating the need for a new suture or an instrument tie.

Summary

In pacemaker implantation, knot tying is an essential component of the procedure. We introduce a new knot tying technique that allows one to finish or tie a knot efficiently with very little slack on the suture. If completed properly with adequate tension this new surgical knot will have similar strength as the classic one-handed surgeon's knot since they both have similar locking principles in their throws (these principles will also be illustrated in the figures). The flat square knots and surgeon's knots have been shown to have similar tension at failure and likelihood of untangling. Given the similarity in the knot configuration to the surgeon's knot, the new "Frugal Tie" technique will offer the same reliability as this standard approach.

Conclusion

The new one-handed knot tying technique, the "Frugal Tie", allows for greater efficiency and the ability to salvage a knot during crucial parts of a surgical procedure.

NOVEL DEVICE POCKET LOCALISATION FOR EPICARDIAL SINGLE AND DUAL CHAMBER PACEMAKERS

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Background: Epicardial pacemaker implantation in adults is reserved for special indications. Device pockets behind the rectus muscle have been widely used in the past with the drawback of intra-abdominal device perforation as a serious complication. We retrospectively investigated a novel parasternal, subpectoral device pocket localisation.

Methods: Between January 2013 and January 2014, seven patients (mean patient age 72.6±13.6 years, 4 male, 3 female) received epicardial pacemaker systems. In all patients indication for epicardial implantation was infection. In 6 patients a concomitant lead extraction procedure was performed, in five cases transvenously, in one patient surgically.

Results: Epicardial pacemaker implantation with generator placement in the novel parasternal, subpectoral device pocket position was successfully achieved in all cases (100%). In 6 cases a dual chamber and in one case a single chamber system was implanted. In 85.7% a minimal-invasive approach was performed (1 subxiphoidal, 5 partial lower mini-sternotomy). Mean operative time was 136.4±78.2 minutes comprising lead extraction procedures in 6 cases. Operative mortality was zero. No procedural complications were encountered.

Conclusion: This new parasternal, subpectoral device pocket localisation can surgically be achieved in an easy and safe manner. Due to its position anterior to the ribs generator perforation is impossible. Long term performance needs to be evaluated in the future.

Evaluation of the late safety and efficacy of left axillary pacemaker generator implantations with a direct puncture of the left axillary vein

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Abstract

Background: A pacemaker generator is traditionally implanted in the anterior chest, but in some cases, where to place the generator may need to be considered from the mental, functional, and cosmetic standpoints. In this paper, we evaluated the late safety and efficacy of the pacemaker generator placement in the left axilla with a direct puncture of the left axillary vein.

Methods: In 40 consecutive patients who underwent pacemaker generator implantations in the left axilla, changes in the lead sensing, pacing threshold, and impedance were evaluated as safety indexes for a mean follow-up of 3.4 years. In addition, the efficacy was evaluated by comparing questionnaire survey results to those from a control group consisting of 119 patients with a generator implanted in the traditional left anterior chest.

Results: Lead dislodgements were observed in 2 patients. There were no migrations of generator from the implantation site or abnormal variations in the pacing threshold, lead sensing, or impedance. In the anterior chest group and left axillary group, 85% and 10% of the patients were worried about an external impact; 80% and 25% were worried about electromagnetic waves; and 68% and 0% answered that the pacemaker implantation site was noticeable, respectively. More patients had a sense of security and cosmetic satisfaction with the left axillary implantation.

Conclusion: The left axillary generator implantations reduced the mental burden. In addition, the long-term evaluation suggested that this procedure causes no safety concerns. Left axillary implantations may be useful from the mental, functional, and cosmetic standpoints.

16_49

SUBSUMMARY DEVICE IMPLANTATION - LONG TERM RESULTS*Jonathan C. Pitts Crick Bristol Heart Institute, Bristol, UK*

Conventional pacemaker and ICD implantation in women can be disfiguring with adverse psychological and social effects. The submammary position, between breast capsule and pre-pectoral fascia, allows devices to be hidden with good tissue cover. Implantation is by a small inframammary incision for vein access and lead fixation; a second incision lateral or inferior to the breast gives access to the submammary plane for creation of the pocket. The lead(s) are tunneled to the pocket and the device implanted in a central retromammary position. The lower incision is closed in 4 layers and the upper in 2. Details of the technique are discussed.

The results of 131 consecutive single-operator procedures on 74 women, age 15-79 (mean 42) years between 1986 and 2013 are reported. The devices were pacemakers (118), ICDs (11) and Internal loop recorders (2). The initial procedures were primary implants (70) and revision or replacement of existing systems (5). Further procedures were generator replacement (35), lead revision, replacement or addition (11), pocket revision (6), system replacement (2) and system removal (2). Early complications were small pneumothorax (2) and lead displacement (5). There was no loss of sensation in the breast and no persistent discomfort or limitation of movement except in some cases of device migration.

Average follow-up from initial procedure is over 12 years (3-327 months, mean 145). Late complications were device migration (7), skin erosion and infection (3) and lead failure (3). Further procedures were undertaken by other operators: device replacement (4) lead revision (1) and upgrade to ICD (1). Four patients have died from non-device-related causes. Present follow-up status is unknown for 4 patients.

Submammary device implantation is a safe and successful procedure. Developments in technique over the study period have reduced complications especially lead displacement and device migration.

16_50

Computed Tomographic Anatomic Assessment of the Azygos Vein for Defibrillator Lead Placement*Mesubi O*, Kumar R, Mickelsen S, Sigurdsson G, Giudici M. Division of Cardiovascular Diseases, University of Iowa, Iowa City, USA*

Introduction: Placement of subcutaneous arrays in high DFT patients adds significant time, expense, and morbidity to the implant procedure. The azygos vein (AZV) is an attractive alternative as it courses posterior to the left ventricle. We assessed the suitability and reliability of the AZV anatomy for placement of commercially available high voltage leads.

Methods: We reviewed contrast enhanced CT scans of the chest performed for various indications in 21 patients (age 66±19 yr; 10M/12F). The AZV has an almost horizontal segment (draining into the SVC) and a vertical segment. The diameter of the vein was measured at 3 levels: 1cm before draining into the SVC (level 1), 1cm below the horizontal segment (level 2) and at the narrowest retrocardiac segment (level 3). Lengths of the horizontal segment and the visualized vertical segment, and the inferior angle between the SVC and the horizontal segment of the vein were measured.

Results: Visualization of the AZV was adequate for assessment in 20 of 21 patients. In 3 patients, a retrocardiac segment of the vein was not visualized (dominant hemiazygos vein in 1 and absent vertical segment in 2). Dimensions of the vein are as shown in table.

	Median (range)	Mean±SD
Minimum diameter at level 1 (mm)	9.4 (5.3-13.4)	8.9±2.4
Minimum diameter at level 2 (mm)	7.0 (3.7-11.2)	7.1±1.8
Minimum diameter at level 3 (mm)	5.7 (4.5-8.2)	5.7±1.1
Length of horizontal segment (mm)	36.8 (25.9-69.9)	38.5±10.8
Visualized vertical length (mm)	145.6 (81.1-186.3)	137.5±28.3
Inferior angle between SVC and horizontal segment of the azygos vein (°)	118.3 (96.5-135.0)	117±11

Conclusion: AZV anatomy appears to be consistent across a random sample of subjects and its dimensions can accommodate currently available defibrillator leads. AZV lead placement may be a reliable, safe, cost effective, more patient-friendly, and technically less challenging alternative to lower high DFTs.

16_51

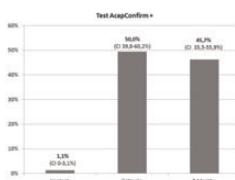
UTILITY OF A NEW ALGORITHM (ACAP CONFIRM®) FOR AUTOMATIC ATRIAL CAPTURE TESTING: CLINICAL PERFORMANCE AND RESULTS*Lapuerta Irigoyen J.A, Valverde André I, Vigil Escalera P. Dep. Cardiology. Cabueñas Hospital. Gijon (Spain)*

Introduction: The new AcapConfirm® algorithm (St. Jude Medical) monitors and adjusts the atrial output to address a patient's changing atrial thresholds. The aim of this study is to investigate the feasibility and short-term clinical and technical outcome of this test.

Methods: Patients scheduled for DDD pacemaker implantation (Zephyr XL DR 5826) were enrolled into this prospective evaluation. Set-up test ACC viability and manual step-down (0.4ms) atrial threshold test as well as automatic threshold testing by ACC were performed at implant, 2 weeks and 3 months after implantation. Participants who successfully completed both an automatic and manual capture thresholds test during follow-up were compared. The success rate was evaluated and their results were compared to a manual pacing threshold.

Results: Data from 92 patients (58M/34F, 70.8 ± 8.3 years old) were analyzed. Bipolar atrial leads (1882T and 1999T) were used. ACC activation rates are shown in the figure below. At 2 weeks and 3 months, threshold results from ACC and atrial manual capture test were: (0.61 ± 0.21 V versus 0.66 ± 0.23 V; r=0.95), and (0.61 ± 0.16 V versus 0.68 ± 0.19 V; r=0.90) respectively. The differences between automatic and manual measurements were ≤0.25V in all patients.

Conclusion: In this single-center prospective observation, we report an unexpected failure rate of the algorithm AcapConfirm. Automatic atrial thresholds measurements (ACC) can be programmed ON, in only 45.7% of patients at 3 months. However, there is a good correlation between automatic and manual atrial thresholds when their activation is feasible.



16_52

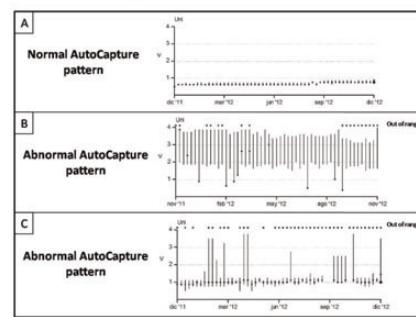
LIMITATIONS OF THE AUTOCAPTURE PACING SYSTEM IN PATIENTS WITH CARDIAC STIMULATION DEVICES: SAVING OR WASTING ENERGY?*Benezet-Mazuecos J, Iglesias JA, Rubio JM, de la Vieja JJ, Calle S, Quiñones MA, Sanchez-Borque P, Farre J. Department of Cardiology, Hospital Universitario Fundación Jiménez Díaz-IDC, Universidad Autónoma de Madrid, Madrid, Spain*

Purpose: Although pacemaker (PM) AutoCapture algorithm is aimed to assure capture minimizing energy consumption, some patients might not benefit from it.

Methods: Long-term AutoCapture efficiency was assessed using the data recorded in the programmer reports of patients undergoing scheduled PM check-ups during 2012.

Results: 160 consecutive patients (58% men) aged 78 ± 9 years were evaluated. PM stimulation mode was VVI in 44 patients (27.5%) in chronic AF. History of AF was present in 97 patients (60%). There were no statistical differences regarding PM indication, history of AF, use of antiarrhythmic drugs, renal function, active/passive lead fixation, R-wave detection, stimulation threshold or electrode impedance. 73 patients (45.6%) showed an Abnormal AutoCapture pattern defined as the presence of a high variability of the AutoCapture threshold values along time (≥ 5 variations > 1 V) and/or the presence of repeated out-of-range values (≥ 5 episodes). After multivariate analysis, Abnormal AutoCapture pattern was associated to the presence of atrial fibrillation (OR 3.96 [1.59 - 9.82; p <0.05]); and a ventricular pacing $\leq 25\%$ of the time (OR 4.80 [2.09 - 11.05; p <0.05]).

Conclusions: Although AutoCapture algorithm has shown both efficacy and safety, some patients with atrial fibrillation and/or ventricular pacing $\leq 25\%$ may not benefit from it. Activation should be individualized according to the patient's characteristics and long term AutoCapture pattern checked in the routine follow-up.



IS PACEMAKER THERAPY ESSENTIAL FOR ICTAL ASYSTOLE CAUSED BY TEMPORAL LOBE EPILEPSY: LONG-TERM FOLLOW-UP

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Background and purpose: Ictal asystole (IA) caused by temporal lobe epilepsy (TLE) is an infrequent cause of bradycardia-triggered transient loss of consciousness (T-LOC) but one which is therapeutically important to recognize. However, although TLE may be associated with long asystolic events, controversy remains regarding the necessity of cardiac pacemaker treatment versus the anti-epileptic drugs (AEDs). The purpose of the study was to evaluate the role of pacemaker therapy in TLE patients who presented with IA.

Methods: Six patients (2 men, mean age of 66+/-16 years) with documented prolonged asystole on ECG in association with TLE by electroencephalogram, were followed for an average 19.7 years (range 2-37 years). Mean IA duration was 12.6+/-6.2 sec. (range 3.5 sec. to 20 sec). All patients were treated with antiepileptic drugs (AEDs), and 4 patients received combined therapy with pacemaker implantation for back-up pacing at 40 beats/min. The remaining 2 patients were treated with AEDs alone, but underwent ambulatory monitoring at for ≥3 years by an implantable loop recorder (ILR).

Results: All patients were successfully treated with no recurrence of T-LOC episodes or reported epileptic seizure during follow-up. Regular pacemaker / ILR interrogation in the pacemaker clinic after initiation of AED therapies showed no evidence of necessary pacing intervention (cum% Vp=0%) in 4 pacemaker or of asystole events in the 2 ILR patients.

Conclusions: AED therapy appears to be very effective for IA prevention in TLE. Pacemaker implantation is not needed in most cases, and should be reserved for AED failures.

HYPERTENSION AND NON-SUSTAINED VENTRICULAR TACHYCARDIA: AN OBSERVATIONAL STUDY IN PATIENTS WITH PERMANENT PACEMAKERS

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Background: Permanent pacemaker electrograms record any unexpected arrhythmias including non-sustained ventricular tachycardia (NSVT). Little has been reported regarding the demographics of patients with pacemakers who experience NSVT. Furthermore, the incidence of NSVT in hypertensive patients with pacemakers after long term monitoring is unknown.

Methods: Stored electrograms from Medtronic pacemakers implanted at one institution between July 1, 2009 and July 1, 2011 were reviewed. Adult patients were included if they had at least two subsequent follow up visits over two years after implantation and an ejection fraction (EF) ≥ 40%. Demographic information was obtained from the institution's outpatient and inpatient records as well as the social security death index.

Results: 418 patients were implanted with a Medtronic pacemaker over two years. Out of these 214 patients met the inclusion criteria. The mean age for the population was 78.87 ± 10.31 years, 47.2% were male. The mean and standard deviation of the patients' EFs were $0.58\% \pm 0.09\%$, 32.71% had coronary artery disease (CAD), 66.82% were taking beta-blockers (BB), 41.59% were taking an angiotensin converting enzyme inhibitor (ACEI) or an angiotensin receptor blocker (ARB) and 16 patients died during the follow-up. Of the 214 patients, 57 (26.5%) had NSVT and 173 had HTN (80.84%). In patients with NSVT, 52 (91.2%) had HTN. The association between HTN and NSVT was significant ($P < 0.01$, OR: 4.09, 95% CI: 1.39, 12.04). This association persisted after adjusting for age, gender, EF, CAD, beta blocker use and ACEI/ARB use ($P < 0.003$, OR: 5.92, 95% CI: 1.82, 19.25). Gender was associated with NSVT ($P < 0.001$, OR: 3.07, 95% CI: 1.57, 6.02). There were no significant associations between age ($P = 0.09$), EF ($P = 0.28$), CAD ($P = 0.87$), BB ($P = 0.68$) or ACEI/ARB ($P = 0.49$) and NSVT. There were three deaths in the NSVT group (5.26%) and 13 deaths in the non-NSVT group (8.28%). There was no significant association between NSVT and mortality ($P = 0.56$).

Conclusions: There was a high prevalence of NSVT in pacemaker patients with HTN. The association between HTN and NSVT persisted after controlling for age, gender, EF, CAD and BB and ACEI/ARB. In this population NSVT was not associated with increased mortality.

TRANSVENOUS STIMULATION OF RENAL SYMPATHETIC INNERVATION INCREASES BLOOD PRESSURE

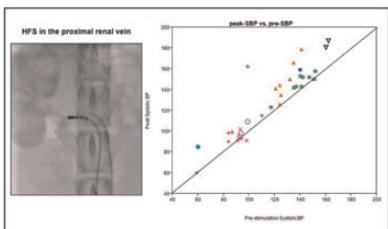
Elisa Ebrille, MD^{1,2}, Malini Madhavan, MBBS¹, Christopher V DeSimone, MD, PhD¹; Siva K Mulpuri, MD¹, Susan B Mikell³, Susan B Johnson³, Scott H Suddendorf³, Dorothy J Ladewig³, Emily J Gilles³, Andrew J Daniels³, and Samuel J Asirvatham, MD^{1,4} Department of Medicine, Division of Cardiovascular Diseases, Mayo Clinic, Rochester, MN 2Department of Medicine, Division of Cardiovascular Diseases, Città della Salute e della Scienza, University of Turin, Turin, Italy 3Department of Mayo Clinic Ventures, Mayo Clinic, Rochester, MN 4Department of Adolescent and Pediatric Medicine, Mayo Clinic, Rochester, MN

Purpose of the study: Neurocardiogenic syncope (NCS) is a common and sometimes debilitating disorder due to a combination of bradycardia and vasodilation with no consistently effective treatment. Although pacemaker devices have been used in treating the bradycardic aspect of NCS, no device based therapy exists to treat the coexistent vasodilation that occurs. The renal sympathetic innervation has been the target of denervation to treat hypertension. We hypothesized that stimulation of the renal sympathetic nerves can increase blood pressure (BP) and counteract vasodilation in NCS.

Method used: High frequency stimulation (HFS) (Grass stimulator, 800-900 pps, 10 V, 30-200 s) was performed using a quadripolar catheter in the renal vein of 7 dogs and 1 baboon. Femoral arterial blood pressure was continuously monitored. Each animal underwent multiple HFS trials with a median of 4 (range 1-9).

Summary of results: HFS was performed in the renal vein on a total of 34 occasions. A significant increase in BP [median (IQR) systolic BP 123 (93-140) vs 138 (98-152) mmHg, median diastolic BP 76 (62-89) vs 79 (67-110) mmHg] was noted during the stimulation, with return to baseline after cessation of stimulation. The mean increase in systolic and diastolic BP was 13.0 ± 3.3 ($p=0.006$) and 10.2 ± 4.6 ($p=0.08$) respectively.

Conclusion: We report the first ever study of feasibility and safety of high frequency electrical stimulation of the renal sympathetic innervation to increase BP in animal models. This has potential applications in the treatment of hypotensive states such as NCS.



ANALYSIS OF THE MICRA FIXATION MECHANISM USE CONDITIONS AND HOLDING ENERGY REQUIREMENTS

=> Vladimir Grubac*, Ryan Goff*, Ken Rys*, Mike Eggen*, Matt Bonner*, Vladimir Nikolski* - Medtronic Inc., Mounds View, MN, USA

Introduction:

The fixation for the Micra™ Transcatheter Pacing System (TPS) consists of four active fixation Nitinol tines which penetrate the myocardium and anchor the device in the right ventricle. This fixation mechanism holds the pacing electrode in close contact with the endocardium and prevents dislodgement. The objective of this study was to characterize the tine fixation energy

Methods:

The energy required to transition from the deployed to non-deployed state (fixation energy) was measured by recording the force and displacement while retracting the TPS into the delivery system.

The fixation energy was assessed in four awake sheep at rest using a 3-axis accelerometer placed in a TPS emulator. This energy was calculated by integrating the acceleration during the largest acceleration excursion and multiplying that by half the weight of the device. Further, for simulated exercise conditions, the peak to peak acceleration was measured in sheep, dog, and swine animal models during an anesthetized, dobutamine challenge. The fixation energy was compared to the calculated kinetic energy based on endocardial acceleration to determine the expected safety factor for dislodgement.

Results:

The sheep had the greatest peak to peak endocardial acceleration during the dobutamine challenge (9 G), and was higher than reported in literature for exercise in humans. At rest the sheep maximum endocardial acceleration was 5 G. The holding energy of a single tine was calculated by dividing the results of the retraction energy of the TPS by four and was 2.6 mJ. From these findings it was calculated that the tine holding energy for 1 tine engaged in tissue would give at least and an 8X safety margin during dobutamine challenge and a 39X safety margin at rest.

Conclusions:

The Micra TPS fixation mechanism is designed to hold the device securely within the myocardium with a high margin of safety during rest and exercise conditions.

16_57

SESSION 16: CRT

16_58

IMPLANTATION OF MICRA TRANSCATHETER PACEMAKER DOES NOT CAUSE ARRHYTHMIAS

Matthew Bonner^a, Medtronic CRDM Research, Mounds View, USA

Background: Medtronic's Micra™ Transcatheter Pacemaker System (TPS) is a pacemaker small enough to implant directly within the heart eliminating the lead and the pocket while maintaining similar programmability and longevity to existing pacemakers. The primary benefit of the Micra TPS is reducing complications associated with the lead and the pocket, and eliminating the bulge under the skin associated with traditional pacemakers. The fixation system of the Micra is a novel arrangement of four Nitinol tines that can embed into the myocardium. Since such a system has never been used clinically, we characterized the occurrence of arrhythmias after implants with Micra and compared those results with the results after helix lead implants in a similar animal model.

Methods: The study was divided into two groups with 10 test Yucatan mini-pigs implanted with a Micra device in the RV apex, and 10 control Yucatan mini-pigs implanted with a Model 5076 lead in the RV apex for 12 weeks. The 5076 lead was connected to a commercially available Medtronic Model SEDRO1 Sensia pacemaker implanted on the right thorax. Every animal was implanted with a Medtronic Model 9529 Reveal XT on the right thorax programmed to record any events over 200 beats per minute. Arrhythmias were also studied by recording and reviewing all of the implant ECG with the results after helix lead implants in a similar animal model.

Results: During implant, typically a few ectopic beats and some short runs of ectopic beats occurred during manipulation of the lead or delivery tool within the heart and during deployment of both the device and the lead. However, these ectopic beats and short runs disappeared within a few seconds after deployment.

The Reveal devices recorded 565 episodes in the Micra animals and 1514 episodes in the lead animals. However, after careful review all of these episodes were rapid sinus rhythm or noise from rubbing against the cage. No bradycardia episodes were recorded.

Conclusions: We have found that implanting either the Micra TPS or the 5076 lead created a few ectopic beats during implant but neither device created any tachy arrhythmias or brady arrhythmias within 3 months after the implant.

ANALYSIS OF MICRA FIXATION STABILITY VIA PACING THRESHOLD MEASUREMENT AND FLUOROSCOPY

Michael Eggen^a, Matthew Bonner^a, Todd Sheldon^a, Eric Williams^a, Medtronic, Inc., Minneapolis, MN, USA

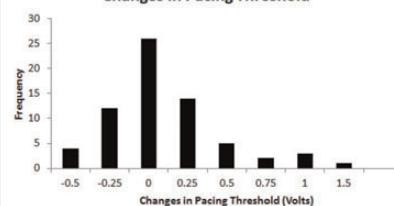
Background: Fixation for the Micra™ Transcatheter Pacing System (TPS) consists of four active fixation nitinol tines which penetrate the myocardium and anchor the device in the right ventricle (RV). This fixation mechanism is designed to hold the pacing electrode in close contact with the endocardium and prevent dislodgement. In this study, we characterized the stability of this fixation mechanism using chronic pacing thresholds, fluoroscopy, and gross necropsy.

Methods: A total of 113 Micra devices with tine fixation were implanted in 89 animals, consisting of 20 Yucatan swine and 69 sheep. The devices were implanted in both the RVA and RVOT positions via a jugular approach. Of these implants, 67 devices had capabilities to measure pacing thresholds, where a 0.2-0.27 ms pulse duration was used. The duration of the implants ranged from 6-91 weeks. Changes in chronic pacing threshold were determined by subtracting the threshold at implant from the final threshold at termination. Device dislodgment was determined by analyzing the pacing threshold trend, fluoroscopy images at implant and termination, and by gross necropsy. In addition, the number of tines engaged in tissue was determined by doing a tug test at implant under fluoroscopy.

Results: No dislodgements were observed in any of the 113 Micra devices implanted, as confirmed by gross necropsy and fluoroscopy analysis. The median number of tines engaged in tissue at implant was 2 (min = 1, max=4). The average pacing threshold was 0.59 +/- 0.2 V at implant, and 0.65 +/- 0.36 V at term. As shown in the histogram, only 5 animals had pacing threshold increases >0.5 V, and only 1 animal had a pacing threshold increase >1 V.

Conclusion: There were no dislodgements observed in any Micra implants, and the pacing thresholds were low and stable.

Changes in Pacing Threshold



16_59

SUPERIOR ACUTE HAEMODYNAMIC RESPONSE WITH BASAL AND MID WALL EPICARDIAL LEFT VENTRICULAR PACING.

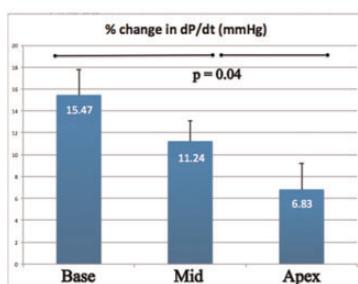
Behar J, Shetty A, Sohal M, Jackson T, Sammut E, Claridge S, O'Neill M, Gill J, Razavi R, Rinaldi CA, St Thomas's Hospital, Kings College London, UK

Introduction: The location of LV lead position appears to influence clinical outcomes as demonstrated in the MADIT-CRT study; apical pacing is associated with worse outcomes. Improved acute hemodynamic response (AHR) may be related to chronic response to CRT and we therefore set out to review how the AHR varies with LV lead position during implantation.

Methods: 20 patients with conventional CRT criteria were implanted with MRI guided LV lead placement (based on avoiding scar and aiming for the most de-synchronous segment) at our centre. Acute hemodynamic data measuring LVdP/dt was obtained, the LV lead introduced into as many coronary sinus veins and positions as possible. Pacing was in DDDLV mode with fixed AV delay 100ms, 5-10 beats above intrinsic rate (VVI LV for AF patients).

Results: Mean age was 66 years \pm 11.4, 17 (85%) were male. Mean LV ejection fraction 23% \pm 8 with mean QRS duration 150ms \pm 19. 10 (50%) had ischaemic aetiology. Patients were implanted with St Jude Medical devices (100% CRT-D). Figure 1 demonstrates the % increase in dP/dt (mmHg) from baseline by epicardial LV pacing in basal, mid and apical segments. 6/20 (30%) patients sustained anti tachycardia pacing or DC shock from their device for an appropriate ventricular arrhythmia. 2/20 (10%) patients died with mean follow up 26 months.

Conclusion: Acute hemodynamic response is improved in basal and mid segments compared with the apex. This adds further weight to a potential positive correlation between basal and mid LV epicardial pacing and downstream improved clinical outcomes.



16_60

VENTRICULAR LEAD POSITION AND LEFT-VENTRICULAR DYSSYNCHRONY: RESPONSE TO CARDIAC RESYNCHRONIZATION THERAPY

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Purpose: To evaluate both the influence of baseline left ventricular (LV) mechanical dyssynchrony and ventricular leads location on long-term outcome in patients with cardiac resynchronization therapy (CRT).

Methods: A retrospective study including 40 adults in sinus rhythm with CRT-devices implanted according to current guidelines. Two groups of patients were taken: Group I, N=20, with high response to CRT, Group II, N=20, with low response to CRT (non-responders). High response was defined as more than 15% decrease of end-systolic LV volume (LVESV) 10% relative increase of LVEF, an improvement of at least 1 NYHA functional class of heart failure (HF). Right atrial (RA) lead was implanted into the RA appendage, right ventricular (RV) lead was positioned in the interventricular septum (IVS) or in the RV apex, LV lead was implanted into one of the coronary sinus veins. Ventricular leads position was assessed using ECG vector analysis during the isolated left/ right ventricular pacing for the observation period. LV mechanical dyssynchrony was evaluated with tissue Doppler imaging (TDI) before CRT implantation and in 12 month follow-up (FU). 12 LV segments were used to determine both LV lead location and the latest mechanical LV activation zone. Leads location to each other was assessed according to 12 LV segments and 3 RV segments (basal IVS, mid IVS, RV apex). The mean duration of FU was 12±1.7 months.

Results: Baseline patient group characteristics had no differences in gender, age, NYHA functional class and echocardiography parameters. Biventricular pacing was \geq 95% during observation period. Ischemic cardiomyopathy was obtained in 52.5% (N=21) of all patients and significantly prevailed in Group II, 75% (N=15), p<0.014. Number of latest mechanical LV activation zones was bigger in Group I (23 vs. 16, p=0.051). Overlap of LV lead location and the latest mechanical LV activation zone was bigger in Group I (12 vs. 6, p=0.028). Comparison of three conventional interlead location (IL) schemes to the dynamics of the LV volumes and LVEF showed that the biggest IL was associated with the biggest LVESV reduction and LVEF increase, r = 0.410 (LVESV/ID), r = 0.493 (LVEF/ID), p<0.05. After 12 month FU there were significant improvement in LV diameters, volumes, LVEF and NYHA functional class in Group I, p<0.001. The mean LVEF in Group I was 44.9±5.9% vs. 26.9±6.4% in Group II. In 12 month FU the absence of mechanical dyssynchrony was 95% in Group I vs. 80% in Group II without statistical differences.

Conclusions: Placing the LV lead concordant with the site of the latest mechanical LV activation was associated with superior response to CRT during long-term FU. Baseline mechanical dyssynchrony and interlead location can be predictors of the better CRT response.

INFLUENCE OF CARDIAC RESYNCHRONIZATION THERAPY ON MITRAL REGURGITATION

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BACKGROUND: Functional mitral regurgitation (FMR) is common in patients who have indications for cardiac resynchronization. There is data about positive influence of resynchronization on presence of FMR, but clinical meaning of reduction of FMR achieved by this therapy is not well documented.

AIM: Evaluation of mitral valve function in patients with moderate or severe FMR undergoing implantation of CRT

MATERIAL AND METHODS: 56 patients (24- nonischemic etiology, 32-ischemic) who underwent CRT implantation according to I class ESC indication, were prospectively evaluated. ERO, VC, JA, JA/LAA were assessed. LVEF, LVEDD and LVESD were also evaluated. All parameters were measured before implantation, 6 weeks and six months after procedure.

RESULTS: Quantitative parameters of mitral regurgitation – ERO, VC, JA, JA/LAA were significantly reduced ($p<0.001$) after 6 weeks already. Tendency was maintained in both groups during 6 months follow up. Mitral annulus width, tenting area, LAA were also reduced after 6 weeks and 6 months. FMR reduction, positive LV remodeling and clinical improvement was better expressed in group I, after 6 months of follow-up. Significant reduction of FMR was correlated with wider QRS complex and with LBBB presence. It was noted that ERO $> 0.33 \text{ cm}^2$, VC $> 4\text{cm}$, JA/LAA $> 29\%$ were predictors of good clinical response. Mitral annulus width $< 39 \text{ mm}$, ERO $\leq 0.22\text{cm}^2$, after 6 months correlated with good clinical outcome in this period of time.

CONCLUSIONS: FMR reduction after CRT implantation was associated with positive remodeling of LV (improvement of EF, LVEDD and LVESD reduction) and with reducing of mechanical and electrical dyssynchrony. To better resolve this issue it is needed to evaluate bigger group of patients, with longer follow-up.

Key words: functional mitral regurgitation, cardiac resynchronization.

CRT REVERSES ELECTRICAL AND MECHANICAL REMODELING

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Purpose: T-wave alternans (TWA) represents myocardial instability. The purpose of this study was to determine the occurrence of positive TWA in heart failure patients who planned to receive cardiac resynchronization therapy (CRT) and the impact of CRT on TWA.

Methods: TWA was analyzed using a spectral method in 27 CRT-ICD patients. Ambulatory device electrograms (EGMs) were collected and left ventricular ejection fraction (LVEF) was measured at baseline (7 days post implant, but before CRT) and at 3 months following CRT. Device EGMS consisted of one channel for far-field EGM (Can-to-RVcoil) and the other channel for near-field EGM (LVtip-to-LVring). EGM TWA was measured during atrial (AAI) and CRT pacing tests. Each pacing mode had the up-titration pacing rate from 90 to 105 bpm with 90 seconds for each pacing rate. Spectral TWA was positive only when the K score was > 3 in either EGM during the pacing test.

Results: At the baseline, 20 (76.9%) of 27 patients had positive TWA during AAI pacing and 13 (48%) during CRT pacing ($P=0.043$ between two pacing modes, an acute reduction with CRT pacing). Following 3 months of CRT, positive TWA was identified in 11 patients (45.8%) during AAI pacing (a 31.1% reduction from the baseline, $P=0.023$, the phase-2 chronic reduction with CRT) and 7 patients (28%) during CRT pacing (a 22% reduction from the baseline, $P=0.108$). Overall, LVEF improved to $35.9\pm10.5\%$ after 3 months of CRT from the baseline $27.3\pm5.5\%$ ($P<0.001$). At baseline, LVEF was significantly higher ($32.8\pm4.8\%$) in patients with negative TWA than in those with positive TWA by AAI pacing ($25.6\pm4.9\%$, $P=0.006$). At 3 months post CRT, LVEF appeared higher ($40.1\pm12.0\%$) in patients who had negative TWA than that ($32.9\pm6.0\%$, $P=0.086$) in patients who had positive TWA during AAI pacing.

Conclusions: In heart failure patients receiving CRT-ICD, CRT produces less positive TWA acutely and chronically in addition to the improvement of cardiac function by 3-month CRT, suggesting a reverse electrical and mechanical remodeling.

ASSOCIATION BETWEEN RED CELL DISTRIBUTION WIDTH AND MORTALITY AFTER CARDIAC RESYNCHRONIZATION THERAPY

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Introduction: Cardiac resynchronization therapy (CRT) is a non-pharmacological option used in patients with heart failure and inter-ventricular desynchronization. Elevated red cell distribution width (RDW) reflects higher size heterogeneity of erythrocytes and has been associated with poor long-term outcomes in patients with chronic heart failure (CHF). We aimed to examine the association between RDW levels and outcomes after CRT implantation.

Methods: We conducted a cohort analysis of 156 patients (126 men; mean age 67.2 ± 11.8 years) who underwent CRT implantation during 2004–2008 in our institution. RDW measured in 3 time points before and after implantation is the basis of this study. Primary outcome was defined as all-cause mortality. Secondary outcome included hospital re-admissions. We investigated the association between RDW levels and outcome during a median follow-up of 5.4 years.

Results: A total of 76 patients (48.7%) died during follow-up. Higher baseline RDW levels were associated with all-cause mortality ($p=0.04$). On multivariate analysis adjusted for age, gender, ischemic cardiomyopathy, atrial fibrillation, hemoglobin, renal failure and chronic obstructive pulmonary disease, baseline RDW levels were associated with mortality (HR 1.43, 95% CI 1.22–1.69). RDW levels 6 months and 12 months post implantation were also associated with mortality ($p=0.02$, $p=0.008$ respectively). Patients who were re-admitted to the hospital during follow-up ($n=78$) had higher baseline RDW levels as compared to those who were not ($15.1\pm1.6\%$ vs. $14.6\pm1.5\%$, $p=0.027$). Higher baseline RDW levels were also associated with higher number of re-admissions ($p=0.025$).

Conclusion: An elevated RDW level before and after CRT implantation is independently associated with all-cause mortality.

CIEDS DEMANDS IN RUSSIAN FEDERATION: NEW INSIGHT

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Purpose. In 2012 capacity for implantation of CRT and ICD devices in Russian Federation was 115 and 200 per 1,000,000 HF patients respectively. However the actual number of patients meet the national criteria for ICD and CRT implantation is unknown. The main objective of this study was to estimate the needs for ICD/CRT therapy in HF population.

Methods. The present study is a cross-sectional epidemiological one center study. In 2013 466 consecutive patients with HF admitted to city clinical hospital for any cause were enrolled as participants in the study. Epidemiological, clinical and laboratory data were collected for each patient. 192 (41.2%) were male, age 70.5 ± 11.7 years ($M\pm SD$). We observe the following distribution in NYHA functional class: I, II, III, IV in 31 (6.7%), 190 (40.8%), 186 (39.9%) and 59 (12.6%) patients respectively. Nonischemic cardiomyopathy was reported in 373 (80.0%) patients. Prevalence of severely impaired left ventricular ejection fraction (less than 35%) was 14.2% ($n=66$). Intraventricular conduction disorders (LBBB and RBBB) were revealed in 51 (10.9%) and 23 (4.9%) patients respectively.

Results. According to national and European guidelines 6.4% ($n=30$) and 13.9% ($n=65$) of participating patients were eligible for CRT and ICD implantation respectively. Thus current capacity for implantation of CRT and ICD in Russian Federation corresponds to less than 1% coverage of the eligible population (estimated absolute unmet needs for CRT and ICD devices of 504,689 and 1,096,520 individuals respectively).

Conclusions. Despite proved benefits of CRT and ICD in selected patients with HF unmet population needs in Russian Federation remain very high. The magnitude of unmet needs requires broader strategies to plan cardiovascular implantable electronic devices supply programs.

16_65

SHORT STATURE AND ISCHEMIC STROKE IN PATIENTS WITH NONVALVULAR ATRIAL FIBRILLATION: NEW INSIGHT INTO THE OLD OBSERVATION

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Backgrounds: Atrial fibrillation (AF) serves as a major predisposing condition of ischemic stroke of which impact on mortality and morbidity is substantial. For decades, there have been repeated epidemiologic observations regarding the inverse relationship between stature and cardiovascular (CV) diseases including stroke. This study investigated whether patient's height is associated with remodeling of the heart and ischemic stroke in nonvalvular AF.

Methods: All 558 AF patients were enrolled. Echocardiography and computed tomography were performed to evaluate cardiac structure and function. Characteristics were compared between the patients with and without ischemic stroke.

Results: (1) AF patients with ischemic stroke (n=211, 144 men, 68±10 years) are significantly shorter than without stroke (n=347, 275 men, 56±11 years) (164±8, vs. 169±8 cm, p<0.001); (2) short stature was an independent predictor of stroke (OR 0.93, 95% CI 0.91-0.95, p<0.001) along with left atrial (LA) anterior-posterior diameter and diastolic mitral inflow velocity (E) to diastolic mitral annulus velocity (E') (E/E'). Meanwhile, body mass index failed to predict ischemic stroke; (3) Height showed significant inverse correlation with E/E' independently, even after other variables, including age, sex and body weight and comorbidities were adjusted for (β -0.20, p=0.003); (4) when all patients were divided in 3 groups according to their heights, LA and LA appendage volumes do not depend entirely on stature, whereas left ventricular size increases according to height of the patients with AF.

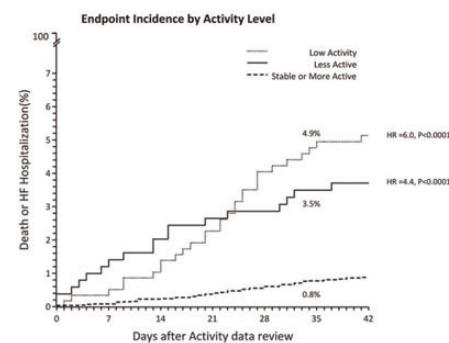
Conclusions: Short stature is related with ischemic stroke and diastolic dysfunction in AF patients. Height is a nonmodifiable risk factor of stroke and might be more important than obesity in Asian AF patients who are relatively lean than western population.

16_66

CHANGES IN PHYSICAL ACTIVITY PREDICT MORTALITY AND HOSPITALIZATION IN HEART FAILURE PATIENTS

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Purpose: We investigated if periodic review of activity data captured by the accelerometer of implanted devices can identify patients at risk of mortality or hospitalization for heart failure (HF). **Methods:** Periodic activity review was simulated on pooled data from 2 trials of implanted monitoring in patients with HF and indication for ICD or CRT-D (SENSE-HF and DOT-HF). For each patient, follow-up was divided into 6-week periods. At the end of each period, average device-measured activity from the closing period was compared to the period before, and classified as Low Activity (<1hr/day active), Less Active (>20% decrease), More Active (>25% increase), or Stable (all other). Endpoint occurrence was compared using Cox regression corrected for multiple periods per patient. **Results:** The analysis included 836 HF patients with ICD (20%) or CRT-D (80%) devices, followed for 15±7 months. There were 7,878 periods of 6 weeks duration, classified as Low Activity (8.2%), Less Active (6.7%), More Active (7.9%), or Stable (77.3%). After a Less Active period, patients had a 4.4 times higher risk of events than after a More Active or Stable period (p<0.0001). **Conclusion:** Periodic review of device-measured activity identifies patients at imminent risk of death or HF hospitalization.



16_67

EXPLORATORY COST-EFFECTIVENESS ANALYSIS OF CARDIAC RESYNCHRONIZATION THERAPY WITH SYSTEMATIC DEVICE OPTIMIZATION

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Background: Recent studies provide evidence of improved clinical benefits associated with cardiac resynchronization therapy (CRT) optimization. Our analysis explores the cost-effectiveness of systematically optimized (SO) vs. non-systematically optimized (NSO) CRT. **Methods:** A longitudinal cohort model was developed to predict clinical and economic outcomes for SO vs. NSO strategies over 5 years. Data from CLEAR post hoc study was used with 199 pts with CRT pacemaker (CRT-P). The analysis was performed from the payer perspective. Main economic outcome measure was incremental cost-effectiveness (ICER) expressed as cost per QALY gained. To assess the impact of data uncertainty, a sensitivity analysis was performed. The model also predicts outcomes for the two optimization strategies for CRT-D therapy versus optimal medical treatment (OPT). **Results:** At 1 year, ICERs for SO CRT vs. NSO CRT-P range between € 16,672 (Spain) and € 22,009 (Germany). After 4 to 5 years the SO method develops into the dominant strategy (health benefits and cost savings) in most of the analyzed countries. These favorable outcomes are supported by the sensitivity analysis. Systematic optimization of CRT-D might also improve the cost-effectiveness of this device therapy (compared to NSO CRT-D vs. OPT) by 34% to 39% dependent on the country analyzed (cf Table 1). **Conclusions:** Our economic evaluation shows promising health economic benefits associated with SO CRT. These preliminary findings need further confirmation.

	ICER at 5 years SO CRT-D vs. OPT.	ICER at 5 years NSO CRT-D vs. OPT.	Difference SO vs. NSO CRT-D
Germany	14642€	22327€	-34%
France	14052€	23019€	-39%
Spain	21807€	34936€	-38%
Italy	13260€	20738€	-36%
UK	13318€	20861€	-36%

16_68

PATIENT-REPORTED QUALITY OF LIFE AND SOCIAL FUNCTION STRONGLY PREDICT PROGNOSIS IN PATIENTS RECEIVING CARDIAC RESYNCHRONIZATION THERAPY

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Purpose: This is the first study to examine if patient-reported health status at the time of implant is associated with prognosis in heart failure (HF) patients treated with CRT. **Methods:** Consecutively implanted CRT-D patients (N=139; mean age=65.6±10.1; 30% women) were recruited from the University Medical Center Utrecht, the Netherlands. All patients completed the Kansas City Cardiomyopathy Questionnaire (KCCQ) at the time of implant. The KCCQ assesses HF-specific health status and consists of 4 subscales: Physical Function (PF), Symptoms (S), Quality of Life (QoL) and Social Function (SF). Summary and subscale scores range from 0-100 and were dichotomized into poor (<50) versus good (≥50) health status. Major adverse clinical events (MACE) were defined as HF-hospitalization or all-cause death in the first 2 years after implantation. Uni- and multivariable Cox regression analyses were performed to examine the relationship between KCCQ (subscale) scores and MACE. In multivariable analyses, we adjusted for age, gender, ICD indication, ischemic etiology, comorbidities (i.e., renal failure, diabetes, COPD, and/or atrial fibrillation), NYHA class, LVESV, QRS duration and BNP assessed at the time of implant. **Results:** During the 2-year follow-up period, 32 (23%) patients either died or were hospitalized for HF. Patients with a poor KCCQ summary score at the time of implant (N=49) were at a significant increased risk of MACE compared to patients with a good score (35% versus 17%; univariable HR=2.4; 95% CI=1.2-4.8; multivariable HR=4.2; 95% CI=1.4-12.4). When examining the KCCQ subscales, only a poor score on the QoL and SF subscales were independently associated with MACE (HR=3.7; 95% CI=1.2-11.2 and HR=3.3; 95% CI=1.1-10.4) in multivariable analyses. Of note, none of the covariates were independently associated with event-free survival. **Conclusion:** Poor patient-reported QoL and SF at the time of implant is a strong predictor of 2-year mortality and morbidity in CRT-D patients, independent of cardiac risk factors, with the associated risk being more than 3-fold. These results emphasize that the KCCQ is a valuable measure that could be used to identify patients at risk for poor prognosis, and that the impact of poor psychosocial functioning in CRT-patients should not be underestimated.

COMPLICATIONS ASSOCIATED WITH CARDIAC RESYNCHRONISATION THERAPY UPGRADES VERSUS DE NOVO IMPLANTS: 3-YEAR EXPERIENCE AT A REGIONAL PACING CENTRE

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Purpose of Study Indications for cardiac resynchronization therapy (CRT) are expanding; included in this are patients with symptomatic heart failure and chronic RV pacing undergoing upgrade procedures. Previously reported data from the REPLACE registry suggest a much higher complication rate (18.7% overall) associated with CRT upgrade procedures than de novo implants. We report our 3 year experience at a regional pacing centre in North-East England.

Methods We undertook a retrospective observational study in a UK tertiary pacing centre. We reviewed the electronic hospital records and pacing files of 183 consecutive patients who underwent their first attempted CRT implantation between January 1st 2010 and December 31st 2012. We compared de novo implants with upgrade procedures, recording all documented complications up to the most recent device clinic follow-up. Significance of between group differences were calculated using Fisher's 2-tail test.

Results Complications

Complication	De Novo Implants n=136 (%)	Upgrades n=47 (%)	P value
Failed Placement of LV lead	19 (13.9)	4 (8.5)	0.32
Pneumothorax	0	1 (2.1)	0.26
Haematoma	1 (0.7)	3 (6.4)	0.05
Perforation	1 (0.7)	0	1
Coronary Sinus Dissection	1 (0.7)	0	1
Death	0	1 (2.1)	0.26
Phrenic nerve stimulation unresolved by reprogramming	3 (2.2)	1 (2.1)	1
Threshold increase unresolved by increased output	4 (3.0)	1 (2.1)	1
Lead Displacement / Failure to Pace	6 (4.4)	0	0.34
Repositioned Leads	6 (4.4)	1 (2.1)	0.68

In total, 13 leads stopped working, and were either switched off due to twitch (n=3), threshold too high (n=4), or radiographically/electrically displaced (n=6). 7 of these leads were repositioned and 6 were turned off or it is unclear from the notes what was done. Only 2 of the 7 leads repositioned were done acutely, 1 for intractable phrenic nerve stimulation and 1 for radiographic displacement. The other cases of unresolvable phrenic nerve stimulation and increased threshold were late (>30 days) complications.

Conclusions Our data compares favourably to previously reported data in terms of overall complication rates of LV lead implantation. What we found striking was that complication rates for upgrade procedures were not significantly different to de novo implants and may be because over a quarter (26%) of our CRT procedures are upgrades.

FIVE-YEAR OUTCOMES OF CARDIAC RESYNCHRONIZATION THERAPY: COMPARISON BETWEEN DE NOVO IMPLANT AND UPGRADE FROM CHRONIC RV PACING

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Introduction: The use of Cardiac resynchronization therapy (CRT) has been expanded to patients with chronic right ventricular pacing (RVP) and evidence of heart failure (HF). However, little is known about the long term outcome of these patients after CRT. **Objective:** The aim of this study was to compare patients that received de novo and upgrade CRT implants with regard to baseline demographics, clinical and laboratorial features, and 5-year outcomes. **Material:** A total of 220 consecutive patients who received CRT device for HF were retrospectively analyzed. One hundred and twenty patients had their device implanted *de novo* and 100 were upgraded from RVP. Baseline characteristics are listed in Table 1. Clinical responder was defined as >10% increase in LVEF or improvement in NYHA functional class (FC) post CRT. Mean follow-up time was 5.2 ± 0.7 yrs.

Results: After 5 years, clinical response rate was similar among *de novo* and upgraded CRT patients (reduction in NYHA 33% and 50% ($p=0.09$); and persistent improvement in LVEF 52 and 37% of patients ($p=0.4$), respectively). The shortened QRS duration was more prevalent in the upgrade group (17% *de novo* vs 60% upgrade group, $p<0.001$). Mortality rate was comparable (all cause mortality: 57 and 67%, $p=0.58$; and cardiac mortality: 21% and 32%, $p=0.58$ among *de novo* and upgrade groups, respectively). A total of 35% of patients were lost to follow-up, which was comparable among groups.

Conclusions: Chronically RV paced patients with HF show similar benefit from upgrading to CRT as patients with *de novo* implantation, with comparable long term outcome.

	De Novo	Upgrade	P Value
Age	74.2 ± 10.5 yo	76.2 ± 9.8 yo	0.14
Male Gender	77%	88%	0.04
NYHA FC III/IV	94%	91%	0.17
Ischemic/ Non-ischemic	41/ 59%	44/55%	0.59
LVEF	$25.6 \pm 8.4\%$	$27.2 \pm 9\%$	0.15
LVDD (mm)	61 ± 8.9 mm	60.2 ± 9.8 mm	0.33
QRS duration (ms)	154 ± 20	184 ± 29	<0.001
Responders (%)	NYHA FC=33%	NYHA FC= 50%	0.09
	EF = 52%	EF = 37%	0.34
Mortality (%)	All:57%	All:67%	0.58
	Cardiac:21%	Cardiac:32%	0.58

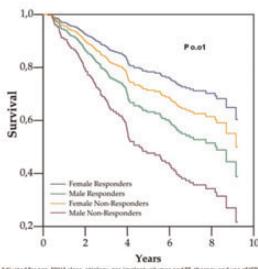
GENDER AND LV REVERSE REMODELING INTERACTION IN 9-YEAR SURVIVAL AFTER CRT

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Purpose: CRT reduces morbidity and mortality in HF patients. LV reverse remodeling at 6-month and female gender are established predictors of mid-term survival, but their interaction in the long-term is unknown. We evaluated predictors of survival at 9 years FU.

Method: We enrolled 189 consecutive CRT patients (20% females) implanted between January 2003 and January 2005. Responders were defined according to percentage of LV End Systolic Volume (LVESV) reduction; 2 cut-offs (-15% and -25%) were tested. End-points were overall and cardiac mortality.

Summary of Results: Overall survival at 1, 5 and 9 years was 82%, 54% and 33%, respectively; median survival was 6 years. Female gender and LVESV reduction ≥25% were associated with higher overall and cardiac survival (log-rank test $P<0.05$ for both). At Cox regression analysis, independent predictors of overall survival were female gender (HR 0.49), NYHA class III (HR 0.63), age (HR 1.04) and LVESV reduction ≥25% (HR 0.64, $P<0.05$ for all). Gender and LV reverse remodeling showed positive interaction for cardiac survival ($P<0.05$), and a strong trend for overall survival ($P=0.06$). Non responder-males had an adjusted HR of dying for any cause of 3.1, compared with responders-women, $P=0.01$ (Fig); HR was higher (4.4) for cardiac death ($P<0.001$).



Adjusted for age, NYHA class, etiology, pre-implant volumes and EF, therapy and use of ICDs

Conclusion: in CRT patients, gender, LV reverse remodeling at 6 months, age and better functional status are predictors of survival at very long follow-up. Female gender and LV reverse remodeling show positive interaction with one another.

CARDIAC RESYNCHRONIZATION THERAPY IN OCTOGENARIANS: 5 YEAR-FOLLOW-UP

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Introduction: Cardiac Resynchronization therapy (CRT) is a well established modality for treatment of heart failure, with improvement in functional capacity and reduction in mortality rate. However, limited data is available for octogenarian patients. **Objective:** The aim of this study was to evaluate the long-term clinical outcomes (5 year follow-up) of CRT in octogenarians in comparison with patients <80yo at the time of implant. **Methods:** A total of 264 patients received CRT between 2002-08. A retrospective analysis divided the population in 2 groups: Group A - 170 pts (64%) implanted age <80yo (70 ± 10 yo) and group B - 94 pts (36%) age >80yo (84 ± 3 yo). The loss of follow-up was similar in groups A (35%) and B (32%); $p=0.06$. There gender distribution was similar (79% and 82% males in groups A and B, respectively; $p=0.6$), and so was the proportion of ischemic pts in groups A (54%) and B (34%); $p=0.16$. The indication for CRT (de novo implant or upgrade from RV pacing) was similar among groups A and B (de novo implant: 57% and 49%, respectively; $p=0.21$). The proportion of pts with CRT-defibrillation (CRT-D) was higher in group A (81%), while CRT-pacemaker (CRT-P) was more prevalent in group B (60%); $p<0.001$. The proportion of responders was similar among groups A and B, respectively: improved functional class (58% and 60%; $p=0.8$) and improved EF on echocardiogram (55% and 44%; $p=0.3$). All-cause mortality was significantly higher in group B (82%) compared to group A (50%); $p<0.001$. Non-cardiac death was slightly more prevalent in group B (67% vs 54%), but it was not statistically significant ($p=0.17$). The interval time from implant to death was similar in both groups A and B (3 ± 2.1 yrs and 2.8 ± 1.8 yrs, respectively, $p=0.53$).

Conclusion: Baseline characteristics of octogenarians receiving CRT were similar to younger population and they received more CRT-P. The response to CRT was comparable among groups. The mortality rate was significantly higher among octogenarians due to non-cardiac causes. However, in the mortality group, the duration of CRT therapy (time from implant to death) was similar between groups. Octogenarians benefit from CRT at similar rates compared to younger population.

EFFICACY AND SAFETY OF CARDIAC RESYNCHRONIZATION THERAPY IN OCTOGENARIANS

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Background

Cardiac resynchronization therapy (CRT) improves symptoms and reduces mortality in selected patients with impaired left ventricle ejection fraction (LVEF). Outcomes of CRT in octogenarians require further evaluation.

Methods

We retrospectively identified 96 consecutive patients greater than or equal to 80 years old who underwent an initial implant or an upgrade to CRT, with or without defibrillator (CRT-D vs. CRT-P), at our institution between January 2003 and July 2008. The control cohort consisted of 177 randomly selected patients < 80 years old undergoing CRT implant during the same time period. Baseline covariates, procedural details and clinical outcomes, including rates of defibrillator shocks and mortality, were collected. The primary efficacy endpoint was all-cause mortality at 36 months, assessed by Kaplan-Meier time to first event curves.

Results

In the octogenarian's cohort, mean age at CRT implant was 83.1 ± 2.9 yrs, vs. 60.1 ± 8.8 yrs among controls ($p<0.001$). Across both groups, 70% were male, mean LVEF was $24.8 \pm 14.1\%$ and QRS duration was 154 ± 24.8 msec, without significant differences between groups. However, octogenarians were more likely to have ischemic cardiomyopathy (74 vs. 37%, $p < 0.001$) and more likely to undergo upgrade to CRT instead of an initial implant (42 vs. 19%, $p < 0.001$). Ninety percent of patients in both groups were implanted with defibrillators (i.e. CRT-D). Left ventricular lead was successfully implanted in 99% of patients in each group. During follow-up, the rate of appropriate defibrillator shocks was lower among octogenarians (14 vs. 27%, $p=0.02$) whereas the rate of inappropriate shocks was similar (3 vs. 6%, $p=0.55$). At 36 months, there was no significant difference in the rate of all-cause mortality between octogenarians (11%) and controls (8%, $p=0.381$).

Conclusion

Appropriately selected octogenarians who are candidates for CRT have similar procedural outcomes, rates of defibrillator shocks and intermediate-term mortality compared to younger patients with HF receiving CRT. Candidates for CRT should be offered this therapy even if they are of advanced age.

THE ROLE OF LEFT VENTRICULAR PACING IN PATIENTS WITH NARROW QRS UNDERGOING RESYNCHRONIZATION THERAPY.

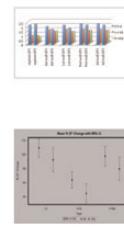
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Purpose: Increasing evidence suggests that patients with a QRS <130 msec undergoing resynchronization therapy (CRT) receive minimal benefit and may even be detrimental. We hypothesized that this may be related to the potential adverse effects of right ventricular pacing in such patients.

Method: We assessed changes in left ventricular ejection fraction (EF), and regional contraction using speckle tracking (Global Longitudinal Strain) (GLS) in patients with QRS of < 130 ms (GP I) compared to those of QRS > 130 ms (GP II). The changes were assessed during simultaneous LV – RV pacing (V-V 60), left ventricle pacing 60 ms before RV (V-V 60) and during LV only pacing (LV).

Summary of results: There were 69 patients in Group I and 202 patients in Group II. There were no differences in age or presence of ischemic heart disease. Mean EF was (22.34 ± 9.35) in GP I and (23.28 ± 10.19) in GP II at baseline. QRS duration was (120.01 ± 12.13) in GP I and (152.83 ± 12.90) in GP II. Compared to LV EF at baseline the percent increase in EF was $43\% \pm 6.5$ in GP I and $67\% \pm 6$ in GP II with V-V 0, ($p<0.001$), $80\% \pm 8$ GP I and $100\% \pm 7$ GP II with V-V 60 ($p=n.s$) and $93\% \pm 8$ in GP I and $112\% \pm 7$ in GP II with LV only ($p=n.s$). GLS showed improvement in segmental contraction particularly in the septum in both groups when compared to V-V 0. The greatest benefit occurred in patients with LV only pacing. The changes were similar in both groups (Wall Motion Scores = 0 normal, 1- mild hypokinesia, 2 -moderate hypokinesia, 3 -severe hypokinesia, 4- akinesia, 5- dyskinesia.)

Conclusions: Patients with QRS <130 msec, show a trend to less benefit in global and regional contraction compared to patients with wider QRS during simultaneous LV – RV pacing. However, during LV pacing both groups benefit to a similar degree. The adverse influence of RV pacing is more pronounced during CRT in patients with narrow QRS. Appropriate programming is needed in these patients.



PREDICTORS AND RESPONSE FOR CARDIAC RESYNCHRONIZATION THERAPY IN CHAGAS DISEASE

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Introduction: Cardiac Resynchronization Therapy (CRT) has resulted an effective treatment for heart failure (HF) in patients with systolic dysfunction and ventricular dyssynchrony. In Chagas disease (CD) however this therapy don't have large studies and the records in the literature are limited to a few series cases. We present a cohort of 130 patients (pts) of our experience with CRT in CD.

Methods: Between January 1992 and December 2013, 156 pts with CD and HF were submitted to CRT. Clinical records of 130 pts were analyzed retrospectively: males (57.3%) and females (42.6%) with a mean age of 58.25 years. Preoperatively, 27 pts (23%) were in NYHA class I, 50 pts (36%) in NYHA III, 5 pts (6%) in NYHA II and none in NYHA I. All pts had intraventricular conduction disturbances: 50 pts (60.9%) with Right Bundle Branch Block (RBBB) + Left Anterior Fascicular Block (LAFB) and 32 pts (39%) with Left Bundle Branch Block (LBBB). Mean width of QRS complex was 186.1 ± 31.31 ms.

The echocardiogram showed important systolic dysfunction in all pts with mean Ejection Fraction (EF) of $27.71 \pm 10.44\%$. All 82 pts were submitted to CRT, 69 pts (84.14%) received a CRT pacemaker (CRT-P) and 13 pts (15%) a CRT defibrillator (CRT-D). The statistical analysis of data was performed using the program SPSS Statistics v. 20.0. In mean follow-up of 24.5 ± 39.7 months we observed clinical benefits in 80% of pts. 19 pts (23%) were in NYHA class I, 47 pts (57%) in NYHA class II, and 16 (20%) remained in NYHA class III or IV ($p < 0.0001$). There was a significant reduction of the mean width of QRS complex after CRT (110.55 ± 9.72 ms, $p < 0.0001$). The PR interval decreased from 202.9 ms to 133.45 ms ($p < 0.0001$). The number of hospitalizations also showed a significant reduction from 2.84 to 0.89 post intervention ($p < 0.0001$).

Results: In terms of medications, we found a significant reduction in the average doses of diuretics (from 60mg before to 35mg after surgery, $p < 0.0001$) and a significant increase in the average doses of Beta Blockers (from 22.2 mg to 35 mg after surgery, $p < 0.0001$).

There was also a considerable improvement in EF from $27.71 \pm 10.44\%$ pre implantation to $35.77 \pm 9.72\%$ post treatment ($p < 0.0001$). We observed a total of 29 (35.36%) deaths, all in patients with CRT-P. 25 deaths (86.2%) were from cardiac causes and 13 (52%) were sudden. There no episodes of sudden death in the CRTD arm, but all patients in this arm had appropriate therapies for ventricular arrhythmias.

Conclusions: There was no difference in results among patients with LBBB and RBBB+LAFB. The position of the left ventricular lead and the distance between the left and right leads show significant difference in the acute response to the therapy. CRT proved to be useful in the treatment of refractory HF of CD in the cases studied. Considering the high mortality for sudden cardiac death, even in the group of good responders with CRT-P, we should always consider the indication of CRT-D for those pts.

Indices of an adverse long term outcome in the ongoing APRET Heart Failure Study

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Purpose: Heart Failure (HF) is the final syndrome affecting severe coronary artery disease (CAD) and Dilated Cardiomyopathy (DCMP) patients. This syndrome presents with increased rates of total mortality (TM).

Methods: A total population of 376 heart failure patients (LVEF:32±10%; CAD:80%; DCMP:20%) prospectively followed up. After 38.8 months 114 out of 376 patients (30%) died. Data from clinical characteristics and therapy analyzed for TM end points.

Results: Univariate analysis on table. After Cox regression analysis with the basic model adjusted for age, diabetes, NYHA class, urea, b-blockers & diuretics the NYHA class presented Hazard Ratio 2.294 for TM (95% CI:1.478-3.561), $p<0.001$, diabetes presented a Hazard Ratio 1.562 for TM (95% CI:1.030-2.368), $p=0.036$ and b-blockers therapy a Hazard Ratio 0.658 for TM (95% CI: 0.428-1.011), $p=0.056$.

Conclusions: Serious differences observed between deceased and alive HF patients. The deceased patients were older, had diabetes, were treated during their acute coronary syndromes with lower rates of PTCA and thrombolysis, had more often atrial fibrillation and suffered from severe systolic dysfunction and had serious affected NYHA clinical stage whereas had lower Hematocrit and Sodium with higher Urea and Creatinine. Considering their therapy they received significantly less often b-blockers, ARBs and Clopidogrel and significantly more often Coumarine, Nitrates, Diuretics, Spironolactone, Digoxin and CACs.

	All (n=376)	Dead (n=114)	Alive(n=262)	p value
Age(years)	66±13	71±10	64±13	<0.001
Diabetes(%)	36	48	31	0.002
PTCA (%)	25	17	29	0.013
Thrombolysis (%)	4.2	0.9	5.6	0.046
Atrial Fibrill. (%)	18	25	14	0.011
LVEF(%)	32±10	28±9.7	33±9.9	<0.001
NYHA(class)	2.3±0.5	2.6±0.4	2.2±0.4	<0.001
Ht(%)	40±0.5	38±0.5	41±0.4	<0.001
Urea (mg/dl)	56±36	68±43	51±32	<0.001
Creatinine (mg/dl)	1.3±0.6	1.4±0.6	1.2±0.7	0.026
Sodium (meq/L)	138±4	137±4	138±3	0.038
B-blockers (%)	66	55	70	0.005
ARBs(%)	20	13	23	0.028
Clopidogrel (%)	27	18	32	0.007
Coumarine (%)	21	30	17	0.012
Diuretics (%)	63	80	56	<0.001
Spironolactone (%)	18	32	11	<0.001
Digoxin(%)	12	25	7	<0.001

ECHOCARDIOGRAPHIC RESPONSE AT ONE YEAR ASSOCIATED WITH IMPROVED LONG-TERM SURVIVAL IN CRT PATIENTS WITH BASELINE RENAL DYSFUNCTION

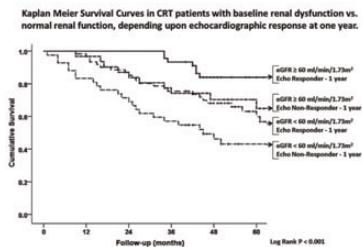
Stefan BOGDAN¹, Robert KLEMPFNER¹, Avi SABBAG¹, David LURIA¹, Osnat GUREVITZ¹, David BAR-LEV¹, Igor LIPCHENCA¹, Eyal NOF¹, Ilan GOLDENBERG¹, Michael ELDAR¹, Michael GLIKSON¹, Roy BEINART¹, Leviev Heart Center, Sheba Medical Center, Tel Hashomer, Israel.

Introduction: There is limited data regarding eGFR and CRT response. We sought to evaluate the impact of baseline eGFR (MDRD formula) on echocardiographic one year response and long term mortality in CRT patients.

Methods: The study included 179 patients implanted with CRT device from 2007 to 2010. Patients had echocardiographic assessment in the first year after CRT. Echocardiographic response was defined as an absolute variation of the LVEF of => 5% and/or decrease in LV end-systolic volume of => 10%. Patients with normal renal function (eGFR => 60 ml/min/1.73m²) were compared to those with renal dysfunction (eGFR < 60 ml/min/1.73m²). Survival data were obtained up to 6 years post-implant.

Results: During a mean follow-up of 4.0 ± 1.6 years 73 patients died (40%). Patients with renal dysfunction ($n=103$) were older (72 ± 12 vs. 64 ± 12 years; $p<0.001$) and had higher prevalence of ischemic heart disease (74% vs. 53%; $p=0.001$). Baseline renal dysfunction did not predict echocardiographic response at 1 year (OR 1.05; 95%CI: 0.48-2.26; $p=0.89$). The 4-year mortality was higher in the renal dysfunction group (53.4% vs. 23.6%; Log Rank $P < 0.001$). Responders with renal dysfunction had higher mortality by comparison to non-responders with normal renal function (47.5% vs. 18.8%), yet they still had improved survival compared to non-responders with renal dysfunction (52.5% vs 38.1%) (Figure 1; Log Rank $P < 0.001$). Multivariate analysis demonstrated that echocardiographic response to CRT at one year was associated with 40% reduction in 4-year all-cause mortality (HR 0.58; 95%CI: 0.36-0.95; $p=0.019$) after adjustment for renal function (eGFR) (HR 0.97; 95%CI: 0.96-0.99; $p=0.003$).

Conclusions: Echocardiographic response at one year is associated with improved long-term survival in CRT patients with baseline renal dysfunction, despite worse overall prognosis.



RESPONDER TO CARDIAC RESYNCHRONIZATION AND PROGNOSIS IN ATRIAL FIBRILLATION

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Purpose. Patients with reduced left ventricular ejection fraction (LVEF) often have chronic atrial fibrillation (CAF). We assessed relationships between responder and prognosis in CAF patients undergoing cardiac resynchronization therapy (CRT) compared with sinus rhythm (SR).

Methods. CUBIC study is registry of 995 Japanese patients undergoing CRT. Among them, after excluding other supraventricular arrhythmia and paroxysmal atrial fibrillation, we assessed 131 patients with CAF, and 520 with SR. Each group was divided into those who responded to CRT (Res) and not (nonRes). The responder was defined as patients whose LVESV decreased >15% or LVEF increase >25% in the 6-month echocardiography after CRT. The primary event was defined as a composite of all-caused death and hospitalization for heart failure.

Result. The responder rate was 68% in CAF group and 64% in SR group ($p=0.474$). Among CAF group, CAF-Res group had significantly more dilated cardiomyopathy etiology ($p=0.034$), larger baseline LVESV ($p=0.035$), lower baseline LVEF ($p<0.001$), and more frequent anti-arrhythmic drugs (AAD) use ($p=0.001$). The primary event rate was significantly higher in CAF group than in SR group (log-rank $p=0.008$). Among SR group, SR-Res group had lower rate of the primary event than SR-nonRes group (log-rank $p<0.001$). Among CAF group, there was no difference between CAF-Res and CAF-nonRes in the primary event rate (log-rank $p=0.202$), but as to heart failure rehospitalization, CAF-Res group had lower rate than CAF-nonRes group (log-rank $p=0.021$). In all patients, responder and CAF were appeared to be the independent predictors of the primary endpoint ($p<0.001$ and $p=0.003$). Among overall responder patients, the primary event rate was significantly higher in CAF-Res group as compared with SR-Res group (log-rank $p=0.007$). The independent predictors of the primary endpoint in responder patients were CAF ($p=0.015$), ventricular arrhythmia ($p=0.014$) and high class of NYHA ($p=0.020$).

Conclusion. Non-responder to CRT and CAF have worse clinical outcome in patients undergoing CRT. And in responder patients, CAF influences their prognosis significantly. Further evaluation is needed about characters of CRT patients with CAF and their management of heart failure.

ATRIAL FIBRILLATION IN CARDIAC RESYNCHRONIZATION RECIPIENTS WITH AND WITHOUT PRIOR ARRHYTHMIC HISTORY. HOW MUCH OF ARRHYTHMIA IS TOO MUCH?

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Background

Arrhythmia incidence, predisposing factors and prognostic role of atrial fibrillation (AF) characteristics is unknown in cardiac resynchronization (CRT) recipients.

Aim

To assess long-term incidence of AF in CRT recipients with and without prior arrhythmic history, identify factors predisposing to arrhythmia, and to evaluate the prognostic power of cumulative arrhythmia burden, duration of the longest episode and the number of episodes.

Methods

Device-collected data on any AF episode during 24 months in 96 participants of randomized CRT trial were analyzed (61.5 years, 15% with NYHA class IV, sinus rhythm, median LVEF 24% and QRS duration 169ms). Blinded adjudicated major adverse events (MACE) and any-cause death were censoring variables.

Results

Two-year incidence of AF was 70%, including 66% in patients without previous history. No baseline characteristics distinguished those who developed arrhythmia de novo. Percent of time spent in AF, but not number of episodes predicted mortality (adjusted hazard ratio HR 1.05 ± 95% confidence interval CI 1.01-1.10) and MACE incidence (HR 1.03± 1.01-1.07; P=0.03). Duration of the longest episode predicted also mortality (HR 1.06 ± 1.01-1.12; both P=0.03). Prognostic impact of AF load was marked only in patients with slower ventricular response (<98/min), but was independent from CHADS₂ scores, pacing burden, or prior nodal ablation.

Conclusions

Seven out of ten CRT patients had AF within two years, including two-third of subjects without arrhythmic history. No baseline features distinguished those who will develop *de novo* AF. Arrhythmia burden and duration of the longest episode, but not the number of episodes influenced outcomes in CRT-patients, irrespectively from pacing burden or prior node ablation.

PROGNOSTIC VALUES OF CHADS₂ SCORE IN HEART FAILURE WITH REDUCED EJECTION FRACTION AND ATRIAL FIBRILLATION: IMPLICATIONS OF COHORT STUDY

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Purpose

Heart failure is associated with increased risk of stroke in patients with non-valvular atrial fibrillation (NVAF), incorporated in stroke risk stratification scores. The role of quantitative ejection fraction in stroke risk prediction remains uncertain. The purpose of this study was to clarify the role of ejection fraction in stroke and prognostic values of CHADS₂ score in patients with NVAF and severe left ventricular impairment.

Methods

This prospective cohort study analyzed data from 242 patients with both NVAF and echocardiographic left ventricular ejection fraction (LVEF) less than 35%, in Chang Gung Memorial Hospital (CGMH) from January 1st, 2010 to December 31st, 2011 in Taiwan. LVEF was categorized as <20%, 20-25%, 25-30%, and 30-35%. Primary outcome is ischemic strokes or mortality. Cox proportional hazard model and multivariable-adjusted risk were used to evaluate outcome predictors and correlation between LVEF, stroke and mortality. Medication such as angiotensin-converting enzyme inhibitor (ACEi) / angiotensin receptor blocker (ARB), β-blockers, and anticoagulants in the Cox model are set as time-dependent covariates.

Results

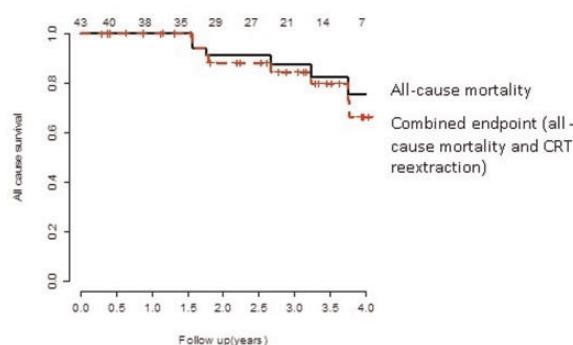
Among 1310 patients with LVEF less than 35%, 242 patients with NVAF were included, 26 patients (10.7 percent) had new onset stroke after the enrollment. There were no statistical differences in stroke, stroke/death or all-cause death between different EF values. In multivariate analysis, only diabetes mellitus [HR=2.49, 95%[CI]1.09-5.72, p=0.031] increased the risk of stroke, and diuretic [HR=0.38, 95%[CI]0.17-0.85, p=0.018] lowered the risk of stroke. Female gender, hypertension, vascular disease, previous stroke and EF were not statistically significant in stroke prediction. In analysis between clinical characteristics and all-cause mortality, only age [HR=1.03, 95%[CI]1.02-1.06, p<0.001] and chronic kidney disease(CKD)[HR=2.30, 95%[CI]1.45-3.64, p<0.001] were associated with the increased risk of mortality. And medication as beta blocker [HR=0.59, 95%[CI]0.40-0.87, p=0.008] was associated with the decreased risk of mortality.

Conclusions

In patients with reduced ejection fraction and atrial fibrillation, values of ejection fraction, previous stroke and hypertension are no relevant to predict ischemic stroke but other CHADS₂ risk factors are. Diuretics are key point to prevent ischemic stroke.

Prognosis of patients with CRT reimplantation after complete device extraction
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The number of CRT implantations, upgrades and box changes in Europe as well as increase of lead dysfunction leads to more device and lead extractions particularly in combination with device related infections. We investigate the success of reimplantation procedure with focus to coronary vein and prognosis. Methods: We analyzed all patients with CRT reimplantation after complete device and lead extraction in our center (n=53; age 68±9.9 yr; 60 days (49-87) median time interval extraction to reimplantation). Results: Only 30 of 53 patients could implanted in the optimal posterolateral or lateral coronary vein. In 16 of all patients the past coronary vein were obstructed, in 4 patients both subclavian veins were occluded and in 3 patients a complete thrombosis of the cava superior vein were found. For that reason no CRT reimplantation were reached in 7 patients. In the median follow up of 25.4 (8.5-39) months 7 patients died and 2 patients reached a surgical tricuspid valve reconstruction. Further 3 (6%) patients developed a new bacteremia with a repeat need of complete device and lead extraction and in 5 (9%) patients a new pocket or lead revision were followed. Conclusion: Thrombosis of coronary and subclavian veins are common in patients with prior CRT device extraction. For that reason the success of CRT reimplantation procedure is not comparable to first CRT implantation. The prognosis of these patients is marked with higher mortality and reinfection.



BASELINE LBBB IS NOT ASSOCIATED WITH REDUCED 4-YEAR MORTALITY IN A REAL-LIFE COHORT OF CRT PATIENTS

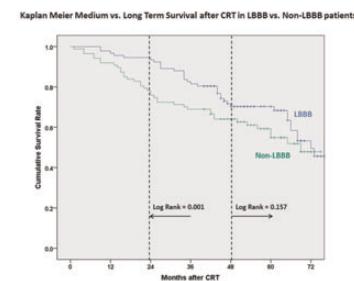
Stefan BOGDAN, Robert KLEMPFNER, Avi SABBAG, David LURIA, Osnat GUREVITZ, David BAR-LEV, Igor LIPCHENCA, Eyal NOF, Ilan GOLDENBERG, Michael ELDAR, Michael GLIKSON, Roy BEINART. Leviev Heart Center, Sheba Medical Center, Tel Hashomer, Israel.

Introduction: Wide QRS with left bundle branch block (LBBB) morphology is a good predictor for positive clinical and echocardiographic outcome in cardiac resynchronization therapy (CRT) patients. We sought to assess the effect of LBBB on long term mortality in a real-life cohort of CRT patients.

Methods: We included all patients with implanted CRT device between 2007 and 2010. Clinical and echocardiographic outcome was assessed during the first year post CRT. Clinical response at one year was defined by using a composite score based on NYHA class, 6-minute walk test and Quality of Life. Patients with LBBB at baseline were compared to all other patients. Survival data were obtained up to 6 years after implant.

Results: From the 179 included patients 73 died during a follow-up of 4.0 ± 1.6 years. Non-LBBB patients had a higher rate of atrial fibrillation (60.7% vs. 39.3%; p=0.002) and atrio-ventricular node ablation (6.8% vs. 1.0%; p=0.05). Mortality in LBBB patients was lower at two years (6.5% vs. 24.1%; Log Rank p=0.001), but not at 4 years (47.9% vs. 52.1%; Log Rank p=0.157). LBBB predicted clinical response at one year (OR 2.42; p=0.009) and was associated with lower 2-year mortality (HR 3.74; p=0.005). No significant difference was found between patients with QRS of 120-150 ms vs. >150 ms. Multivariate analysis demonstrated that one-year clinical response was associated with 55% reduction in 4-year all-cause mortality (HR 0.43; p=0.023).

Conclusions: LBBB is associated with improved 2-year all-cause mortality but the effect tapers off at 4 years.



The incidence, clinical significance and treatment effects of depression in patients undergoing cardiac resynchronization therapy.

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Purpose: The aim of the study was to assess the incidence, clinical impact of depression and effectiveness of treatment of this syndrome in cardiac resynchronization (CRT) patients.

Methods: The prospective, single-center, interventional, non-randomized trial included 260 consecutive CHF-patients who were implanted with CRT-D. All patients completed the Beck Depression Inventory (BDI-II) and underwent a psychiatric examination at the time of implantation. The assessment of psychiatric status was repeated at 3, 6 and 12 months after implantation. 129 (49.6%) patients with depression at baseline (Depression Group) were included into further analysis. Among this group 51 (39.5%) subjects received antidepressants (Treated Group), whereas 78 (60.5%) patients, who refused to take antidepressants, were included into non-Treated Group. Data on long-term follow-up were screened to identify patients who developed a composite endpoint defined as death or hospitalization for decompensated heart failure.

Results: Considering whole depressive group, the significant reduced incidence of depression was observed 6 and 12 months after a CRT-D implantation (32.5% and 34.1%, respectively; p<0.05). Depression remission after 6 months was achieved in 40 (78.4%) patients from the Treated Group and in 30 (38.5%) subjects not taking antidepressants (p<0.05). During 12-month observation patients with depression at baseline had a significantly higher risk for the development of a composite endpoint than CRT-D population free of this disorder: 34.0% vs 14.4% (p<0.05). Additionally, depression was found to be an independent predictor for a composite endpoint in CRT-D population (HR 2.55).

Conclusions: Depression is a common mental disorder in patients with severe CHF, affecting half of the CRT candidates. Resynchronization therapy reduces significantly the incidence of this syndrome, also in patients not taking antidepressants. Nevertheless, the remission-rates are 2-fold higher in patients taking antidepressant drugs. Depression at baseline is the independent predictor of unfavorable outcomes in CRT-D population.

[18F] -FDG PET FOR PREDICTION OF CARDIAC RESYNCHRONIZATION THERAPY EFFECTIVENESS

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The problem of finding new methods of predicting the effectiveness of cardiac resynchronization therapy CRT is still actual. **The purpose** of this study was to estimate the diagnostic value of positron emission tomography (PET) with [18F]-FDG for prediction an improvement of systolic function after CRT.

Methods: We examined 11 patients with dilated cardiomyopathy and CHF 3-4 NYHA. All patients had symptoms despite maximal medical therapy, sinus rhythm, left ventricular ejection fraction (LVEF) less than 35%, left bundle branch block (LBBB) - QRS >120 ms. Patients with coronary artery disease were not included in the study. [18F]-FDG PET was performed twice: before and in 7-9 months after CRT. Septal-to-lateral glucose metabolism ratio was determined as FDG uptake in the septa divided by the uptake values of the lateral wall. CRT response was defined as: (1) improvement of one or more grades in the NYHA classification and (2) end systolic LV volume reduction greater than 15% in 6 months after CRT.

Results: Inspite of absence of any significant clinical and echocardiographical differences at baseline, 6 patients were considered as responders after CRT and 5 patients were nonresponders. The values of the septal-to-lateral ratio at baseline were different for responders and nonresponders and negatively correlated with clinical and functional improvement after CRT. ROC curve analysis was performed to define the optimal cut off value to predict response to CRT. The optimal cut off value, defined as the septal-to-lateral ratio <0.67, yielding a sensitivity of 100% and specificity of 80% to predict response to CRT.

Conclusion: We believe that the septal-to-lateral ratio may be considered as an additional criterion to predict the response to CRT.

SCINTIGRAPHIC PREDICTORS OF CARDIAC RESYNCHRONIZATION THERAPY EFFICACY IN PATIENTS WITH DILATED CARDIOMYOPATHY

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Aim. The aim of the study was to identify possible predictors of efficacy of cardiac resynchronization therapy (CRT) by using radionuclide methods.

Material and methods. The study included 28 patients aged 32 to 62 years (55.4 ± 8.3 years) with dilated cardiomyopathy, NYHA functional class (FC) III–IV heart failure (HF), and left ventricular ejection fraction (LVEF) of $29.7 \pm 6.4\%$ according to echocardiography. All patients received CRT. Before implantation of CRT device, all patients underwent SPECT with ^{99m}Tc-MIBI at rest to evaluate myocardial perfusion and ¹²³I-BMIPP to evaluate myocardial metabolism. Gated blood pool single photon emission computer tomography (GBPS) was performed both before and 6 months after CRT to assess hemodynamic parameters and left ventricular dyssynchrony.

Results. Based on GBPS results 6 months after CRT, all patients were divided into 3 groups: group 1 included patients whose LVEF increased by more than 10% (n = 10) (hyperresponders); group 2 included patients with LVEF increase of less than 10% (n = 11) (responders); and group 3 included patients whose LVEF remained unchanged or worsened compared to that before treatment (nonresponders) (n = 7). Prior to CRT, no statistically significant intergroup differences were found between hemodynamic parameters (LVEF, end-diastolic volume, and end-systolic volume), intra- and interventricular dyssynchrony, as well as in the perfusion defect sizes. According to SPECT with ¹²³I-BMIPP, sizes of the defect of fatty acid accumulation were significantly higher in the third group compared to the first group ($22\% \pm 8.12\%$ vs. $13.73\% \pm 1.1\%$, respectively, p < 0.01).

Conclusions. Our data suggest that size of fatty acid metabolism defect according to SPECT with ¹²³I-BMIPP may be considered as one of the possible predictors of successful outcome in patients with dilated cardiomyopathy.

REDUCED MORTALITY WITH QUADRIPOLEAR COMPARED TO BIPOLEAR LEFT VENTRICULAR LEADS IN CARDIAC RESYNCHRONIZATION THERAPY

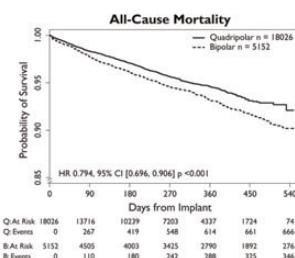
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Purpose: In cardiac resynchronization therapy (CRT), quadri polar (Q) left ventricular (LV) leads offer pacing sites and vectors unavailable with bipolar (B) leads. CRT reduces mortality in heart failure patients and these pacing options may improve its effectiveness. We compared survival with Q and B leads using an observational cohort of patients with newly-implanted CRT-D systems.

Methods: We identified serial patients in St. Jude Medical device registration records with a *de novo* implant in the U.S. from Nov., 2011 to May, 2013. The primary exposure was type of LV lead (Q or B). The outcome was death, reported in the Social Security Death Index. A Cox proportional hazards regression, adjusted for age and sex, determined the association of lead type with mortality.

Results: Among 23,178 patients (age 69.8 ± 11.3 , 28% female), 78% had Q and 22% had B LV leads. The Q and B groups had 5.88 and 7.23 deaths/100 patient-years, respectively (p = 0.003). After multivariate adjustment, the Q lead was associated with a lower risk of death (HR 0.794, 95% CI [0.696, 0.906], p < 0.001; Figure). Results were similar in a sex- and age-matched cohort (5.89 vs. 7.41 deaths/100 patient-years; HR 0.764, 95% CI [0.695, 0.841], p < 0.001).

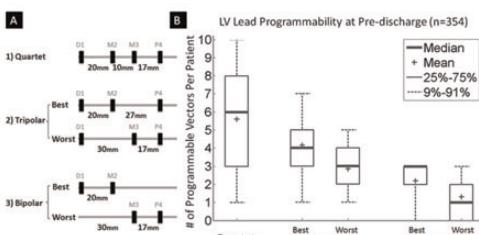
Conclusion: In this observational study of CRT, the Quartet™ LV lead was associated with increased survival over bipolar leads. These findings imply that patients with quadri polar LV leads may receive more effective CRT. Possible mediators of the observed survival differences require exploration.



QUAD LV LEAD PROVIDES BETTER PROGRAMMABILITY THAN TRIPOLAR EQUIVALENTS

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Purpose: Currently, quadri polar LV leads allow 3 or 4 unique anatomic pacing locations due to different electrode spacings. We compared the programmability of Quartet™ LV lead (St. Jude Medical) vs. traditional bi- and tripolar equivalents to evaluate any benefits of additional electrodes. **Methods:** Capture threshold and phasic stimulation (PS) for Quartet's 10 pacing vectors were tested at pre-discharge in 354 CRT recipients enrolled in 6 trials. We defined programmable pacing vectors (PPVs) as those without PS and with capture threshold $\leq 2.5V$. Number of PPVs per patient was evaluated in 3 settings (Fig. A): 1) Quartet with all 4 electrodes; 2) Quartet with 3 electrodes simulating tripolar leads; and 3) Quartet with 2 adjacent electrodes simulating bipolar leads. With at least 2 PPVs, distance between 2 furthest pacing cathodes was calculated using Quartet's electrode spacings (Fig. A); 1 mm was used for only 1 PPV. **Results:** Quartet provided the most PPVs compared to best bipolar (D1-M2-P4) and best tripolar (D1-M2) configurations (median 6 vs. 4 vs. 3, respectively) (Fig. B). Median distance between 2 furthest programmable pacing cathodes was significantly larger for Quartet at 30 mm (IQR 20–47 mm) compared to best tripolar at 20 mm (IQR 20–47 mm) and best bipolar at 20 mm (IQR 1–20 mm) (p < 0.05). **Conclusion:** Quartet provides additional viable programmable pacing vectors and wider spatial coverage than bi- and bipolar equivalents, potentially facilitating successful CRT implant and sustained therapy with optimal LV pacing.



A) Different lead configurations with their corresponding inter-electrode spacings. B) Number of programmable pacing vectors in Quartet with all 4 electrodes (D1-M2-M3-P4) compared to the best tripolar (D1-M2-P4), the worst tripolar (D1-M3-P4), the best bipolar (D1-M2), and the worst bipolar configurations (M3-P4) at pre-discharge in 354 CRT recipients. D1 denotes the most distal electrode, M2 and M3 are the two middle electrodes, and P4 denotes the most proximal electrode.

INTER AND INTRA-VENTRICULAR DYSSYNCHRONY VARIABILITY BETWEEN DIFFERENT CONFIGURATIONS OF QUADRIPOLEAR CARDIAC RESYNCHRONIZATION THERAPY

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Introduction. The Quartet LV lead (St. Jude Medical)- for cardiac resynchronization therapy (CRT) provides 10 different left ventricular (LV) pacing configurations. This study aimed at evaluating the echocardiographic spectrum of inter- and intra-ventricular dyssynchrony over these 10 configurations.

Methods. Consecutive quadri polar CRT-recipients underwent a trans-thoracic echocardiogram one month after implantation for the assessment of inter and intra-ventricular dyssynchrony across the ten different LV vectors. The best configuration was determined by inter-ventricular mechanical delay (IVMD) at Pulsed Doppler, septum-to-lateral wall delay (S-L WD) in time to peak velocity at color-tissue Doppler (TDI) and septum-to-posterior wall delay (S-P WD) in time to peak systolic strain at 2D speckle tracking (2D ST).

Results. Nineteen quadri polar CRT-recipients (57.9% male, mean age: 67 ± 8.2 y) affected by dilated cardiomyopathy (42.1% post-ischemic; mean EF: $30.2 \pm 4.9\%$; 84.2% NYHA III) were enrolled. Conventional bipolar vectors (D1-M2, D1-RVC, M2-RVC) were rarely associated with the best improvements in inter- and intra-ventricular dyssynchrony. IVMD was significantly greater by pacing from the configurations D1-M2 (26.3 ± 17.3 ms), D1-RVC (34.1 ± 28.7 ms) and M2-RVC (31 ± 19.1 ms) in comparison to the best configuration (4.2 ± 4.1 ms) for every patient ($P < 0.001$, $P < 0.001$ and $P < 0.001$ respectively). S-L WD at TDI was significantly greater by pacing from D1-M2 (188.8 ± 139.5 ms), D1-RVC (167.7 ± 126.7 ms) and M2-RVC (142.15 ± 133.4 ms) in comparison to the best configuration (50.2 ± 49.4 ms) ($P = 0.009$, $P = 0.004$ and $P = 0.012$ respectively). S-P WD at 2-D ST-radial strain was also significantly greater by pacing from D1-M2 (179 ± 152.9 ms), D1-RVC (123.1 ± 101.3 ms) and M2-RVC (125.1 ± 124.2 ms) in comparison to the best configuration (24.2 ± 22.1 ms) for every patient ($P < 0.001$, $P < 0.001$ and $P = 0.027$ respectively).

Conclusions. Unconventional LV pacing vectors of quadri polar CRT may acutely improve inter and intraventricular dyssynchrony in comparison to bipolar LV vectors.