THE MOUNT SINAI HOSPITAL, NEW YORK STANDARD: Protocol	SUBJECT NO. CSC-3
DEPARTMENT: NSICU SUBJECT: SAH (Non-Traumatic) Management Protocol	

CROSS-REFERENCE:
CSC-2 Protocol for the Initial Evaluation and Management of Patients with Ischemic or Hemorrhagic Stroke
CSC -4 Intracranial Hemorrhage Management Protocol

Original date of issue September 2008

Reviewed:							
Revised:	3/26/2010	12/17/2014	2/22/2015	3/28/2015	3/03/2017		

This protocol is meant as a guideline for management and can be superseded by clinical judgment

At initial presentation to the Emergency Department (ED)

Information gathering important for communication to Neurosurgery Consultant:

- HPI
- age
- date/time of SAH onset, (or last time seen normal)
- h/o head trauma, h/o seizure or syncope at onset
- PMH/ SH:
    - past history of stroke/MI/PVD
    - past history of cocaine use/Utox
- clinical exam location of SAH
- presence of hydrocephalus of IVH
- presence of ICH
- evidence of trauma
- Laboratory findings: Plt count, PT/PTT/INR
- EKG findings

Pre-transfer/ Initial Management: While in parallel arranging the transfer, some suggestions for initial management in consultation with the accepting and transferring physician.

- ABCs
- Initial studies: Head CT, CBC, chem. 7, PT/PTT/INR, LFTs, Troponin, type and hold, EKG, CXR
- Fosphenytoin (or phenytoin equivalent) 20 mg/kg IV load or Levetiracetam (Keppra) 1 g PO/IV
- Nimodipine
  - 60 mg PO q 4 h for SBP≥140
  - 30 mg for SBP 120-140
  - hold for SBP ≤120
- Keep SBP between ≤140 mmHg with:
  - Nicardipine trip (preferred), Clevidipine drip, Labetolol drip (avoid nitroprusside as this can raise ICP)
  - and ≥90 mmHg with neosynephrine)
- Consider Amicar-4 g bolus and starting a drip at 1 g/hour
- Assess for hydrocephalus
- Consider Mannitol 20% 1-1.5 g/kg bolus (100g if weight unknown) or 30cc 23% saline (23% saline must be pushed over 10-20 min. via central line by MD) for suspected elevated intracranial pressure if patient is not following commands and/or CT is suggestive of elevated ICP
- Transfer for definitive aneurysm treatment must not be delayed for line placement.
- Make sure plain film or CD copy of HCT is transferred with patient
- If high suspicion for SAH and HCT negative, LP should be performed
- Coagulation & Antiplatelet correction should be initiated immediately if appropriate. Please refer to CSC-4 Intracranial Hemorrhage Management Protocol for reversal guidance.
- Contact neurointensivist attending through **1-800-TO-SINAI** or the Neuroemergencies Hotline at **1-800-748-6445**

After admission to Neurosurgery from the ED

Mount Sinai Initial Management ICU Day 1

URGENT Stabilization:

- ABCs
- Assess for emergent EVD (non-command following exam) If EVD placed give Ancef 1 g prior to EVD insertion then D/C antibiotics (do not continue prophylactic antibiotics).
- Assess for elevated intracranial pressure (if patient is not following commands and/or CT is suggestive of elevated ICP)
- Consider Mannitol 20% 1-1.5 g/kg bolus (100g if weight unknown) for suspected elevated intracranial pressure or 30cc 23% saline (23% saline must be pushed over 10-20 min. via central line by MD)
- Angiogram/coiling/clipping of aneurysm should be scheduled and performed

Studies

- Labs: CBC, chem. 7, Mg, PO4, coags, LFTs, Troponin/CKMB q8h x 3 if EKG changes, type and hold, HbgA1c (for hyperglycemia protocol), dilantin and free dilantin levels Baseline EKG, CXR
- Order baseline TTE
- HCT baseline with follow up CTA (should be ordered between day 5-8). MUST BE DONE AS SOON AS PATIENT IS STABILIZED. Call neuroradiology fellow if not done in a timely fashion, a delay in obtaining this study must not delay angiogram/definitive treatment of aneurysm.
- Patient must have a 18 or 20 gauge arm IV, a central line alone is inadequate.
- If Cr elevated >1.0 give Mucomyst 600 mg PO BID x 2d and HCO3 drip (3 amps NaHCO3 in 1 liter D5W at 1cc/kg/h for 1 hour prior to CT and 6 hours after CT
- If HCT shows evidence of elevated intracranial pressure consider Mannitol or hypertonic saline bolus as above.

Medications and drips prior to securing aneurysm

- Continue phenytoin 300 mg IV qd (assure that patient has already received complete 20 mg/kg IV fosphenytoin load or Keppra 1 g PO/IV)
- Continue Nimodipine (if patient NPO place NGT to ensure administration):
- 60 mg PO q 4 h for SBP≥140
- 30 mg for SBP 120-140
- hold for SBP ≤120
- Keep SBP between ≤140 mmHg with Nicardipine (preferred), Clevidipine, Labetolol (avoid nitroprusside as this can raise ICP) and ≥90 mmHg with neosynephrine
- NS at 75 cc/h
- Check daily EKG (watch for ↑ PR, QRS, QT interval)
- Monitor daily K+, Ca++
- Nexium 40 mg PO qd
- Senna/Colace
- Propofol or Fentanyl to light sedation if patient is on ventilator and agitated

Procedures

- Place triple lumen catheter and A-line for Hunt-Hess grades 3-5
- Assess for multimodality devices
- Place NGT if patient unable to PO
- Schedule angiogram
- Schedule daily TCDs
- NPO
- Order compression boots
- Elevate HOB 30 degrees
- If EVD in place: q1 hour ICP checks

ICU Day 2 and onward

- Continue above orders and additionally:
- Order Lovenox 40 mg SQ to begin immediately after aneurysm coiling, continue compression boots if craniotomy was performed and start lovenox 40 SQ qd 48 hours after craniotomy
- Daily dilantin levels, also check free dilantin if patient is on another cyp450 metabolized medication
- D/C of antiepileptics in good grade patients (Hunt-Hess 1-2)
- Consider switching from dilantin to Keppra 1000 IV BID if antiepileptics are continued
- Daily EKG, also daily troponin if patient is on pressors
- Start feeds according to feeding protocol
- If craniotomy performed: Cefuroxime 1.5g q 6h x 24h, if PCN allergy use Vancomycin 1g IV q 12h AND Gentamycin 1.5 mg/kg (ideal body weight) q 8 h x 24h total (per Mount Sinai Medical Board Policy)
- CI goal > 4.0, ICP goal <20 cm H2O, CPP goal ≥60 mmHg, Licox PbO2 goal ≥20 mmHg
- Check TTE
- Check CSF cells and culture if EVD in place AND patient febrile or infection suspected. Continue q 1 hour closed ICP checks
- Daily TCDs
- Assess for arctic sun if patient's temp >38.3ºC x 2 readings 2 hours apart
- (initiate normothermia protocol)
- If patient is hyponatremic, make sure Ins ≥ Outs, replace salt and volume as this is most likely cerebral salt wasting. Options include salt tabs, hypertonic saline and normal saline
- If patient on vent: Daily sedation interruption and pressure support trial and evaluation for extubation or early trach
- If patient on pressors institute PICOO to follow Cardiac output and index
- Assess for early PEG and/or trach
- If ready to D/C EVD give Ancef 1 g IV prior to pulling EVD
- Consider screening HCT and LP after EVD D/C'd to assess for elevated ICP
- If patient has chronic renal failure and/or requires dialysis, please schedule patient for CVVH or SLED (slow dialysis)

If patient develops clinical signs of vasospasm (symptomatic vasospasm)

- Increase IVF or frequency of albumin dosing
- Make sure Ins ≥ Outs
- Trial of Phenylephrine or Norepinephrine to increase SBP by 20-30 mmHg, recheck exam in 20-30 min. for improvement, titrate phenyephrine or norepinephrine per exam to max BP 220/110 mmHg
- Check daily EKG and troponin on pressors
- Check TTE if not already done
- HCT, CTA/CTP (follow guidelines as above)
- Schedule angiogram
- Rule out other causes of deterioration (i.e. symptomatic hydrocephalus, seizure, metabolic disarray, fever etc.)
- Hold nimodipine if patient receiving pressors

Important contact information:
TRANSFER HOTLINE: 1-800 TO-SINAI
Neuroemergencies Hotline: 1-800-748-6445
Neurocritical Care fellow: 42100
MSH Neuroradiology: 44261
MSH CT: 47412

References:

Connolly ES Jr, Rabinstein AA, Carhuapoma JR, Derdeyn CP, Dion J, Higashida RT, Hoh BL, Kirkness CJ, Naidech AM, Ogilvy CS, Patel AB, Thompson BG, Vespa P; American Heart Association Stroke Council; Council on Cardiovascular Radiology and Intervention; Council on Cardiovascular Nursing; Council on Cardiovascular Surgery and Anesthesia; Council on Clinical Cardiology. 'Guidelines for the management of aneurysmal subarachnoid hemorrhage: a guideline for healthcare professionals from the American Heart Association/American Stroke Association.' Stroke. 2012 Jun;43(6):1711-37

Morgenstern LB, Hemphill JC 3rd, Anderson C, Becker K, Broderick JP, Connolly ES Jr, Greenberg SM, Huang JN, MacDonald RL, Messé SR, Mitchell PH, Selim M, Tamargo RJ; American Heart Association Stroke Council and Council on Cardiovascular Nursing. 'Guidelines for the management of spontaneous intracerebral hemorrhage: a guideline for healthcare professionals from the American Heart Association/American Stroke Association.' Stroke. 2010 Sep; 41(9):2108-29