



## Subarachnoid Hemorrhage Guideline

### Abbreviations

CI = Cardiac Index  
CPP = Cerebral Perfusion Pressure  
CSF = Cerebrospinal Fluid  
EEG = Electroencephalogram  
EVD = External Ventricular Drain  
ICP = Intracranial Pressure  
IVC = Inferior Vena Cava  
LP = Lumbar Puncture  
MCA = Middle Cerebral Artery  
PAP = Pulmonary Artery Pressure  
SAH = Subarachnoid Hemorrhage  
SBP = Systolic Blood Pressure  
SVV = Stroke Volume Variation

### Emergency Department Management and Diagnosis

- SAH is a medical emergency that is frequently misdiagnosed
- A high level of suspicion for SAH should exist in patients with **acute onset of severe headache**
- Diagnosis
  - Obtain detailed history and physical examination, noting any focal neurologic deficits, neck pain, or photophobia.
  - Obtain Head CT
    - If negative
      - LP for analysis of CSF (Note: Do not perform LP within 2 hours if ictus)
  - To assess severity of SAH, use of an accepted clinical and radiographic grading scale is recommended
    - Hunt and Hess (Appendix A)
    - Fisher Scale (Appendix B)
    - World Federation of Neurological Surgeons Scale (Appendix C)
- Once diagnosis is made **or** doubt of the diagnosis but still concerning **consult Neurosurgery**
  - Obtain cerebral angiography via CT or MRI
  - Obtain pertinent labs
    - Complete blood count
    - Chemistry
    - Coagulation tests
    - Liver function tests
    - Platelet function assay (if on outpatient antiplatelet agent)
    - Troponin
    - Toxicology screen



## **Initial Management (Unsecure Aneurysm)**

### **Airway/Breathing/Circulation**

- If requiring intubation, consider induction agents that are hemodynamically neutral
  - Recommend, if no contraindication: Etomidate 0.3 mg/kg IV
- Consider use of short acting paralytics
  - Recommend, if no contraindication: Succinylcholine 1.5-2 mg/kg or Rocuronium 1.2 mg/kg IV
- Avoid hypoxia

### **Prevention of Rebleeding**

- NSICU admission
- Bed rest
- Aggressive treatment of pain, anxiety, nausea, and vomiting
- Strict Blood Pressure Management (Unsecure Aneurysm)
  - SBP 110-140 mmHg
  - Intravenous antihypertensive drips preferred
    - Nicardipine initiated at 5 mg/hr
    - Clevidipine initiated at 1-2 mg/hr
  - Avoid potent vasodilators (i.e. nitroglycerin, nitroprusside)
- Use of prophylactic antiepileptic drug acceptable until aneurysm is secure
- Consider Aminocaproic acid if early aneurysm protection is not an option
  - Aminocaproic acid 4 g IV loading dose over 1 hour followed by 1 g/hour continuous infusion for 24-48 hours
- Maintain the following coagulation parameters
  - Platelets > 100,000
  - INR < 1.4

### **Pre-Operative Checklist**

- Prior to surgery, discuss hemodynamic targets with anesthesiologist
  - Focus on minimizing the degree and duration of intraoperative hypotension
  - Consider use of pharmacologic strategies to induce hypertension during temporary vessel occlusion in certain situations
  - Induced hypothermia is not routinely recommended but may be a reasonable option in some cases at physician discretion
- Arterial catheter placement
  - Not required prior to surgery but should be completed while under anesthesia
- If EVD is present, discuss drainage, ICP, and CPP targets with anesthesiologist
- Neurologic examination



## **NSICU Management**

- Immediate post-operative neurologic examination
- SBP goals discussion with endovascular neurologist/neurosurgeon with the following recommendations:
  - POD 0-1 SBP < 160 mmHg
  - POD 2+
    - Secure and obliterated: SBP 110-180 mmHg
    - Unsecure or partially obliterated: SBP 110-160 mmHg
    - Completely unsecure: SBP 110-140 mmHg
- Initiate oral/enteral Nimodipine 60 mg q4hours
  - If SBP unstable with above dose may change dose to 30 mg q2hours
- Maintain euvolemia and normothermia (please see normothermia protocol)
- Sedatives and analgesics
  - Please see NSICU sedation and analgesia guideline
- Routine transcranial doppler examination
- Echocardiogram
- Electrocardiogram
- Follow NSICU glucose management protocol
- Heparin SQ to be started by 24 hours after surgery
  - ≥ 50 kg: 5,000 units TID
  - < 50 kg: 5,000 units BID
- SCDs on admission
- Avoid anemia

### **Neuro checks and Transitioning Care**

- Q1h neuro checks, consider decreasing frequency of neuro checks when clinical exam is stable
- Consider CT angiography at post bleed day 7 and downgrade from ICU if no clinical and radiographic vasospasm is present, consider downgrading out of the ICU.

### **Cerebral Vasospasm**

- Small vessel vasospasm
  - Consider volume expansion
  - Consider induction of hypertension with vasopressors
- Large vessel vasospasm
  - Volume expansion
  - Vasopressors
  - Selective intra-arterial vasodilator
  - Cerebral angioplasty
- Refractory vasospasm
  - Volume expansion
  - Vasopressors
  - Selective intra-arterial vasodilator
  - Cerebral angioplasty
  - Intraventricular calcium channel blockers

Developed by: Shaheryar Hafeez, MD

Approved by Neuro ICU CMT: November 2017

Approved by P&T Committee: January 2018



### **Hydrocephalus**

- CSF diversion is recommended if depressed consciousness with ventriculomegaly
- If chronicity is demonstrated, permanent CSF diversion is recommended

### **Seizures**

- Obtain 24 hour continuous EEG if patient is comatose or does not follow commands
- Routine long-term use of anticonvulsants is **not** recommended
  - May be considered in patients with the following risk factors:
    - Prior seizure or seizure on presentation
    - Parenchymal hematoma
    - Large infarct
    - MCA aneurysms

### **Hyponatremia and Volume Contraction**

- If Sodium < 135
  - Consider use of salt tablets, fludrocortisone, or hypertonic saline
  - Q1h I/O
  - Urine studies – Urine sodium, specific gravity, osmolality
  - \*Avoid fluid restriction\*

### **Euvolemia**

- Consider placing non-invasive cardiac monitoring and aim for:
  - CI > 2.0
  - CVP 3-10
  - SVV < 13%
- In some instances, it may be reasonable to reduce fluid administration to maintain a euvolemic state

### **Appendices**

- Hunt and Hess (Appendix A)
- Fisher Scale (Appendix B)
- World Federation of Neurological Surgeons Scale (Appendix C)

### **References**

Connolly ES, Rabinstein AA, Carhuapoma JR, et al. Guidelines for the Management of Aneurysmal Subarachnoid Hemorrhage: A Guideline for Healthcare Professionals from the American Heart Association/American Stroke Association. *Stroke* 2012;43:1-39.