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

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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 euvoemia 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

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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
  o 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
  o 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:
  o CI > 2.0
  o CVP 3-10
  o SVV < 13%
• In some instances, it may be reasonable to reduce fluid administration to maintain a euvoletic state

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

References