Management of Aneurysmal Subarachnoid Hemorrhage (SAH)

Making / Confirming the 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.
- To assess severity of SAH, use an accepted grading system (e.g., Hunt and Hess Severity Scale, Fisher Scale, or World Federation of Neurological Surgeons Scale). See scales below.

To make a differential diagnosis or to confirm SAH:
- Obtain further history and physical exam, and/or
- Obtain diagnostic testing:
  - Head CT without contrast
  - Lumbar puncture for analysis of CSF, if head CT negative

If SAH confirmed or any doubt about the diagnosis

Consult Neurosurgery to determine if additional testing necessary, such as:
- Selective cerebral angiography
- Computed tomography angiography (CTA) of the head and neck
- Magnetic resonance imaging (MRI) and/or magnetic resonance angiography (MRA) of the brain

See next page for “Treating the Patient” and “Possible Complications”

Subarachnoid Hemorrhage Grading Scales

A. Hunt and Hess Severity Scale
- Grade 1 – Asymptomatic, mild headache
- Grade 2 – Moderate to severe headache, nuchal rigidity, no focal deficit other than cranial nerve palsy
- Grade 3 – Mild mental status change (drowsy or confused), mild focal neurologic deficit
- Grade 4 – Stupor or moderate to severe hemiparesis
- Grade 5 – Comatose or decerebrate rigidity

B. World Federation of Neurological Surgeons
- Grade 1 – Glasgow Coma Scale 15, no motor deficit
- Grade 2 – Glasgow Coma Scale 13-14, no motor deficit
- Grade 3 – Glasgow Coma Scale 13-14, motor deficit present
- Grade 4 – Glasgow Coma Scale 7-12, motor deficit may be present or absent
- Grade 5 – Glasgow Coma Scale 3-6, motor deficit may be present or absent

C. Fisher Scale (Computed Tomography Appearance)
- Group 1 – No blood
- Group 2 – Diffuse deposits of subarachnoid hemorrhage blood, no clots, no layers of blood > 1 mm
- Group 3 – Local clots or vertical layers or blood ≥ 1 mm thickness
- Group 4 – Diffuse or no subarachnoid hemorrhage, but intracerebral or intraventricular clot
**Treating the patient**

### General Medical Care
- Mechanical VTE prophylaxis is indicated
- Pharmacological VTE prophylaxis is contraindicated until surgical intervention.
  - Note: On post-op day 1, SQ heparin is preferable to LMWH
  - Monitor for heparin-induced thrombocytopenia (HIT)
- Screen for dysphagia prior to any oral intake
- Provide stroke education
- Tobacco cessation information
- Consult Physical Medicine & Rehabilitation, PT, OT and Speech Language Pathology as indicated
- Obtain lab values for Hb A1C and fasting lipids; if elevated, manage appropriately
- Aggressive fever control with goal normothermia

### Medical Care to Prevent Rebleeding after SAH
- **Blood Pressure Control**
  - Manage hypertension appropriately to balance risk of stroke, hypertension-related rebleeding, and maintenance of cerebral perfusion pressure.
  - **Target ranges:**
    - Prior to intervention: SBP < 160 mmHg
    - After intervention: SBP < 220 mmHg (to maintain adequate perfusion and prevent vasospasm)
    - Caution: For coiled aneurysms, SBP must be maintained at < 160 mmHg until thrombosis is formed
  - Avoid use of medications in the management of hypertension that may induce cerebral vasodilatation (including nitroglycerin and nitroprusside).
  - Suitable options include labetalol and nicardipine.
- Bed rest
- Consider aminocaproic acid (Amicar®) when early aneurysm protection is not an option.

### Surgical and Endovascular Methods
- Assess by neurosurgeon before and after surgery as well as endovascular procedures.
- Perform surgical clipping or endovascular coiling to reduce rate of rebleeding.
- Complete obliteration of aneurysm recommended.
- Early versus delayed surgery aneurysm treatment reasonable and probably indicated in the majority of cases.

### Anesthetic Management
- Prior to surgery, discussion should occur with anesthesiologist regarding hemodynamic targets.
- Minimizing the degree and duration of intraoperative hypotension during aneurysm surgery probably indicated.
- Consider use of pharmacological strategies to induce hypertension during temporary vessel occlusion in certain instances.
- Induced hypothermia during surgery may be a reasonable option in some cases but is not routinely recommended.

### Possible complications

#### Cerebral Vasospasm
- Early management begins with treating the ruptured aneurysm, and in most cases, maintaining normal circulating blood volume and avoiding hypovolemia.
- Administer oral nimodipine (Nimotop®) 60 mg q4h while hospitalized to reduce poor outcomes.
- For small vessel vasospasm, consider:
  - volume expansion
  - induction of hypertension (vasopressors)
- For large vessel vasospasm, consider:
  - cerebral angioplasty
  - selective intra-arterial vasodilator
  - volume expansion
  - vasopressors

#### Hydrocephalus
- Use temporary or permanent CSF diversion in symptomatic patients with chronic hydrocephalus after SAH
- Consider ventriculostomy in patients with ventriculomegaly and diminished level of consciousness after acute SAH

#### Seizures
- Routine long-term use of anticonvulsants is not recommended, but may be considered for patients with risk factors such as:
  - prior seizure
  - parenchymal hematoma
  - infarct
  - middle cerebral artery aneurysms
- Unsecured ruptured aneurysm

#### Hyponatremia and Volume Contraction
- Generally avoid administration of large volumes of hypotonic fluids and intravascular volume contraction after SAH.
- Monitoring volume status in certain patients with recent SAH using some combination of central venous pressure, pulmonary artery wedge pressure, fluid balance, and body weight is reasonable, as is treatment of volume contraction with isotonic fluids.
- Use of hypertonic saline* and fludrocortisone acetate is reasonable for preventing and correcting hyponatremia.
- In some instances, consider reducing fluid administration to maintain euvoletic state.
- Target sodium levels are dependent on baseline levels. Do not increase sodium by more than 10-12 mEq/L for the first 24 hours.

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*Formula for hypertonic saline: sodium requirement (mEq) = total body water X (desired serum sodium concentration – current sodium concentration) Where the total body water = weight (kg X factor). Factor = 0.6 in children; 0.6 and 0.5 in nonelderly men and women, respective; and 0.5 and 0.45 in elderly men and women, respectively.
Order Sets

- OSU IP ED: Hemorrhagic Stroke – Confirmed [2972]
- OSU IP ED: Stroke Alert [2265]
- OSU IP NV1: Admission Subarachnoid Hemorrhage [2186]
- OSU IP PMR: Admission Stroke Rehab [2030]
- OSU IP NV1: Stroke Bundle [2473]

References


Quality Measures

- Venous thromboembolism (VTE) prophylaxis
- Dysphagia screening
- Stroke education
- Tobacco cessation
- Assessed for rehabilitation

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