

Practice Guidelines

Acute Stroke Practice Guidelines for Inpatient Management of Subarachnoid Hemorrhage

Policy statement:

OHSU Healthcare has adopted these practice guidelines in order to delineate a consistent, evidenced-based approach to treating the patient who presents with signs and symptoms consistent with acute stroke. Although these guidelines assist in guiding care, responsibility to determine appropriate care for each individual remains with the provider themselves.

Outcomes/ goals	<ol style="list-style-type: none"> 1. Create a multi-disciplinary, evidence-based, approach to the management of acute non-traumatic subarachnoid hemorrhage (SAH) patients. 2. Patient plan of care to take into consideration the entire continuum of care from emergency department through rehabilitation.
Physician	<p>Determine the appropriate unit for admission.</p> <ol style="list-style-type: none"> a. Admission Criteria for Neurosciences ICU <ol style="list-style-type: none"> i. All acute non-traumatic subarachnoid hemorrhage patients (CT or LP positive) will be admitted to the NSICU.
Physician	<p>Complete admission standard work, including appropriate orders, in electronic medical record:</p> <ol style="list-style-type: none"> a. NSICU Admission order set (includes ventilator and sedation/analgesia order sets) b. Admission orders include: CBC, CMP (complete metabolic set), INR/PTT, urine toxicology, and EKG. Activity orders for bedrest until aneurysm secured, or angiography negative for aneurysm. Diet orders, code status, GI and VTE prophylaxis according to standard work. c. Calculate Hunt & Hess Score and WFNS score within 6 hours of arrival (prior to surgical intervention/ invasive intracranial procedures) and document in H&P.
Pharmacy, and RN	<p>Process physician orders according to OHSU policy.</p>

RN	<ol style="list-style-type: none"> 1. Complete admission database and initiate nursing plan of care according to the appropriate OHSU Adult Inpatient Standards of Care. <ol style="list-style-type: none"> a. NPEOC - Adult Critical Care Standard of Care b. NPEOC - Inpatient Adult Acute Care Adult 2. Perform focused neurological assessments based on patient condition and physician orders, every 1-2 hour while in the ICU and every 2-4 hours in acute care. 3. Neurological assessment to include at a minimum: Glasgow Coma Scale (GCS), level of alertness, orientation, pupil reactivity, speech, visual fields, strength based on drift, hand grip, and foot movement. Physician to be notified for any change on exam; notification to be documented. 4. Intracranial pressure (ICP), and partial brain tissue oxygen (PbtO2) to be recorded hourly with EVD clamped, if monitor in place. 5. Provide a quiet, low light, environment for the patient. Strict bed rest until aneurysm secured, (unless interdisciplinary team determines that mobilization and/or assessment can occur prior to securement), less stringent activity restrictions in setting of non-aneurysmal peri-mesencephalic or cortical SAH. 6. Cautious sedation & analgesia, if intubated. In non-intubated patients, analgesia will always include non-opiates, if no contraindications, and opioids only if necessary. 7. Anti-emetics as needed.
Physician	<ol style="list-style-type: none"> 1. Evaluate for loss of airway protection and need for intubation. Intubation recommended for GCS < 8 and patients with deteriorating GCS (i.e. Hunt & Hess Scale 4, 5 and select Hunt & Hess 3). 2. Consider delaying feeding tube insertion until aneurysm is secured to reduce risk of re-bleed caused by coughing.
Physician, RN, and RT	<p>Maintain oxygenation saturation greater than or equal to 93% (PaO2 > 70 mmHg) and adequate ventilation. Avoid prophylactic or prolonged hyperventilation. In intubated patients, use continuous ET/CO2, correlate with ABG reading at least once daily, (goal PaCO2 35-45).</p>

Physician and RN

- a. Until aneurysm is secured, keep mean arterial pressure (MAP) > 70 and systolic blood pressure < 140 in patients with no concern for elevated ICP (Hunt & Hess 1-2); MAP > 80 and SBP < 160 for patients with concern for elevated ICP (Hunt & Hess 3-5) prior to external ventricular drainage (EVD) placement and availability of ICP monitoring. Place arterial line for beat-to-beat blood pressure monitoring.
- b. Use titratable IV agents to achieve blood pressure control (PRN labetalol and hydralazine; use nicardipine continuous infusion if unable to achieve control with PRN agents).
- c. Initiate fluid resuscitation and vasopressors as needed to achieve MAP goals. Consider neurogenic stressed myocardium (NSM) when evaluating hypotension. Obtain urgent TTE if NSM is a concern.
- d. Consider EVD for patients based on neurological status, GCS score < 8 or evidence of neurological deterioration and suspected or proven hydrocephalus.
- e. If EVD placed, ICP goal < 20, surveillance sampling of cerebrospinal fluid (CSF) Su/Th by Neurosurgery (more frequent if clinically indicated).
- f. Measures to prevent increased ICP include: head of bed elevation > 30 degrees, avoiding excessive hip flexion, keeping head in midline position as much as possible, avoiding pressure on neck from endotracheal tube tape, and suctioning only as needed using short acting sedative and/or analgesic.
- g. Isotonic fluids at 1-1.5 mL/kg/hr total fluid intake recommended for maintenance.
- h. Maintain euvolemia. Restrict diuresis to patients exceeding goals of euvolemia, and only if clinical evidence of volume overload that manifests as hypoxia and/or evidence of significant pulmonary edema/heart failure (HF), and always aim for euvolemia.
- i. Cerebral salt wasting (CSW) may necessitate use of hypertonic saline as single bolus or on prn basis consistent with clinical (I/O) euvolemia goals. Consider addition of hypertonic saline and/or fludrocortisone for associated hyponatremia.
- j. Aggressively reverse coagulopathy. For coagulopathy related to pharmacological anticoagulation, see [add link to current OHSU protocol].
- k. For warfarin-associated ICH and INR > 1.4: Refer to current OHSU protocol.
- l. Consider seizure prophylaxis in select patients (associated cortical intraparenchymal hemorrhage (IPH), especially when IPH is temporal; associated subdural hematoma (SDH); and with unclear etiology, or with possibly traumatic SAH) for no greater than 1 week. Recommendation for IV Keppra >> Fosphenytoin as drug for seizure prophylaxis.
- m. In high grade SAH Hunt & Hess 3-5 or in patients with neurologic deterioration not otherwise explained, consider continuous EEG monitoring to rule out non-convulsive status epilepticus (NCSE). If evidence of seizure activity, start anti-epileptic therapy as usual.
- n. Start nimodipine 60 mg po every 4 hours to be given for 21 days, alter regimen to 30 mg po every 2 hours if medication causes hemodynamic instability, hold if patient in clinical vasospasm and unable to tolerate medication secondary to undesired blood pressure drops. 30 mg every 2 hours of oral solution can be given sublingual if patient has no enteral access.
1. CBC: Check Hemoglobin (Hgb) daily, goal Hgb > 9; transfuse to Hgb goal > 10 in setting of symptomatic vasospasm.
2. Na (sodium): Goal of normonatremia unless evidence of increased ICP, significant mass effect, or global cerebral edema.
3. Maintain glucose levels with sliding scale insulin titrated to blood glucose 140-180 mg/dL. Use Insulin infusion if blood glucose > 180 mg/dL.
4. Maintain normothermia. Treat fever by trying to identify source; tailor interventions to possible source (use NSICU normothermia protocol [link to order set])
5. Daily transcranial Doppler (TCD) for vasospasm surveillance while in the ICU.
6. CTA or Conventional angiogram for aneurysm detection.
7. When patients are admitted with SAH due to a ruptured aneurysm the Neurosurgeon and the Interventional Neuroradiologist will collaborate to determine whether definitive surgical aneurysm repair or coil embolization is the superior treatment. If it appears endovascular coiling would be safe and effective, the patient or their surrogate should be given this option.
8. Repeat CTA/ conventional angiogram in 1 week if angio negative for SAH and high clinical suspicion for aneurysmal etiology.

	<p>1. VASOSPASM:</p> <ul style="list-style-type: none"> i. If clinical evidence of symptomatic vasospasm increase MAP with goal titrated to reversal of neurological deficits (MAP 110-130 mgHg). ii. If patient cannot tolerate hypertensive therapy, consider inotropic therapy (dobutamine/ milrinone) with titration to cardiac index (CI). Continuous momonitoring of cardiac output is required for inotropic therapy. iii. Use fluid only to support hypertension. No benefit of hypervolemia per se. Transfuse to Hemoglobin goal > 10. iv. Indications for invasive hemodynamic monitoring (PiCCO): <ul style="list-style-type: none"> 1. Vasospasm and failure of traditional triple-h therapy necessitating inotrope trial. 2. Vasospasm in setting of significantly stunned myocardium (SM). 3. Vasospasm in setting of patient with moderate to severe HF (ejection fraction < 40%). v. Indications for cerebral angiogram (diagnostic/ therapeutic: IA [intra-arterial] vasodilators, balloon angioplasty): <ul style="list-style-type: none"> 1. STAT order/ Emergent (To be performed within 0 – 4 hours): Failure to respond to traditional medical therapy OR complications secondary to institution of triple-h therapy necessitating alternative management (patient with high pre-test probability of vasospasm). 2. Urgent (To be performed the same day or following morning if ordered after hours): Diagnostic in patients in whom etiology of neurological deterioration unclear. 3. Surveillance: at 7 days. <p>2. CEREBRAL SALT WASTING</p> <ul style="list-style-type: none"> vi. Na, K every 6 hours. vii. Fludrocortisone 0.2mg bid, maximal dose 0.2-0.3 mg tid. viii. Hypertonic saline for Na < 135 mmol/dL. ix. Match fluid losses with crystalloids.
RN	<ul style="list-style-type: none"> 1. Changes in patient condition to be reported to the physician in a timely manner. 2. Maintain VAP (Ventilator Associated Pneumonia) precautions per protocol.
RN and Rehabilitation Services	<ul style="list-style-type: none"> 1. Keep head of bed 30-45 degrees, if vented, and not contraindicated. Use reverse trendelenberg position as needed. 2. Bedrest until aneurysm is secured (unless interdisciplinary team determines that mobilization and/or assessment can occur prior to securement), then advance activity as tolerated to promote alertness, active exercise, strength training, and gait training when the interdisciplinary team assesses patient as clinically appropriate for early mobilization. 3. RN to initiate interventions as needed to prevent formation of contractures, subluxation, and minimize edema formation, using bracing/orthotic devices as needed. 4. Consult Rehabilitation Services to provide aphasia treatment, cognitive rehabilitation, delirium management, communication devices, mobility/balance/gait training, spasticity treatment, functional adaptation to visual/spatial neglect, and activities of daily living training. <ul style="list-style-type: none"> a. If patient has returned to prior level of function and does not need rehabilitation services during this hospitalization, this will be documented.
RN, Rehabilitation Services, and Nutrition Services	<ul style="list-style-type: none"> 1. Dysphagia screening, using the Bedside Swallow Screen, to be completed prior to anything by mouth. Initiate Speech Language Therapist consult for formal swallow evaluation, as needed, and when patient able to participate. 2. Place feeding tube within 24 hours of admission if patient unable to swallow to optimize nutrition needs. 3. Nutrition consult, as needed, to maximize nutritional support
Physician and RN	<ul style="list-style-type: none"> 1. Initiate VTE prophylaxis by hospital day 2 with intermittent pneumatic compression (SCD's) in all SAH patients. Initiate chemoprophylaxis per current NSICU recommendations (POD 2 after aneurysm is secured via clip or coil, 12 hours following insertion of extra-ventricular drain). Chemoprophylaxis will be continued throughout ICU stay regardless of patient's mobilization status. Primary Attending may choose to opt out of chemoprophylaxis for individual patients, and this decision must be documented in the medical record. Vascular ultrasound for patients with clinical symptoms of DVT or PE. 2. Initiate peptic ulcer prophylaxis (PUD) per current NSICU recommendations. 3. Review FAST HUG during daily rounds.

RN, Social Worker (MSW), Case Manager, and Physician	<ol style="list-style-type: none"> 1. Provide social and psychological support for the patient and their significant others as needed. 2. Social work will perform a caregiver assessment and assist in creating a plan for respite, when applicable. If a patient is returning to an independent living situation, social work will provide independent living resources. They will screen patients for depression and provide additional evaluation as indicated, and provide patients/family with education and resources with regard to post stroke depression. 3. Case management services to begin upon admission, providing ongoing utilization review. Works with multiple disciplines to determine patient's condition and needs/barriers for discharge. Coordinates discharge planning with patient and family (e.g., inpatient rehab, skilled nursing facility, home health, outpatient rehab, and durable medical equipment).
Multi-disciplinary team	<ol style="list-style-type: none"> 1. Identify patient and family education needs and provide appropriate information and resources found in the stroke education packet. This should include identification of personal modifiable risk factors, such as tobacco cessation, alcohol intake, nutrition, exercise, and blood pressure regulation; warning signs for stroke; activation of EMS; need for follow-up after discharge; and medications prescribed. 2. Document education provided in the Patient Education section of the electronic medical record or LIP documentation in progress notes.

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Related documents:

- [Acute Stroke Practice Standard for the Emergency Department](#)
- [NPEOC - Adult Critical Care Standard of Care](#)
- [NPEOC – Inpatient Adult Acute Care Adult](#)
- [Bedside Swallow Screen Form](#)
- [Anti-Shivering Protocol Form](#)
- [NSG: Aneurysmal Subarachnoid Hemorrhage Orders.](#)
- [NSG: Craniotomy for Aneurysm: ICU post-op Orders](#)

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