Adult Intracerebral Hemorrhage

Prior to making any medical decisions, please view our disclaimer.

Guidelines for Emergency Management of Intracerebral Hemorrhage

Identification of patients with suspected intracranial hemorrhage requires urgent brain imaging. Unenhanced CT is the study of choice given its availability, ease of use and sensitivity to subarachnoid hemorrhage, but MR imaging may contribute to the evaluation and management of suspected brain hemorrhage. Intracranial hemorrhage includes epidural (EDH), subdural (SDH), subarachnoid (SAH), intraventricular (IVH), hemorrhagic transformation of ischemic stroke (HT), venous hemorrhage from cortical vein or sinus thrombosis (CVST), and intracerebral (ICH). For patients with ICH, the following underlying conditions must always be considered: coagulopathy, trauma, vascular lesions, venous thrombosis, aneurysmal rupture and hemorrhagic mass lesions such as tumors.

FUNC Score Calculator

While this is not a part of the MGH Adult Intracerebral Hemorrhage protocol, the FUNC score[1] may be useful to clinicians by providing guidance in clinical decision-making and patient selection for clinical trials.

ICH volume (cc)
Age (yrs)
ICH Location
GCS
Pre-ICH Cognitive Impairment

Calculate FUNC Score

For more informations, see the FUNC Score Calculator page.

The Following Guidelines Apply to Intracerebral Hemorrhage (ICH)

These guidelines should be used only as medical and educational reference tools. They are not intended to be used as a diagnostic decision-making system and must not be used to replace or overrule a physician’s judgment or diagnosis. Application of this information in a particular situation remains the professional responsibility of the practitioner.

The following steps should be considered in parallel rather than in sequence, especially in the stabilization of vital functions and correction of coagulopathy.

A. Assess vital functions. Determine if intubation is required for patient safety during imaging evaluation. If so, consider use of an ultra-short acting neuromuscular blockade or sedative-hypnotics agent to allow for rapid return of motor control and assessment of neurologic deficits. Establish if co-morbid acute myocardial injury is a risk in patients with severely elevated BP.
B. STAT PT/INR, PTT, CBC with platelets, D-dimer, fibrinogen, electrolytes, BUN/Cr, glucose, liver function tests, type and screen to blood bank.
C. Alert neurosurgery. Cerebellar ICH is a neurosurgical emergency. Hematoma evacuation can be considered for patients with lobar ICH who demonstrate progressive clinical deterioration. Patients may also be candidates for intracranial pressure monitoring or emergency external ventricular drain placement.
D. Consider the Differential diagnosis:
   1. Spontaneous ICH (SICH): Unless there is a contraindication to contrast use, such as renal failure or contrast allergy, vascular imaging (typically CT angiography) is usually indicated to assess for underlying aneurysm or vascular malformation. Page the acute stroke team for evaluation for clinical trial eligibility (Beeper 34CVA).
2. If an aneurysm is confirmed, contact neurosurgery immediately and see the subarachnoid hemorrhage protocol.

3. ICH secondary to underlying tumor, AVM cavernous malformation, venous sinus thrombosis: Additional brain imaging is necessary to exclude an underlying lesion. Both contrast CT or contrast MRI may be useful initially and several weeks later once hemorrhage products have begun to be reabsorbed. Digital subtraction angiography can also be useful in certain settings.

4. Hemorrhagic conversion of ischemic infarction (HT): Additional brain imaging with MRI (and DWI if available) may be needed to confirm the underlying ischemic etiology in regions that were not subject to hemorrhagic transformation. Regions of subtle petechial hemorrhage that are not visible on unenhanced CT but easily seen on MR gradient echo susceptibility sequences have an unclear significance with respect to initiation of antithrombotic therapy. If acute ischemic stroke is suspected (onset less than 12 hours), contact acute stroke team immediately (Beeper 34CVA).

E. Measure ICH volume, GCS, NIHSS. Measure volume using ABC/2 method, where A is the greatest hemorrhage diameter by CT, B is the diameter 90 degrees to A and C is the approximate number of CT slices with hemorrhage multiplied by slice thickness in cm.

F. Correct coagulopathy
   - Warfarin
     1. If patient is on warfarin and INR is elevated or if PT is elevated in the absence of warfarin therapy: administer Vitamin K 10 mg IV over 10 minutes (see warfarin reversal notes 3a) followed by Fresh Frozen Plasma 10-20mL/kg (Each unit of FFP contains roughly 200 mL) (see warfarin reversal notes 3b).
     2. Vitamin K and FFP must be dosed STAT and the team must designate a single physician to take personal responsibility for ensuring that these therapies are administered as fast as possible.
        - Vitamin K should be administered within 5 minutes of the order.
        - As soon as FFP is ordered, a "runner" should be dispatched to the blood bank to collect FFP, which should be administered as soon as possible.
     3. Notes on Warfarin reversal:
        a. Intravenous vitamin K is associated with a small risk of severe allergic reaction. When administered intravenously, the rate should not exceed 1mg/minute. Reversal of anticoagulation by any means (vitamin K or FFP) is associated with a risk of thrombosis depending upon the patient's underlying indication for anticoagulation.
        b. FFP should be dosed based on patient weight 10-20mL/kg (usual adult dose is 4-5 units). Dosing at the higher end is often necessary depending upon the initial INR. If FFP is administered without concomitant vitamin K, the effect of FFP will dissipate in 6-8 hours and so FFP should never be used without concomitant vitamin K for ICH. Depending on the clinical condition of the patient judicious administration of diuretics may be indicated.
   - Standard (Unfractionated) Heparin
     1. If initiated within 30 minutes of last heparin dose: Give 1mg protamine per 100U heparin.
     2. If initiated within 30-60 minutes: Give 0.5-0.75 mg protamine per 100U heparin.
     3. If initiated within 60-120 minutes: Give 0.375-0.5mg protamine per 100U heparin.
4. If heparin stopped greater than 120 minutes ago: Give 0.25-0.375 mg protamine per 100U heparin.
5. Give by slow IV injection, not to exceed 5mg/min, with total dose not to exceed 50mg.
6. Monitor for signs of anaphylaxis; the risk is higher in diabetics who have received insulin.

Follow-up therapy
1. STAT PTT q1 hour for the next 4 hours, then q4 hours through 12 hours of hospitalization.
   - Low Molecular Weight Heparin--Protamine sulfate reverses only about 60% of the anti-factor Xa activity of low-molecular-weight heparin, has negligible effects on danaparoid (a mixture of anticoagulant glycosaminoglycans used to treat heparin-induced thrombocytopenia) and fondaparinux (a synthetic antithrombin-binding pentasaccharide with exclusive anti-factor Xa activity).
   - Enoxaparin: 1 mg protamine for each mg of enoxaparin; if PTT prolonged 2-4 hours after first dose, consider additional dose of 0.5 mg for each mg of enoxaparin.
   - Dalteparin or tinzaparin: 1 mg protamine for each 100 anti-Xa IU of dalteparin or tinzaparin; if PTT prolonged 2-4 hours after first dose, consider additional dose of 0.5 mg for each 100 anti-Xa IU of dalteparin or tinzaparin.
2. Direct Thrombin Inhibitors (Argatroban, Lepirudin, Bivalirudin, Ximelagatran): There is no specific antidote for these drugs at this time. Consider antifibrinolytic agents such as Amicar (EACA). Phone consult with the blood bank fellow on call, the acute stroke attending, or hematology.
3. Thrombolytic Agents
   - Consult Neurosurgery for possible intervention.
   - Check STAT labs: CBC, PT, PTT, platelets, fibrinogen and D-dimer.
   - If fibrinogen less than 100 mg/dL, then give Cryoprecipitate 0.15 units/kg rounded to the nearest integer. If still bleeding at 1 hr and fibrinogen level still less than 100 mg/dL, repeat cryoprecipitate dose.
   - Institute frequent neurochecks and therapy of acutely elevated ICP, as needed.
4. Additional Options or considerations
   - If platelet dysfunction suspected, give platelets 4 units.
   - If heparin has been administered in the past 3 hours:
     - Discontinue the heparin infusion and order Protamine sulfate. Calculate total amount of heparin received over the preceding 3 hours.
     - If initiated within 30 minutes of last heparin dose: Give 1mg protamine per 100U heparin.
     - If initiated within 30-60 minutes: Give 0.5-0.75 mg protamine per 100U heparin.
     - If heparin stopped greater than 120 minutes ago: Give 0.25-0.375 mg protamine per 100U heparin.
     - Give by slow IV injection, not to exceed 5mg/min, with total dose not to exceed 50mg.
     - Monitor for signs of anaphylaxis; the risk is higher in diabetics who have received insulin.
     - Follow-up with STAT PTT q1 hour for the next 4 hours, then q4 hours through 12 hours of hospitalization.
   - For uncontrolled, life-threatening bleeding, consider aminocaproic acid (Amicar) 10 g IV in 250 cc NS IV over 1 hr as a last resort. Note there is a significant risk of pathologic thrombosis with Amicar.
   - Systemic hemorrhage should be treated in a similar manner. Manually compress and compressible sites of bleeding, and consult appropriate additional services to consider mechanically occluding arterial or venous sources of medically uncontrollable bleeding.

Platelet disorders
- Antiplatelet agents, such as aspirin: Platelet transfusions are of uncertain benefit but can be considered.
- Thrombocytopenia (platelet count less than 100,000/uL)--Transfuse with platelets until platelet count exceeds 100,000/uL.
- Von Willebrand syndromes: Treat with 0.3 mcg/kg DDAVP given I.V. over 30 minutes. Phone consult with a staff member of hematology or transfusion medicine for dosing of VWF factor concentrate.
- DDAVP may also benefit patients with:
  1. Uremic platelet dysfunction.
  2. Congenital platelet function disorders.
  3. Recent ingestion of combinations of antiplatelet agents such (e.g. ASA and clopidogrel).

G. Blood pressure management
- Blood pressure should be managed according to American Heart Association 2007 Guidelines for the Management of Intracerebral Hemorrhage. All patients who require treatment with continuous intravenous antihypertensive therapy should undergo urgent placement of an intra-arterial catheter for blood pressure monitoring and central venous catheter for central venous pressure monitoring as well
as administration of IV antihypertensive medications. Once a physician determines that a patient requires treatment with IV antihypertensive therapy, he/she must designate an individual who will remain at the bedside and monitor effectiveness of therapy until blood pressure is controlled.

- **Elevated blood pressure (suggested medications in approximate order of preference)**
  - Labetalol: 5-100mg/hr by intermittent bolus doses of 10-40mg or continuous drip (2-8mg/min)
  - Nicardipine: 5 mg/hr increased by 2.5 mg/hr q15 minutes to max 15 mg/hr.
  - Esmolol: 250 mcg/kg as a load; maintenance use, 25-300 mcg/kg/min.
  - Enalapril: 0.625-5mg IV Q6h.
  - Hydralazine: 5-20mg IV Q30min.
  - Nitroprusside: 0.1 - 10 mcg/kg/min.

- The following suggested algorithm is adapted from the AHA 2007 Guidelines for ICH:
  - If SBP is greater than 200 mm Hg or MAP is greater than 150 mm Hg, then consider aggressive reduction of blood pressure with continuous intravenous infusion, with frequent blood pressure monitoring every 5 minutes.
  - If SBP is greater than 180 mm Hg or MAP is greater than 130 mm Hg and there is evidence of or suspicion of elevated ICP, then consider monitoring ICP and reducing blood pressure using intermittent or continuous intravenous medications to keep cerebral perfusion pressure greater than 60 to 80 mm Hg.
  - If SBP is greater than 180 mm Hg or MAP is greater than 130 mm Hg and there is not evidence of or suspicion of elevated ICP, then consider a modest reduction of blood pressure (eg, MAP of 110 mm Hg or target blood pressure of 160/90 mm Hg) using intermittent or continuous intravenous medications to control blood pressure.
  - Any clinical deterioration in association with reduction of BP should prompt reconsideration of ongoing BP management strategy.

- **Hypotension**
  - The etiology of hypotension must be established. Volume replenishment is the first approach. Isotonic saline or colloids can be used and monitored with central venous pressure. If CVP is normal or elevated in the setting of hypotension, then a pulmonary artery catheter should be placed to monitor pulmonary artery pressures. If hypotension persists after correction of volume deficit, continuous infusions of vasopressors should be considered, particularly for low systolic blood pressure such as less than 90 mmHg.
    - Phenylephrine: 2-10 mcg/kg/min.
    - Dopamine: 2-20 mcg/kg/min.
    - Norepinephrine: 0.05-0.2 mcg/kg/min.

- **Glycemic control.** For glucose greater than 140 mg/dl institute insulin therapy either in the form of a sliding scale dose regimen or continuous IV drip.

- **Seizures.** Anti-epileptic therapy should always be used for treatment of known seizures. Brief periods of prophylactic antiepileptic therapy are of uncertain benefit in patients with either lobar or deep hemispheric hemorrhage and can be considered.

- **Temperature—**Maintain temperature less than or equal to 38 degrees using PO/PR acetaminophen 650 mg q6h. In the setting of poor airway control or if temperature remains elevated despite acetaminophen, consider external cooling.

- **Repeat neuro-imaging:** Non-contrast cranial CT scan whenever concern for ongoing hemorrhage or hematoma expansion is raised or in the setting of clinical deterioration.

**References**


**Authoring Information**

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