

Elmhurst Hospital Center
Guidelines for the Management of
Spontaneous Intracerebral Hemorrhage
Revised Tuesday, February 05, 2008

The following is not to delineate a standard of care, but is to be used as a guideline for clinical management. It can be superseded by clinical judgment given the individual patient's circumstances.

Purpose

This protocol provides guidelines for the management of patients with acute intracerebral hemorrhage (ICH). This applies to patients with a diagnosis of primary intracerebral hemorrhage and may not be relevant to patients with other types of intracranial bleeding (i.e., primary SAH, hemorrhagic infarctions, SDH, TBI, etc.)

Diagnosis of ICH

The diagnosis of ICH is based on findings on neuroimaging studies, i.e. CT or MRI. Unenhanced CT is the imaging procedure of choice for initial evaluation of patients with suspected ICH. Further imaging with administration of contrast, MRI and/or angiographic techniques may be indicated depending on the level of suspicion of an underlying condition, i.e. neoplasm, aneurysm, vascular malformation, venous thrombosis, vasculitis, Moyamoya disease, etc.

Initial Management

- Assess vital signs and the “ABCs” (Airway, Breathing, Circulation)
- Notify Neurology (beeper #11500)
- If endotracheal intubation is necessary, consider using ultra-short acting neuromuscular blocking agents and sedative hypnotics. If time allows, premedication to blunt increases in intracranial pressure is advisable.
- STAT Fingerstick Glucose, PT/INR, PTT, CBC, Complete Metabolic Panel, and EKG.
- Consider neurosurgical consultation, especially for any non-trivial cerebellar hemorrhage, lobar ICH (particularly non-dominant) with progressive neurologic deterioration, clinically significant hydrocephalus and/or extensive intraventricular hemorrhage.
- In addition to a detailed neurologic examination, signs of trauma should be carefully sought. History of anticoagulant and/or antithrombotic medication use should be documented.

Correction of Elevated INR

If patient is on Coumadin **and** the INR is elevated (1.5 or above) the following should be administered **as soon as possible**:

**-Vitamin K 10 mg IVPB over 10 minutes
&
-PCC (Bebulin) 20 International Units/kg IVPB over 20 minutes
-If PCC is not available, administer FFP 15 cc/kg IVPB over 90 Minutes, in addition to the vitamin K**

If patient has liver failure **and** the INR is elevated (1.5 or above) the following should be administered **as soon as possible**:

**-Vitamin K 10 mg IVPB over 10 minutes
&
-FFP 15 cc/kg IVPB over 90 Minutes**

Vitamin K

Administer Vitamin K 10 mg IVPB over 10 minutes. Intravenous vitamin K is associated with a small risk of severe allergic reaction; when administered intravenously, the rate should not exceed 1 mg/minute.

Prothrombin-Complex Concentrates (PCC)

PCCs, which consist of the vitamin K dependent coagulation factors (II, VII, IX, and X), normalize the INR more rapidly than FFP, but may be associated with some increased risk of thrombotic complications and are very expensive. They should not be given to patients who are felt to have a dismal prognosis (e.g. comatose with herniation). PCC should only be given at the discretion of the Neurology, Neurosurgery or the ED attending.

PCC should be given after administration of IV Vitamin K. At Elmhurst, our PCC of choice for these patients is ***Bebulin***. This drug does not require approval from Hematology if used for a hemorrhagic stroke patient, but they are available for consultation on dosing guidelines or if any questions arise. PCC is dispensed from the Blood Bank.

Fresh Frozen Plasma (FFP)

FFP 15 ml/kg should be administered over 90 minutes if PCC is unavailable or inappropriate. This volume of FFP may be associated with fluid overload, especially in patients with preexisting heart failure. In these situations, the patient should be treated symptomatically.

Each unit of FFP contains roughly 200 mL. If FFP is to be administered, the blood bank should be called **immediately** and asked to thaw the units; this will take approximately 40 minutes. The FFP should be administered as soon as possible after the diagnosis of coagulopathy. FFP effects dissipate after 6-8 hours, so it should be used with Vitamin K.

Repeat Testing

Patients with anticoagulant related ICH are at high risk for prolonged bleeding and hematoma expansion. Non-contrast cranial CT scans should therefore be repeated at appropriate intervals (approximately every 12 hrs from time of initial CT would be reasonable in most cases) until ICH volume is stable on 2 consecutive CT scans. In addition, CT scanning should be repeated when neurologic deterioration occurs.

The PT/INR can be repeated 10 minutes after the completion of the PCC infusion. An additional dose of PCC 20 IU/kg should be considered if $INR \geq 1.5$.

If FFP was used, repeat PT/INR at 4 hours. If the INR is not <1.5 at 4 hours, administer second dose of Vitamin K 10 mg IVPB and infuse a second dose of FFP (15 ml/kg over 90 minutes.)

The PT/INR should be repeated at regular intervals (a reasonable timing interval would be approximately q4hrs for the first 24 hours; then q6hrs x 36 hours; then as needed). If the INR is still elevated at 8 hours, evaluate the patient for disseminated intravascular coagulation (D-dimer/fibrinogen) and consider a hematology consult.

Correction of Patients on Heparins

Standard (Unfractionated) Heparin

Administer Protamine IVPB slowly over 10 minutes.

Dose selection:

- 1 mg of Protamine sulfate for every 100 Units/hr of heparin if administered within 30 minutes of cessation of heparin infusion.

- 0.75 mg of Protamine sulfate for every 100 Units/hr of heparin if administered between 30 and 60 minutes of cessation of heparin infusion.
- 0.5 mg of Protamine sulfate for every 100 Units/hr of heparin if administered between 60 and 120 minutes of cessation of heparin infusion.

There is a risk of anaphylaxis to Protamine, particularly in diabetic patients who have received insulin.

Attempt to obtain PTT every hour for the next 4 hours, then q4 hours for the next 12 hours of hospitalization, then at least q24 hours over the first 3 days of hospitalization.

Low Molecular Weight Heparins

Protamine sulfate reverses only about 60% of the anti-factor Xa activity of low-molecular-weight heparin. It 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

- Within 8 hours of the last dose of enoxaparin, give 1 mg protamine for each mg of the last dose of enoxaparin.
- If >8 hours since the last dose, give 0.5mg of Protamine for each mg of the last dose of enoxaparin.
- If PTT prolonged 2-4 hours after first dose, consider additional dose of 0.5mg for each mg of the last dose of enoxaparin.

Dalteparin or Tinzaparin

- 1 mg protamine for each 100 anti Xa InternationalUnits of the last dose 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 International Units of the last dose of dalteparin or tinzaparin.

Correction of Platelet Disorders

Thrombocytopenia (Platelet Count <100,000/mcL)

Transfuse with platelets until platelet count exceeds 100,000/uL.

Von Willebrand syndromes

Treat with 0.3 mcg/kg dDAVP given IVPB over 30 minutes. Consult with hematology for the possible use of VWF factor concentrate.

Platelet Dysfunction

dDAVP is also of benefit in patients with uremic platelet dysfunction or congenital platelet dysfunction. Administer 0.3mcg/kg dDAVP given IVPB over 30 minutes.

Aspirin

If aspirin was taken in past 24 hours, can consider administering **dDAVP 0.3 mcg/kg given IVPB over 30 minutes** but there is no outcome data to support its use in this setting.

Clopidogrel (Plavix)

If Plavix has been taken in the past week, can consider administering **dDAVP 0.3 mcg/kg given IVPB over 30 minutes**
&
Platelets 6 units IVPB
but there is no outcome data to support their use in this setting.

Hypertension

The optimal level of a patient's blood pressure should be based on individual factors such as chronic hypertension, increased ICP, age, presumed cause of hemorrhage and interval since onset. In patients with a history of chronic hypertension, BP levels should be maintained below a MAP of 130 mm Hg. Placement of an intra-arterial catheter for blood pressure monitoring may be appropriate for patients who require continuous intravenous anti-hypertension therapy. Patients requiring IV anti-hypertensives should be cared for in a unit capable of close hemodynamic monitoring (Intensive Care Units, CCA, ED Cardiac Room, ED Trauma Room).

Intravenous Medications for Control of Elevated Blood Pressure ¹

Drug	Intravenous Bolus Dose	Continuous Infusion Rate
Labetalol	5 to 20 mg every 15 min	2 mg/min (maximum 300 mg/d)
Nicardipine	NA	5 to 15 mg/h
Esmolol	250 mcg/kg IVP loading dose	25 to 300 mcg/kg/min
Enalapril*	1.25 to 5mg IVP every 6h*	NA
Hydralazine	5 to 20 mg IVP every 30 min	1.5 to 5 mcg/kg /min
Nipride†	NA	0.1 to 10 mcg/kg/min
IVP indicates intravenous push; NA, not applicable		
*Because of the risk of precipitous blood pressure lowering, the first enalapril test dose should be 0.625mg.		
† Nipride should only be used if no other agent is effective due to its potential to raise ICP through cerebral vasodilation.		

- Nicardipine doses should be reduced to 3 mg/hr after achieving desired blood pressure.
- If ICP monitoring is available, attempt to maintain cerebral perfusion pressure >60 mm Hg at all times.
- Any clinical deterioration in association with reduction of BP should prompt reconsideration of ongoing BP management strategy.

Recommended Guidelines for Treating Elevated Blood Pressure¹

1.	If SBP is >200 mm Hg. Then consider aggressive reduction of blood pressure with continuous intravenous infusion, with frequent blood pressure monitoring every 5 minutes.
2.	If SBP is >180 mm Hg or MAP is >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 >60 mm Hg.
3.	If SBP is >180 mm Hg or MAP is >130 mm Hg and there is not evidence of or suspicion of elevated ICP, then consider a modest reduction of blood pressure (e.g. MAP of 110 mm Hg or target blood pressure of 160/90 mm Hg) using intermittent or continuous intravenous medications to control blood pressure, and clinically re-examine the patient every 15 minutes.
SBP indicates systolic blood pressure; MAP indicates mean arterial pressure.	

Hypotension

The etiology of hypotension must be established. Volume replenishment is the first approach. Isotonic saline or colloids can be used; consider monitoring with central venous pressure. If hypotension persists after correction of volume deficit, continuous infusions of vasopressors should be considered, particularly with MAPs < 80. Acceptable choices are:

Norepinephrine	2-30 mcg/min
Phenylephrine	50-180 mcg/min

Patients with negative inotropy as the cause for their hypotension may benefit from:

Dobutamine	5-10 mcg/kg/min
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Patients requiring continuous infusions of pressors or inotropes to maintain their mean arterial pressure may need invasive hemodynamic monitoring to assess fluid status and cardiac output.

Additional Therapies

Glycemic control

For glucose > 140 mg/dl institute insulin therapy (sliding scale or continuous IV drip.)

Temperature

Body temperature should be maintained at normal levels. Acetaminophen 650mg and/or cooling blankets should be used to treat hyperthermia > 38°C. If infection is suspected, appropriate cultures should be obtained and antibiotics administered.

Antiseizure management

- If patient seizes, treat with benzodiazepines for rapid control, and load with phenytoin.
- Seizures in the early period after ICH may be non-convulsive; a high level of awareness for this condition is essential.

DVT prophylaxis

Pneumatic compression devices +/- compressive elastic stockings should be used when the patient reaches the admission floor.

Fluid management

In cases where increased ICP is a concern, hypotonic IV fluids (e.g. D5W, ½.NS, Lactated Ringers) should be avoided. Normal saline at maintenance fluid rates is an acceptable regimen. Boluses of normal saline can be given as necessary, fluid overload can be deleterious.

Head of Bed

The head of the bed should be maintained at least at 30°

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These guidelines are based on:

1. AHA Guidelines for the management of spontaneous Intracerebral hemorrhage (Stroke 2007; 38:2001)
2. Massachusetts General Hospital Stroke Service Guidelines
3. Mount Sinai Department of Emergency Medicine Spontaneous Intracerebral Hemorrhage Guidelines