7/5/12

**UCSD Guidelines for Management of Non-traumatic Intracerebral Hemorrhage**

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**A. Initial Management: call Neurocritical Care attending for admission**

1. *Immediate Assessment*

a. Airway: Evaluate indications for intubation. Intubation recommended for:

-GCS < 8

-Deteriorating GCS

b. Consult neurosurgery for consideration of immediate neurosurgical intervention in:

-cerebellar hemorrhage >3cm w/ 4th ventricle effacement (SOC craniectomy)

-hydrocephalus with neurological deterioration (EVD)

-select lobar ICH >30cc and <1cm from surface. (craniectomy or endoscopic evacuation)

-herniation in select patients (craniectomy)

-select patients for medically refractory ICP

c. Consider ICP monitor/EVD for any of the following:

-GCS <8

-Deteriorating GCS

-IVH with casted 3rd or 4th ventricle

-Hydrocephalus

d. Emergent BP management: TARGET BP <160/90 or MAP <110

-check BP q5min and place arterial line

-if SBP>200 or MAP>150: start **nicardipine 5-15mg/h (preferred),** clevidipine drip 2mg/h, or labetalol drip; titrate quickly to achieve goal.

-if SBP>160 / MAP>130 WITHOUT ELEVATED ICP: use drips or IVP **(labetalol 10mg q 15 min PRN or enalprilat 1.25mg q5min preferred; may also use hydralazine 10mg q15min)**

-IF ELEVATED ICP: use IVP or drip antihypertensives, target CPP>60 (MAP 70-110 if no ICP monitor in place)

e. Emergent Coagulopathy Reversal

-Aggressively reverse coagulopathy to INR goal </= 1.4 using

Fresh Frozen Plasma (FFP) STAT and Vitamin K 10 mg IV/PO q24h x 3 doses (NOT SC); add PCC if INR >2 per UCSD Coagulopathy Reversal Protocol for Spontaneous Intracranial Hemorrhage

-If on dabigatran, rivaroxiban, or apixaban, infuse PCC and FFP per UCSD Coagulopathy Reversal Protocol for Spontaneous Intracranial Hemorrhage

-Consider Factor VIIa (20-80 mcg/kg) in coumadin-associated ICH, ONLY if PCC is unavailable, and with ongoing neurological deterioration/ hematoma expansion with any of the following:

i. failure to respond to FFP and INR>1.4

ii. delayed access to FFP and INR>1.4

iii. spot sign on CTA and INR>4

iv. immediate emergent surgical intervention planned w/ INR>1.4

-Aggressively correct platelet abnormalities with platelet transfusion (6-12 pack) if any of the following:

i. patient is on antiplatelet therapy (including gingko or garlic supplements) AND has positive platelet inhibition assay

ii. platelet count <100,000

-For ICH related to tPA, give platelet transfusion 6u and cryo 4-6u.

-For ICP related to heparin, give protamine dosed by timing/amt heparin

f. Management of mildly elevated ICP <20 (for ICP emergency, see below)

i. increase/optimize analgesia and sedation, ensure normocarbia

ii. 3% saline 250cc bolus (needs central line) intermittently, or continuous

3% infusion 25-150cc/h, check Na/K q4-6h to target Na goal 5 points over baseline sodium, (usual starting target is 145-155)

iii. mannitol 1gm/kg bolus, may repeat as needed q6h. Check osms q6, stop mannitol if osms>340.

g. Management of clinical herniation or ICP emergency (>20 x 3 minutes):

Initiate UCSD Brain Code protocol.

h. Vascular Access

- Place arterial line IMMEDIATELY in any patient with labile blood pressure.

- Pts requiring continuous infusions of antihypertensives or vasopressors may be managed without an arterial line; however, an a-line is preferred.

-Place central line IMMEDIATELY if patient has increased ICP, needs continuous infusions that require central access, or has poor peripheral access. Always place subclavian line UNLESS patient has increased ICP; in that case ONLY place femoral line with patient in reverse Trendelenburg (head up)

2. *Admission orders*

a. Admit to: ICU. First Call: Neurocritical Care

b. Diagnosis: Intracerebral hemorrhage

c. Condition: Fair or Critical

d. Vitals goals:

-SBP < 160 IF NO ELEVATED ICP

-MAP goal >70, SBP <180 IF ELEVATED ICP w/ NO EVD/ICP monitor.

-If patient has EVD/ICP monitor, ICP goal<20; CPP goal>60, SBP<160 (no MAP goal)

-Temperature <38.0.

-02 saturation >/= 95%

-HR, RR as per routine goals

e. Ventilator orders:

-Choose vent mode for patient comfort [AC TV500 (target ~ 8-10cc/kg) PEEP 5 FiO2 40%]

-If concerned for elevated ICP always use AC and target normocarbia—do NOT hyperventilate.

-If using “lung protective ventilation” for ALI/ARDS, permissive hypercarbia *discouraged*.

-Order ETC02 monitor, correlate with ABG, target ETC02 that corresponds to PaC02 35-45 (prevents inadvertent hypercarbia)

. f. Activity order: Strict bedrest.

g. Nursing:

-Neurochecks q1h for pts w/ GCS<8 or patients with expected neurologic deterioration (hydrocephalus, IVH, coagulopathy), q2h for all other pts; MD to be notified for ANY change on exam.

-HOB 30 degrees, head midline, avoid excessive pressure from ETT tape,

suction only as needed using short acting sedative prior to suctioning.

-Foley, strict I/O

-SCD and TED

-Vitals q1h INCLUDING TEMPERATURE

-Normothermia protocol

h. Diet: NPO. Consider NG insertion after 24h (to prevent rebleed from coughing).

i. IV Drip Medications:

-*Antihypertensives*: **nicardipine or clevidipine drip PRN** (tell nurse to start drip if pt needs IVP more than once)

-*Sedation/Analgesia*: If patient is intubated, patient MUST be on sedation.

Titrate to minimal amount to ensure patient comfort. Start fentanyl drip at 25mcg/hr or dexmedetomidine at 0.3mcg/kg/min; titrate to patient comfort. If inadequate, add propofol starting at 20mg/hr, titrate up as needed.

-*Vasopressors*: only initiate if necessary to achieve MAP/CPP that are significantly below goal; may increase risk for rebleed. Phenylephrine > norepinephrine > dopamine vasopressor of choice. In setting of myocardial stun, consider use of dobutamine (may increase ICP).

j. IV fluids: initiate **NS at 1 ml/kg/**h; I/O goal = euvolemia. DO NOT give

1/2NS or fluids containing dextrose.

k. Medications:

Leviteracetam 1000mg IV q12h first dose now ONLY IF witnessed or suspected sz, concern for underlying lesion, planned surgery

GI prophylaxis: lansoprazole or famotidine

Appropriate home meds (especially statins and antihypertensives)

Ondansetron 8mg IV q8h PRN nausea/vomiting

Tylenol 650mg PO/NG/PR PRN fever/pain

Fentanyl 12.5-25mg IV q1h PRN pain if no relief with Tylenol

Labetalol 5-10mg IV q30min PRN SBP>160 , hold for HR <60

Enalprilat 1.25mg IV q5 min PRN SBP>160

Hydralazine 5-20mg IVP q30min PRN SBP>160 ONLY if labetalol/enalprilat

unavailable/contraindicated labetalol does not work

Electrolyte replacements: Mag, K, Ca, Phos

Insulin sliding scale, goal FSBG 140-180

NO SC Heparin until >24h from documented clot stability on serial CT

l. Labs/studies:

-Admission CBC, CMP, PT/INR/PTT, cardiac enzymes q8hx3,

UTox. EKG, CXR, TTE

-Repeat CTH noncon 6-8h after initial CT.

-Ongoing: Na/K q6-8h if ICH is large or may cause problematic edema, INR q4-8h if INR elevated upon admission

m. Code Status: document code status, patient’s medical decisionmaker/ph#. If

patient NOT ALREADY DNR/I prior to hospitalization, POSTPONE

NEW DNR orders until the 2nd full day of hospitalization

**B. Ongoing management**

1. *Workup*

a. CTH sufficient if pt is >45 yo AND has h/o HTN AND SBP>160 on admit AND ICH is in basal ganglia or thalamus.

b. Consider additional MRI, CTA, or conventional angiogram for patients <45 or not meeting above criteria

2. *Vitals*: after 24h, target BP <140/90 if no evidence of increased ICP.

3. *EVD management*: routine CSF surveillance sampling not indicated unless concern for CNS infection (fevers, neurological deterioration)

4. *Antiepileptics*: If pt has had a seizure, continue antiepileptic at least through ICU discharge. If no actual seizure and pt was started on AED for being “high risk” for seizure, discontinue AED after 1 week.

5. *DVT prophylaxis*: 24h after documented hematoma stability on 2 serial CT scans, initiate pharmacological ppx w/ Heparin SQ 5000 q8h or Lovenox 40qd; in patients <60kg heparin 5000 q12h. Hold 12h prior to and 24h after EVD insertion/removal, shunt, craniotomy, or any other surgical procedure. Consder checking Xa levels in patients that are above or under normal weight.

6. *Temperature control*: AGGRESSIVELY maintain normothermia (core temp <38.0)

using Tylenol, cooling blankets, ice packs. Aggressively control shivering as per normothermia protocol. If failure to achieve temperature goal within 2 hrs initiate Arctic Sun protocol.

7. *Lab goals*:

a. Sodium: Normonatremia unless evidence of elevated ICP/mass

effect/cerebral edema.

b. Phenytoin: If phenytoin used, check daily total (goal 10-20) and free levels

(goal 1.0-2.0).

c. INR: </= 1.3

d. Platelets: >100,000

e. Glycemic control: maintain glucose <180 mg/dL w/ sliding scale insulin.

Use insulin drip if blood glucose > 200 mg/dL for two consecutive checks.

8. *Multimodality monitoring:*

a. Continuous EEG: in GCS<8, perform 24- 48h continuous EEG monitoring to rule out non-convulsive status epilepticus.

9. *Physical therapy*: get patient mobilized as soon as pt is stable

10. *Occupational therapy*: obtain consult as soon as possible for splinting/orthotics

11. *Speech therapy*: Bedside Swallow Screen prior to anything by mouth. Obtain ST consult

for formal swallow evaluation as needed.

12. *Nutrition*: place NGT after 24h w/ TF if pt cannot eat

13. *Tracheostomy/PEG*: early, as indicated

14. *Dispo:* social work/case management as needed

15. *Stroke education*: provide to patient and/ or family prior to discharge.

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