Intracerebral Hemorrhage

Mayo Clinic – Flagler Stroke Outreach Education day
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Intracerebral Hemorrhage

Suspicion of Intracerebral Hemorrhage

Adequate Airway

No

RSI

Yes

Non-Contrast Head CT

No ICH

IS, Coma, or Other Appropriate ENLS Protocol

ICH

Brief Medical and Medicine History

BP Control 140-180 mm Hg Systolic

Hemostasis

Consider Surgery

Consider EVD

Characterize ICH

- ICH Score
- Volume
- Location

Transfer

Plan to communicate transfer to NCCU or capable care site

INR < 1.4
- Reverse anti-coagulants
- Consider platelets or DDAVP if surgery planned

Life-threatening deterioration
- Cerebellar > 3 cm diameter

Suspected ↑ ICP and
- GCS < 9
- Goal ICP < 22 mm Hg
- Goal CPP > 60 mm Hg

Intracerebral Hemorrhage

Objectives

• Perform a rapid neurological assessment on a patient
• Calculate the ICH score
• Recognize hydrocephalus
• Manage the patient's airway and decide if assisted ventilation is necessary
• Reverse coagulopathy if appropriate
Intracerebral Hemorrhage - ICH

Definition:
spontaneous non-traumatic bleeding into the parenchyma of the brain

Frequent causes:
Chronic hypertension (~60% of cases)
Cerebral Amyloid Angiopathy (CAA)
Antithrombotic associated (warfarin, antiplatelet meds)
Vascular Anomalies (AVM, cavernous malformation)
Sympathomimetic drugs (cocaine, methamphetamine)
# Checklist in Emergency Department

- Complete blood count with platelet count, PT, PTT, INR
- Head imaging results: hematoma size, location, presence of intraventricular hemorrhage
- Glasgow Coma Scale (GCS) score
- Calculate ICH Score

## Interventions

- Coagulopathy reversal (goal INR < 1.4)
- Blood pressure lowering (goal SBP 140-180)
- Surgical hematoma evacuation (if indicated)
- Airway/ventilation management
Right basal ganglia ICH with intraventricular hemorrhage (IVH)
ICH – The Golden Hour

• What Can Go Wrong (or Is Going Wrong)?
  • Herniation and brain(stem) compression
  • Airway compromise
  • Hematoma expansion
  • Elevated intracranial pressure
  • Secondary brain injury
    • Seizures
    • Fever
    • Hyperglycemia
ICH – Focus in the Golden Hour

1. Stabilization and reassessment of the patient’s airway, breathing, circulation
2. Rapid and accurate diagnosis using neuroimaging
3. Concise clinical assessment regarding ICH characteristics and patient condition
4. Targeted assessment for potential early interventions:
   - Control of elevated blood pressure
   - Correction of coagulopathy
   - Need for early surgical intervention
5. Anticipation of specific patient care needs such as:
   - Specific treatment related to underlying ICH cause
   - Risk for early clinical deterioration and hematoma expansion
   - Need for intracranial pressure (ICP) or other monitoring
   - Patient disposition from the emergency department
ICH – Case 1

88 y/o man with hypertension, atrial fibrillation, pacemaker, and moderate dementia

Witnessed onset of garbled speech and mild right sided weakness at 06:20 AM

EMS ➔ stroke center, arrival 07:00 AM

Glasgow Coma Scale score 12 (E3, V4, M5)

BP 190/80 mmHg, HR 60 with pacemaker
Focus should be on:

• Important medical hx
  • Hypertension
  • Atrial fibrillation
  • Pacer history
• Medications
  • Antiplatelets ?
  • Anticoagulants ?
• Social History
  • drugs of abuse
  • tobacco use

His family states he is taking dabigatran
Blood Pressure Control

Keep SBP 140-180 mmHg (ATACH II, and INTERACT II trials)

Basic principles of control:
- Rapid correction
- Titratable agents

Our patient is not in goal at 190/80 mmHg

Labetalol pushes prn
Nicardipine drip
Avoid nitroprusside
Hemostasis

- INR < 1.4
- Reverse anticoagulants
- Consider platelets or DDAVP if surgery planned

Dabigatran? INR not a good tool
## Warfarin Coagulopathy Reversal

- Vitamin K 10 mg IV
- Options include FFP or PCC
  - Most recent guidelines recommend weight-based dosing of PCC when available
  - The PCC dose is adjusted based on the INR

<table>
<thead>
<tr>
<th>INR</th>
<th>4-factor PCC dose</th>
<th>Max dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-3.9</td>
<td>25 units/kg</td>
<td>2500 units</td>
</tr>
<tr>
<td>4-6</td>
<td>35 units/kg</td>
<td>3500 units</td>
</tr>
<tr>
<td>&gt;6</td>
<td>50 units/kg</td>
<td>5000 units</td>
</tr>
</tbody>
</table>
## Other Coagulopathy Reversal

<table>
<thead>
<tr>
<th>MEDS</th>
<th>REVERSAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>UFH</td>
<td>Protamines</td>
</tr>
<tr>
<td>Antiplatelets</td>
<td>Consider DDAVP (0.4 mg/kg)</td>
</tr>
<tr>
<td></td>
<td>Platelets <strong>NOT</strong> recommend unless undergoing neurosurgical procedure</td>
</tr>
</tbody>
</table>

### Factor Xa inhibitors
- **Rivaroxaban**
- **Apixaban**
- **LMWH**

- FFP and vitamin K are not effective
- Andexanet antidote for rivaroxaban and apixaban
- Consider activated charcoal (50 gm) if last oral dose was within 2 hours for other DOACs with either FEIBA or 4-factor PCC 30 IU/kg
- Protamine for LMWH given < 8 hrs for partial rev.

### Direct Thrombin Inhibitors
- New antidote for Dabigatran (idarucizumab*), emergent dialysis, consider rVIIa 80μg/kg or

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*Pollack et al. NEJM 2015; 373:511-20*
## Role of NeuroSurgery

### Consider Surgery

- Life-threatening deterioration
- Cerebellar
  - > 3 cm diameter

### Location | Surgery urgently:
--- | ---
Cerebellum | • Declining neuro exam  
  • Size > 3 cm, or  
  • Compressive effects brainstem, or  
  • hydrocephalus

Lobar | ICH causing mass effect/herniation in severely affected but salvageable patient and as a life-saving measure
Consider EVD

- ICP may be elevated

- Patients with IVH are at risk for hydrocephalus and elevated ICP

**EVD recommended in:**
- GCS < 9
- Large mass effect
- Hydrocephalus
Supratentorial origin
L temporal lobe
Mild IVH

Volume = \( \frac{ABC}{2} \)

\( A = \) largest diameter = 4.2 cm
\( B = \) perpendicular = 2.8 cm
\( C = \) clot thickness = 2.5 cm

\[ \text{Volume} = \frac{(4.2 \times 2.8 \times 2.5)}{2} = 14.7 \text{ cc} \]
Spot Sign

Contrast Extravasation
## Case 1 - ICH Score

<table>
<thead>
<tr>
<th>Component</th>
<th>ICH Score Points</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GCS Score</strong></td>
<td></td>
</tr>
<tr>
<td>3-4</td>
<td>2</td>
</tr>
<tr>
<td>5-12</td>
<td>1</td>
</tr>
<tr>
<td>13-15</td>
<td>0</td>
</tr>
<tr>
<td><strong>ICH Volume (cc)</strong></td>
<td></td>
</tr>
<tr>
<td>≥ 30</td>
<td>1</td>
</tr>
<tr>
<td>&lt; 30</td>
<td>0</td>
</tr>
<tr>
<td><strong>Intraventricular Hemorrhage</strong></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>1</td>
</tr>
<tr>
<td>No</td>
<td>0</td>
</tr>
<tr>
<td><strong>Infratentorial Origin</strong></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>1</td>
</tr>
<tr>
<td>No</td>
<td>0</td>
</tr>
<tr>
<td><strong>Age (years)</strong></td>
<td></td>
</tr>
<tr>
<td>≥ 80</td>
<td>1</td>
</tr>
<tr>
<td>&lt; 80</td>
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<tr>
<td><strong>Total ICH Score</strong></td>
<td></td>
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<tr>
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Each point increase in the ICH Score is associated with an increased risk of mortality and a decreased likelihood of good functional outcome.

It should not be used for prognosis; use it as a method for communicating disease severity.
ICH – Case 1

Handoff Checklist Suggestions

☐ Age, sex, pertinent comorbid
☐ GCS
☐ Hematoma volume and location
☐ Other CT findings (intraventricular hemorrhage, hydrocephalus, spot sign)
☐ ICH Score
☐ Airway status
☐ Blood Pressure, target, and treatment initiated
☐ Coagulation parameters (INR, PT, PTT, platelet count) and reversal treatment
☐ Plan for surgery or not, observation
ICH – Case 2

- 65 y/o woman with no medical history had sudden headache, vomiting, and slurred speech at 2:30 PM
- She told the paramedics that she doesn’t go to doctors and doesn’t take medicines
- GCS 15 in the field
- On ED arrival
  - BP 235/120 mmHg
  - GCS 10 (E2, V3, M5)
Right Cerebellar Hemorrhage
Deteriorating or obtunded due to cerebellar hematoma = indication for emergent hematoma evacuation.

INR 1.1
Plts 238,000
No meds to reverse

BP 235/120
Give Labetalol & start Nicardipine

INR < 1.4
Reverse anticoagulants
Consider platelets or DDAVP if surgery planned

BP Control 140-180 mm Hg Systolic

Hemostasis

Consider Surgery

Life-threatening deterioration
Cerebellar hematoma > 3 cm diameter
Infratentorial origin,
R cerebellar hemorrhage

A = 2.8 cm
B = 2.6 cm
C = 3.0 cm
[0.5 cm slices x 6 slices (5 full + 2 half)]

\[
\frac{ABC}{2} = \frac{(2.8 \times 2.6 \times 3.0)}{2} = 10.9\text{cc}
\]

No IVH
No contrast extravasation
GCS now 6
**Case 2 - ICH Score**

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Hemphill, Stroke 2001
### Checklist for the 1st hour

- Complete blood count with platelet count, PT, PTT, INR
- Head imaging results: hematoma size, location, presence of intraventricular hemorrhage
- Glasgow Coma Scale (GCS) score
- Calculate ICH Score

### Interventions

- Coagulopathy reversal (goal INR < 1.4)
- Blood pressure lowering (goal SBP 140-180)
- Surgical hematoma evacuation (if indicated)
- Airway/ventilation management

### Communication

- Age
- GCS
- Hematoma volume and location
- Other CT findings (intraventricular hemorrhage, hydrocephalus, spot sign)
- ICH Score
- Airway status
- Blood Pressure, target, and treatment initiated
- Coagulation parameters (INR, PT, PTT, platelet count) and reversal treatment
- Plan for surgery
Questions?