The ED Management of Pediatric Intracerebral Hemorrhage Patients

Edward Sloan, MD, MPH
Professor
Department of Emergency Medicine
University of Illinois College of Medicine
Chicago, IL

Global Objectives
• Improve outcome in pediatric stroke & ICH
• Know how to Rx pediatric ICH patients
• Understand current guidelines
• Be aware of future therapies
• Improve Emergency Medicine practice

Session Objectives
• Review peds stroke epidemiology, etiology
• Examine adult ICH patient ED Rx
• Discuss the relevant treatment issues
• Explore pediatric ICH ED Rx
• Discuss NIHSS & ED documentation
• Consider articles that might change EM practice both in adults and children

Pediatric Stroke and ICH: Epidemiology, Etiology and ED Presentation
**Pediatric Stroke Epidemiology**

- **Children to age 19:**
  - Incidence rate: 2.3/100,000
  - 1.2 ischemic, 1.1 hemorrhagic (ICH 2x > SAH)
  - Greatest risk up to one year of age
- **Young adults age 20-45:**
  - Incidence rate: 23/100,000
  - 10 ischemic, 13 hemorrhagic
- **Males, minorities at greater risk**

**Pediatric Stroke Etiology**

- **Hemorrhagic strokes:** AVMs, arterial aneurysms, stimulants and hematological conditions
- **Ischemic strokes:** hematological (sickle cell disease), vasculitides, metabolic and genetic conditions
- **Al-Jarallah:** ICH, 68 non-trauma pediatric pts:
  - Over 90% had some risk factor for ICH
  - 43% with a congenital vascular abnormality
  - 32% with a coagulation disorder
  - 13% with a CNS tumor.

**Pediatric Stroke Outcomes**

- Recent overall in-hospital mortality: 16.5%
- Mortality: SAH 75%, ICH 54%, ischemic 19%
- Blacks, males higher mortality risk
- Greatest risk seen in age < one year pts
- Mortality rate down by 58% over 20 years
- **ICH:** 50% have residual impairment
- Quality of life diminished in hemophilia, ICH

**Pediatric Stroke ED Presentation**

- **68 ICH pediatric patients**
  - Headache and vomiting in 59%
  - Seizures in 37%
  - Hemiparesis in 16%
  - Irritability in 9%
  - Coma in only 3% of patients

- **Model 99% accurate in excluding ICH**

**Stroke Type Prediction**

- 540 adult patients, 18% hemorrhagic
- Hemorrhagic stroke: onset during physical activity, headache onset within 2 hours, AMS, meningismus, increased SBP
- Ischemia stroke: history of obesity, peripheral arterial disease, TIA history, and the presence of hemiparesis
- Model 99% accurate in excluding ICH

**Intracerebral Hemorrhage: Pathophysiology**
ICH Volume and Outcome

- Broderick: 1993 Stroke
- Key Concept: Hemorrhage volume and GCS predict 30 day mortality
- Data: 60 cc blood, GCS < 9, mort 91%
- Data: 30 cc blood, GCS > 8, mort 19%
- Implications: Simple ED observations allow for a reasonable outcome assessment

ICH Hemorrhage Growth

- Brott: 1997 Stroke
- Key Concept: ICH volume is dynamic, changes correlate clinically
- Data: 1 hr: 26% had 1/3 growth
- Data: 20 hr: another 12% had 33% growth
- Data: 1/3 growth = drop in NIHSS, GCS
- Implications: Efforts directed at stabilizing hemorrhage volume may impact patient outcome

The ED Management of Intracerebral Hemorrhage
ICH Treatment Guidelines

- ASA Council: 1999 Stroke
- Key Concept: ICH guidelines exist
- Data: Detailed data on disease, epi
- Data: Specific recs on BP, ICP Rx
- Implications: This article will enhance the understanding of any EM physician on acute ICH patient management, make care consistent

ICH Overview

- Emesis, AMS, HTN
- CT is the test of choice
- Angiography if surgery is indicated
- No angiography if surgery not clinically indicated or if no likely surgical lesion
- Timing of angiography can be variable

ICH & MRI

- MRI and MRA may replace angiography
- Indications becoming better known
- Example: If angiography negative, but surgery is still a consideration
- Type, location of bleed may also suggest surgical lesion and desire to further test with MRI, MRA

ICH & BP Management

- Remember: only 4 studies on acute Rx!
- Be aggressive, treat elevated BP
- Caveat: No clear relationship between BP Rx and hemorrhage volume, outcome
- More recent data may more clearly show benefits of aggressive BP Rx

ICH & BP Management

- 230/140: go directly to nitroprusside
- Marked elevations: labetalol, esmolol, analpril or other titratable medications
- Maintaining MAP at an elevated level key
- Normal MAP in older HTN pt may be 110
- 230/140: MAP of 170
- May wish to treat to MAP of 120-130
ICH & ICP Management

- Elevated ICP: > 20 mm Hg
- CPP = MAP – ICP (110 - 10 = 100 mm Hg)
- Need to maintain CPP > 70 mm Hg
- If SBP < 90, ICP > 20, CPP less than 70
- Fluids boluses to maintain adequate BP
- Careful SBP Rx if the pt is hypertensive

ICH & ICP Management

- Head of bed elevation
- Mannitol: 0.5 g/kg every four hours
- Steroids: Not clinically indicated
- pCO2: 30-35, constant TV 12-14 ml/kg
- Adjust pCO2 by changing RR on vent
- In TBI, only useful with pt deterioration
- Benzos, paralysis to avoid ICP spikes
- Euvolemia; Avoid fever, seizures

ICH: Surgical Concepts

- Remember: Only 4 clinical trials!
- Total of 353 patients studied in all
- Remove clot, reduce pressure
- Manage brain trauma and edema
- Minimize trauma (superficial clots best)
- Minimally invasive approaches now used
- 75-100% mortality in surgical ICH trials

ICH: Surgical Indications

- Hard to specify...however...
- Cerebellar hemorrhage: 3 cm or larger or those that cause mass effect, compression
- ICH related to a surgical lesion
- Young patients who deteriorate
- Other indications less clear

STITCH ICH Surgical Trial

- Mendelow: 2005 Lancet
- Key Concept: Surgery within 24 hours does not affect 6 month outcome
- Data: 25% of pts had a good outcome
- Data: Surgery did not change this rate
- Implications: ED Rx becomes more important, given lower likelihood of operative neurosurgical intervention
STITCH ICH Surgical Trial

- Mendelow: 2005 Lancet
- 1033 pts, non-US settings
- Data: early surgery vs. medical, surgical
- Data: Hemorrhage volume: 40 cc
- Data: 81% had GCS 9-15
- Data: Surgical time: 30 hrs, 60 hrs
- Data: Only 16% had surgery < 12 hrs

STITCH ICH Surgical Trial

- Mendelow: 2005 Lancet
- Key concept: This study may not exactly tell the story of US practice
- May still need to consider operative intervention, will need to stabilize patients first

The ED Management of Intracerebral Hemorrhage: Implications in Peds Patients

Cardiopulmonary, Physiologic

- Maintain adequate oxygenation
- Hypotension rare: Rx fluids, pressors
- Treat hyperthermia
- Treat hyper and hypoglycemia
- Prophylaxis, Rx seizures in ICH
- Nimodipine in SAH
- Reverse coagulopathies
- tPA not studied in children

Antihypertensive Rx

- Hypertension rare etiology of peds stroke
- Rx elevated BP as in adults, titratable Rx
- Rx BP aggressively with aortic dissection and in setting of encephalopathy
Elevated ICP Rx

- Bolus mannitol in setting of neurological deterioration presumed due to ICP
- Also Rx with mild hyperventilation pCO2 30-35 mm Hg when neurological deterioration observed and ICP implicated
- Prophylaxis with these Rx NOT indicated
- Caution: hyperosmolarity, renal failure

NIHSS & ED Pediatric Stroke Patient Documentation

Four Main NIHSS Areas

- CN/Visual: Facial palsy, gaze palsy, visual field deficit
- Unilateral motor: Hemiparesis
- LOC: Depressed LOC, poor responsiveness
- Language: Aphasia, dysarthria, neglect
- 28 total points

NIHSS ED Estimate

- CN (visual): 8
- Unilateral motor: 8
- LOC: 8
- Language/Neglect: 8
- Mild: 2, Moderate: 4, Severe: 8
- +/- Incorporates other elements

Case NIHSS Estimate

- CN/Visual: R vision loss, no fixed gaze 4
- Unilateral motor: hemiparesis 8
- LOC: mild decreased LOC 2
- Language: speech def, neglect 4
- Approx 18 points total
- Severe stroke range, worse if MS impaired

Patient Neuro Exam

- CN: R mouth droop, no lid weakness
- Motor: R upper and lower ext weakness
- Sensory: ?? Light touch dec R
- Reflex: No pathological reflexes
  - Normal corneals
  - Normal gag reflex
**Patient Neuro Exam**

- Cerebellar: Slight truncal ataxia, to R
- Visual/Neglect: ?? Lost vision & neglect, R
- Language: Dysarthria, expressive aphasia  
  No receptive aphasia
- LOC: Slightly somnolent, responds to verbal stimuli, GCS=14
- Approximate NIHSS: 8

**CT Documentation**

- ICH: L parietal area 5 cm diameter
- No skull fracture evident
- No subdural or epidural
- No mass effect or midline shift
- No ventricular extension
- No hydrocephalus

**ICH Patient Management**

- Airway patent, urgent intubation NCI
- CT findings: parietal ICH, no SAH
- HTN noted. Labetalol Rx to MAP= 120
- No deterioration or acute ICP Rx
- Fosphenytoin given
- Pt stable, critical family aware
- Neurosurgery to evaluate pt, CT
- Surgical Rx prn

**Diagnoses**

- AMS, near syncope
- Intracerebral Hemorrhage
- HTN
- Critical care time 35 minutes

**ED Pediatric ICH Patients: Journal Club**
FVIIa in Warfarin-Related ICH

- Key Concept: Warfarin-related ICH can be treated successfully with rec FVIIa
- Data: 62 micrograms/kg Factor VIIa
- Data: INR decreased from 2.7 to 1.1
- Implications: This therapy used today as an adjunct to blood therapies in ICH patients whose bleed is INR-related

Rec FVIIa Safety in ICH

- Mayer: 2005 Stroke
- Key Concept: FVIIa is safe when given within 3 hours of presentation
- Data: 36 patients, 6 doses tested
- Data: No safety issues preclude phase III
- Implications: Larger study is justified, given data on hemorrhage volume growth and outcome

Rec FVIIa Safety in ICH

- Mayer: 2005 Stroke
- Key Concept: Careful with thromboembolic events
- Data: 2 Significant AEs
- Data: DVT at 72 hours, Angina at 29 days
- Implications: Careful pt selection may allow for minimal complications to occur
**FVIIa Safety, Efficacy in ICH**

- Mayer: 2005 NEJM
- Key Concept: FVIIa is safe when given within 3 hours of presentation
- Data: 399 pts, 3 doses, ICH growth, 90-day
- Data: Less ICH growth, improved outcome
- Data: Thromboembolic events noted
- Implications: Larger study is critical in order to establish clear benefit, safety

---

**FVIIa Safety, Efficacy in ICH**

- Mayer: 2005 NEJM
- Key Concept: Optimal patient population
- Data: GCS 14, NIHSS 12-15
- Data: 24 cc hemorrhage volume
- Data: 180 minutes to treatment
- Implications: Good population for surgical Rx, fits with ED paradigm of stabilization
- Role in larger population of ICH pts?

---

**FVIIa in ICH: Commentary**

- Brown: 2005 NEJM
- Key Concept: Editorial provides perspective on Mayer study
- Data: How should data be interpreted?
- Data: What can be learned from study?
- Implications: What are the implications of this study? What do we do now?
NINDS ICH Research Agenda

- NINDS Workshop: 2005 Stroke
- Key Concept: Fundamental questions Re: ICH treatment and research
- Data: Critical medical, surgical issues
- Data: Extensive info regarding acute Rx
- Implications: Although much theoretical info, an important source of facts that will enhance current clinical practice

Key Learning Points

- ICH is a dynamic process, volume key
- Outcome related to volume, mental status
- Guidelines exist that drive clinical practice
- Pediatric ED Rx derived from adult Rx
- Future research with FVIIa critical
- Research priorities based on clinical need
- Pt outcome and EM practice can be enhanced in adults & children

Questions??

www.ferne.org
ferne@ferne.org
Edward P. Sloan, MD, MPH
edsloan@uic.edu
312 413 7490