Overview of Abusive Head Trauma: What Everyone Needs to Know

11th Annual Keeping Children Safe Conference
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Plan for this talk:

• Terminology
• What’s in a name?
• The injuries
• Medical evaluation
Cranial Anatomy – knowing the layers

- Scalp
- Galea
- Skull
- Dura mater
- Arachnoid membrane
- Pia mater
The Layers

- scalp
- galea
- skull
- dura
- arachnoid

brain
Where is the blood?

- subscalpular
- subgaleal
- epidural
- subdural
- subarachnoid
- intraparenchymal
Subgaleal hematoma
Epidural hematoma
Subdural hematoma
Intraparenchymal bleeding
Case BC

- 13-month-old female
- Healthy child, developing normally
- 2-yo step sib may have jumped on her
- She had a seizure and vomited
- Step-mom calls 911
- On exam, unconscious and covered with bruises
Case BC

- CT: acute subdural hematoma
- No fractures, massive retinal hemorrhages
- Hospital course: development of massive irreversible cerebral edema and was declared brain dead less than 48 hours after admission
- Investigation: lots of bruises since stepmom around, history changed multiple times, visitor to home reports child was fine
- Step-mom charged with and convicted of murder
ABUSIVE HEAD TRAUMA
“Shaken Baby Syndrome”

• First used in a 1984 article by Ludwig and Warman
• Other terms: Whiplash Shaken Infant Syndrome, Inflicted Traumatic Brain Injury
• SBS is a *subset* of Abusive Head Trauma
  – Contact injury alone
  – Crush injury
• Excellent public recognition, and very useful for prevention programs
“SBS” terminology problems

• Accuracy of the term itself
• Inaccurate application to cases
• Inappropriate focus on a specific mechanism of injury rather than abuse itself
• Legal challenges about the term distract from:
  – perpetrator accountability
  – safety of the victim
Terminology change

AHT as the preferred terminology for inflicted injury to the head and its contents – a more inclusive, less specific label than Shaken Baby Syndrome
Epidemiology

• Incidence: 16-34 cases per 100,000 infants per year
  – Type I diabetes: 4-9/100,000
  – Bacterial meningitis (2-23mo): 7/100,000

• Slight male predominance

• Mostly infants
  – 1-9 months
  – Can be older or adult

• Perpetrators: fathers, mother’s boyfriends, female babysitters, mothers, stepfathers
"I shook him for more than 2 months, several times a week at arm’s length."

"I was feeling really bad; I was at the end of my rope from not sleeping. I shook him several times a week, I don’t know exactly, always at night."

"I took her by the shoulders; I shook her and I yelled."

"I was holding my daughter under the arms, and I shook her. Her head wasn’t being held and was snapping back and forth."

"I thought I might have dislocated his shoulder when I shook him."

"I didn’t want to choke him, but I wanted him to stop crying. I picked him up and I shook him; I threw him on the bed and he bounced on the sheet."

"He was crying; it drove me crazy. I shook him... maybe 10 times, and threw him on the sofa."

"Once or twice I’ve held him at arm’s length and shaken him; I’ve blown a fuse; over more than a month I’ve shaken him several times."

"I had fits of anger. She would cry; sometimes, when she did that, I’d shake her... I got worked up and twisted her arm; I was slapping her hard for more than 2 months."

"I hold him up in front of my face; I swing him back and forth; I’m not holding his head... because I’m exasperated; my movements are sometimes rough."
The Injuries

- Subdural hemorrhage/hematoma
- Brain injury
- Retinal hemorrhages
- Non-intracranial injuries:
  - Skin, including scalp
  - Fractures
- EXTERNAL SIGNS NOT NECESSARY
Subdural hemorrhage

- Often the first clue to AHT
- Best seen by CT or MRI – not head ultrasound
- Convexity and/or interhemispheric
- From tearing of bridging vessels
- May be unilateral
- May appear to be different ages
Acute on chronic subdural
Acute subdural
Subdural hemorrhage

- Rarely space-occupying in abuse, but may be
- Can be seen in accidental injuries!
  - Often small, directly under a skull fracture
- Can be a result of birth
  - Should be gone by ~1 month
  - Should be posterior
- In abuse cases, the SDH is a marker for the more serious brain injury
Brain injury

• Often difficult to tell from CT – unless brain swelling present early
• MRI is better for picking up brain injury
• Neurologic symptoms are often the indicator of the brain injury:
  – high-pitched cry, extreme irritability, altered level or loss of consciousness, seizures, coma
Brain injury

• Brain injury may be worsened by:
  – Lack of oxygen due to poor breathing
  – Ongoing seizures
  – Secondary metabolic cascades
  – Loss of blood flow due to swelling

• It’s the BRAIN INJURY that causes disability and/or death
Retinal hemorrhages

• Present in up to 85% of children who have suffered AHT
• May be unilateral
• Not all RH are the same, and RH don’t automatically indicate abuse
  – Birth – almost all gone by 3 weeks
  – Accidental traumas, medical conditions
Retinal hemorrhages

- Multiple, multilayered, extending to the periphery (ora serrata) – highly associated with AHT
- Retinoschisis – only associated with AHT
- Due to vitreoretinal traction (most likely)
- Terson Syndrome – an adult diagnosis
NOT a retinal hemorrhage
Retinoschisis
Additional injuries

• Skin findings: bruises, lacerations
• Fractures:
  – Skull
  – Long-bone, including classic metaphyseal lesions
  – Ribs
• Cervical ligamentous injury
THE MEDICAL EVALUATION
The purpose of a thorough medical evaluation is to determine the etiology of the child’s symptoms and injuries.

It’s not to prove or disprove abuse
History

• DETAILED history – with timeline
• Starting from *before* the child became symptomatic
• What symptoms noted
• Progression of symptoms
• Caregivers’ response to symptoms
• ANY accidental traumas – with details
• Prior episodes of similar symptoms
Symptoms

• **Wide range of symptoms:**
  – Fussiness, low-grade fever, vomiting unconscious, seizing, respiratory distress or arrest
  – Symptoms may progress – or resolve - over time

• **Children with milder symptoms often missed**
  – Very young, white, intact families
  – no seizures, resp symptoms, or external head trauma

• **Symptom onset is IMMEDIATE**
Important Past Medical History

• Primary Care Physician
• Growth, immunization status
• Detailed birth history
• Previous injuries, inc bruises
• Detailed developmental history and current abilities
• Parental perception of child
Important Past Medical History

• Detailed Family History
  – Bleeding disorders, developmental issues, seizures, mental health issues, etc

• Detailed Social History
  – Identity of all caregivers, risk factors for abuse/neglect
A good Physical includes...

- Growth parameters, plotted correctly on the growth chart
- Exact description of injuries, with measurements/diagrams/photos
- Close look at scalp, pinnae, frenula, palate, all skin
- Eyes
- Neurologic exam
- Bones
- Anogenital area
Laboratory Evaluation

• CBC
• Coagulation testing
• Chemistries
• Drug screen
• Others: metabolic testing, testing for bone problems – case dependent!
Radiologic Evaluation

• Cranial imaging:
  – Head CT, then MRI

• Skeletal survey (according to standards)

• Consider cervical spine MRI

• Consider cranial MRA or MRV if needed

• Follow-up skeletal survey at 2 weeks
Other Subspecialists

• Ophthalmology
• Neurology
• Neurosurgery
• Genetics/metabolic
• Rehabilitation
Outcome

- Of shaken children:
  - ≥20% mortality rate; of survivors:
  - More than ½ are severely disabled
  - ¼ may be able to function, but often have other sequelae
  - It is impossible to determine long-term outcome at time of discharge from the hospital