

Advanced Medical Issues in CPS: Abusive Head Trauma

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ROCKEFELLER COLLEGE UNIVERSITY AT ALBANY, STATE UNIVERSITY OF NEW YORK

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Advanced Medical Issues in CPS: Abusive Head Trauma

Case Presentation

- 10 month old male is picked up from daycare and presents with sudden onset of lethargy, poor tone and vomiting to primary care physician
- Diagnosis: viral gastroenteritis, sent home
- Slowly improved over 2-3 days at home, then returns to daycare
- Upon being picked up from daycare, is noted by father to be limp, vomiting and is taken to ER
- Diagnosis: dehydration, Rx: IV fluids, sent home

Case Presentation

- Slowly improved over 2-3 days
- Returned to daycare
- Parents received a call in the early afternoon that the child was in cardio-respiratory arrest and enroute to DVCH
- Patient survived and was noted to have retinal hemorrhages and multiple subdural hematomas of several ages
- Outcome: Child survived with profound cognitive and motor disabilities

Case – Key Issues

- Abusive head trauma has predictable patterns of symptoms and injuries
- These injuries can be devastating and lead to death and life-long disability
- Even knowledgeable parents and professionals can miss the diagnosis
- Parents and professionals need to consider the abusive head trauma when there are patterns which go beyond routine pediatric illness

Advanced Medical Issues in CPS: Abusive Head Trauma

Abusive Head Trauma (AHT)

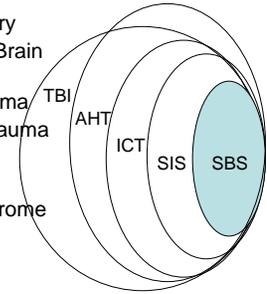
- AHT is unique form of inflicted intracranial injury often called "Shaken Baby Syndrome"
 - Causes more subdural hemorrhage (SDH) in young children than motor vehicle collisions
 - Most victims under 1 year of age, but may occur at any age
 - Mortality: 15-20%, long-term morbidity >50-75%
 - Patterns noted in child, family and perpetrator characteristics
 - Infant crying thought to be a key trigger

Abusive Head Trauma (AHT)

- Degree of injury severely out of proportion to the history given.
 - Severe head injury without a witnessed event or with a discrepant history of minor trauma
 - Primary Injuries: Patterns of intracranial bleeding and diffuse axonal injury
 - Secondary Injuries: retinal bleeding, fractures and other injuries

TBI / AHT / ICT / SIS / SBS

- TBI= Traumatic Brain Injury
- ITBI= Inflicted Traumatic Brain Injury
- AHT= Abusive Head Trauma
- ICT= Inflicted Cerebral Trauma
- SIS= Shaken Impact Syndrome
- SBS= Shaken Baby Syndrome



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Head Injuries

- Excluding skull fractures, more mortality and morbidity from head injuries than from any other form of child abuse
- In inflicted injury deaths, intracranial injury is found in 60%-90%
- Evidence of blunt or sharp trauma from an identified or unidentified weapon.
- Over 70% of children with abusive head injury have additional skeletal injuries
- Impact and/or shaking possible with lack of external evidence
- Direct blow and/or contact injury more likely with external trauma

How Do These Children Come into The Medical System? (Clinical Presentation)

Clinical Presentations

- Behavioral
 - feeding difficulties, dehydration
 - irritability, seizures
 - lethargy, coma, altered mental status
 - intracranial bleeding
- Respiratory
 - respiratory distress to apnea
- Cardiovascular
 - tachycardia, cardiac arrest

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Common Clinical Misdiagnoses

- “Viral Syndrome”
 - viral gastroenteritis
 - influenza
- Accidental Head Trauma
- Meningitis / Sepsis
- Apparent Life Threatening Event (ALTE)
- Sudden Infant Death Syndrome (SIDS)

Abusive Head Trauma - Missed Cases

- Among 173 children, ages 0-3 years, during 1990-1995 in Denver, CO:
 - 54 (31.2%) were seen by physicians and diagnosis of abusive head trauma (AHT or SBS) was not recognized.
 - Mean time to correct diagnosis: 7d (0-189d)
 - Risk: white, young infants with “intact” families
 - Reason: radiologic, other diagnosis, failure to suspect
 - 15 were re-injured; 22 had complications because of the missed diagnosis.
 - 4 of 5 later deaths were considered preventable.
- Jenny, C et al. JAMA 1999;281:621-626.

Characteristics of the History, Offenders, and Triggers (Risk Factors)

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Head Trauma- Risk Factors in History

- Changing level of consciousness
- "trouble breathing"
- "trouble feeding / vomiting"
- "cries a lot"
- "don't know"
- "eyes rolled back"
- "sick for days"
- "must have fallen"
- "sibling did it"
- Substance abuse, criminal history, mental illness, abuse
- Multiple caretakers
- Past injury / Previous Abuse
- Delay in seeking help / other complaints

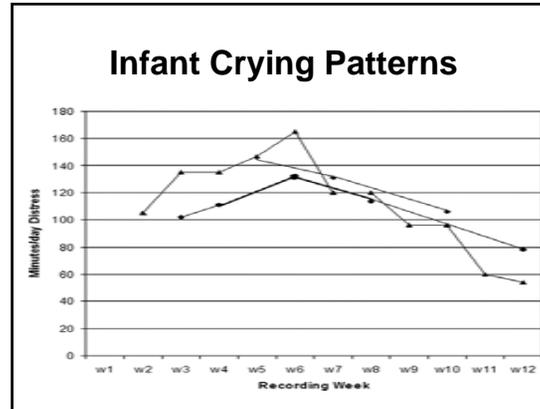
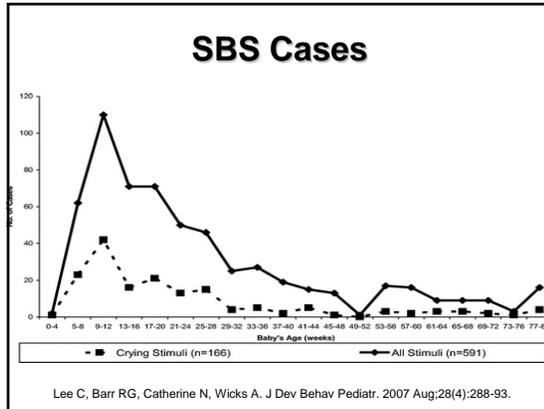
Perpetrator Admissions

- 20-year retrospective review of 81 cases in VA noted that: 'shaking' (68%) was the most common mechanism admitted by perpetrators.
 - Impact was not described in 54%.
 - 91% with shaking had immediate symptoms and none were 'normal'
 - In cases with only impact, 60% had skull or scalp injury; 12% of those with shaking alone also had skull or scalp injury
- [Starling et al. Arch Pediatr Adolesc Med 2004;158:454-458]

Age-related Incidence of Publicly Reported Shaken Baby Syndrome Cases: Is crying a trigger for shaking?

- 591 cases of infants up to 1.5 years of age who had been reported to have been shaken or shaken and physically abused.
- Of these, crying was reported as the stimulus in 166 cases.
- The curves of age-specific incidence started at 2-3 weeks, reached a clear peak at about 9-12 weeks of age, and declined to lower more stable levels by about 29-32 weeks of age, similar to the normal crying curve.
- These curves have similar onsets and shapes and a slightly later peak compared to the normal crying curve.
- CONCLUSIONS: The findings provide convergent indirect evidence that crying, especially in the first 4 months of age, is an important stimulus for SBS.
- Lee C, Barr RG, Catherine N, Wicks A. J Dev Behav Pediatr. 2007 Aug;28(4):288-93.

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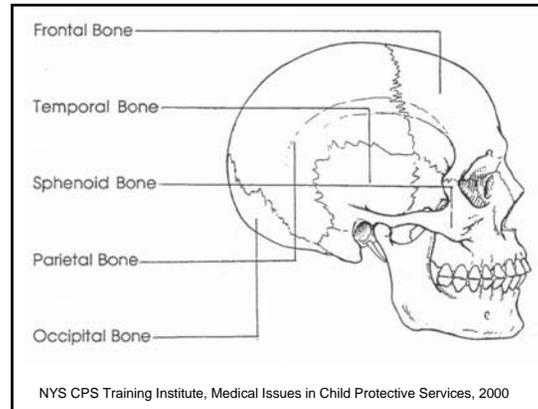


- ### Abusive Head Injuries
- Contact injuries
 - Scalp Injury
 - soft tissue swelling / bruising / alopecia
 - subgaleal hematoma / cephalohematoma
 - Cranial Injury - contusion / fracture
 - Mouth, Ears, Face
 - Intra-Cranial Hemorrhage (ICH):
 - Epidural Hematoma (EDH)
 - Subdural Hematoma (SDH)
 - Subarachnoid Hemorrhage (SAH)
 - Parenchymal hemorrhage/ contusion
 - Non-contact injuries
 - Subdural Hematoma (SDH)
 - Shear → Diffuse Axonal Injury (DAI)
 - Hypoxic-ischemic Injury
 - Retinal Hemorrhage (RH)

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Imaging Findings

- Skull Fractures (direct contact)
- Intracranial Hemorrhage
 - Subdural
 - Subarachnoid
 - Parenchymal (brain matter)
 - Intraventricular
- Brain Injury Itself
 - Edema from Diffuse Axonal Injury (DAI) & shear
 - Hypoxic-ischemic injury



Skull Fracture Patterns

- Accidental
 - single, linear, hairline, <2mm wide, parietal, single bone, may have underlying intracranial injury (rare), dating by reliable history
- Abusive
 - multiple, complex, growing, crosses sutures, diastasis>3mm, occipital, bilateral, extensive intracranial injury, dating by soft tissue swelling (no callus)

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Subdural Hematomas

- Require Substantial Angular Forces
- Rare as Birth Trauma
- Rare in Trivial Falls
- Rare in Coagulopathies, Vascular Abnormalities and Malignancies
 - morphologically different
- Often of Multiple Ages

Retinal Hemorrhages

- Produced by the same forces that produce subdural hemorrhages
- Common at birth but resolve quickly
- Rarely produced by severe accidental injury
- Rarely produced by acute bleeding from vascular malformations and increased intracranial pressure
- Retinal hemorrhages from accidental head injury and other non-traumatic causes are different in number and appearance

How Does the Medical Practitioner Make the Diagnosis?

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Abusive Head Trauma - Recommendations

- Do not quickly attribute facial or head bruising to accidental injury unrelated to the presenting illness in young infants.
- Consider AHT and perform complete physical examination, measure head circumference and palpate fontanel for children with non-specific symptoms such as vomiting, fever, or irritability. Consider retinal exam.
- When collecting spinal fluid for sepsis, examine it for xanthochromia.
- Have pediatrically trained radiologists interpret skeletal surveys and head CT's

Jenny, C et al. JAMA 1999;281:621-626.

Diagnosis

- AHT has a pattern of injuries which can only be caused by abusive forces after excluding some catastrophic accidents
- AHT can cause diffuse brain injury and intracranial and retinal hemorrhage
- Resulting neurologic symptoms usually commence immediately in severe cases
- External signs of trauma often absent
- Metaphyseal and ribs fractures are strong evidence of abusive force

Diagnosis

- With bruises or fractures, consider head imaging, particularly for infants
- Consider AHT in infants with:
 - intracranial bleeding/injury after minor trauma
 - retinal hemorrhages
 - rib fractures
 - macrocephaly and/or developmental delay
 - inconsistent history, injury pattern, ALTE, SIDS
- Consider and exclude potential alternative hypotheses

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Medical Work-up Head Trauma

- X-rays of the skull
- X-rays of other bones (skeletal survey)
- Computerized axial tomographic scans (CTs or CAT scans) of the skull and brain
- Magnetic Resonance Imaging (MR or MRI) of the brain, often with several sequences (T1, T2, DWI, DTI) as indicated
- Ultrasound of the head (occasionally)
- Ophthalmologic exam for eye bleeding (RH)
- Metabolic and bleeding tests as indicated

Conditions We Need to Exclude (Differential Diagnosis)

Alternative Diagnoses

- Automobile collisions
- Falls from great height
- Birth related
- Meningitis
- Brain tumors, neuroblastoma
- Metabolic disease, such as glutaric aciduria type I (GA-1)
- Bleeding disorders

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Intracranial Injury From Known Accidental Trauma

Falls out of bed.....	0%
Falls out of bed.....	0%
Falls from bunk beds.....	1.5%
Falls in baby walkers.....	1%
Falls in baby walkers.....	8%
Falls down stairs/walkers.....	0%
Falls down stairs.....	4%
Falls from shopping carts.....	0%

Prevention

- Increase community recognition
- Support all new parents
- Recognize frustration & exhaustion
- Identify high risk families
- Provide parenting materials and support groups
- Refer to community resources
- Support effective prevention programs

Infant Crying and Parenting Theories

Is it Colic?

Most colic appears not to be medical condition

Some potential resources for families:

- Behavioral stage infant will outgrow, support parents- Dr. Ronald Barr: Period of Purple Crying
- Infant may need a fourth trimester- Dr. Harvey Karp: Happiest Baby - The Five S's

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Questions CPS Workers Need to Ask as Part of the Investigation

Evaluation of Scene

- General appearance of house- cleanliness, location of injury
- Furniture-number,type and appearance of beds, kitchen appliances, TVs and other household appliances- are they secured?
- Safety items-smoke detectors, window guards
- Children's toys, games, clothes

CPS Assessment Issues- Head Trauma

- Were the child and caretakers interviewed concerning the history and explanation of the injury?
- When did the child first become ill? When did an objective observer determine that the child was last normal? Was there a delay in seeking medical care?
- Has the physician recorded a precise description of damage to the skin on the scalp and the presence of skull fracture, brain injury and location of any bleeding?
- Was a CAT scan and/or MRI done? Was a skeletal survey done?
- Are there retinal hemorrhages or other fractures? Have the eyes been examined by a pediatric ophthalmologist? Are their pictures of the retinas?

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CPS Assessment Issues- Head Trauma

- Has there been a discussion with the physician regarding the child's condition and their opinion as to the nature, severity and cause of the injuries? What is the child's prognosis for recovery? Has a pediatric radiologist or neuroradiologist reviewed the images?
- Can the injuries be dated as to timeframes?
- Are there concerns about other reasons for the findings other than abuse? What workup has been done to exclude these alternative diagnoses?

Summary

- AHT/SBS can happen quickly. Just 3 seconds of shaking can cause brain damage, paralysis, blindness, learning and behavior difficulties, and even death.
- The average age of SBS victims is 6 months old.
- Continuous crying is the number one reason caregivers shake babies.
- The good news is that SBS is completely preventable. A few simple strategies can help caregivers cope with a crying baby and prevent the irreversible harm of SBS.
- Many SBS resources are available 24 hours a day, 7 days a week. These resources can help save lives and prevent lifelong complications.

Resources

- Upstate New York Shaken Baby Project:
www.wchob.org/shakenbaby
- Brain Injury Association of New York:
www.bianys.org (518) 459-7911
- The Skipper Initiative: www.skippervigil.com
- The Shaken Baby Alliance:
www.shakenbaby.com
- National Center on Shaken Baby Syndrome:
www.dontshake.com
