# TALES FROM THE CRIB: HISTORY OF A FALL AND A SUBDURAL HEMORRHAGE

Ann S. Botash, MD
SUNY Upstate Medical University

## HISTORY

- 3 month old, previously healthy infant, brought to the primary care physician due to a fall
- He was being carried by the father, who tripped over the family dog
- Fell from dad's arms to the hardwood floor
- Cried immediately and eventually settled down

## HISTORY

- No loss of consciousness but was fussy and vomited three or four times prior to presenting to the PMD
- Father waited for the mother to come home from work before they both decided to bring the baby to the office
- Birth History and Family History unremarkable
- Social History – Lives with mother and father (and dog)
  No prior CPS history
  Father unemployed

## PAST MEDICAL HISTORY

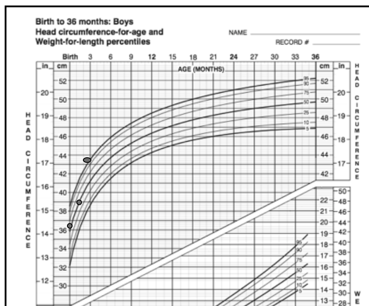
- Received first set of immunizations at 2 months
- Had several episodes of vomiting within a few days after becoming irritable after shots
- Multiple documented phone calls to the pediatrician
- Evaluated 2 weeks prior to the current presentation and diagnosed with gastroenteritis
- A brown bruise was noted under the left eye at that time
- HT/WT/HC were at the 50%

## THE CULPRIT

## PHYSICAL EXAMINATION

- Baby was irritable and slightly pale
- No swelling or bruising identified
- Vital signs were normal
- Ht and Wt were at the 50% for age, but HC now at the 95%
- Non-focal neurological exam
- Anterior fontanel was bulging in sitting and lying positions

## HEAD CIRCUMFERENCE-FOR-AGE AND WEIGHT-FOR-LENGTH PERCENTILES

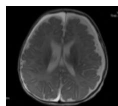



## ADDITIONAL WORK-UP

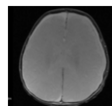
- Indirect Ophthalmologic examination was normal (no retinal hemorrhages)
- Skeletal survey – Negative for fracture, including the skull

## MRI IN OUR PATIENT

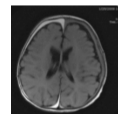
AX T2



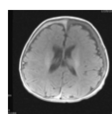
AX T2*



AX T2 FLAIR



AX T1

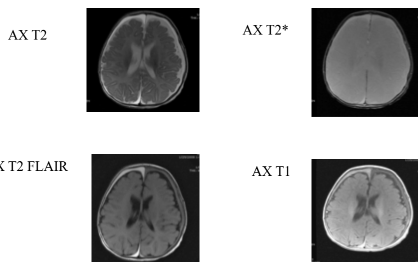


A right subdural hematoma outlining the right cerebrum measuring 10 mm in greatest thickness is noted demonstrating high signal on T1 and T2-weighted imaging. A left subdural hematoma is also noted measuring 8 mm in greatest thickness demonstrating isointense signal on T1 and T2-weighted imaging. These likely indicate subdural collections of different ages.

## MRI - INTENSITY BASED ON BIOCHEM FORM OF HEMOGLOBIN

- T1---Iso-low with hyperacute bleed
  - Iso-low with acute
  - High I with early subacute, late chronic, early chronic
  - Iso-low I with chronic
- T2 --- High I, with hyperacute
  - Low I with acute, early subacute
  - High with late subacute, early chronic
  - Low I with chronic

## MRI IN OUR PATIENT

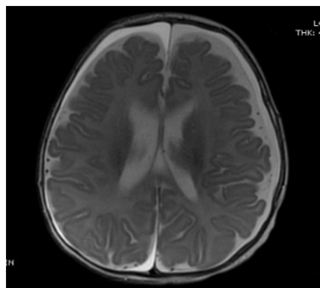



A right subdural hematoma outlining the right cerebrum measuring 10 mm in greatest thickness is noted demonstrating high signal on T1 and T2-weighted imaging. A left subdural hematoma is also noted measuring 8 mm in greatest thickness demonstrating isointense signal on T1 and T2-weighted imaging. These likely indicate subdural collections of different ages.

## INTERPRETATION OF AGE

- MRI is better for determining old vs. new blood.
- CT is more sensitive and specific than MRI or US for hyperacute/acute hemorrhage in all compartments.

## AXIAL T2



## MIXED DENSITY SDH ON INITIAL CT

- Mixed density convexity SDH is often speculated to be the result of multiple traumas.
- Heterogeneous subdural collections could be admixtures of clotted blood and spinal fluid or acute clotted blood and hyperacute unclotted blood.

## WHY NOT?

- Mixed density can be seen within 48 hours of the time that the trauma has occurred (even in accidents). Tung, G. A., M. Kumar, et al. (2006).
- Case study where CT in 8 mo mimicked acute on chronic hemorrhage but autopsy showed no evidence of chronic SDH. Barnes & Robson (2000).
- Sargent. Report a case of CT mimic of recurrent bleed (1996).

## MIXED DENSITY BLEEDS

- Use caution about making inferences on the specific timing, pattern or cause of brain injury from a single noncontrast CT scan.

## ABUSIVE HEAD TRAUMA

- Rate of hospitalization for infants with abusive head trauma has been reported to be as high as 30/100,000 infants.
- Risk factor for increased mortality include RH, cerebral edema and low Glasgow coma Scores.
- Chronic subdurals are associated with decreased mortality.

Shein SL, Bell MJ, Kochanek PM, Tyler-Kabara EC et al. Risk factors for mortality in children with abusive head trauma. *J Pediatr* 2012; 161: 716-22.

## SIGNS AND SYMPTOMS

- Asymtomatic
- Lethary
- Irritability
- Vomiting
- Apnea
- Loss of consciousness
- Seizures
- Sudden arrest
- Bulging fontanel, enlarging HC
- Poor tone
- Bruising

## EXTRACRANIAL SIGNS AND SYMPTOMS

- Retinal hemorrhages
- Other fractures
- Abdominal trauma
- Bruises

## WHEN DO SYMPTOMS OCCUR AFTER INJURY?

- Laskey, *J Peds* 2004, 11/38, 29% had positive neuroimaging findings despite being neurologically asymptomatic.
- Starling, *Arch Ped* 2004 study of perpetrator confessions; 52/57 symptoms were nearly immediate.
- Biron *J Paeds* 2007 (16 cases)
  - The period between the assault and the onset of symptoms is brief.
  - 15 minutes--10 hours

## RECOGNITION OF SYMPTOMS

- Are they really "asymptomatic"?
- Did a parent know something was wrong and ignore the symptoms?
- If physician's miss the diagnosis, how can we expect parents to recognize the symptoms?

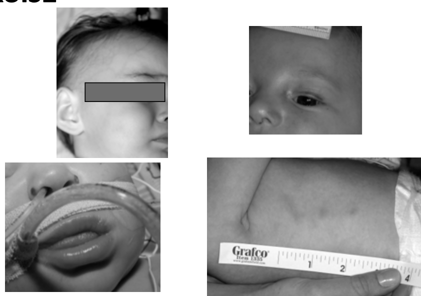
## MISSED ABUSE

- Jenny C, Hymel K, Ritzen A, et al. Analysis of missed cases of abusive head trauma. *JAMA*. 1999; 281(7): 621-626
  - 54/173 infants seen by their physicians and diagnosis missed--98 visits with dx
  - Mean time to correct diagnosis was 7 days

## FREQUENT ERRONEOUS DIAGNOSES

- Viral gastroenteritis or flu (14)
- Accidental head injury (10)
- Rule out sepsis (9)
- Increasing head size (6)
- Non-accidental trauma (not-head injury) (4)
- Otitis media (5)
- Reflux (3)
- Apnea (2)
- URI (2)
- UTI (2)
- Bruising of unknown etio (2)
- Hydrocephalus (2)
- Meningitis (2)
- Others

## "THOSE THAT DON' T CRUISE RARELY BRUISE"




Sugar F, Taylor JA, Feldman KW. Bruises in infants and toddlers: Those who don' t cruise rarely bruise. *Arch Pediatr Adol Med* 1999; 153: 399-403.

## FOLLOW UP

- Serial head circumferences
- Early intervention
- Eye examinations
- Repeat skeletal surveys

## CAUTIONARY THOUGHTS ON TRADITIONAL TEACHING!

- Low height falls do not cause intra-cranial injury.
- Intra-cranial hemorrhage evolves radiographically in a predictable fashion.
- Impact injuries will have evidence of impact.

## OTHER KEY POINTS

- Recognize the symptoms and the common "stories."
- Timing is almost always important in the legal case and the need for further protection.
- Signs of abusive trauma are often subtle and missed.