



**CAN ECHO  
JANUARY 11, 2021  
CASE DISCUSSIONS**

**Case 1:**

5 mos ex 38-week twin born by c-section with no complications p/w fever, decr po and sleepiness x 3-4d brought to ed on 12/21

Tested pos for COVID on 12/3, quarantined until Friday, 12/18 when patient and twin brother returned to daycare. On Friday noted to be taking less po at daycare, picked up by father and en route to home, had emesis in car and 2 episodes thereafter, nbnb. No further emesis after that – thought to be due to reflux. At home, temp 102 over weekend. Mom in touch with pmd office throughout wknd and due to her concern about mis-c went to local ED. At the local ED, the U/A was negative, and patient was overall well appearing so sent home. Mom pointed out subconjunctival hemorrhage and told it was likely due to the vomiting. Next day father noted “swollen” anterior fontanelle so brought patient to pmd office where rsv/flu neg and sent in to Yale ED for evaluation of meningitis. No fevers on day of presentation but patient remained sleepy/cranky per mom. Mom mentioned noting red spot in R eye which was noticed after patient vomited on Friday.

- In ED, afebrile, sats and rr wnl, hr 118, bp 90/70
- Nontoxic, full fontanelle, tiny subconj hemorrhage on L eye
- Labs +covid, wbc 16.6, hb 10.2, plts 635
- Trauma brain mri showed subdurals vs artifact
- LP performed → wbc wnl
- Mis c eval negative (nl lfts, crp)

On floor, Urine, bld and csf cx remained negative  
Patient remained afebrile throughout admission  
Covid pcr thought to be positive from initial infection

MRI brain and total spine revealed subdural hemorrhages, subarachnoid hemorrhages  
Eeg wnl  
Mra/mrv wnl

Skeletal wnl, repeat skeletal 2 weeks later revealed a skull fracture that was then picked up on the original imaging!

Optho exam bilateral and extensive retinal hemorrhages

Diagnosed with abusive head trauma, discharged home with parents, AHT likely occurred at daycare. Daycare unlicensed and has been closed while undergoing evaluation.

### Take Home Points:

- Accept that diagnosing abusive head trauma is challenging (this patient had a fever after all!) but nonetheless critical not to miss, caregivers often provide no h/o trauma or a history of minor trauma
- Consider subconjunctival hemorrhage a sentinel injury for which abusive injury should be evaluated
- Careful history taking that revealed improving fever curve but worsening/persistent symptoms of fussiness, irritability
- Consider own biases in this case (abuse is under evaluated in white families and in those where parents are together)
- Are there prediction rules that help frontline providers decide when to image kids with vague symptoms like fussiness, and vomiting without diarrhea??

The **Pittsburgh Infant Brain Injury Score (PIBIS)** is a validated clinical prediction rule for well-appearing infants <12 months of age presenting to an emergency department **with a high-risk chief complaint, including apnea or ALTE, vomiting without diarrhea, seizures, tissue swelling of the scalp, bruising, or other non-specific neurologic symptom and no history of trauma.** It was developed and prospectively validated in a multicenter study to help providers determine which well-appearing but high-risk infants should undergo cranial CT.<sup>12</sup> **The 5-point PIBIS includes an abnormality on skin examination (2 points), age > 3 months (1 point), head circumference > 85th percentile (1 point), and serum hemoglobin < 11.2 g/dL (1 point). At a score of 2, the sensitivity for abnormalities found on cranial CT was 93.3% (95% confidence interval 89.0%–96.3%) and the specificity was 53% (95% confidence interval 49.3%–57.1%).** A recent cost effectiveness analysis of AHT detection strategies in emergency department settings without rapid MRI availability in well-appearing infants with no reported history of trauma presenting with high-risk chief complaints (i.e., vomiting without diarrhea, fussiness, seizure or spell, brief resolved unexplained event, feeding difficulties, or non-specific complaint) showed that PIBIS followed by a CT scan was the most cost-effective strategy.<sup>13</sup> When rapid MRI was available, universal rapid MRI followed by a confirmatory CT scan was economically favorable and both strategies were effective at identifying AHT compared with clinical judgement.

## Case 2:

4 wk ex 39-week male born by nsvd pw fussiness and poor po intake. Living with a foster mom who had worked a night shift the night before presentation when he was with her 24 yo son and husband. Foster mom noted that morning when she returned home that he seemed fussier than usual, had high pitch cry and seemed less interested in the bottle. She gave him Tylenol and btw 3-9 p, noted some shaking of bl upper extremities. During this time, he was not taking po and was not sucking on bottle so foster mom brought him to ed. No h/o trauma provided

### In ED

- T 34.6, hr 180, bp 99/55, sats initially ok but then desated to 60s with eye deviation
- Gas 7.16/75/23/-2, lactate 5
- Hb 9.3, ast/alt wnl
- More apneic spells in setting of seizures
- Intubated, given Ativan and fospheny
- Started on vanc/ctx/acyclovir, plan for LP in picu
- Non-contrast head ct prior to picu admission showed bl subdurals, trace subarachnoid, nondisplaced l parietal fracture, R parietal fractures and L frontal skull fx

SH born to a 17 yo g1p1, mom in foster care with significant mental illness and drug use Discharge home with foster parent. Foster mom is former dcf worker and has longstanding relationship with bio mom. plan was eventual reunification with bio mom

PICU: MRI with 40% abnormal diffusion, subdurals thought to be new and old, MRI spine with SDH causing cauda equina compression

Optho bilateral retinal hemorrhages

Skeletal with no addl fractures

Continued clinical and subclinical seizure activity, patient given alias, foster family restricted access and bio mom made decisions, ultimately discharged to different foster family

### Take home points:

-Consider abusive head trauma when no history of trauma and otherwise vague symptoms – seizures, vomiting without diarrhea, apnea/brue, fussiness

Piteau SJ, Ward MG, Barrowman NJ, Plint AC. Clinical and radiographic characteristics associated with abusive and nonabusive head trauma: a systematic review. *Pediatrics*. Aug 2012;130(2):315-23. doi:10.1542/peds.2011-1545

-While prosecution rates for perpetrators of AHT remain low (due to the inability to determine which individual may have perpetrated the injuries), dcf can help restrict future access to children (loss of fostering license, etc.)

-Below are some prediction rules for hospitalized babies presenting with head injury that help distinguish AHT from accidental head injury.

**The Pediatric Brain Injury Research Network Clinical Prediction rule (PediBIRN CPredR)** was developed to aid pediatric intensivists make early decision on whether to undergo an evaluation for abuse.<sup>14-16</sup> It was derived in a prospective study including 209 children and validated in a prospective study including 291 children in 14 US hospitals. The population of interest included acutely head-injured children aged <3 years admitted to the pediatric intensive care unit. The authors derived a 4-variable CPredR with maximum sensitivity to determine the risk of AHT. In the validation study the CPredR achieved a sensitivity of 0.96 and a specificity of 0.46 to detect AHT cases. The variables included respiratory compromise, bruising involving the ears, neck and torso, bilateral/interhemispheric subdural hemorrhages and skull fractures (other than an isolated, unilateral, non-diastatic, linear, parietal skull fracture). If one or more variable was positive, the tool recommended that the child should undergo further evaluation for abuse. In an external validation study, the PediBIRN CPredR was applied to 141 patients with abnormal neuroimaging results in 5 Australian and New Zealand tertiary pediatric centers. The CPR was applied to PICU admissions only, and any head injury admissions. Excluding indeterminate cases, in the PICU (n=28), the CPR was 100% (75-100%) sensitive and 11% (0-48%) specific; in all admitted patients (N=141), sensitivity was 96% (82-100%) and specificity was 43% (32-53%).<sup>15</sup>

From a systematic review and individual patient data analysis, Cowley et al. derived the **Predicting abusive head trauma tool (PredAHT CPredR)**, using multilevel logistic regression to predict the likelihood of AHT. They then externally validated the rule, consisting of 6 high-risk features including retinal hemorrhage, rib and long-bone fractures, apnea, seizures, and head or neck bruising, in children <36 months of age admitted with a known intracranial injury to 2 sites. The majority of children (97%) were <24 months old, and similar to the derivation results, the presence of  $\geq 3$  features in a child <36 months old with intracranial injury, the estimated probability of AHT was >81.5% (95% CI, 63.3-91.8). The sensitivity of the tool was 72.3% (95% CI, 60.4-81.7), the specificity was 85.7% (95% CI, 78.8-90.7), area under the curve 0.88 (95% CI, 0.823-0.926).<sup>17</sup> Several implementation studies have followed examining the acceptability of the PredAHT tool and possible changes in clinical management with implementation of the tool. In a qualitative study examining acceptability of the tool, the authors found that the PredAHT tool may increase professionals' confidence in their decision-making when investigating suspected AHT, but may be of less value in court.<sup>18</sup> When examining potential changes in clinical practice, Cowley et al conducted a clinical vignette study in which clinicians provided AHT probability estimates and child protection actions before and after using the PredAHT tool and concluded that the PredAHT influenced clinicians' AHT probability estimates, but had minimal impact on their child protection actions.<sup>19</sup>