Looking Out for Child Abuse: Recognition & Evaluation of “Sentinel Injuries”

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Disclosure

I have no relevant financial relationships

I have provided expert witness testimony in cases of alleged child maltreatment

Objectives

Upon completion of this session, participants should be able to:

- Understand concept of “sentinel injury”
- Describe common symptoms and presentations suggestive of child abuse in infants and young children
- Discuss approach to medical and social evaluation and management of suspected physical abuse
- State how to access additional resources for concerns about suspected child abuse & neglect at Mayo Clinic
Case 1

A 4-month-old female who presents to the emergency department with her father for concerns about tongue swelling. Dad says that he is currently undergoing a separation with the patient’s mother but they both still care for the patient. Exam shows a small left medial subconjunctival hemorrhage (SCH) and a dime-sized bruise over the left forehead. Dad says bruise from toy dropped on infant by 1 year-old sibling and SCH from scratching. Dad was asked if he had any concerns about infant being abused and says “no”.

What is most appropriate next step?

- A. Report to social services for suspected abuse and screen for other injuries
- B. The small jaw bruise and SCH will heal quickly, so no action is needed
- C. Discuss accidental injury precautions with dad
- D. A and C
- E. B and C

Case 1

- At 6 months of age infant reportedly falls from dad’s arms striking head on edge of table
- Brought to ED by dad ~ 1 hour later. In ED GCS goes from 15 to 7. Electively intubated
- Noted to have right flank and right LE bruising
- CT head shows displaced right parietal fracture and non-displaced occipital fracture, right convexity and posterior falx SDH and underlying brain contusion
- Brain MRI shows right frontal lobe and right parietal lobe brain lacerations
- Right eye intra-retinal hemorrhages extending to ora serrata
Case 2

6-month-old male brought in by mom for concern about fussiness. Child cared for by mom’s boyfriend during day while she is at work. He has been feeding well from a bottle. He has not been vomiting. On exam infant is alert, happy and in no distress. Noted to have 1 cm linear bruise over right upper abdomen. Mom reports no history of trauma or concerns regarding BF. She thinks the bruise is from the car seat buckle.

What is most appropriate next step?

- A. Report to social services for suspected abuse and screen for other injuries
- B. Since he is feeding well and has not vomiting the abdominal bruise is of no consequence, so no action is needed
- C. Discuss appropriate use of car seat and adjust straps with mom
- D. A and C
- E. B and C

Case 2

- AST: 94
- ALT: 626

Case 3

27 month-old previously healthy male presents with scrotal swelling and pain. No history of trauma, fever, dysuria, or abdominal pain. No past documentation of hydroceles. Scrotal US showed diffuse scrotal wall edema and large bilateral hydroceles with debris suggestive of pyoceles (infected hydroceles).

Thoughts about genital exam?

What is most appropriate next step?

- A. Treat with antibiotics
- B. Report to social services for suspected abuse and screen for other injuries
- C. A and B
- D. None of the above
Case 3

- Maternal depression
- Domestic violence, dad currently in prison
- CPS currently involved with family as older brother accused mom of hitting him
- Mom reported during 2nd ED visit that “it’s like he’s being picked on by a ghost”

Case 4

8 week old male left in the care of boyfriend/father. Dad called mom at work to report that infant had some oral bleeding attributed to him scratching his gums. Mom reports that day before admission she noticed a "rash" in diaper area. When mom returned home from work infant’s cry seemed different and his eyes were gazing off to the side. Brought to ED for evaluation. Mom reports no history of falls or other trauma.

Mom returned to work when infant was around 4 ½ weeks of age. Dad primary caregiver during day as he does not otherwise work.

What is most appropriate next step?
- A. Report to social services for suspected abuse and screen for other injuries
- B. Evaluate for bleeding disorder
- C. Trim infant’s nails and discuss safety precautions
- D. A and B
- E. B and C
Missed Cases of Abuse

- Jenny et al (1999) found ~ 30% of AHT cases missed initially
  - Mean time to diagnosis 7 days
  - Mean # of visits until correct diagnosis ~ 3
- Thorpe et al (2014) identified 33% of children later diagnosed with abusive fracture had one or more prior missed visits with signs of trauma (bruising, swelling, etc.)
- Ravichandiran et al (2010) found a 21% missed prior visit rate in children with abusive fractures

Meaning of “Sentinel”

Dictionary (OED):
1. A soldier or guard whose job is to stand or keep watch
2. An indicator of the presence of disease

Joint Commission:
1. Unexpected occurrence
2. Portending risk of serious injury or death
3. Signal need for immediate investigation & response
Classic Definition of Sentinel Injury

1. A visible, poorly explained, but medically minor injury that portends future risk of more serious abuse
2. Heal quickly and completely without direct sequelae
3. Typically involves pre-mobile infants
4. Often recognized by caretaker
5. History inconsistent with cause or severity of injury

Classic Sentinel Injuries

- Bruise in infant < 6 months old
- Intraoral injury
- Subconjunctival hemorrhage

More Recent Definitions

1. Any injury recognized retrospectively as being an indicator of abuse
2. Any injury strongly associated with a diagnosis of abuse, e.g.:
   - Rib fracture
   - Corner metaphyseal fracture
   - Liver laceration
3. Any injury that reflects risk for serious co-existing underlying injury
4. Any injury where the pre-test probability warrants routine testing for other signs of abuse
Why are sentinel injuries important not to miss

Multiple studies show that occurrence of initial sentinel injury predicts future more serious abuse and mortality

- Sheets et al identified prior sentinel injury in 28% of infants later diagnosed with definite abuse
- 80% of initial injuries were bruises; 66% occurred before 3 months; medical providers aware of injury in 42%
- In a prospective birth cohort, Putnam-Hornstein found that children with prior allegation of NAT reported to CPS had 5.5X higher mortality rate from intentional injury than children not reported
- Deans et al reported a 25% mortality rate among children previously hospitalized for NAT who experienced recurrent abuse

1 Sheets LK et al. Pediatrics 2013;131:701-7
Infant Distress & Infant Abuse

- Early increased crying is a normal phenomena across all mammalian species studied.
- Significance of crying relates to its perception and response.

Why are sentinel injuries important not to miss

Multiple studies show that the presence of even a single sentinel injury is a marker for more serious concurrent underlying injury.

Harper et al found a 50% rate of unexpected new injuries (skeletal, brain, abdominal) among 146 infants < 6 months of age evaluated for abuse after presenting with isolated bruising.

Why is abuse missed

Professionals miss abuse because:
1. Symptom or sign not perceived
2. Abuse not considered in differential diagnosis
3. Injury appears trivial
4. Cognitive error made
   - Common misperception that injury is minor and therefore unimportant
5. Family is nice
6. Obvious social risk factors are absent
7. ‘Anything But Abuse’ (ABA) bias
Bruising

- Bruising is not normal and is rare in healthy infants
  - “Those who don’t cruise rarely bruise”
- In infants, a single bruise just as concerning as multiple bruises
- Children with bleeding and/or non-patterned bruising in the absence of skeletal and abdominal trauma should be tested for bleeding disorders
  - Limited bleeding diathesis panel:
    - PT, aPTT, TT, D-Dimer, Soluble Fibrin Monomer, Fibrinogen, Factors 8 & 13, von Willebrand Ag and activity
    - Factor 9 done if aPTT prolonged

“Those who don’t cruise don’t bruise”

- N = 930
- < 1% of infants under 6 months have bruises

Bruising Prevalence in Infants

- Pierce et al (2016) conducted prospective observational study of bruise prevalence in infants seen in 3 Pediatric EDs
  - 2488 infants seen
  - Median age 5 months
  - Bruising prevalence 1.3% and 6.4% for infants ≤ 5 months & > 5 months

Bruising and Child Abuse

- Case-control study of children < 48 months admitted to PICU due to trauma
  - 42 with abuse; 53 with accidental trauma
- Bruising characteristics (# and body region) assessed
- Bruising clinical decision rule predicting abuse developed
- 97% sensitivity; 84% specificity


Characteristics of abusive bruising in children

- TEN-FACES-P:
  - TEN: Torso, Ear, Neck in child < 4 years
  - ANY bruising in infant < 4 months (4.99 mo)
  - FACES: Frenulum, Angle of Jaw, Cheek, Eyelids, Sclera
  - Patterned bruising
  - Multiple planes

Bruises as a sign of abuse

Abusive versus accidental distribution

“Young children are forward-moving, frontally-oriented beings”
4 month-old infant
Concern for Abuse?

Linear Petechial Bruising

From presentation by Leslie Strickler, DO, FAAP
Patterned Bruising from Squeezing

Bruising and Bleeding Disorders
- Bruises on cheeks, ears, neck, buttocks, eyes and genitalia absent or extremely rare (<0.5% of collections) in pre-mobile children** with bleeding disorders, regardless of severity and absent in children without bleeding disorder
- Among children without bleeding disorder and with mild/moderate bleeding disorders, ≤1% and 3% of collections, respectively, had bruise in any other location
- Children with severe bleeding disorders had substantially more collections with bruises (>10% of collections) predominantly on upper arms, feet, rear trunk, front of thighs and below knee

** Pre-mobile: not crawling, cruising or walking


Dating Bruises
- Very difficult and not reproducible
- Dependent on depth, location, skin color, age
- No agreement in regard to:
  - Initial color
  - Evolution of color
  - Specific succession of color
- Yellow color appears as early as 18 hours
- Lack of yellow color does not mean it is new
- Cannot determine age of bruise
Case 5

- 27 day-old term female infant born by uncomplicated vaginal delivery
- Doing well until 3rd week of life when developed fussiness and episodes of screaming, attributed to colic
- ROS: Drinking well; no vomiting or lethargy. No trauma, falls or injuries. Toddler and 2 dogs in home. Parents and grandmother caregivers.

Exam:
- Well-appearing infant who cries on exam but consoles readily
- Skin: no bruising
- Head: no hematoma; AF soft
- Abdomen: soft, non-tender
- Extremities: unremarkable
- Thorax: crepitus over right anterior chest
Case 5

Labs:
- CBC normal
- Ca++, Phos, alk phos normal
- 25-OH Vit D: 18
- PTH: 81
- Lipase <10, AST 38, ALT 113

Screening for abusive abdominal injury in children

- ~3% of 2890 consultations with abdominal injury
  - Liver, bowel, spleen, pancreas, adrenal, kidney
- 26% of these abdominal injuries were clinically occult
  - No bruising, tenderness, distention
- AST or ALT cutoff of 80
  - Sensitivity 77%
  - Specificity 87%
- For every 100 children that get LFTs, 18 CT scans done, 3 new injuries detected
- CT modality of choice to look for forensically significant injury
Case 5

Follow up skeletal survey

Case 6

- 2 month-old male infant presents with mom to local ER because of constipation over past week and now has red eyes
- Limited prenatal care
- Newborn and 2 week Well Child exams unremarkable
Case 6

- Mom states infant's father has been squeezing his abdomen to try to relieve constipation
- Recent domestic violence incident between parents

Subconjunctival Hemorrhage (SCH)

- DeRidder et al (2013) evaluated 14 children with SCH
- Ages 1 mo to 5 years (median 6.5 mo)
- No hx of cough, vomiting or constipation
  - Bruising (79%); fractures (43%), intracranial or abdominal injury (21%)
- SCH outside the neonatal period should raise concern for abuse, especially in pre-cruising children

DeRidder et al. Pediatr Emer Care 2013
Differential Diagnosis of Subconjunctival Hemorrhages

1. Traumatic
   a. Acute thoracic compression & traumatic asphyxia
   b. Immersion / near drowning
   c. Blunt and penetrating trauma
   d. Abusive Head Injury
   e. Birth trauma
2. Infection
   a. Enterovirus, Adenovirus
   b. Herpes zoster / Varicella
   c. Pertussis
   d. Others
3. Valsalva/severe vomiting
   a. Pyloric stenosis
   b. Constipation
4. Oncologic
   a. Neuroblastoma
   b. Leukemia
5. Hematologic
   a. Hemophilia
   b. Thrombocytopenia
   c. Histiocytosis

Oral Injuries

- Result when frustrated caregiver rams something into mouth
- In infants not yet able to walk should be considered abusive until proven otherwise
- Common in ambulatory children

Frenula Tear

Adapted from: Lynn K. Sheets, MD
Sublingual Hematoma

Red Flag History for Child Physical Abuse

- No history or denial of trauma despite severe injury
- Implausible history for degree or type of injury
- Unexplained or excessive delay in seeking care
- Injury attributed to in-home resuscitation efforts
- Caregiver histories that change with retelling or conflict with versions from other observers
- Severe injury explained as self-inflicted or blamed on other young children or pets

From: UpToDate®
www.uptodate.com/contents/physical-child-abuse-recognition
Injury Considerations

- Age
- Development
- Mechanism
- Injury characteristics
  - Location
  - Pattern

Non-specific red flag symptoms in infants

- Vomiting
- Fussiness
- Poor feeding
- Altered mental status or unresponsiveness
- Apnea/BRUE
- Seizure

When does a possible bruise need a medical evaluation?

- Any suspected injury in a pre-cruising infant
- All patterned injuries
- Suspected excessive discipline with an implement
- Bruising on neck, hands, feet, ears, genitals, anal area, and buttocks in young children

From: Lynn K. Sheets, MD
Medical Input

- Medical expertise (highest quality available) usually necessary when abuse is suspected, even in "obvious" cases
- Underlying but unapparent brain, skeletal and abdominal injury frequently present in well-appearing infant/child
- Maltreatment frequently missed or misdiagnosed as due to accident or another condition
- Medical conditions and accidental injuries not infrequently mistaken for abuse

Adapted from: Lynn K. Sheets, MD
Mayo Child and Family Advocacy Program (MCFAP)

- “MCFAP” or “Abuse” in Mayo Clinic intranet
- Children’s Advocacy Center telephone: (507) 266-0443
- 24/7 call schedule on intranet (with cell numbers)
- Staff:
  - Arne Graff, MD (Medical Director)
  - Ellen Case (Program Coordinator)
  - Chris Derauf, MD
  - Mark Mannenbach, MD
  - Sherry Bush-Seim (Forensic Interviewer)
  - Shawna Wollbrink, RN (Pediatric Nurse)
  - Jenny Nohner (Administrative Assistant)