The Importance of Screening for Occult Trauma – Case Examples
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SAFE CARE ECHO
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I have no financial disclosures.

Case #1: 7-month-old with a fever

- 2 days cough, congestion, fever (T-max 100.7 F)
- Less active, more tired, decreased PO intake, decrease UOP (2-3 wet diapers, usually 4-6)
- Parental concern for UTI
Case #1: ROS, PMH, SH

ROS: No eye redness or drainage, ear drainage, increased work of breathing, or color changes with her cough, vomiting, diarrhea, constipation, rashes.

PMH: Facial bruising, physical abuse at 2 months of age, E. Coli UTI at 3 months of age.

SH: Lives with both parents, MGM, MGM’s boyfriend.

Case #1: Physical Exam

- MSK: Mild swelling of the right thigh compared to the left. During the exam, pt was lying on her back in no acute distress. However, when palpating her right thigh, pt begins to cry. Palpation of the left thigh/LE does not provoke any crying. Any movement of the right leg causes the pt to cry loudly. She also cries loudly when picked up. She calms with lying still on her back. There are no obvious upper or lower extremity deformities. She has normal muscle bulk and tone. She moves all her extremities spontaneously.

Case #1:

- Metaphyseal corner fracture to distal right femur.

- Soft tissue swelling of right thigh.
Classic Metaphyseal Fracture: Location

- Occurs near ends of long bones
  - Wrists
  - Elbows
  - Shoulders
  - Knees
  - Ankles
- Often called corner or bucket handle fractures

Classic Metaphyseal Fracture: Mechanism

- Proposed Mechanism: Bending + torsion + tensile forces
  - Yanking extremity
  - Pulling and twisting extremity
  - Inertial forces (shaking)?
- Support
  - Breech birth (Lysack 2003, O'Connell 2007)
  - Clubfoot repair (Grayev 2001)
  - IV placement (Burrell 2015)
  - Porcine models (Thompson 2015)

Classic Metaphyseal Fracture: Morphology

- Fracture Morphology:
  - CMLs extend in a planar fashion through the metaphysis separating a mineralized fragment
  - Extend through the trabecular transition zone of the metaphysis
  - Junction of the primary and secondary spongiosa
Classic Metaphyseal Fracture: Significance

- Significance of CMLs
  - Small fractures
  - Highly specific for child physical abuse
  - Indicative of use of significant force
  - Most commonly infants < 1 year
  - Difficult to date
    - Healing bone/periosteal reaction not consistently seen

Case #1: Additional Evaluation

- Obtained:
  - Skeletal Survey
  - Head CT
  - Labs...

- Admitted to Trauma Surgery

Case #1: Skeletal Survey

- Healing right third and left sixth rib fractures.
- Classic metaphyseal fracture seen involving the right femur with adjacent diaphyseal periosteal reaction.
- Periosteal reaction seen involving the right tibia and fibula surrounding likely bowing type fractures.
- Classic metaphyseal fracture of the left femur with adjacent diaphyseal periosteal reaction.
- Periosteal reaction seen involving the left tibia and fibula surrounding a bowing type fracture.
- Subtle irregularity of the proximal left radial neck, likely acute fracture. No definite adjacent periosteal reaction seen at this time.
- Irregularity of the distal radial and ulnar metaphyses, favor normal.
Fractures: Bone Health Labs

**When to order?**
- Young child presenting with isolated fractures (no bruising, head trauma)
- Clinical or radiographic features of metabolic bone disease
- Risk factors for metabolic bone disease

**What to order?**
- Calcium
- Magnesium
- Phosphorus
- Alkaline phosphatase
- Parathyroid hormone (PTH)
- Vitamin D 25-OH level
- Genetic Testing + / -
- Typically discuss with Genetics first to help determine basic vs expanded genetic testing

**Case #1: Outcome**
- Child placed into protective custody
- Doing well with foster parent at time of follow up appointment in SCAN, diagnosed with child physical abuse
- Repeat Skeletal Survey:
  - Healing right third rib fracture
  - Healing left sixth rib fracture
  - Healing right femur CML
  - Healing bowing fractures of right tibia and fibula
  - Healing left femur CML
  - Healing left tibia and fibula bowing fracture
  - Healing proximal left radial neck fracture

**Typically obtained + LFT = normal**
Case #2: 2-year-old with bruising

- 2 year 10-month-old girl had visit with bio mother and siblings for a few days over holidays
- Returned to adoptive mother’s house with scratch marks and bruising
- Also more fussy than usual but mom thought maybe just tired
- Brought to ED for medical evaluation
  - Has eczema, otherwise negative and/or noncontributory PMH, no meds, no allergies

Case #2: Physical Exam

- Gen: Sitting on mom’s lap, stranger anxiety, will play with toys
- Head: Normocephalic, large contusion to the right/middle forehead that extends to the bridge of the nose. Mild tenderness to palpation. Not boggy. No step off of the frontal bone. No drainage or warmth is noted.
- Chest Wall: Mild tenderness to the right side of the chest on palpation. No erythema, warmth or edema.
- Gastrointestinal: Mild tenderness to the epigastric abdomen. Abdomen is otherwise soft, non-distended, no organomegaly, normal bowel sounds.
- Musculoskeletal: No deformity, moves all extremities.
- Neurologic: No focal defects, normal tone and power, normal age-appropriate development.

Case #2: Additional Evaluation

- Head CT:
  - Right forehead and nasal frontal scalp/face hematoma.
  - No other CT-evident head injury. No skull fracture or intracranial hemorrhage.
- Skeletal Survey:
  - No acute or healing fracture identified
Case #2: Additional Evaluation

Test Results:

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Case #2: Abdominal CT w/ contrast

IMPRESSION:
1. Nondisplaced right 8th-10th rib fractures, with adjacent tiny hemopneumothorax.
2. Small AAST grade 1 posterior inferior right hepatic parenchyma hematoma.

Testing for Occult Abdominal Injuries

- Abdominal injuries may be difficult to detect
- Pre-verbal children are an even greater challenge
- Young, suspected victims of abuse should have liver function tests
- Children with elevated liver function tests should have an abdominal CT
- Identification of occult abdominal trauma contributes to the medical diagnosis and forensic evaluation
Prospective, observational, multicenter trial, children <60mo referred for consultation for physical abuse
- Abdominal injury = radiographic or pathologic evidence of solid organ laceration, contusion, hematoma, perforation, tear
- Occult injury = no bruising, tenderness or distension
- 1676 consults for child abuse, 404 (25%) w/o screening labs
  - Abdominal injury identified in 54 patients (3.2%)
  - 17 clinically occult injuries
  - Transaminase levels elevated in 14/17 patients with occult injury

We recommend using a threshold of 80 for either AST or ALT as an indication for pursuing definitive testing in a population with concern for abuse regardless of exam findings.

Mildly elevated or normal transaminase levels do not exclude abdominal injury, especially in children with clinical indication of injury such as abdominal bruising, distention or tenderness.

Case #2: Follow Up...
- Child was “whooped” for having a urinary accident on the couch while at biological mother’s home
- Diagnosis:
  - Child Physical Abuse
  - Patterned bruising to leg
  - Subgaleal hematoma
  - Fractures of right posterior 8th-10th ribs
  - Liver hematoma
- Doing well at follow up clinic appointment
  - 1 yo sibling seen for eval
Questions? Thoughts?

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