Orthopedic Injury: Accidental or Not?

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Objectives

Highlight evaluation and management of pediatric fractures
Understand when fractures should raise concern for child abuse
Emphasize AAOS 2009 and AAP 2014 Clinical Practice Guidelines
Encourage partnership with Orthopedic Surgeons and Child Abuse Pediatricians
## Fractures in Hospitalized Children <36 Months

Leventhal et. al. Pediatrics 2008

<table>
<thead>
<tr>
<th>Cause</th>
<th>% (N = 15 143)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>50.42</td>
</tr>
<tr>
<td>Abuse</td>
<td>12.08</td>
</tr>
<tr>
<td>Other accident</td>
<td>11.60</td>
</tr>
<tr>
<td>Motor vehicle accident</td>
<td>11.40</td>
</tr>
<tr>
<td>Uncertain whether accidental or intentional</td>
<td>2.17</td>
</tr>
<tr>
<td>Bone abnormality</td>
<td>0.85</td>
</tr>
<tr>
<td>Metabolic abnormality</td>
<td>0.12</td>
</tr>
<tr>
<td>Birth trauma</td>
<td>0.05</td>
</tr>
<tr>
<td>No injury E-code</td>
<td>11.32</td>
</tr>
<tr>
<td>Total</td>
<td>100.01</td>
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</tbody>
</table>
## Abusive Fractures in Hospitalized Children
Leventhal et. al. Pediatrics 2008

<table>
<thead>
<tr>
<th>Age, mo</th>
<th>Cases per 100 000 Children</th>
</tr>
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<tbody>
<tr>
<td>0–11</td>
<td>36.1 (31.0–41.2)</td>
</tr>
<tr>
<td>12–23</td>
<td>4.8 (3.8–5.7)</td>
</tr>
</tbody>
</table>
Case Presentation

6 month old
Case Presentation
When Is a Fracture Suspicious?

No history of injury

History of injury not plausible (mechanism; energy load; severity)

Inconsistent or changing history

Fracture in a non-ambulatory child

Fracture with high specificity for abuse

Multiple fractures

Fractures of different ages

Other injuries suspicious for child abuse

Delay in seeking care for an injury
When is a Fracture Suspicious?

High specificity
- CMLs
- Rib fractures, especially posteromedial
- Scapular fractures
- Spinous process fractures
- Sternal fractures

Moderate specificity
- Multiple fractures, especially bilateral
- Fractures of different ages
- Epiphyseal separations
- Vertebral body fractures and subluxations
- Digital fractures
- Complex skull fractures

Common, but low specificity
- Subperiosteal new bone formation
- Clavicular fractures
- Long-bone shaft fractures
- Linear skull fractures
<table>
<thead>
<tr>
<th>Bone fracture/studies</th>
<th>Age range</th>
<th>Positive predictive value for suspected or confirmed abuse (95% CI)</th>
</tr>
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<tbody>
<tr>
<td>Femur/nine studies (confirmed or suspected)</td>
<td>0–18 months</td>
<td>50.1% (CI 34.1–66.1)</td>
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<tr>
<td>(36, 38, 53–59)</td>
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<td>Femur/eight studies (confirmed or suspected</td>
<td>12–48 months</td>
<td>11.7% (CI 6.1–17.3)</td>
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<td>abuse): (36, 38, 43, 54, 55, 57–59)</td>
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<td>0–18 months</td>
<td>43.8% (CI 27.6–59.9)</td>
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<td>abuse): (37, 40, 56, 58, 60)</td>
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<td>18–48 months</td>
<td>1.8% (CI –0–3.9)</td>
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<td>Rib fractures/four studies (confirmed or</td>
<td>0–48 months</td>
<td>66% (CI 42.5–89.7)</td>
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<td>suspected abuse): (35, 61–63)</td>
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<tr>
<td>Skull fractures/four studies (confirmed or</td>
<td>0–48 months</td>
<td>20.1% (CI 13.3–26.9)</td>
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Suspicious Injuries

Torn frenulum in a non-mobile child
Suspicious Injuries
Abusive bruising patterns.
Suspicious Fracture(s)

Fracture(s) inconsistent with a child’s motor development

Fracture (type) inconsistent with caregiver history

Unexplained fracture(s) in a child with normal bones

Fractures in different stages of healing in a child with normal bones

CPS REPORT
Suspicion of Abuse

Child Protective Services (CPS)
  • **MANDATORY REPORT**
  • Safety Assessments; Community Services
  • Jurisdiction Specific Hotlines
    • 1 800 422 4453

• Child and Adolescent Protection Center (CAPC)
  – Recommended
  – Clinical Assessments
  – Service to Metropolitan Area
    • 202 476 4073 (Clinic)
    • 202 476 5000 (On-call MDs, SWs)
Clinical Assessment

• Skeletal Survey - mandatory in all cases of suspected physical abuse in children < 2 yrs  *AAP 2014 ACR 2009*

• Skeletal Survey - AP view of every bone in body, AP and lateral skull and spine, with bilateral oblique ribs (if < 2 yrs)

• 2 to 3 week limited follow-up survey can increase diagnostic yield  *Harlan et. al. 2009*

• Non-contrast Head CT (if <1 yr or possible brain injury)
Clinical Assessment

Calcium
Phosphorus
Alkaline Phosphatase
iPTH
25-hydroxy Vitamin D
DNA sequencing of COL1A1 and COL1A2

• AST, ALT, amylase, lipase, UA
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Pitfalls

Vitamin D Insufficiency *Schilling 2011*
- 20ng/cc to <30 ng/cc
- No difference in prevalence of fractures compared with healthy children

Osteogenesis Imperfecta *Greeley 2013*
- Rib fractures occur in neonates and children but not infants
- 3 or more fractures at time of OI diagnosis is unusual
Case Presentation

Initial forearm film: 3 fractures.
Skeletal survey: 34 acute and healing fractures.
No lab or XRAY indications of Vitamin D deficiency or Osteogenesis Imperfecta.
Biological father confesses to multiple episodes of abusive injury...
Questions?

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Thank you
Additional Resources


http://www2.aap.org/sections/childabuseneglect/

- 2014 AAP Statement: Evaluating Children With Fractures for Child Physical Abuse
- Link to Child Abuse Specialists (by State)
- Online Child Maltreatment Courses
- Upcoming Conferences
CPS Hotlines Verified 5/22/2014

National Child Abuse Hotline: 1-800-4- A CHILD (422 4453)

Washington, D.C Hotline: 202-671-SAFE (7233)
Virginia Commonwealth Hotline: 1-800-552-7096
  - Fairfax County 703-324-7500
  - Loudoun County 703-777-0353
  - Arlington County 703-228-1550
State of Maryland Hotline: 1-800-332-6347
  - Prince George's County 301-909-2450
  - Montgomery County 240-777-4417
  - Anne Arundel 410-421-8400
  - Charles County 301-392-6739
  - Calvert County 443-550-6969

Report to jurisdiction of occurrence.

Report to jurisdiction in which patient resides if jurisdiction of occurrence is unknown.