Understanding Medical Evidence in Physical Abuse Cases

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Special problems in child abuse evaluations

Physicians and nurses need the best history of how the injury occurred in order to determine whether the history and the injury are consistent

- Children may be too young to tell history
- Children may be afraid to tell the history
- Parents may not know what happened
- Parents may provide intentionally false history
- Both "accidents" and abuse are common

Medical conditions confused with physical child abuse

- Dermatologic conditions
- Coagulation disorders
- Genetic disorders of metabolism
- Metabolic, genetic, and infectious bone disorders
- Folk medicine practices
- Unintentional, non-inflicted injuries

General principles

- Falls and other "accidents" are common
- Fractures and bruises due to falls are common but not in infants
- Child abuse is common, but less common than accidents
- Metabolic/genetic diseases are uncommon
- Spontaneous bruising and fractures are very uncommon (implausible)
- Neither an actual "accidental" event nor the presence of a disease protects a child from abuse

Common "Accidental" Injuries

- Falls
- Burns
- Fractures
- Motor vehicle accidents
- Ingestions (poisonings)
- Submersion (near drowning, drowning)

Child Abuse - Trauma Relationship

- 10 year data from National Pediatric Trauma Registry for hospitalized children < 5 y.o.
  - CA represented 10.6% of all blunt trauma
- 9 year data from single Pediatric Trauma Center for hospitalized children 0-17 y.o.
  - CA represented 7.3% of all blunt trauma
- Mean age CA hospitalizations = 12 mos.
- Injuries more severe in CA

Basic concept- Accidental trauma vs child abuse

- many inflicted injuries in children are indistinguishable from accidental trauma on clinical or radiological grounds
- most important factor is a detailed description of the "accidental event"

Common features of abuse situations

- The HISTORY does not fit the location, pattern or reported timing of the injury event
  - The history is inconsistent, implausible, changing, absent (unexplained), or there is delay in seeking care
- The PHYSICAL findings are not typical of accidental injury in pattern and location
  - The findings often include multiple injuries, injuries of different duration, inflicted patterns, "surprise"

Bruises

Bruises and Abuse

- Babies that don't cruise rarely bruise – 2% of non-cruisers, 18% of cruisers, 52% of walkers
- Bruises uncommon in simple falls- one study of 207 child falls from hospital furniture <1% had bruises
- Pattern, location, and distribution of bruises key to distinguishing abuse from "accidental"

Bruises and Abuse

- Rate of healing/ resolution depends on depth, location, amount of bleeding, baseline skin color and circulation
- Bruises are difficult to date accurately – if there is any yellow a bruise is at least 18 hours old
- Physicians vary but can date into new, intermediate and old group with 50 – 75% accuracy

Bruises, Abuse, & Bleeding Disorders

- Consider bleeding or coagulation disorders if a child has suspected abuse bruises and –
  - The child is a young infant
  - A young child (especially preverbal) with only bruises but no other types of abuse injury
  - The bruising appears unusually severe
  - Child has a history of excessive bleeding or brusing
  - Family has history of bleeding disorder
- Children with bleeding disorders can also be abused!

Bruises, Abuse, & Bleeding Disorders

- Basic coagulation assessment
  - Platelet count, prothrombin time (PT), partial thromboplastin time (PTT)
- Extensive coagulation assessment
  - Von Willebrand factor antigen
  - Factor VIII activity assay, ristocetin cofactor and multimer analysis
  - Thrombin time
  - Factor XIII assay
  - Fibrinogen
  - PFA 100

BRUISES SUMMARY

- Bruises in non-cruising infants are unusual and are suspicious
- "Normal" bruises occur over boney prominences & are irregular oval to round areas
- Inflicted bruises occur on soft tissue areas and show patterns or shapes with distinct borders or involve multiple body planes
- Dating of bruises is not an exact science
- Geometic or patterned injury often abusive
- Cutaneous injury often multiple – sites, types, agents, durations

Burns

Burns and Abuse

- Burns are difficult to date: estimates of age of injury are estimates only
- Rate of healing depends on location, type and depth of burn injury
- Patterns of burns is key to distinguishing abuse from "accidental"

Types of Burns

- Thermal
  - Scald
  - Contact
  - Flame
- Chemical
  - Acid, alkali, peppers, garlic
- Electrical (high voltage)
- Radiation

Exposure Time for Burns
(to cause second degree burns)

Temperature F	Adults	Children
122	5 minutes	
127	60 seconds	
130	30	10
140	5	1
150	2	< 1
158	1	

BURNS SUMMARY

- CAUTION: not everything that looks like a burn is the result of physical trauma.

  You must also consider:

  - Cellulitis
  - Contact dermatitis
  - Drug reaction
  - Bullous impetigo
  - Insect bites
  - Phytophotodermititis
  - Folk medicine practices

BURNS SUMMARY

- Burn severity is related to both the temperature and duration of contact with hot liquid or object
- Accidental scald burns show a pattern of cooling liquids or splash marks
- Inflicted scald burns show a clear demarcation line
- Accidental contact burns on palmar surface
- Inflicted contact burns reveal object shape
- Geometic or patterned injury often abusive
- Cutaneous injury often multiple – sites, types, agents, durations

CUTANEOUS INJURY SUMMARY

- Most common manifestation of physical abuse
- Often the only organ system involved
- Sometimes associated with other organ system involvement
- Pattern of the injury is key to identifying cause

Fractures

“Facts” about abusive fractures

- More than 50% of abusive fractures are in children < 1 y.o
- 80% abusive fractures are in children < 3 y.o.
- 43% abusive fractures are unsuspected clinically
- Up to 80% of occult abusive fractures on skeletal survey are found in infants < 1 y.o.
- Multiple fractures seen in > 50% of abusive fractures

Fractures in infants are often from abuse

- 40 to 80% of all fractures in infants < 1 y.o. are due to abuse
- 60% of femur fractures in infants < 1 y.o. are due to abuse
- 37% of humerus fractures in infants < 15 m.o. are due to abuse
- 80-85% of rib fractures in children < 3 y.o. are due to abuse

Abusive Fractures

- In cases of abuse there often is:
  - More than one fracture
  - Fractures in multiple locations
  - Fractures in different stages of healing
  - Occult fractures
  - Fracture type is not explained by history
  - Highly specific types of fractures
- Most commonly seen in infants and toddlers

Fracture injury plausibility

- History details – initial position, injury event dynamics, final position
- Review complete skeletal survey
- Biomechanical compatibility of history with fracture type
- Child's age
- Family history

Fracture injury plausibility

- Additional physical findings
- Evaluation for other "occult" trauma
  - depending on age of child, history, and other findings
  - "trauma labs", head CT, ophthalmology exam
- Serum calcium, phosphorus, alkaline phosphatase

Fractures in child abuse

- Highly specific fractures
  - Metaphyseal fractures ("bucket handle", "corner")
  - Infant rib fractures, especially posterior
  - Scapular, vertebral spinous process, or sternal fractures
- Moderately suggestive fractures
  - Multiple fractures
- Common but not specific fractures
  - Any fracture in a young child

Abdominal injury

Internal injuries and child abuse

- Leading cause of death due to physical abuse is inflicted head trauma
  - Can be caused by impact and or shaking
  - Clinical presentation very variable
- Second leading cause of death is abdominal trauma
  - Can involve solid and or hollow organs
  - Clinical presentation very variable

Falls and childhood injury

- minor falls common in childhood
- skull fractures, clavical Fx in 1 -2% of minor falls; other fractures uncommon in infants, more common in children
- falls in arms of caretakers, fall down stairs & walker falls more complex
- minor falls rarely cause significant injury to brain, chest or abdominal organs, or to multiple body planes

General evaluation guidelines

- Consider abuse ANY TIME you observe an injury
- Obtain skeletal survey on all children < 2 y.o. with suspected abuse
- Obtain head CT scans on all infants < 13 mo. old with suspected abuse; consider head CT on others
- Obtain coagulation screen (platelets, PT, PTT)
- Obtain urine drug screen if mental status change
- Consider "trauma labs" & abdominal CT

Basic concepts- Types of abdominal injury

- Penetrating injury
  - Causes by object penetrating through the abdominal wall
- Blunt impact injury
  - Caused by externally applied forces

Basic concepts- Types of abdominal organs

- Solid organs
  - Liver, spleen, pancreas, kidney
- Hollow organs
  - Stomach, intestines, bladder

Protection of abdominal organs from blunt impact injury

- Abdominal muscles contract absorb and dissipate energy
- Rib cage protects liver, spleen, kidney from front, back or side impacts
- Back muscles and spine protect pancreas, duodenum, and kidney from back impacts
- Hollow organs can deform

Risk of abdominal injury with blunt impact in children

- Children have poorly developed abdominal muscles
- Children have relatively small distance from belly button to spine
- Children are less coordinated

Abdominal injury mechanisms

- Motor vehicle accidents (MVA) without proper restraint, car-pedestrian impacts, and significant falls have highest risk
- MVA with only lap belts used, car-bicycle collisions, bicycle handle bars, sports (sledding and snowboarding)
- Inflicted abdominal injury

Abdominal injury and child abuse

- Clinical presentation vary in type and acuity
  - Cardiovascular failure/shock, peritonitis, GI obstruction, abdominal distention, vomiting
- Both solid and hollow organ injured
  - Hepatic injury predominates in some series, others perforation/peritonitis
  - Pancreatic injury less common
  - Multiple organs may be involved

Abdominal Injuries

ABUSIVE

- Younger child (2.6 yr)
- Vague histories
- Delayed medical care
- Often Hollow viscera
- Mortality rate high

ACCIDENTAL

- Older child (7.8 yrs)
- 90% credible accident history (MVA, falls)
- Prompt medical care
- Usually Solid organ
- Mortality rate low

Guidelines – Abdominal injury

- Multiple organ system injury can occur in children with significant non-inflicted and inflicted injury
- A high level of suspicion is needed to detect abdominal injury in abused children
- Infants and toddlers are at highest risk, but any preverbal or minimally verbal child should be considered at risk of inflicted abdominal injury

Guidelines – Abdominal injury

- Any child with suspected abuse with abdominal tenderness, abdominal bruising, abdominal distention, abnormal blood pressure or unconsciousness needs evaluation
- Obtain liver enzymes, pancreatic enzymes, and consider abdominal CT scan if significant elevations in enzymes even if other findings for abdominal injury is absent

Summary: Abdominal injury and child abuse

- Abdominal injury is uncommon among children with either accidental or abusive trauma
- Serious abdominal injury is rare in children except for abuse or motor vehicle accidents
- Second leading cause of child abuse death is abdominal organ injury
- Can involve hollow organs, solid organs or both, but solid organ injury predominates in accidents

Summary: Abdominal injury and child abuse

- Mechanism of injury is typically blunt impact – but bruising is often absent
- Recognition requires considering possible abdominal injury, and recognizing non-cutaneous examination findings
- No single laboratory or imaging study can identify all injuries
- Delay in medical care increases risk of death

Summary: Childhood trauma and child abuse

- most inflicted/ non-inflicted injuries are indistinguishable radiologically and clinically
- most important factor is a detailed description of the "accidental event"

Summary: Evaluation of children with suspected abuse injury

- Obtain skeletal survey on all children < 2 y.o. with suspected abuse
- Obtain head CT scans on all infants < 13 months old with suspected abuse; consider head CT on other young children
- Obtain coagulation screen (platelets, PT, PTT) as a minimum assessment

Most important is to obtain and document a detailed history

Summary: Diagnostic possibilities in suspected abuse

- Clear cut unintentional injury
- Medical conditions that mimic abuse
- Concealed unintentional injury
- Unexplained injuries –could be either, but history absent
- Discrepant injury not compatible with the history
- Clear cut inflicted injury