Bruises, Burns and Broken Bones: Accident or Abuse?

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Child Abuse Facts in US

• ~3 million reports to CPS annually
  – ~1 million confirmed
• ~1200 – 1500 deaths
  – 90% <5
  – 40% <1
• Many seriously injured and murdered children present to ED for initial care

Child Abuse Sequelae

• Child maltreatment is a significant risk factor for adverse outcomes in adult medical and mental health
  – Vincent Felitti/CDC/Kaiser Permanente
  “Adverse Childhood Experiences” studies
Definition of Child Physical Abuse

- The infliction of physical injury as a result of punching, beating, kicking, biting, burning, shaking or otherwise harming a child
  - Includes fractures, burns, bruises, welts, cuts, internal injuries
- May not be intentional
- May result from over-discipline or punishment

Signs and Symptoms of Physical Abuse

- Unexplained bruising
- Patterned bruising
- Bruising in pre-mobile children

Signs and Symptoms of Physical Abuse

- Certain fractures
- Certain types of head injuries
- Injuries inconsistent with history or development and age of child
What is neglect?

- Failure to provide basic needs of child:
  - Physical
    - Food or shelter
    - Adequate supervision
  - Medical
    - Includes medical and mental health treatment
  - Educational
  - Emotional
    - Inattention to child’s emotional needs
    - Failure to provide psychological care
    - Permitting child to use alcohol or drugs

Child Neglect Issues

- May be hardest to prove
  - Intentional or non-intentional
- Role of parental
  - Substance abuse
  - Mental illness
- May be most harmful
  - Mental/emotional health
  - Physical health
  - Lethality

Signs and Symptoms of Child Neglect

- Evidence of:
  - Poor nutrition
  - Poor hygiene
  - Poor general care
  - Failure to seek medical care
  - Must distinguish from poverty and other social/cultural factors
Important Factors To Consider in Child Maltreatment Evaluations

1. History
   • Explanation of injury
     – When
     – Where
     – How
   • Witnesses
     – Usually none in NAT
   • Remember history may be inaccurate
   • "When was child last seen well?"

2. Age and developmental status of child
   • Sitting?
   • Crawling?
   • Pulling to stand?
   • Walking?
   • Climbing?
3. Child’s medical history
   • Congenital & acquired diseases
     – Hemophilia
     – Von Willebrand’s
     – Idiopathic thrombocytopenic purpura (ITP)
     – Osteogenesis imperfecta (“brittle bone disease”)
   • Developmental disability
   • Behavioral problems

4. Response of caretaker
   • When medical attention sought
     – Injuries from abuse may not be readily apparent
   • Affect and behavior
     – Appropriate concern?
     – Comforting to child?
   • Parental expectations of child

5. Location, “age”, patterns
   • Of bruises, burns, fractures, other injuries
   • Injuries from abuse may be non-specific
6. Evidence of multiple injuries
• Not explained by history of event

7. Child’s skin color
• Pigmentation may mask skin injuries
• Children of color more likely to have "Mongolian spots" that may be confused with bruises

Other factors to consider:
• Methods of discipline used in family
• Poverty
• Unemployment
• Substance abuse
• Domestic violence
• Divorce
• Other social stressors
  – Social isolation
CAUTION:

- C. Jenny et al in JAMA Feb. 1999
- “Missed cases of abusive head trauma”
- Abuse more likely to be missed in:
  - Very young children
  - White families
  - Intact families

Other factors, continued

- Amount of force necessary for injury seen
- Gravity
- Other injuries
- Other medical problems
- Conditions or findings that can mimic abuse findings

Goals of medical history

- Determine cause of illness/injury
  - Are there alternatives to abuse?
- Establish chronology
- Assess for illness or disease that may mimic abuse
- Determine if any inheritable diseases in family that may mimic abuse injuries
Medical History

• Explanation of injury
  – Independent history from verbal child, witnesses
  – In abuse, unlikely to get accurate hx from abuser
  – Open-ended, non-challenging, non-accusatory

History of present illness

• When did injury/illness occur?
  – Events preceding injury/illness
  – When was child last seen well
• Where did it happen?
  – Abusive injuries usually in private settings
• Was the injury witnessed?
  – Detailed questions regarding injury
  • How far did child fall?
  • On to what surface?
  • Were any objects in path of fall?
  • Position in which child landed?

HPI, continued

• What was child’s reaction to the injury?
  – Behavior compatible with pain/disability?
• What did caretaker do after injury?
  – When injury/illness first noticed
  – Treatment prior to seeking care
• How much time elapsed before seeking care?
  – Delay in seeking care = red flag
Past Medical History

- General health
- History of other injuries, hospitalizations, surgeries
- Birth history if young infant
  - Birth trauma
    - Forceps, vacuum
    - Footling/breech
    - Big baby
  - Prematurity
    - Prolonged parenteral nutrition
    - Medications

Past Medical History, cont.

- Medications
  - May have side effects
- Medical conditions
  - Bleeding disorders
  - Osteogenesis imperfecta
- Developmental history
  - Crawling, standing, walking?

Gross Motor Developmental Milestones

- 2 months  Able to lift head if prone
- 4 months  Roll over
- 6 months  Sit up independently
- 8–9 months  Crawling
- 9–12 months  Cruising
- >12 months  Walking, falling
Family history

- Family medical history
  - Bleeding disorders (hemophilia, Von Willebrands)
  - Bone disorders (osteogenesis imperfecta)
  - Connective Tissue Disorders (Ehlers-Danlos)
  - Unexplained deaths in infancy

Social history

- Who lives at home
- Who are caretakers and when?
- History of partner violence?
- Parental or partner mental illness?
- Family use of alcohol, drugs?
- Family methods of discipline?

History Red Flags

- History inconsistent with exam
- History of minor trauma with extensive physical injury
- No history of trauma but evidence of injury
- History of self-inflicted injury incompatible with child development
- History that changes with time
- Delays in seeking treatment
- Injury blamed on young sibling/playmate
HOWEVER…
• Consider language barriers
• Minor injury not readily apparent at first
  – Simple, linear parietal skull fracture
  – Toddler fracture
• Delays in care due to:
  – Financial concerns
  – Work obligations
  – Child care problems
  – Prior involvement with CPS, immigration, law enforcement
  – Initial trial of home remedies

BRUISES

Ask yourself:
• Are the history and injury consistent with the child’s age and developmental abilities?
“If They Don’t Cruise, They Shouldn’t Bruise”

- N. Sugar et al 1999
  - ~1000 children <36 months, well child visit
  - Prevalence of bruises:
    - 0.6% <6 months
    - 1.7% <9 months
    - 2.2% not yet walking with support
    - 17.8% cruisers, 51.9% walkers
    - Face (except forehead in walkers) rare

Ask yourself:

- Is the location of the bruise(s) consistent with the history and age/developmental status of the child?

Location


- 177 babies aged 6 – 12 months in for well child visits
- Prevalence 12%
- All front of body over bony prominences: face (primarily forehead) head, shin.
- None >10 mm diameter
- Increased mobility = increased frequency of bruises
Location, location, location

D. Chadwick, Ped Annals, Vol. 21, Aug. 92, “The Diagnosis of Inflicted Injury in Infants and Young Children.”

• “Very Likely Inflicted”: buttocks, ears, genitals, perianal, abdomen, cheeks, neck, multiple sites
• “Possibly Inflicted”: upper arm, chest, “raccoon sign”
• Unlikely”: shins, forearms, elbows, forehead

Bruise patterns

Skin lesions that can be confused with abuse

• Bleeding disorders
• Skin infections
• Allergic reactions
• Folk remedies
• Birthmarks (esp. Mongolian spots)
ITP

- Sudden onset petechiae & purpura
- Platelets <20,000 usually
- Child otherwise looks, feels fine
- Intracranial hemorrhages 0.1 – 1%
- 80% resolve spontaneously

Hemophilia

- Most common severe inherited bleeding disorder
- Deficiency in factor VIII (A) or IX (B)
- Present with easy bruising, intramuscular bleeds, hemarthrosis

Henoch-Schonlein Purpura

- Cause unknown – often follows viral illness
- Vasculitis of small vessels
- Rash = palpable purpura
- Associated with arthritis, abdominal pain
Bite appearance

• May be possible to differentiate adult from child bites by size of bite arc

Oral Injuries
Frenulum tears

• May be from
  – forced feeding
  – hand over mouth
  – hitting
  – falls
• History, developmental status very important

Lip injuries

• May be from
  – falls
  – direct blows to mouth
  – hand over mouth

BURNS
Overview of burns

- Deliberate injury by burning often goes unrecognized
- ~10% of all child abuse cases (range 2 – 30%)
- ~10% of pediatric admissions to burn units
- Almost all <10; majority < 2 years old

How Do Children Get Burned?

- Scald burns:
  - Spill
  - Splash
  - Immersion
- Contact burns
- Chemical burns
- Electrical burns
- Microwave or regular oven
- Any of above may be accidental or intentional

Why Are Children Burned Intentionally?

- Many different reasons
- One of most common is toilet training
- Punishment
- “Teach a lesson”
- Usually loss of caregiver control
- May be homicidal intent, however (i.e. placing child in an oven)
Scald burns

- Most common type
- May be spill/splash type of burn OR
- Immersion burn: most common intentional liquid burn injury
- May be any hot liquid but most deliberate burns are caused by tap water

Spill/splash burns: accidental or intentional?

- Throwing hot liquid:
  - punishment for playing near a hot object or in anger
- More common in assaults on adults
  - Child may have been caught in the crossfire
- May be difficult to tell
- Unlikely to be accidental on back

Spill/splash burns, continued

- Clothing worn at the time may alter the pattern: i.e., fleece sleeper vs. thin cotton T-shirt – important to ask about whether clothing was worn and retain if possible
Immersion burns

• Result from the child falling or being placed into a tub or other container of hot liquid
• Key variables:
  – Temperature of the water
  – Time of exposure
  – Depth of burn
  – Occurrence of “sparing”

Immersion Burns: Accidental or Intentional?

• Deliberate immersion burns most commonly associated with toilet training or soiling of clothing
• DEEP BURNS OF THE BUTTOCKS AND/OR AREA BETWEEN THE ANUS AND GENITALS = DELIBERATE

“Sparing”

• Areas of body within a burn that are spared of injury
  – Flexion sparing
  – Surface contact sparing
  – Perpetrator hold sparing
“Stocking-Glove Burn Patterns”

- Clear and symmetric lines of demarcation
- Uniform burn depth and severity
- Essentially diagnostic for abuse

Contact burns

- Contact with flames or hot solid objects
- “Branding” type injury that mirrors object that caused burn
- Examples:
  - Hot radiator or grate
  - Open oven door
  - Wood burning stove, fireplace
  - Curling iron, steam iron
  - Cigarettes, lighters

Contact Burns: Accidental vs. Intentional

- Important considerations:
  - Age, height, strength, developmental status of child
  - Evidence of other healed burns
  - Shallow, irregular burn vs. clean, crisp burn distinctive pattern of object
Cigarette burn
• 7 mm wide
• End of cigarette is 400 degrees

Skin Conditions That Can Mimic Burns
• Cutaneous infections:
  – Impetigo
  – Severe diaper rash
  – Early scalded skin syndrome
  – Careful history, exam, cultures, and observation over time will usually determine etiology

Skin Conditions That Can Mimic Burns
• Hypersensitivity reactions:
  – Photodermatitis from citrus fruits, cow parsnip, poison ivy/oak may resemble splash burns
  – Allergic reaction causing a severe local skin irritation
  – Exposure history will allow differentiation from burns
FRACTURES

Abusive fractures
- ~30% of all childhood fractures are inflicted
  - 75% in children <1 year old
- Can occur at any age
  - More common in young children
- Predictive for future injury

Evaluating fractures
- Knowledge of child development essential
- Risk of self inflicted injury increases as child development progresses
- Be suspicious of:
  - Fracture in an infant
  - Multiple fractures, especially different ages
  - Fracture not explained
  - Occult fracture
Accident or Abuse?

• Highly specific fractures
  – Metaphyseal
  – Posterior rib
  – Scapular
  – Spinous process
  – Sternal

Accident or Abuse, cont.

• Moderate specificity fractures
  – Multiple, especially bilateral
  – Different ages
  – Epiphyseal separations
  – Vertebral body
  – Digital
  – Complex skull

Accident or Abuse, cont.

• Common but low specificity fractures
  – Clavicle
  – Long bone shaft
  – Linear skull

MODERATE & LOW SPECIFICITY FRACTURES BECOME HIGHLY SPECIFIC WHEN CREDIBLE HISTORY OF ACCIDENTAL TRAUMA IS ABSENT
Spiral fractures

- Spiral fracture does not require as much force as a transverse fracture
- Caused by twisting motion of limb
- “Toddlers fracture” = spiral fx of tibial
  – Common age 9 mos. – 3 years
  – Usually accidental: plant leg, turn
  – Often unobserved
  – Often subtle finding on X-ray

Medical conditions associated with fractures

- Birth trauma
- Neoplasm
- OI
- Prematurity
- Malnutrition or disuse
  – Rickets, scurvy
  – Cerebral palsy
  – Osteopenia/osteoporosis
  – Cotractures
  – Handicapped children at higher risk for abuse!

HEAD INJURIES
Leading cause of death in child abuse injuries

- 95% serious intracranial injuries <1 y.o. due to abuse
- Shaking, impact most common causes of serious injury
- May be no external signs of trauma
- May only be subtle signs: irritability, vomiting, lethargy (“the flu”)
- Or may be obvious

Studies on falls

- 3 studies of 450 children falling out of hospital beds <4 ½ feet (Pediatrics 60, 92, J Ped Ortho 7)
  - No serious injuries
    - Contusions, small lacs, occasional clavicle or skull fractures
- Falls reported from bunk beds (AJDC 144)
  - No life threatening injuries or deaths
    - Lacerations (40%), contusions (28%), concussions (1%), fractures (10%), hospitalizations (10%)
- Other fall injuries (J of Trauma 31)
  - 70 children with falls of 1 – 3 stories
  - 54% head, 33% skeletal injuries
  - No deaths

Studies on falls, continued

- San Diego study: 166 children with reported fall seen at ped trauma center
  - 0 – 4 feet: 7/100 died
  - 5 – 9 feet: 0/65 died
  - 10 – 45 feet: 1/1 died
  - Short fall fatalities: Most had SDH & retinal hemorrhages, many with injuries unlikely to have occurred from fall
Abdominal Injuries

Abdominal visceral injuries

• Infrequent finding (<1% of reported cases of abuse)
• Children with inflicted injury generally younger than with accidental injury
• High mortality (2nd leading cause of death from abuse)
  – Severity of injury
  – Delay in seeking care
  – Delay in diagnosis
  – Young age of victim

Abdominal visceral injuries, cont.

• Elevations of liver enzymes sensitive markers for liver injury
• Mild elevations can identify asymptomatic injury in children
• Enzyme levels rapidly return to normal after trauma
Abdominal visceral injuries, cont.

- Isolated, single, solid organ injury common with both accidental and inflicted mechanisms
  - Especially liver, pancreas
  - Splenic injury uncommon from abuse
- Hollow visceral injuries more common with abuse

Your role

- Assessment and stabilization
- Recognize suspicious injuries & situations
- Documentation
- Report suspected abuse

Documentation of physical findings

Written description
Measure
Drawings
Photographs
Document history given

- History from parent or caregiver
- History from other witnesses
- History from child
- Use actual quotations when possible

Document findings at scene

- General conditions of environment
- Consistencies or inconsistencies
- Caretaker’s response

Reporting suspected abuse

- All states have mandated reporting laws for suspected child maltreatment
  - Check on your laws for primary agency
    - Child protection agency
    - Law enforcement agency
- Most states have immunity for good faith reporting
- Most states have potential penalties for not reporting
- HIPAA expressly allows exceptions
Resources

- AAP CD-ROM Visual Diagnosis of Child Abuse
- Diagnostic Imaging of Child Abuse; Kleinman et al; Mosby
- www.cincinnatichildrens.org
- American Professional Society on Abuse of Children
- National Children’s Alliance
- National Clearinghouse on Child Abuse and Neglect