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 all 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)
  - ConnectiveTissue 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

R.F. Carpenter Arch Dis Child, Vol. 80, 1999, "Prevalence and Distribution of Bruising in Babies."

- **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

BITES

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 be
- 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
- *Child Maltreatment—A Clinical Guide and Reference, 2nd Edition;* J. Monteleone, Ed.; G.W. Medical Publishing
- www.cincinnatichildrens.org
- American Professional Society on Abuse of Children
- National Children's Alliance
- National Clearinghouse on Child Abuse and Neglect