Sentinel Injuries:
How to recognize and understand minor abusive injuries that may precede or accompany serious physical abuse.

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Objectives

• Understand the concept of the sentinel injury and review common sentinel injuries.
• Distinguish between sentinel injuries and normal injury patterns in infants and small children.
• Review the prevalence of sentinel injuries in abused infants.
• Consider:
  – The inherent challenges to recognition of sentinel injuries.
  – The potent diagnostic implications of sentinel injuries.
  – The potent opportunities for prevention that sentinel injuries offer.
• I have nothing to disclose.

• What is Child Abuse Pediatrics?
  – Approved as a specialty by the American Board of Pediatrics and the American Board of Specialties in 2006.
  – First eligible group sat for boards in 2009. 85% of 216 who sat for the boards passed.
  – Comprehensive medical assessment and diagnosis of child maltreatment.
  – Completion of an accredited residency program in General Pediatrics followed by 3-year fellowship program and, previously, commensurate clinical practice experience.
What the Child Abuse Pediatrician Does

- Expert consultation on cases of suspected child maltreatment.
- Membership in Trauma Team.
- Interaction with Child Protective Services (CPS), law enforcement (police), defense attorneys and prosecutors.
- Representation in community efforts to manage child maltreatment (Multidisciplinary Teams).
- Preparation of legal documents (affidavits) to be used in court/testifying in court.
- Child advocacy and child abuse prevention.
- Education.
Framing the risk: babies and toddlers

2014 Child Protective Services data:

- Infants less than 12 months old were victimized at highest rates (24.4/1,000 children) compared to children 1/2/3 years old (12.3/11.6/12.3/11.0/1,000 children).

- Of all child abuse fatalities, 44.2% were infants younger than 1 year old.

- 70.7% of all child abuse fatalities were children less than 3 years old.

Child Maltreatment 2014
What is a sentinel injury?

- A sentinel injury is a relatively minor, but still suspicious, injury.
  - Minor? These injuries are medically mild. They will heal on their own and require no medical treatment.
  - Suspicious? Because these injuries occur in small infants who cannot sustain them under their own power, they are forensically significant.
What is a sentinel injury?

More specifically, sentinel injuries are bruises and intraoral injuries in infants and children too developmentally immature to sustain them accidentally.
Case Illustration

- A two-month-old infant was admitted to the hospital with a history of having suddenly become limp at home.
- A full workup for occult injuries revealed subdural hemorrhages, retinal hemorrhages and acute and healing fractures.
- When questioned, the infant’s mother reported that she noticed a small bruise on the infant’s cheek two weeks prior to admission.
- Had the mother sought medical attention for the bruise, and had the bruise been successfully recognized for its forensic implications, the subsequent head trauma could have been prevented.
Bruising and other superficial injuries: what is normal?

- Depending on the age and developmental ability of a child, some degree of bruising may be normal and not suggestive of physical abuse.

- Other injuries, like a frenulum tear, may be consistent with accidental injury in an ambulatory child.

- The importance of an understanding of a child’s developmental abilities cannot be overemphasized.
What is developmentally normal?

2 Months: Head up 45°

4 Months: Roll over and sit with support

6 Months: Sit—no support

9 Months: Pull to stand/stand holding on/cruise

12 Months: Walk
Bruises: epidemiology

- To determine the frequency and location of bruises in normal infants and toddlers, and to determine the relationship of age and developmental stage to bruising.

- Prospective, cross sectional survey of 973 children 0-36 months seen in primary care settings to document bruises.

- 2 (0.6%) of 366 infants 0-6 months had bruises. 8 (1.7%) of 473 children younger than 9 months had any bruises. Bruises were noted in only 11 (2.2%) of 511 children who were not yet walking with support (cruising).

- **Those who don’t cruise, don’t bruise.**

Sugar et al. 1999
Bruises: epidemiology

- To obtain a prevalence rate and determine the distribution of accidental bruising in babies.
- Prospective cross sectional survey of 177 babies aged 6–12 months seen in hearing testing and primary care settings were examined naked to look for bruises.
- 22 (12%) babies had bruises.
- All bruises were found on the front of the body and were located over bony prominences.
- There was a highly significant increase in bruises with increase in mobility.

Carpenter 1998
Bruises: epidemiology

Carpenter 1998
Bruises: abuse vs. accidental

- To identify discriminating bruising characteristics and to model those findings into a decision tool for screening children at high risk for abuse.

- A case-control study of children 0 to 48 months admitted to a PICU because of trauma.

- Case subjects (N=42) were victims of physical abuse, and control subjects (N=53) were children admitted because of accidental trauma.

- Bruising characteristics (total number and body region) and patient age were compared for children with abusive versus accidental trauma.

Pierce 2010
Bruises: abuse vs. accidental

Characteristics predictive of abuse were:

- bruising on the torso, ear, or neck for a child younger than or equal to 4 years of age and

- bruising in any region for an infant 4 months of age.

- TEN-4

- sensitivity of 97% and a specificity of 84% for predicting abuse.

Pierce 2010
TEN-4

Torso

Ear

Any bruise ≥ 4 months

Neck
Updated: TEN-4 FACES

F: Frenulum tears
A: Auricular area
C: Cheek
E: Eyelid
S: Sclera

96% sensitivity

Pierce 2014
Case Illustration

- A three-month-old infant was seen in the emergency department with a history of vomiting and diarrhea.
- On physical examination, the clinician noted a bruise on the lateral side of the right ankle.
- When questioned, the infant’s caregiver said he may have gotten hung up in the car seat but could not provide details. Discharged home, no evaluation.
- Within five days, the infant presented to the same emergency department with traumatic brain injury, retinal hemorrhages and old and new fractures.
The challenge: subtle findings that one isn’t seeking
Normal bruising (in an ambulatory child)
A word about older, verbal children
Bruises: lessons learned

- Age matters: infants less than 6 months old rarely have bruises/no cruise=no bruise.
- Older infants frequently have “normal” bruises, but they are likely to be confined to bony prominences on the front of the body.
- Unexpected bruises (in small infants) or unusual locations or patterns of bruises (in older infants and children) demand an explanation (*TEN4, TEN4Faces*).
What is the prevalence of sentinel injuries?

- Child abuse pediatricians have many personal stories of cases in which sentinel injuries were documented and misunderstood for their significance.
- These “missed” cases have been the cornerstone of much of the teaching about recognition of abuse that I have done over the course of my career as a child abuse doctor.
- A recent study addressed the question about prevalence of sentinel injuries in more seriously injured children...
Prevalence of Sentinel Injuries

- Case-control, retrospective study of 401, <12-month-old infants evaluated for abuse in a hospital-based setting and found to have definite, intermediate concern for, or no abuse after evaluation by the hospital-based Child Protection Team.

- A sentinel injury was defined as a previous injury reported in the medical history that was suspicious for abuse because the infant could not cruise, or the explanation was implausible.

Sheets, et al 2013
Sentinel Injuries

• Of the 200 definitely abused infants, 27.5% had a previous sentinel injury compared with 8% of the 100 infants with intermediate concern for abuse.

• None of the 101 non-abused infants (controls) had a previous sentinel injury.

• The type of sentinel injury in the definitely abused cohort was **bruising** (80%), intraoral injury (11%), and other injury (7%).

Sheets, et al 2013
Case Illustration

- A 3-month-old infant was brought by her mother (her sole caregiver) to her primary care provider (PCP) for “red dots” and swelling over her hands.
- The PCP sent screening blood work for a bleeding disorder which was normal.
- When the infant was four months old, her mother again sought care for bruising on the infant’s abdomen and back and was sent by the PCP to the Emergency Department (ED).
- In ED, the infant was referred to pediatric hematology.
- Soon after, she was seen by pediatric hematologist with bruises on her forehead and shin. The hematologist sent a full panel of laboratory testing sent to rule out bleeding diathesis (normal).
Case Illustration

- At 5.5 months old, seen for follow up in hematology clinic with new bruising, normal labs, but with a swollen and tender leg.
- On full work-up for occult injury, diagnosed with a total of 5 fractures:
  1. Bucket handle fracture distal left tibia.
  2. Medial and lateral corner fractures left distal femur.
  3. Bucket handle fracture distal right radius.
  4. Medial corner fracture distal right femur.
Do clinicians see sentinel injuries and fail to evaluate/report them?

- Anecdotally, yes.
- **In Dr. Sheets’ study:**
  - In 23/55 infants of the “definite-abuse” cases, or 41.9%, the interviewed parent reported that a medical provider knew of the sentinel injury.
  - Of these 23, in 10 the clinician suspected abuse and in the other 13 there was no evidence that the clinician suspected abuse.
  - Some injuries were noted in the medical record and not commented upon.
  - Some injuries were thought to be self inflicted.
  - Some injuries initially prompted concern for abuse but, when no other injury was diagnosed, no further effort to protect the child was made.
Challenges in the detection and evaluation of sentinel injuries

• Sometimes, these injuries are simply not recognized for what they are.
  – Thought to be medical problem (bleeding diathesis).
  – Thought to be self-inflicted.
  – Not seen as important (possibly due to medical insignificance).

• Sometimes, caregiver qualities or behavior can undermine successful recognition and action in the face of sentinel injuries.
  – Caregiver continually presents an injured child for care.
  – Bias or other barriers may interfere.
Bias in child abuse recognition and reporting: the evidence

In a study of missed cases of abusive head trauma:

- To characterize head injured children in whom diagnosis of abusive head trauma (AHT) was unrecognized and the consequences of the missed diagnoses.
- Race: 37.4% of cases of AHT in white children were missed versus 19% of cases of AHT in non-white children.
- Family composition: 40.2% of missed cases were children from intact families versus 18.7% of missed cases who were children whose parents were not living together.

Jenny et al. 1999
Bias in child abuse recognition and reporting: the evidence

In an emergency department (ED) study to determine whether there are racial differences in the evaluation and CPS reporting of young children hospitalized for fractures:

- Retrospective chart review of cases of skull or long bone fracture in children younger than 3 years.
- Outcomes of interest were ordering skeletal surveys and filing reports of suspected child abuse.
- Minority children were significantly more likely to have a skeletal survey ordered compared to white children.
- Minority children were significantly more likely to be reported to CPS for suspected abuse than white children.

Lane et al. 2002
Illustrative Case

- Healthy full term baby, diagnosed at 5 months of age with eczema by PCP and given 1% hydrocortisone cream.
- At 8 months of age, given steroid cream for eczema.
- At 9 months of age, seen with bruises and skin breakdown over buttocks.
- Two weeks later seen with severe bruising and skin breakdown on buttocks; mother reported using steroid BID on diaper area. Advised to stop steroid. Screening labs sent for possible bleeding diathesis. *Abuse considered but family “seemed okay.”*
Illustrative Case

• Two days later, seen with bruising; call to dermatologist who confirms that steroid cream can cause easy bruising.

• One week later seen with bruising and abrasions over his perineum, no referral.
Illustrative Case

- When evaluated by CAP, had black eye and bruising over his buttocks.
- Full work-up for occult injury:
  2. Brain MRI: subgaleal hematoma.
Barriers: would abuse be suspected and not reported?

- To determine how frequently primary care clinicians reported suspected physical child abuse, the levels of suspicion associated with reporting, and what factors influenced reporting to child protective services.
- Prospective observational study of clinicians who evaluated injured children (PROS).
- Clinicians did not report 27% of injuries thought to be likely or very likely to be due to child abuse, and 76% of injuries thought to be possibly caused by child abuse.
- The authors concluded that “clinicians apparently apply various interpretations to the legal mandate to report when there is a reasonable suspicion of child abuse.”

Flaherty et al. 2008
Barriers: why would abuse be suspected and not reported?

- Telephone surveys of primary care pediatric clinicians identified a sample of clinicians who suspected abuse but did not report it.

- Clinicians who suspected but did not report were interviewed and factors that influenced a decision not to report were identified.

Jones et al. 2008
Barriers: why would abuse be suspected and not reported?

• Familiarity with the family: clinicians who had a high suspicion of abuse but did not report cited a high degree of familiarity with a family.

• Available resources: clinicians who had a high suspicion of abuse but did not report used available consultants significantly less frequently than those who did report.

Jones et al. 2008
Barriers: why would abuse be suspected and not reported?

- Perception of expected outcomes of a report to CPS: clinicians who did not report explained that they anticipated negative consequences to the child or family due to the report.

Jones et al. 2008
Barriers: the anecdotal evidence

- Parents continued to bring child for care, appeared concerned.
- Another, clear possible medical explanation existed.
- Nothing in the social history was especially worrisome.
- It is hard to think about infants and children being abused.
- Family was well presented/appropriate.
- “I asked a few questions.”
- No concern was raised by other medical professionals who evaluated the child.
Illustrative Case

• 20-month-old toddler seen in ED at 18 months of age with what was facial bruising.

• Mother reports to medical staff that this finding is secondary to eczema.

• Child abuse, along with eczema, is noted in the differential diagnosis.

• An additional notation described mother as “appropriate” and child is given final diagnosis of eczema.

• Discharged home with mother.
Illustrative Case

• Two months later presented in shock.

• Full work-up for occult injury revealed evidence of blunt force abdominal trauma, rib fractures, and multiple skin injuries including bruises, abrasions and superficial lacerations over her chest, abdomen, back, sides and thighs as well as multiple deep, healing ulcerations on her anterior neck and an avulsed left thumbnail.
Illustrative Case

- Mother was asked about skin lesions and explained that they were due to eczema.

- No explanation for multiple internal injuries, fractured rib, and avulsed thumbnail was offered.

- Child abuse diagnosed, child placed for safety.
Bias and barriers: lessons learned

- Bias is real and it can influence level of suspicion and decision making in the setting of possible abuse.
- Be careful of “appropriate” families: intact, concerned, care seeking.
- Be especially careful when evaluating suspected abuse in the setting of a longitudinal relationship with a family, and when you find yourself thinking about that last case you reported and how badly it went.
- When abuse is on your differential, remove it only when diagnostic testing rules it out.
- Remember the mandated reporting laws.
- Consider a protocol...
Best practices in evaluating sentinel injury

- Recognize the urgency: ED, admission to the hospital
- A workup for “occult” injury
  - Complete, disrobed physical examination.
  - Full skeletal survey up to 2 years of age, possibly older.
  - Neuroimaging (CT or MRI) up to one year of age.
  - Dilated ophthalmological examination (if neuroimaging is positive).
  - AST/ALT (amylase and lipase).

- Careful consideration of possible medical or accidental explanations for the concerning finding
Opportunities for prevention

Sentinel injuries offer a potent opportunity to recognize a pattern of behavior and intervene to stop it.
Evidence for repeated and escalating abuse

- Another potent finding from Dr. Sheets’ study: the evidence for a pattern of repeated violence toward abused infants rather than just one episode of loss of control.
- In her study, 27.5% of those infants determined to be definitely abused, there was at least one other episode of injury (as evidenced by the history of a sentinel injury) that preceded recognition of a more serious injury.
- In the perpetrator confessions literature, this pattern of repeated violent behavior is echoed.
Repeated behavior offers an opportunity for prevention.

- Consider the chance afforded to medical providers to prevent severe and fatal abuse by the presence of a mild, sentinel injury.
- If every sentinel injury was recognized and evaluated, then other, more serious occult injuries would be diagnosed.
- Even if diagnosed in isolation, if every sentinel injury was recognized and evaluated, a thorough social evaluation might reveal other, actionable risk factors: family/intimate partner violence, mental health problems, substance abuse, or negative attributions ascribed to the child by a caregiver.
What are the prevention steps?

• The education of parents, relatives and those who work with children (home visitors, day care providers, and child protective services(CPS) workers and public health nurses who need to recognize and understand the significance of sentinel injuries.

• Parenting support and education.
What are the prevention steps?

- The education of medical providers who must learn not to accept implausible explanations for sentinel injuries.
  - Dr. Sheets’ study notes a provider who accepted “vigorously kicking the crib” as an explanation for an ankle bruise in an infant, and “scratching self with fingernail” for an intraoral injury.
- Medical providers and CPS workers must be willing to act to protect children who only have a sentinel injury (and no other injury).
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Questions?