




What is that Mark?: Recognizing Sentinel Injuries in Infants



WI CAN Educational Series
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Kids deserve the best.




WI CAN News

- 2017 Lecture Schedule is posted on the WI CAN Website
- There are 10 new lectures including topics that were requested by attendees such as FASD!
- Must register in Ethos to obtain continuing education credits (CME, Nursing CE, SW CE and CLE)




Partnering to
Protect Children

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Date and Time	Topic	Presenter
Friday, January 20, 2017	In-utero drug exposure – What investigators need to know	Michael Purte, MD*
Friday, February 17, 2017	Sexually transmitted diseases in children – Is it abuse?	Jodi Guinn, MD
Friday, March 17, 2017	Holding up the mirror – creating a trauma informed approach	Kelly Hodges, MD
Friday, April 21, 2017	Unusual presentations of child abuse	Hilary Petka, MD
Friday, May 19, 2017	Patterned injuries – Common patterns of injury and what they mean	Casey Brown, MD
Friday, June 16, 2017	Strategies to obtain reliable medical information in cases of suspected child maltreatment	Lynn K. Sheets, MD
Friday, July 21, 2017	The crying infant – Strategies to prevent abuse	Angela Rabbit, DO
Friday, August 18, 2017	Fetal alcohol spectrum disorder (FASD)	David Wargowski, MD
Friday, September 15, 2017	Child maltreatment in special populations.	Barbara L. Knox, MD*
Friday, October 20, 2017	CSEC - Commercial sexual exploitation of children (Trafficking)	Angela Rabbit, DO
Friday, November 17, 2017	Child death investigation	Vincent Tranchida, MD*
Friday, December 15, 2017	Needle in a haystack? Screening for indicators of child physical abuse	Lynn K. Sheets, MD
Friday, January 19, 2018	Abusive head trauma (AHT)	Lynn K. Sheets, MD

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 Disclosure Information for:
Lynn K. Sheets, MD

What is that Mark?: Recognizing Sentinel Injuries in Infants

- There are no relevant financial relationships related to this presentation/program
- There is no sponsorship/commercial support of this presentation/program
- The content being presented will be fair, well-balanced and evidence-based
- Learners who wish to receive Continuing Education Credit (CME/CLE/CE) must complete and turn in evaluations to successfully complete this program (through MCW Ethos CE)




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 Disclaimers

- Contains disturbing images and scenarios!
- Cases are composites to further de-identify


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 Objectives

After this session, the learner will be able to:


- describe the significance of sentinel injuries in pre-cruising infants
- recognize bruises and other 'minor' injuries that suggest abuse
- list potential conditions and skin findings that can be mistaken for abuse injuries

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 Skin "marks" overview


- Skin is easily visible and changes can indicate trauma, disease, risk, contact with the environment or just normal variation
- Size of the "mark" may or may not matter
 - Tiny marks may indicate underlying disease or serious, potentially life-threatening abuse
 - Large marks can occur in benign situations
 - The presence or absence of marks does not screen for abuse in infants, toddlers and preschool age children! (example – fatal abdominal injury)

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 Role of photos




- Photos cannot replace an exam
 - Swelling? Tenderness? Blanching? Injury deeper structures? Wipe off? Other findings not in the photo?
- Assessments based upon photos only are usually more tentative
- Photos can augment an evaluation
 - See the "mark" over time
 - Consider asking for family photos

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 Photos - protocol

- Photograph name/date and face
- Overview photo of body – front and back
- Perspective photo of the part of the body where there is injury (arm, leg, trunk)
- Close-up photo of injury with and without size scale
- Knees and shins








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 **Approach for investigators**


- If you look for skin "marks"
 - Good light- use natural light if available; put lotion on the skin if it is dry
 - Move subject or yourself to get different angles
 - What type of "mark" is it?:
 - Injury:
 - Scratch or scrape (abrasion)?
 - Cut (laceration or incised wound)?
 - Burn?
 - Bruise (contusion, petechiae, ecchymosis)?
 - Rash (dermatitis or inflammation) or bug bite?
 - Other- artificial pigment or dye, birthmark (can look like any of the above "marks"), prominent blood vessels, skin coloring

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 **Abrasions
(scratches/scrapes)**

- Usually the most benign of skin injuries
- Caused by traumatic removal of layers of the epidermis or dermis
- If caused by a narrow object, lesion will appear as a scratch (example-scratch on the face of a baby from her own long fingernails)
- If caused by a broad, often rough object, lesion will appear as a scrape (examples-skinned knee or rug 'burn')
- Large scrapes can need treatment similar to burns

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 **Abrasions**

- Usually caused by something being moved across the skin
- Depending on the type of object and the forces, an object moving across the skin can cause abrasions, bruises, lacerations or all 3!
- Linear injury "marks" can result from
 - an object moving over the skin;
 - impact against a linear implement/edge
 - "crimping" (shear)

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“Cuts”- Lacerations and Incised Wounds

- Lacerations result from blunt trauma and tearing (splitting) of the skin;
- Incised wounds result from sharp objects cutting the skin
- Both can be associated with bruising along the margins of the wound

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More than skin deep...

BRUISING

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What is a bruise?

- Visible blood outside the blood vessels in the skin or soft tissues
- Many different names:
 - Bruise = contusion
 - Petechiae - small, pin point bruises < 2 mm
 - Ecchymosis – bruising due to seepage of blood around an area of trauma. Usually blue-purple in color and round to irregular in shape. Sometimes used for hematomas > 1 cm
 - Hematoma- nonspecific word for collection of blood with or without swelling
 - Purpura – bruising between 2 mm and 1 cm

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Is the 'mark' a bruise?

- Photos are insufficient to determine in many cases
- Requires some medical expertise/sophistication
 - Does the 'mark' blanch?
 - Is there pain or soft tissue swelling?
 - Are there associated injuries?
 - Does the 'mark' heal like a bruise?
 - Are additional tests needed such as X-rays or lab studies?
 - Is the 'mark' a bruise mimic?
- Minor 'marks' may be very subtle, easily missed or healed
- If the 'mark' is a bruise, what does it mean?

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Bruises- what do they mean?

- Is a bruise always just a bruise? What makes a bruise serious?
- Considerations:
 - Age of the child/developmental abilities of the child
 - Specific vulnerabilities of the child
 - Location of the bruise
 - Appearance of the bruise- pattern and size but not color
 - Underlying injury to deeper soft tissues
- Is it a bruise or a mimic?

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Is it just a bruise?

- Need to consider soft tissue, bone and organ injury
- Even fatal abuse may have no or minimal external signs of injury
- Important to know if there is pain, soft tissue swelling or limitation in movement associated with injury (even in obvious abusive injuries)

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When should a bruise create suspicion for abuse?

- **Pattern**- bruise that has a recognizable shape or pattern **or**
- **Location**-bruise in unusual location (anywhere on a young infant or in protected locations such as (ear, hand, neck, buttocks, inner thighs) **or**
- **Age of the baby**- a bruise on an infant who is not yet cruising (infants under 6 mo)
- Often important or "severe" bruises can be very subtle and easily missed!

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Patterns of Bruising/Injury*

- Common patterns of bruising or scarring
- Bites deserve special attention

*Pediatric Clinics of NA, 1990, Vol 37(4), p. 803. Guest Editor – Robert M. Reece
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Patterned Bruises

Patterns of Bruising by Mechanism of Injury		
Mechanism	Abuse example	Example of Not Abuse
Crush - bruise at site of contact	Bite, pinch, grab 'marks'	Bump into furniture or fall onto knee
High velocity impact - outline of implement	Hand slap, looped cord, hanger	Rare accidents such as a motor belt snapping and striking someone
Pressure changes - petechiae	Hickey, strangulation	'Hickey', cough, vomiting, crying, rare strangulation accidents
Incised wounds (cut) - bruise along edges of wound	Knife wound, fingernail gouge injury	Accidental razor blade cut
Lacerations (torn skin with tissue bridges) - bruise at edges of laceration	Punch to face resulting in a laceration	Fall resulting in laceration
Indirect forces (shearing) - bruise distant to contact	Vertical bruises from bare bottom spanking	Genital bruising from vehicle run over event
Dependent - bruise results in blood settling under the effects of gravity	"Black eye" from bruise on forehead	"Black eye" from bruise on forehead

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Petechiae- Pinpoint Bruises

- Causes
 - Mechanical trauma: Blunt impact, or "rubbing," or crush against a patterned surface
 - Pressure changes
 - Suction
 - Increased venous pressure
 - Removal of epidermis- burns and abrasions
- Significance?
 - Clue to mechanism of injury
 - Tend to resolve more quickly than larger, deeper bruises, but no science to accurately date petechiae

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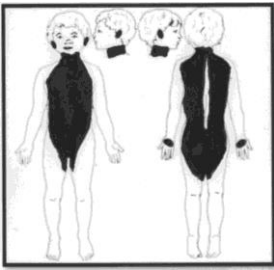
EXAMPLES OF PATTERNS

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Location of Bruises

- Normal bruising of childhood usually occurs over bony prominence.
- Ear, genital, buttock, abdominal bruises are suspicious.
- Assess in terms of the overall distribution of bruises!



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Age of the child: Sentinel Injuries

- Small, apparently insignificant injuries such as bruises and mouth injuries in young infants are often from abuse
- These "Sentinel Injuries" often precede more serious abuse
- When recognized and responded to, escalation of abuse to fractures, head trauma and infant homicide might be prevented

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Bruising in Pre-Cruising Infants



- What do we know?
 - Bruising in pre-cruising infants is unexpected
 - Published studies are based on physical exams of well infants presumed to be non-abused
 - Cannot completely screen out abused infants
 - Well cohorts contain abused infants
 - Unintentional bruising can occur but is unexpected

✓ Mortimer PE. Are facial bruises in babies ever accidental? (Arch Dis Child. 1983;58:75-76)
 ✓ Wedgwood J. Childhood bruising. (Practitioner. 1990;234(1490):598-601)
 ✓ Sugar NF, Taylor JA, Feldman KW. Bruises in infants and toddlers: those who don't cruise rarely bruise. (Arch Pediatr Adolesc Med. 1999;153(4):399-403)
 ✓ Labbé J, Caouette G. Recent skin injuries in normal children. (Pediatrics. 2001;108(2):271-274)



Isolated Bruising – Is It Abuse?

- Isolated bruising in pre-cruising infants evaluated for abuse
 - < 6 months old evaluated for abuse
 - 50% have other serious injury identified on skeletal survey, neuroimaging or abdominal injury screening
 - 70% were screened for bleeding disorders and none identified
 - Bruising can be the first/only injury from abuse!

Harper NS et al. J Pediatr 2014;165(2):383-388
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Injury From Abuse Can Escalate

- Injury from abuse can escalate
- Prevention critical
- Background for the sentinel injury research studies

- ✓ Frenu tears and abusive head injury: A cautionary tale. Thackeray JD. *Pediatr Emerg Care.* 2007;23(10):735-737
- ✓ Fatal abusive head trauma cases: Consequence of medical staff missing milder forms of physical abuse. Oral R, Yagmur F, Noshelsky M, Turkmen M, Kirby P. *Pediatr Emerg Care.* 2008;24(12):816-821
- ✓ The Bruised Premobile Infant: Should You Evaluate Further? Feldman KW. *Pediatr Emer Care.* 2009;25:37-39
- ✓ Bruising in Infants: Those With a Bruise May Be Abused. Pierce MC, Smith S, Kaczor K. *Pediatr Emerg Care.* 2009;25:845-847
- ✓ Facial Bruising as a Precursor to Abusive Head Trauma. Petska HW, Sheets LK, Knox BL. *Clin Pediatr.* published on-line 4/17/2012

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Theory of Injury



Infant Distress



Severe Abuse

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Sentinel Injury Research

- Clinical observations:
 - AHT observations
 - Doctors and family accept implausible explanations. Why?
 - Abuse of an infant is unthinkable
 - Injuries are "minor" or apparently trivial
 - Lack of awareness of bruising significance
 - Biases – families perceived to be low risk
 - How often do abused infants have prior visible injuries and could early detection make a difference?



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Prevention Through Early Detection

- Human - prevent abuse to the child and devastation of families
- Financial –
 - Potential estimated savings of \$210,000 life-time cost for each case prevented (Fang)
 - >\$2,600/year/high risk or maltreated child on Medicaid (Florence)

- ✓ Fang X et al. The economic burden of child maltreatment in the United States and implications for prevention, *Child Abuse & Negl.* 2012;36(2):156-165
- ✓ Florence C et al. Health Care Costs Associated With Child Maltreatment: Impact on Medicaid. *Pediatrics.* 2013;132:1-7

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Definition of Sentinel Injury

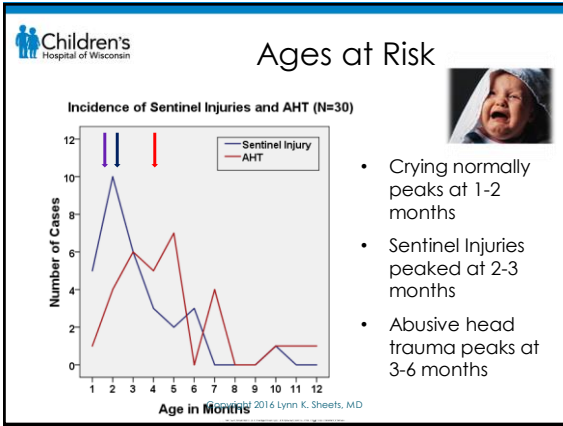
- Sentinel injury –
 - **Visible/detectable** injury reported to have been to at least one parent prior to the events leading to the current admission
 - Occurred at an age when the infant could not cruise and injury was unexplained or poorly explained
 - Examples - bruising or mouth injury in infant < 7 mo
- Example: 6-month old infant with abusive head trauma with these prior injuries
 - healing rib fractures (not sentinel injuries)
 - history of an unexplained cheek bruise at 2 months of age

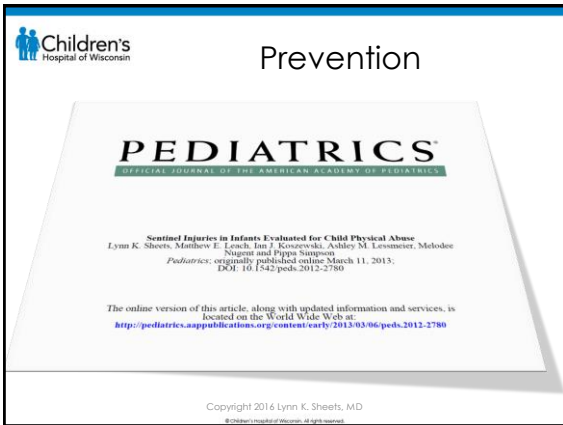
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SENTINEL INJURY STUDY RESULTS

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High stakes- bruising in infants

- 25-30% of severely abused infants have a prior history of sentinel injuries (bruising, oral injury or fractures in a pre-cruising infant) (Sheets LK, Leach ME, Koszewski JJ, Lessmeier AM, Nugent M, Simpson P. Sentinel injuries in infants evaluated for child physical abuse. Pediatrics. 2013;131(4):701-707)
- Most sentinel injuries are 'minor' abusive injuries that will heal completely and quickly such as a bruise or a frenulum tear
- Bruises in pre-cruising infants are serious until medically evaluated
- Medical evaluation of concerning injuries should be performed by the most experienced professional available

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Reduce CAN Fatalities

- Potential for eliminating a significant percentage of child abuse fatalities
- Improved detection by medical providers, home visitors, daycare personnel, parents, other relatives.
- Enhanced detection must be combined with appropriate injury surveillance and an educated response by LE and CPS

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Mouth Injuries

- Common in walking children
- Result from abuse in infants not yet able to walk
- Angry, frustrated caregiver "rams" something in the mouth:

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Subconjunctival Hemorrhage

- Unexpected injury in infancy
- Should raise concern for child maltreatment if not well-explained

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Subconjunctival Hemorrhage

- Rupture of conjunctival capillaries
- Size of hemorrhage not related to the etiology or severity of injury
- Result of direct blow or increased intrathoracic/abdominal pressure
- Differential: trauma, increased intravascular pressure, infection, hematologic and oncologic etiologies

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Subconjunctival Hemorrhage

- Infants are not usually able to generate sufficient intra-thoracic or intra-abdominal pressure to cause SCH
 - Exception for pertussis which also increases vascular permeability
 - 2/100 infants with pyloric stenosis had SCH (none had RH)
- May or may not have other signs of abuse on exam.

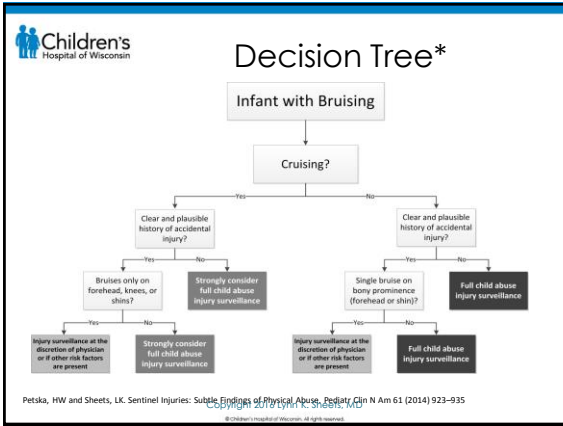
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Isolated Bruising – Is It Abuse?

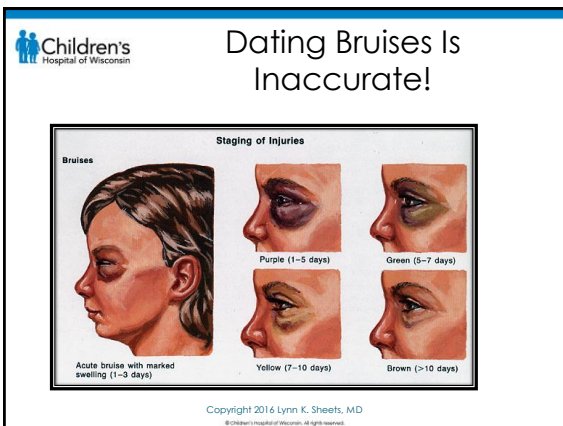
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 - < 6 months old evaluated for abuse
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 - 70% were screened for bleeding disorders and none identified
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PREVENTION

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Inexpensive bleeding study:



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Bleeding work-up

- No national consensus
- Consultation with CHW Hematology has resulted in the following consensus at CHW:
 - “Minor” bleeding such as bruises
 - CBC with auto diff, PTT, PT, TT, PFS, vWD Activity and antigen
 - Severe bleeding (such as abusive head trauma)
 - Same as above plus Fibrinogen and d-Dimer; consider obtaining a hematology consult

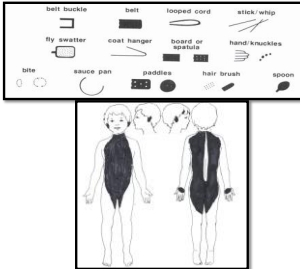
Also see: Thomas AE. The bleeding child; is it NAI? *Arch Dis Child.* 2004;89:1163-1167

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When does a possible bruise need medical evaluation?

- Any suspected injury in a pre-cruising infant All patterned injuries
- Suspected excessive discipline with an implement
- Bruising on the neck, hands, feet, ears, genitals, anal area, buttocks in young children



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Siblings and contacts- How much work-up?

- 2012 Lindberg et al. (*Pediatrics*. 2012;130:1-9)- ExSTRA multisite research study:
- Found ~12% of contacts under 2 y/o had abusive fractures
- Twins at substantially increased risk of fracture when the index child was the other twin; odds ration 20x!!

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Abuse Mimics

- Accidental bruising
- Self-inflicted injury
- Birthmarks- vascular and pigmented
- Cultural treatments
- Bleeding disorders
- Rashes and other skin conditions
- Pigments such as markers
- Venous Congestion, especially between the eyes and in the perianal area


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Benign Blue Spots 'Mongolian Spots'

- Congenital dermal melanocytosis or benign blue spots of infancy
- May be absent at birth.
- Can gradually become more prominent over the first few months of life
- Can occur in unusual locations
- Occurs in infants of any ethnicity/race


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Folk Remedies

- Cao gio (Coin Rubbing)
 - Practiced in Southeast Asia and Southern China
 - Coin is rubbed against oiled skin, causing stripes of petechial bruising
 - Motive is healing
 - Quat sha (Spoonng) is similar, except uses a porcelain spoon


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Medical Input

- Medical evaluation plus photos is best strategy
- Seek medical evaluation by most experienced provider
- If unsure, seek advice (triage) from closest center of excellence
- Don't assume that MD = best provider
- Ask about what alternative hypotheses (differential diagnoses) were considered

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Medical Input

- There are many conditions mistaken for child maltreatment and there are many maltreatment injuries missed or mistaken for other conditions
- Medical expertise (highest quality available) usually necessary when abuse is suspected, even in "obvious" cases
- Important to consider organ and bone injury in infants, toddlers and preschoolers

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Key Points



- Ask about sentinel injuries
- Seek a qualified examination of infants with suspected injury in good light and completely undressed
- Pay attention to minor injuries – ask questions
- When unsure, call a child abuse expert for advice
- Think about other conditions that can mimic abuse
- Look for occult (hidden injury) by performing full work-ups in children suspected of being physically abused – unless injury is clearly explained by history
- Remember – the lack of occult injuries does not rule out abuse!
- Offer resources to parents of distressed infants

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Questions?



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