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Identifying Non-Accidental Trauma in Pediatrics

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Financial Disclosures

I have no relevant financial relationships with any commercial interests.



Learning Objectives:

01

Discuss the prevalence of child abuse and long term effects

02

Explain the relationship between clinical history and physical abuse diagnosis

03

Review common presentations of abusive injuries

04

Identify evaluation and diagnostic choices for suspected child abuse



The Scope of the Problem

- 3 million children received an investigation or alternative response at a rate of 40.7 children per 1,000
- More than 600,000 children were reported abused in the U.S.
 - Of these, an estimated 1,820 children died from abuse and neglect
- Children in the first year of their life have the highest rate of victimization at 25 per 1,000
- More than a quarter of child maltreatment victims are < 2 years old
- The victimization rate for girls is higher than boys, ($8.7 > 7.5$ per 1,000), however boys have a higher child fatality rate than girls ($3 > 2.1$ per 1,000)

About **1 in 7** children experienced child abuse and neglect in the last year.

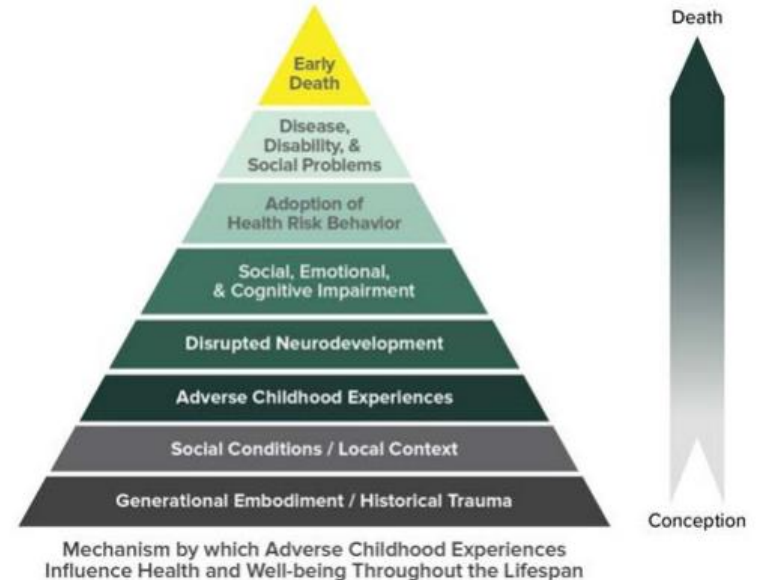


Recognizing Injury is Challenging

- Abuse is initially missed in 20-30% of cases
- Missed instances are typically identified when a subsequent abusive injury occurs,
 - an estimated 35% of cases
- Hospitals are a crucial entry point for many children in the healthcare system
- Why Challenging?
 - Histories are misleading
 - Personal biases: education, experience, attitudes, beliefs
 - Emotionally stressful

Long Term Effects

- Outcomes affected by:
 - Age and developmental status
 - The type, frequency, duration, and severity
 - The relationship between child and perpetrator



Source: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. (n.d.). *Adverse childhood experiences presentation graphics: The ACE pyramid*. Retrieved from https://www.cdc.gov/violenceprevention/acestudy/ACE_graphics.html

Long Term Effects

- Physical Health

- May occur immediately, or take months to years
- Straightforward link between physical abuse and physical health
- Higher risk for health problems
- Association with brain development/function

- Psychological health

- Diminished executive functioning and cognitive skills
- Poor mental and emotional health
- Attachment and social difficulties
- Posttraumatic stress

Prevention

- Primary
 - Directed at the general population
 - Prevention of maltreatment
- Secondary
 - Focused on families where risk factors are present
 - Detecting early signs/symptoms
- Tertiary
 - Focused on families where maltreatment has already occurred
 - Treatment to reduce additional complications



Introduction

- 7-week-old infant presents to the ED after an episode of pallor, vomiting, and decreased responsiveness
- Physical examination: ill-appearing infant with a weak cry
- Medical history: father reported a bruise adjacent to the infant's mouth 2 weeks before admission, bumped head on pacifier

Introduction

- Imaging:
 - CT – blt acute convexity SDH
 - Skeletal survey
 - Acute and healing rib fx
 - Metaphyseal lesion
 - Acute spiral fx of the R tibia
- Dilated Funduscopic Exam – extensive retinal hemorrhages
- Father eventually confessed to abusing infant on multiple occasions

SENTINEL INJURIES

“Sentinel injuries are medically mild, superficial injuries that occur in young and developmentally immature infants who cannot have hurt themselves.”

Box 1

Definition of sentinel injuries

- Minor injuries, such as a bruise or intraoral injury (excluding skin abrasions)
- Precruising infant
- Visible or detectable to a caregiver
- Poorly explained and unexpected

Assessment





Assess the finding thoroughly



**Be objective in assessment,
including other diagnosis**



Consider SCREENing



**Document accurately (and with
photography if possible)**



Historical Questions

- ✓ What events preceded the injury?
- ✓ Who had access to the child?
- ✓ When did the child last feed and behave normally?
- ✓ Is there a triggering event?
- ✓ What was the caretaker's response to the injury?
- ✓ What is the affect of the caregiver? of the child?
- ✓ If the child is verbal, what do they say happened?
- ✓ Are there any adult or child witnesses?



Do the facts as given in the history, correlate with the following:

- severity of the injury?
- age of the injury?
- location of the injury?
- pattern of the injury?
- developmental age of the child?

History Cont.

Medical History

- Preterm?
- Chronic diseases?
- Dietary hx and hx of medications
- Family hx?

Social History

- Who lives in the home?
- Who cares for the child?
- Intimate partner violence?
- Substance use?
- Previous involvement with CPS/DHS

Suspicious Stories

- Child fell from a low height
- Child fell onto furniture, floor, object
- Unexpectedly found dead
- Child choked, shaken to dislodge object
- Child turned blue, shaken to revive
- Sudden seizure activity
- Suddenly stopped breathing
- Injuries from resuscitation efforts
- Tripped or slipped carrying child
- Child left alone for short time
- Child fell down stairs
- Sibling involved

Think Physical Abuse

Bruise or burn with recognizable shape

Injuries of different ages

Injuries in a non-mobile child

No trauma history

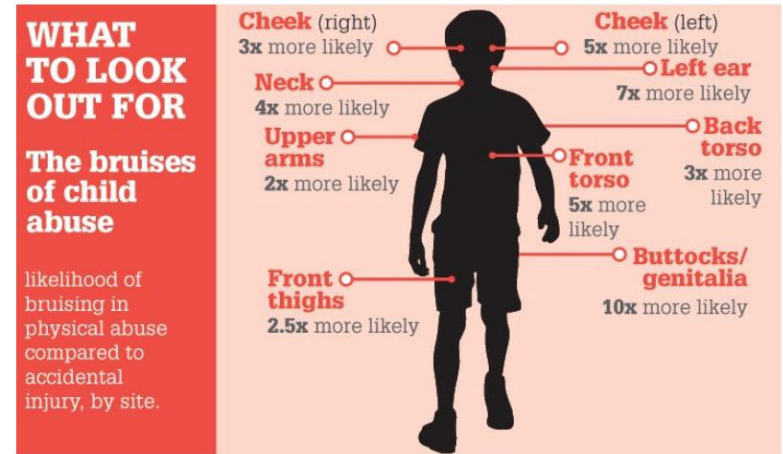
Inconsistencies in the medical history

Delay in seeking care

Child self-report of abuse

Bruising

- Most common and most visible sign of physical abuse
- Not all bruises are due to abuse
 - How can we distinguish between abusive and accidental bruising?
 - Bruising clinical decision rule, TEN-4-FACES



TEN-4-FACEsp

Bruising Clinical Decision Rule

When is bruising concerning for abuse?

If any of the 3 components (Regions, Ages, Patterns) are observed in a child **under 4 years of age**, strongly consider seeking evaluation by a medical provider with expertise in child abuse.

Torso | Ears | Neck



FACES

Frenulum
Angle of Jaw
Cheeks (*fleshy part*)
Eyelids
Subconjunctivae
(*whites of the eyes*)

REGIONS

4 months and younger
Any bruise, anywhere



AGES

Patterned bruising



Bruises in specific patterns
like slap, grab or loop marks

PATTERNS

See the signs

Unexplained bruises in these areas most often result from physical assault.

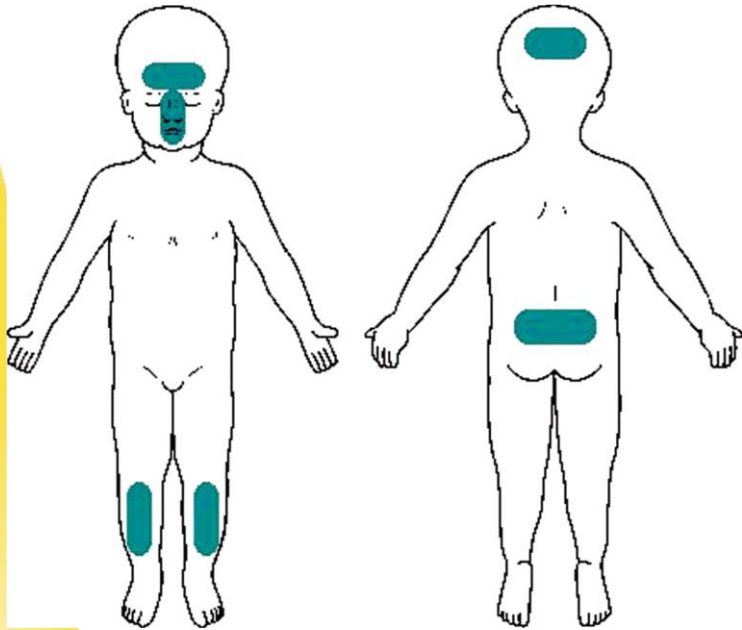
TEN-4-FACEp is not to diagnose abuse but to function as a screening tool to improve the recognition of potentially abused children with bruising who require further evaluation.

TEN-4-FACEsp was developed and validated by Dr. Mary Clyde Pierce and colleagues. It is published and available for FREE download at luriechildrens.org/ten-4-facesp.

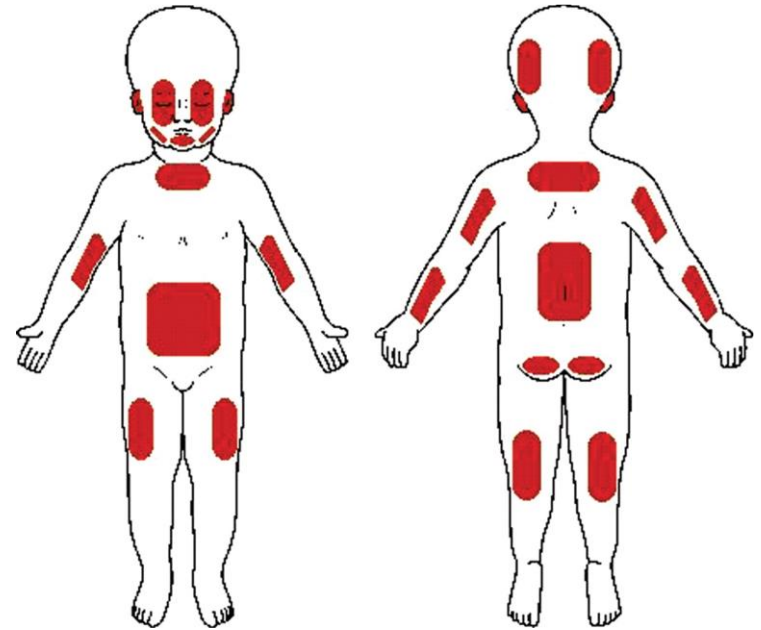
 Ann & Robert H. Lurie
Children's Hospital of Chicago



Accidental Bruising Patterns



Abusive Bruising Patterns



Bruises with Recognizable Shapes



Bruises with Recognizable Shapes



Bruises with Recognizable Shapes



Bruises with Recognizable Shapes



MARKS from INSTRUMENTS

belt buckle



belt



looped cord



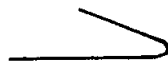
stick/whip



fly swatter



coat hanger



board or spatula



hand/knuckles



bite



sauce pan



paddles



hair brush



spoon



Burns with Recognizable Shapes



Think Physical Abuse

Bruise or burn with recognizable shape

Injuries of different ages

Injuries in a non-mobile child

No trauma history

Inconsistencies in the medical history

Delay in seeking care

Child self-report of abuse

Fractures

- Fx are the second most common injury caused by child physical abuse
- Diagnosis relies on more than just fracture type or location
- No such thing as a pathognomonic fracture

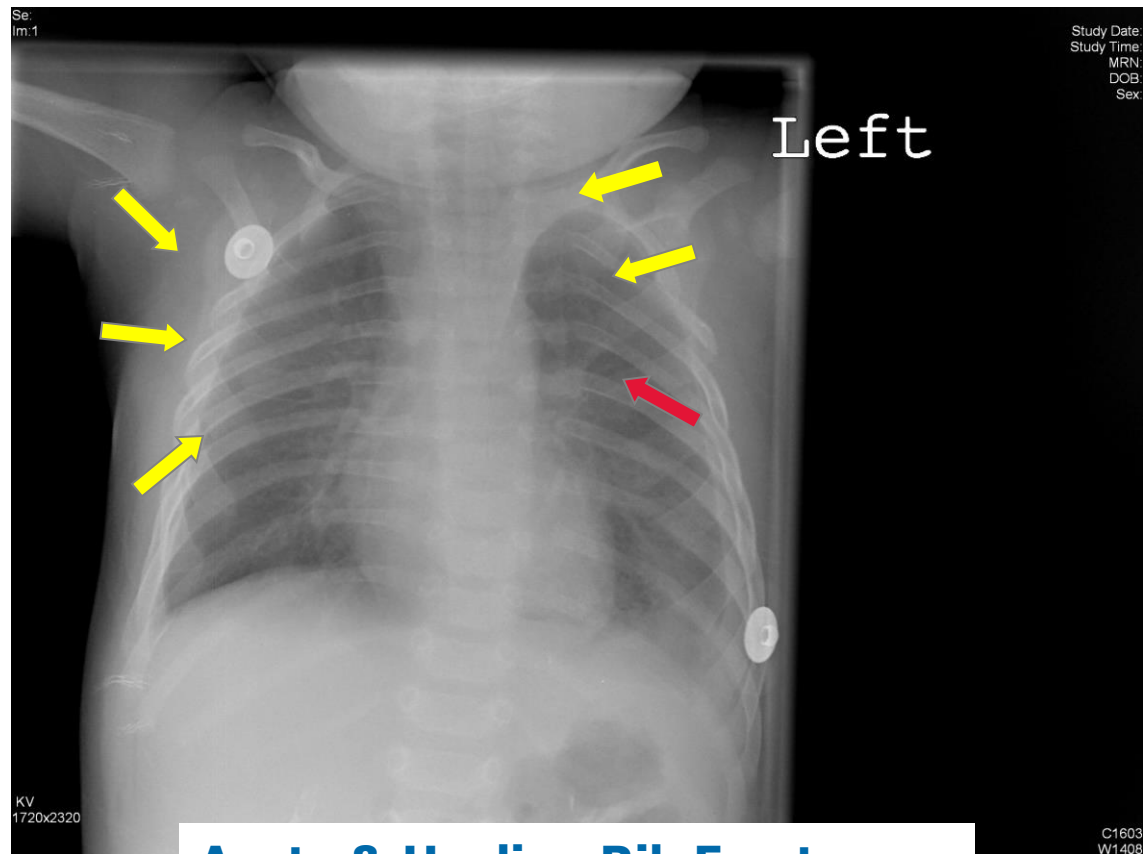
TABLE 1

Specificity of radiologic findings in infants and toddlers¹⁹

High specificity ^a
CMLs
Rib fractures, especially posteromedial
Scapular fractures
Spinous process fractures
Sternal fractures
Moderate specificity
Multiple fractures, especially bilateral
Fractures of different ages
Epiphyseal separations
Vertebral body fractures and subluxations
Digital fractures
Complex skull fractures
Common, but low specificity
Subperiosteal new bone formation
Clavicular fractures
Long-bone shaft fractures
Linear skull fractures

^a Highest specificity applies in infants.

Multiple Injuries, Different Ages



Acute & Healing Rib Fractures

Fractures

TABLE 3

When Is a Fracture Suspicious for Child Abuse?

• No history of injury
• History of injury not plausible—mechanism described not consistent with the type of fracture, the energy load needed to cause the fracture, or the severity of the injury
• Inconsistent histories or changing histories provided by caregiver
• Fracture in a nonambulatory child
• Fracture of high specificity for child abuse (eg, rib fractures)
• Multiple fractures
• Fractures of different ages
• Other injuries suspicious for child abuse
• Delay in seeking care for an injury

Think Physical Abuse

Bruise or burn with recognizable shape

Injuries of different ages

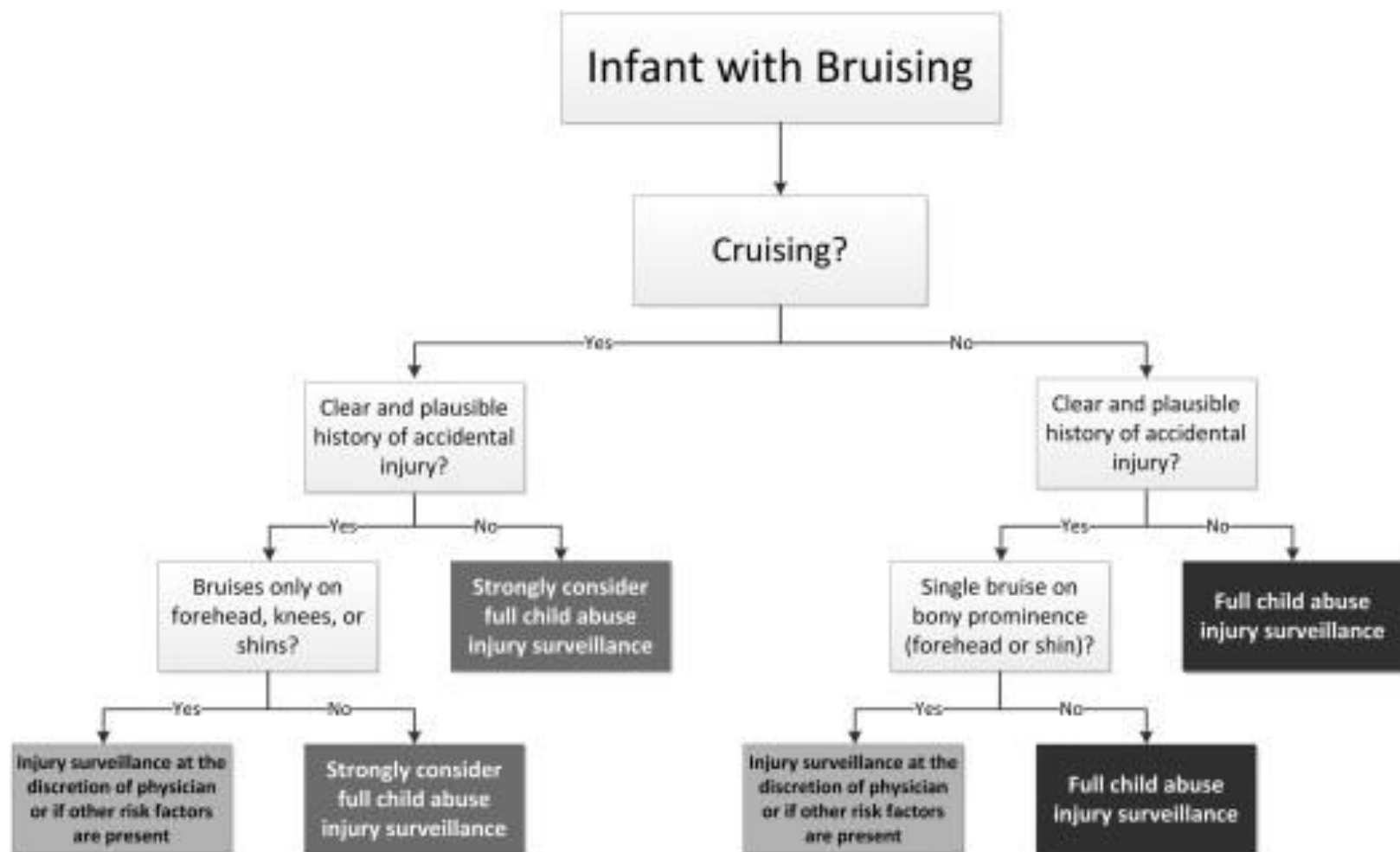
Injuries in a non-mobile child

No trauma history

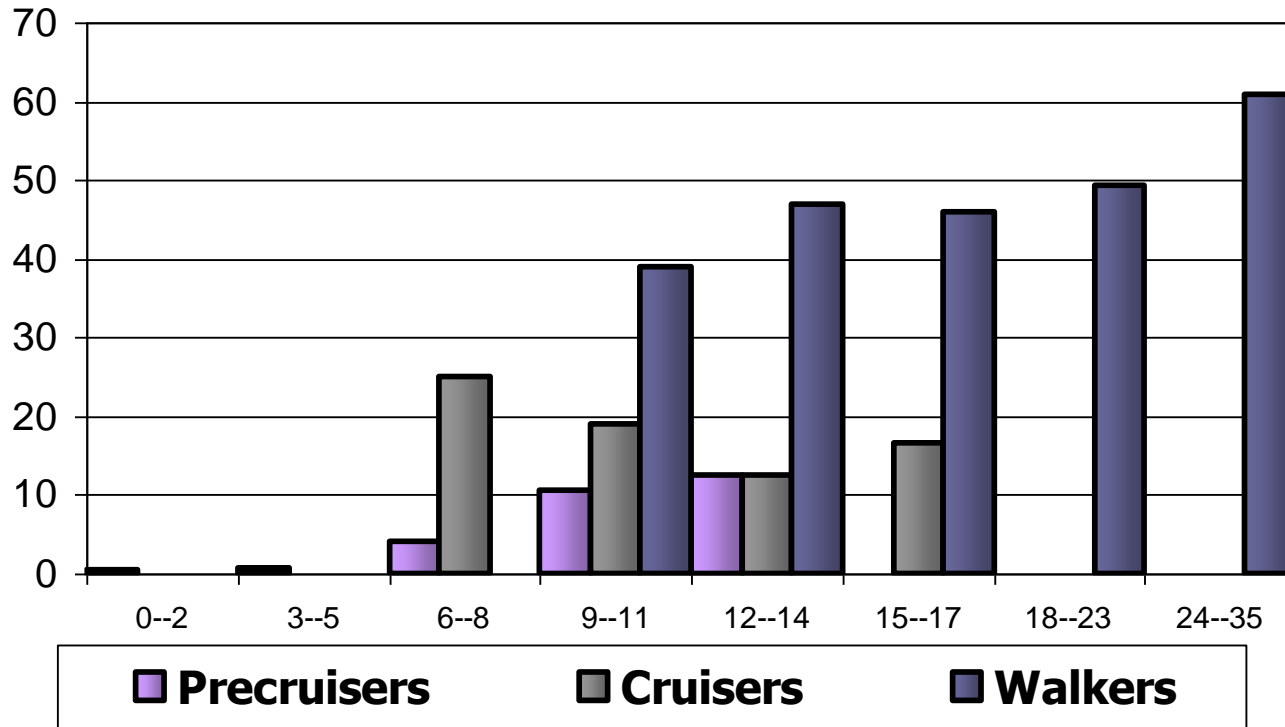
Inconsistencies in the medical history

Delay in seeking care

Child self-report of abuse



Epidemiology of Accidental Bruising



Think Physical Abuse

Bruise or burn with recognizable shape

Injuries of different ages

Injuries in a non-mobile child

No trauma history

Inconsistencies in the medical history

Delay in seeking care

Child self-report of abuse

Lack of Trauma History

- Cornerstone of an abuse diagnosis
- Still must consider other medical causes
 - Mimics
 - Birth related findings
 - Vitamin K deficiency
 - Collagen disorders

Think Physical Abuse

Bruise or burn with recognizable shape

Injuries of different ages

Injuries in a non-mobile child

No trauma history

Inconsistencies in the medical history

Delay in seeking care

Child self-report of abuse

Inconsistency

- Internal Inconsistency
 - History changes with repetition or by informant
- Developmental Inconsistency
- Inconsistent mechanism
 - Minor trauma causing severe injury

Think Physical Abuse

Bruise or burn with recognizable shape

Injuries of different ages

Injuries in a non-mobile child

No trauma history

Inconsistencies in the medical history

Delay in seeking care

Child self-report of abuse

Delay in Care Seeking

New Fracture



Healing Fracture



Think Physical Abuse

Bruise or burn with recognizable shape

Injuries of different ages

Injuries in a non-mobile child

No trauma history

Inconsistencies in the medical history

Delay in seeking care

Child self-report of abuse

Examination and Diagnostic



The Basics

- Physical exam for everyone
 - General assessment
 - Skin assessment
 - Cranial or skeletal injuries
- Skeletal survey for patients < 24 months
- LFTs for patients < 60 months
- Neuroimaging for patients < 6 months with:
 - Rib fracture(s)
 - > 1 fracture
 - Facial bruising/injury

TABLE 1

Diagnostic Tests That May Be Used in the Medical Assessment of Suspected Physical Abuse and Differential Diagnoses

Type of Injury or Condition	Diagnostic Tests	Comments
Fractures	Skeletal survey: humeri, forearms, femurs, lower legs, hands, feet, skull, cervical spine, thorax (including oblique views ⁶¹) and lumbar spine, pelvis ⁶²	1. Recommended for all children with fractures and children with any suspicious injuries under age 2
		2. Repeat skeletal survey in 2 wk for high-risk cases ⁶³
		3. Single whole-body films are unacceptable
Bruises	Tests for hematologic disorders: CBC count, platelets, prothrombin time, partial thromboplastin time, INR, bleeding time; additional testing (eg, factor levels) may be indicated after initial screening tests	1. Recommended when bleeding disorder is a concern because of clinical presentation or family history
		2. A DIC screen should be performed for patients with intracranial injury, because intraparenchymal damage can alter coagulation ⁶⁴
		3. PFA-100: platelet function activity is preferable to bleeding time for establishing platelet function but is not widely available
Liver injury	Liver enzyme tests: aspartate aminotransferase and alanine aminotransferase	1. May be helpful in diagnosing occult hepatic injury ⁶⁵

Skeletal Survey

The AAP on Skeletal Surveys:

Imaging Guidelines

The skeletal survey is mandatory in all cases of suspected physical abuse in children younger than 2 years; its utility diminishes thereafter.^{8,26} The screening skeletal survey or bone scan has little value in children older than 5 years. Decisions about which types of imaging to perform for patients in the 2- to 5-year-old age group must be made individually on the basis of the specific clinical indicators of abuse. At any age, when clinical



Neuroimaging

TABLE 1 Study Inclusion Criteria

Inclusion Criteria: All 4 Criteria Must Be Met	Definition
30–364 d of age ^a AND Well-appearing AND	Self-explanatory Defined as GCS score of 13–15 OR by description of the attending physician when no GCS score assigned
Temperature <38.3°C AND	Defined as no measured temperature \geq 38.3°C in the previous 24 h
No history of trauma AND	History of trauma not given by caretaker as the reason for seeking medical care. If history of trauma was later provided by caretakers, this was not considered to be a history of trauma for purposes of eligibility
Seeking medical evaluation for 1 of the following symptoms	ALTE as defined by the National Institutes of Health ¹⁷
(1) ALTE/apnea	Vomiting without diarrhea defined as >4 episodes of vomiting in the previous 24 h OR \geq 3 episodes of vomiting per 24 h for the previous 48 h
(2) vomiting without diarrhea	
(3) seizures or seizurelike activity	
(4) soft tissue swelling of the scalp	
(5) bruising	
(6) other nonspecific neurologic symptom not described above, such as lethargy, fussiness, or poor feeding	

GCS; Glasgow Coma Scale Score.

^a Children <30 d of age were excluded because the validation of PIBIS was part of a larger study evaluating the use of serum biomarkers to identify brain injury. Because serum biomarkers of brain injury are often abnormal in healthy infants <30 d of age, neonates were excluded from the entire study.

Document!

- Objective statements
- Size, color, location of skin marks
- Avoid subjective statements
 - Be specific about worrisome caregiver behaviors
 - Ask open ended questions
 - Use quotation marks
 - Avoid leading questions
 - “unexplained trauma, concern for abuse”

Take Home Points

- Ask yourself:
 - Is the injury consistent with MOI and child's developmental stage?
 - Am I trying to explain away the findings?
 - Are there inconsistencies in the story?
- Do a complete physical on any child with an injury
 - Ears, mouth, nose, back, buttocks
- Screen when indicated



Case Study



Case Presentation

- CC: vomiting
- ex 36 week preemie, 78 day old twin male
 - No fevers. No diarrhea.
 - Worsening vomiting, now projectile
 - NI VS, weight, exam
- DDx: overfeeding, reflux, pyloric stenosis
- ED Course: Pyloric US – negative
- Fed well in ED with spit up but no emesis
- Discharged home

Case Presentation

- 1 week later follow up seen by PCP.
 - Ongoing “spitting up, worse over past 2 weeks”
 - Weight gain substandard
 - Bruise noted on belly, photo on cell phone
 - PCP questions car seat as cause
- Red Flags?

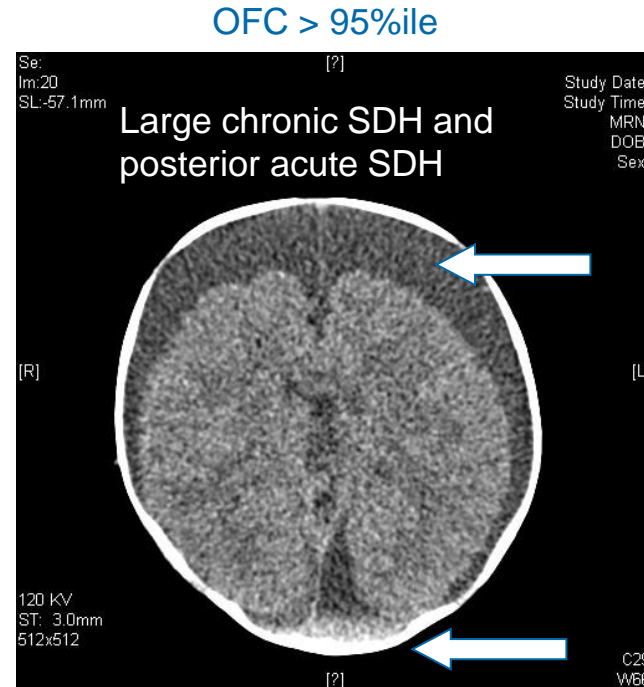


Case Presentation

- 10 days later ER visit for ALTE, vomiting and fussiness
- VS ok but weight down
- CBC: WBC 6.57, HGB 9.4 ,PLT 309
- Repeat u/s for pyloric stenosis
- Dx - ALTE related to choking from spitting up

- Red Flags?

Last ER visit: Dx of Child Abuse



Infant with bruising is a child abuse medical emergency!

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