Child Physical Abuse –
Bruises, Breaks, Burns and Belly Trauma

The Children's Bureau -- annual Child Maltreatment -- data provided by the states to the National Child Abuse and Neglect Data Systems.

- https://www.acf.hhs.gov/sites/default/files/documents/cb/cm2019.pdf

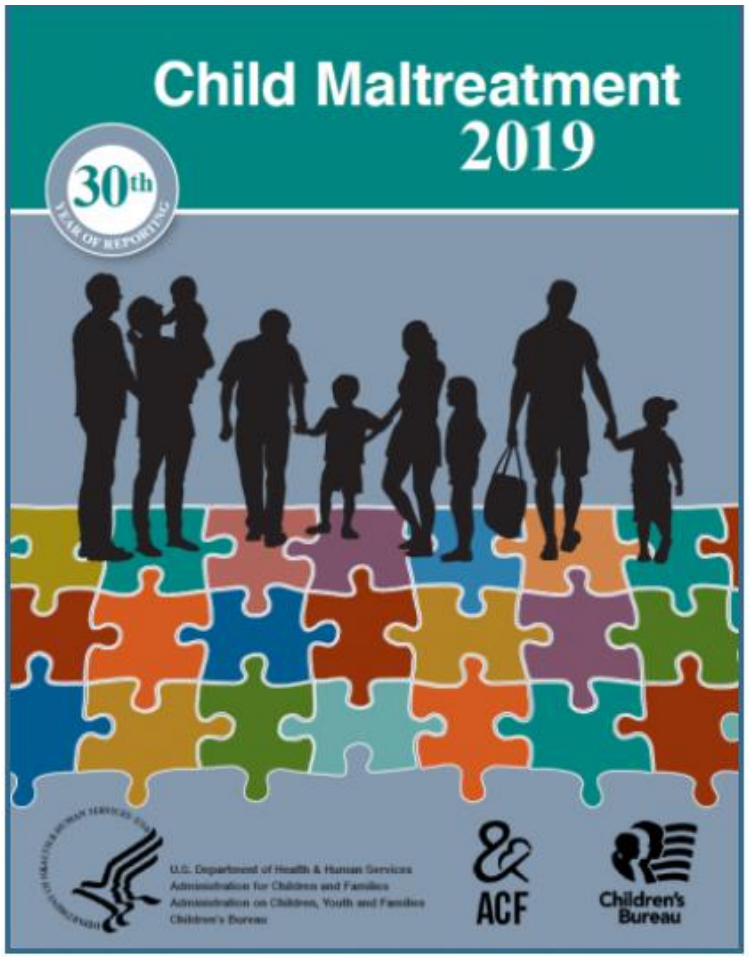
About 700,000 kids/yr

Medical professionals report about 10% of cases among all professionals.

Rates of maltreatment are declining.

Neglect is most common form of maltreatment.

Younger children most commonly involved.



Children's Bureau
An Office of the Administration for Children & Families

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Recognizing Inflicted Injury Is Challenging for Medical Providers

- Histories are misleading
- Injuries are occult
  - Providers must be aware or cases will get missed
- Emotionally stressful
  - Providers may hesitate to report
  - Be swayed by subjective info

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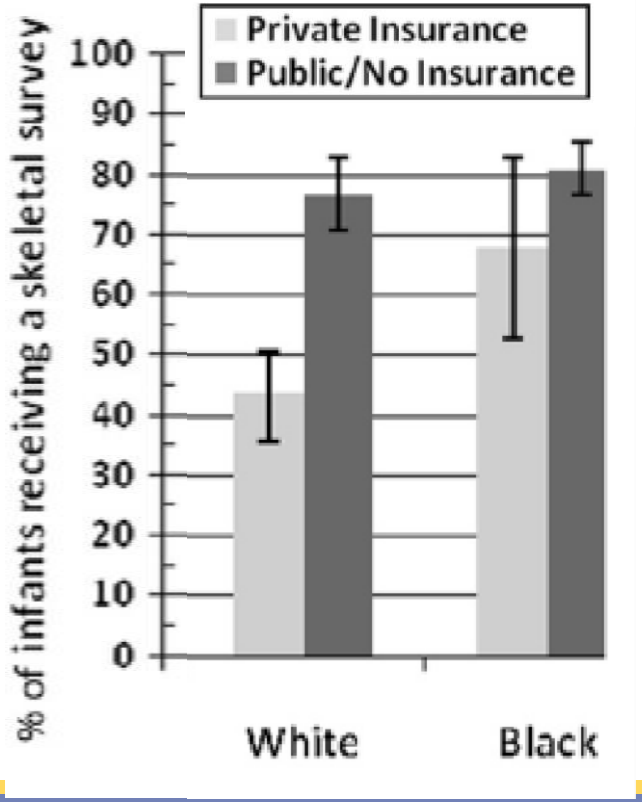
Bias

Disproportionately decreased screening in Caucasian families with higher SES



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Wood et al 2010

Making the Leap

TABLE 2 **Level of Clinician Suspicion According to Decision to Report to CPS**

Management Status	Level of Suspicion, *n* (%)			
	Unlikely	Possible	Likely	Very Likely
Reported to CPS	7 (0.5)	34 (24.3)	25 (86.2)	29 (64.4)
Not reported to CPS	1464 (99.5)	106 (75.7)	4 (13.8)	16 (35.6)

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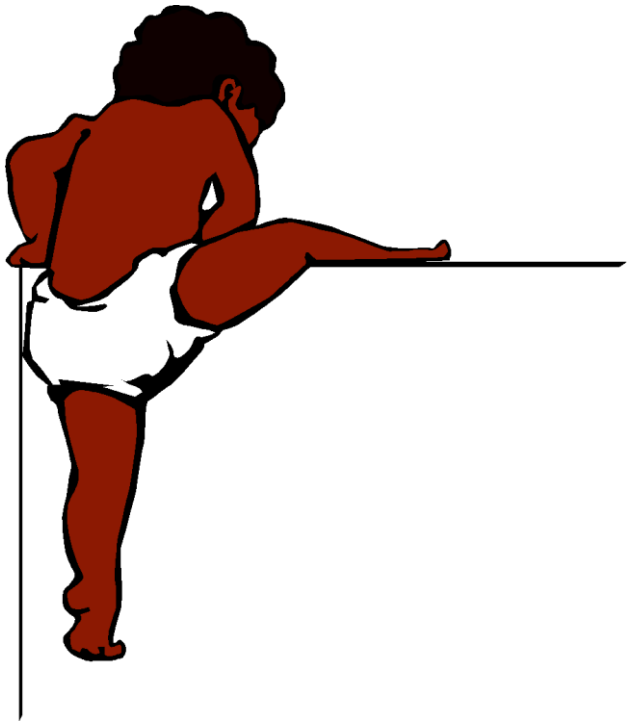
Flaherty et al. 2008

Physical Abuse -- diagnosis



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?

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Lack of Trauma History

THE CORNERSTONE OF AN ABUSE DIAGNOSIS

You still must consider other medical causes.

- Mimics
- Birth related findings
- Vitamin K deficiency
- Collagen disorders

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Don’t Do Anything Differently

Ten History "Red Flags"

1. Injury unexplained by history
2. Absent, changing, or an evolving history
3. Delay in seeking medical care
4. Unusual affect of caregiver
5. Triggering event causing loss of control in caregiver
6. Unrealistic expectations of child
7. Crisis or stress in child's environment
8. Social or physical isolation of child or the family, caregivers
9. Pattern of increasing severity or escalation of event over time
10. Prior history of abuse of caregiver as child

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Testing

Laboratory	Bruising or intracranial hemorrhage	Multiple or unusual fractures:
General for children 5 years and younger: 1. ALT, AST 2. Consider urine toxicology screen	1. CBC; PT/PTT/INR (if concern of low/falling Hgb, repeat in am with retic) 2. If extensive bruising, consider measuring CPK 3. If bruising/bleeding more than expected, but non-specific in patter, consider additional evaluation for possible bleeding disorder, contact hematology.	1. Calcium, phosphorus, Mg, Alk Phos, 1-Oh vitamin D, parathyroid hormone 2. If bones abnormal on X-ray, consider 25-hydroxy Vitamin D battery; very rarely consider DNA for collagen A1, A2/mutation for OI

Radiology

1. Skeletal survey <2 yrs.
2. Head CT (non-contrast with 3D reconstruction) if:
    a. Any concern for abuse and <6 months old
    b. <12 months old with moderate or high concern for abuse.
    c. Abnormal mental status, bulging fontanel, seizures, ALTE, vomiting >1 episode.
3. Abdominal CT if:
    a. s/sx of abdominal trauma
    b. >80 IU/L ALT or AST
    c. Bruising to abdomen or torso

COMPLETE SKELETAL SURVEY TABLE

APPENDICULAR SKELETON
Humeri (AP)
Forearms (AP)
Hands (PA)
Femurs (AP)
Lower legs (AP)
Feet (AP)

AXIAL SKELETON
Thorax (AP, lateral, right and left obliques), to include sternum, ribs, thoracic and upper lumbar spine
Abdomen, to include the pelvis (AP)
Lumbosacral spine (lateral)
Skull (frontal and lateral), to include cervical spine (if not completely visualized on lateral skull)

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Sentinel injuries: Evidence Base

Sentinel Injuries in Infants Evaluated for Child Physical Abuse
Sheets et.al. *www.pediatrics.org/cgi/doi/10.1542/peds.2012-2780*

- Retrospective study looking at infants with known abuse and comparing to non-abused infants
- Sentinel injury = previous injury suspicious for abuse
- Of 200 definitely abused infants, 27.5% had a previous sentinel injury, none for the 101 non-abused infants.
- 2/3 under 3 months of age
- Mostly bruises and intraoral injury
- 41% known to a med provider at time of injury

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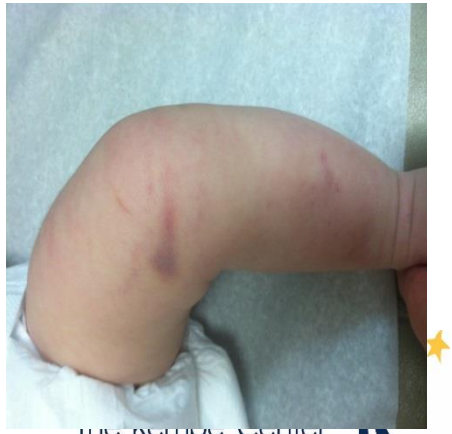
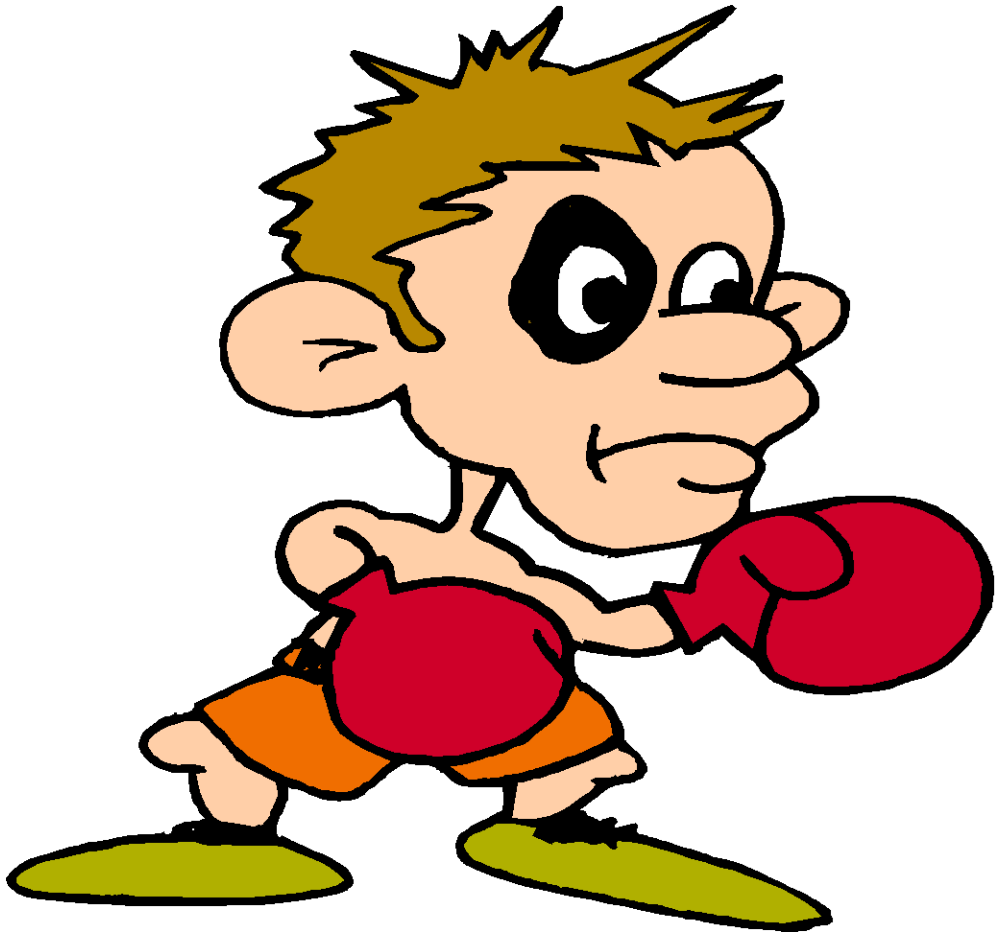
Sentinel Injuries
(Sheets *Pediatrics* 2013)

Particularly: scalp, fontanel, ears, mouth (lips, palate, frena, teeth), skin, genitalia



Injuries to Skin



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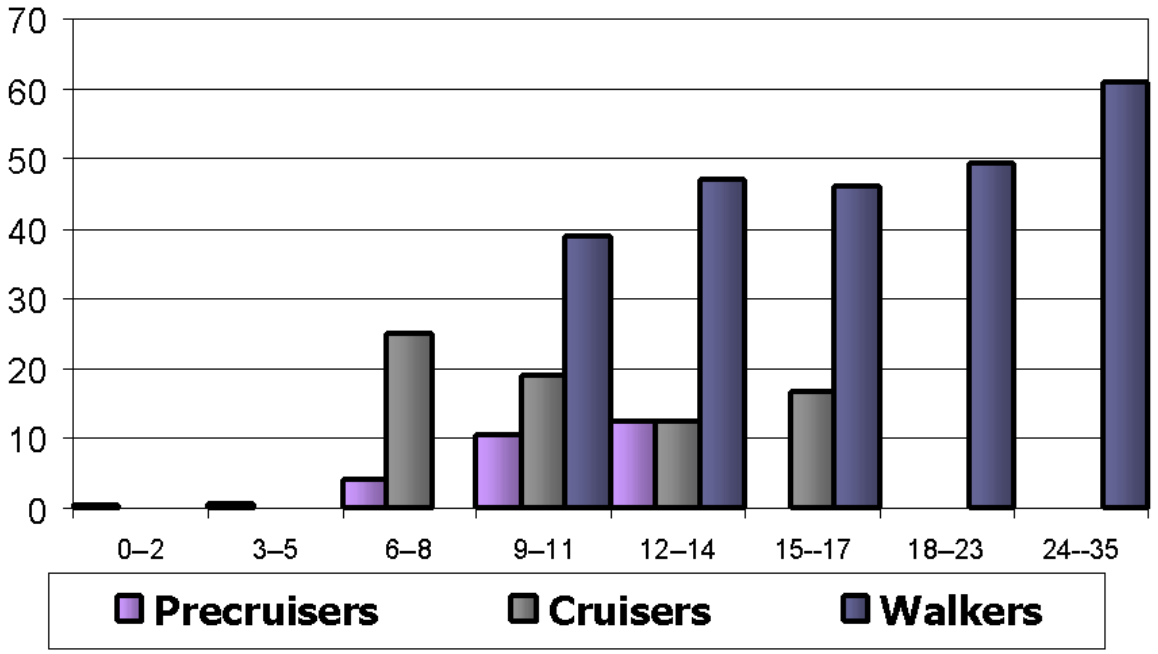
Epidemiology of Accidental Bruising



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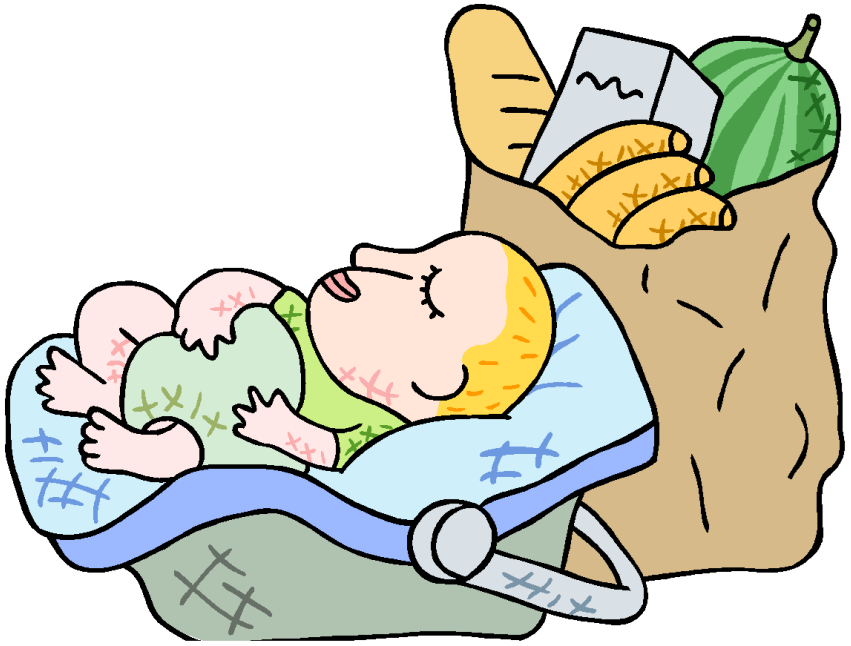
Bruising in Infants

If a baby isn't cruising, there should be no bruising.



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TEN-4 FACES P Bruising Rule

In children less than 4 years of age, bruises on these areas raise concern for physical abuse:

- **T**runk
- **E**ars
- **N**eck

- **F**renulum (tear or bruising)
- **A**uricular area
- **C**heek
- **E**yes
- **S**clera

ANY BRUISE on a child less than 4 months of age is concerning!

Patterned bruising is always concerning!

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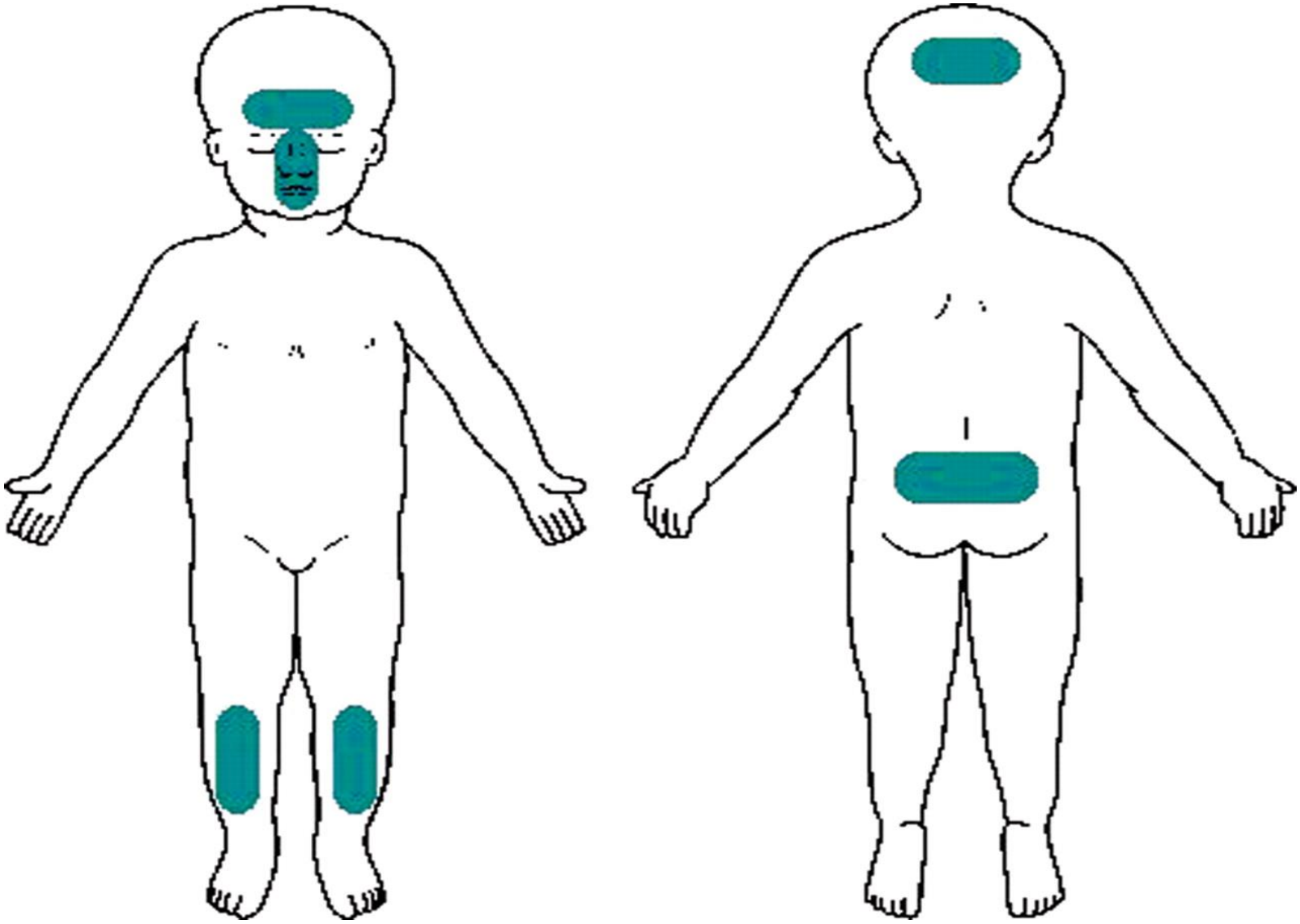
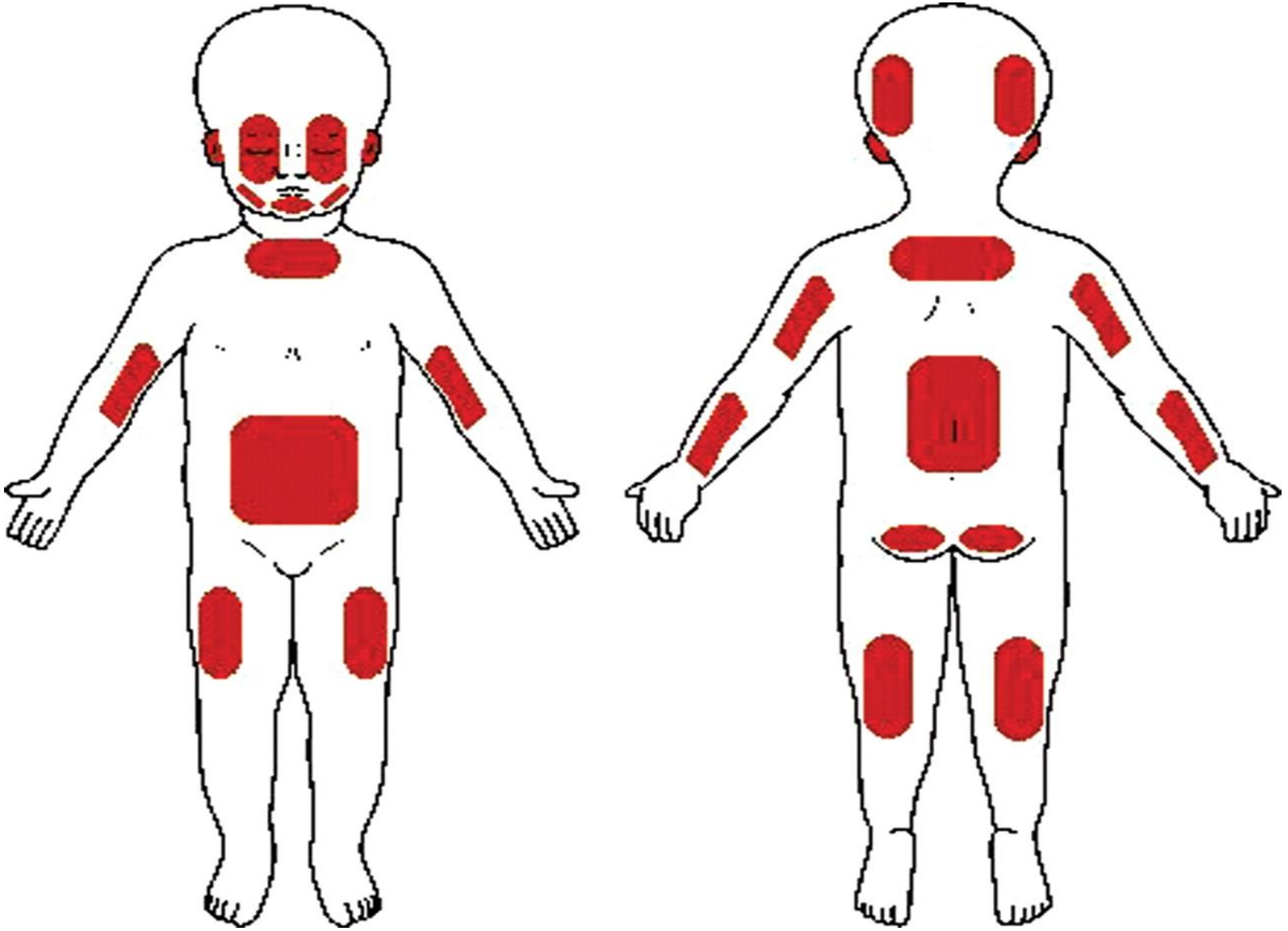
Accidental bruising patterns



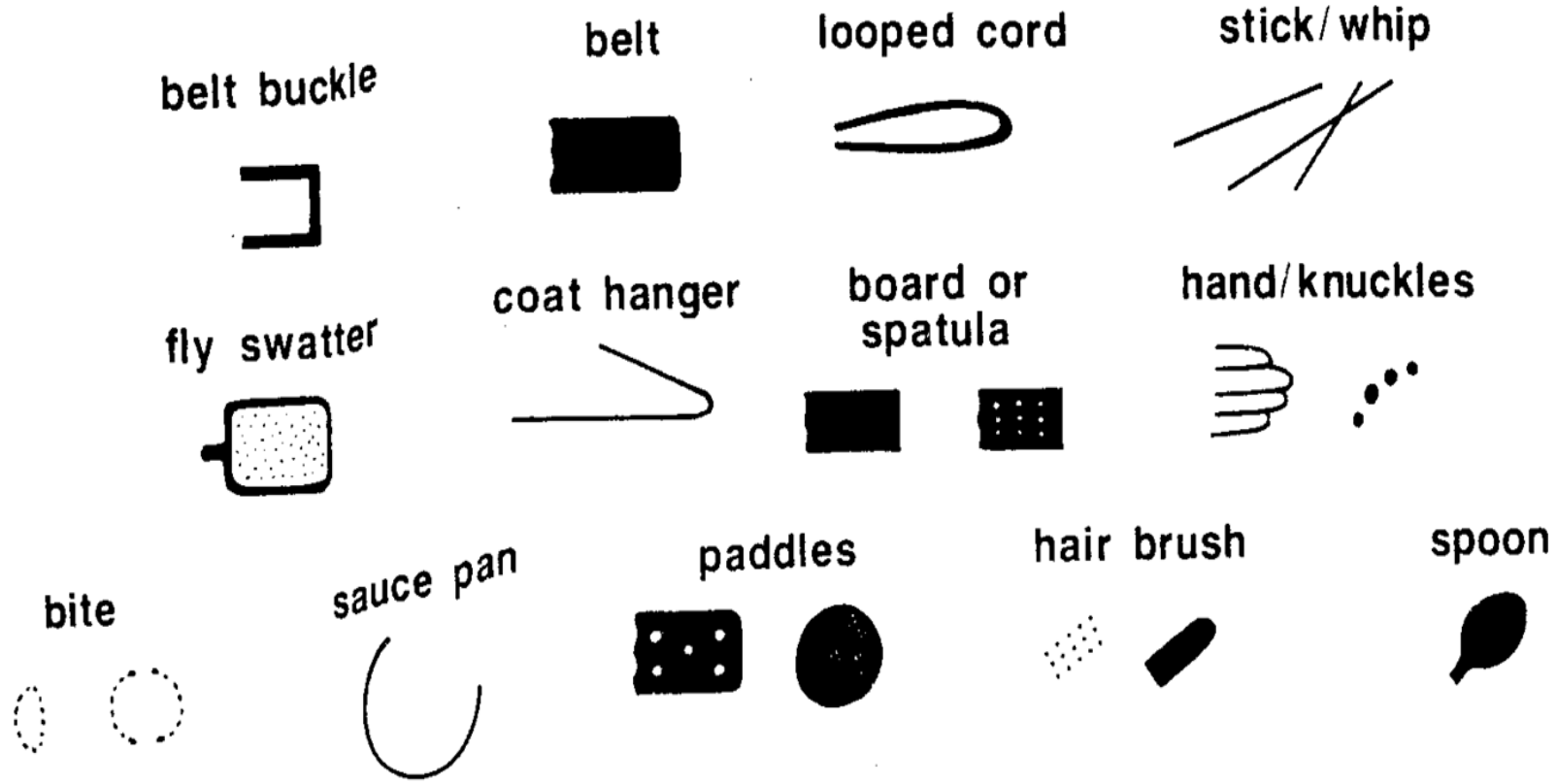
Maguire S Arch Dis Child Educ Pract Ed 2010;95:170-177

Abusive bruising patterns



Maguire S Arch Dis Child Educ Pract Ed 2010;95:170-177

MARKS from INSTRUMENTS



CANNOT DATE BRUISES

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Fractures


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FOR THE PREVENTION AND TREATMENT
OF CHILD ABUSE AND NEGLECT


University of Colorado
Anschutz Medical Campus


Children's Hospital Color

Fractures: Practical Pointers

- Biomechanics
- Development and mobility
- Common accidents
- Absence of bruising is common
- Symptoms sometimes help with timing
- X-rays sometimes help with timing

Specificity of Fractures

High Specificity for Abuse

Posterior rib fractures

Metaphyseal lesions

Scapular fractures

Spinous process fractures

Sternal fractures

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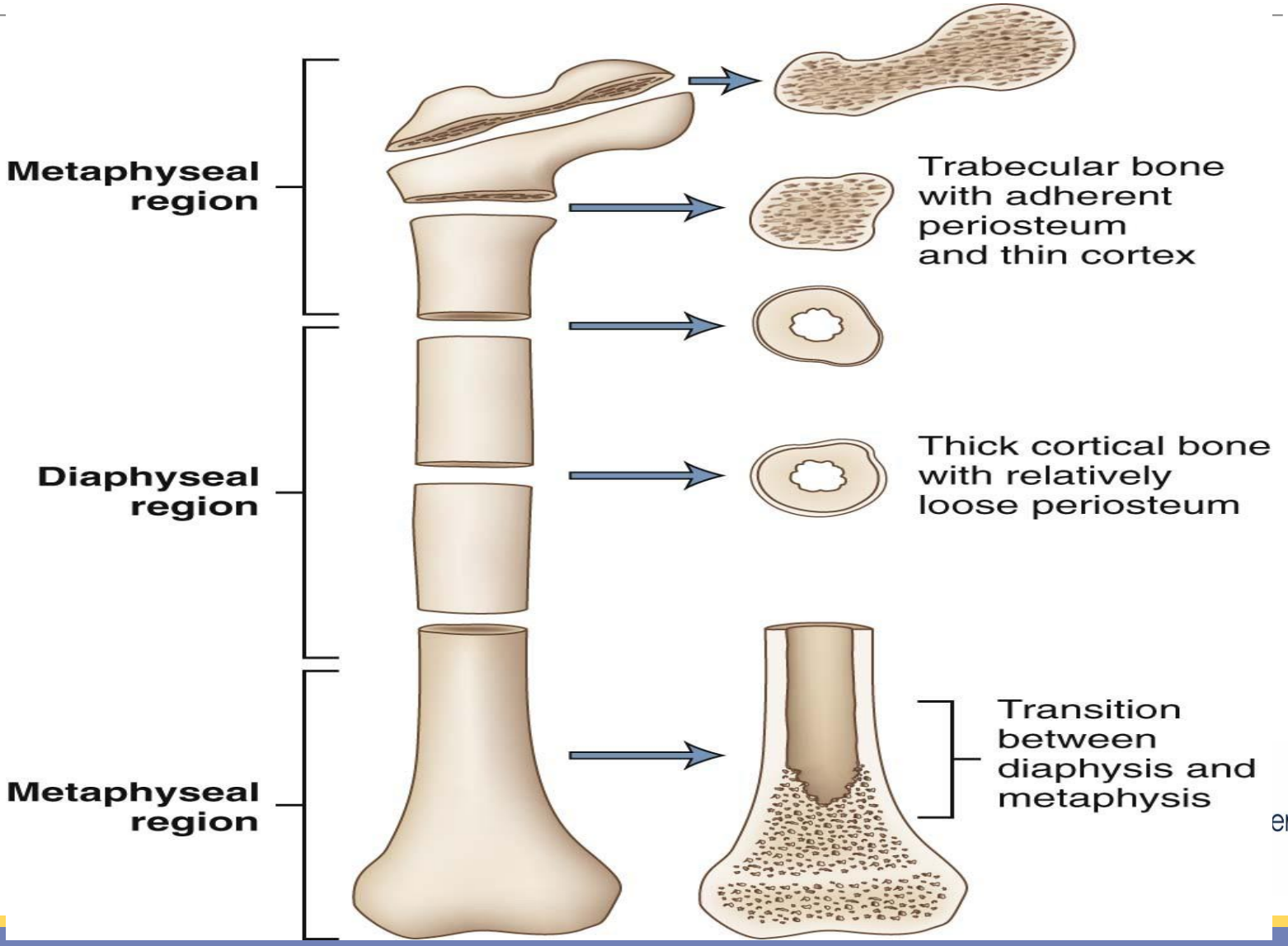
Bone Anatomy 101:Injury Sites



Skeletal Surveys for Suspected Child Abuse

Babygrams are not skeletal surveys

Skull: Frontal & lateral views including c-spine

Spine: Frontal & lateral thoracolumbar spine, sternum

Chest: Frontal, lateral, and oblique ribs

Extremities: Frontal including shoulder, hands, feet, lower lumbar spine, pelvis and feet

***repeat in 2 weeks*

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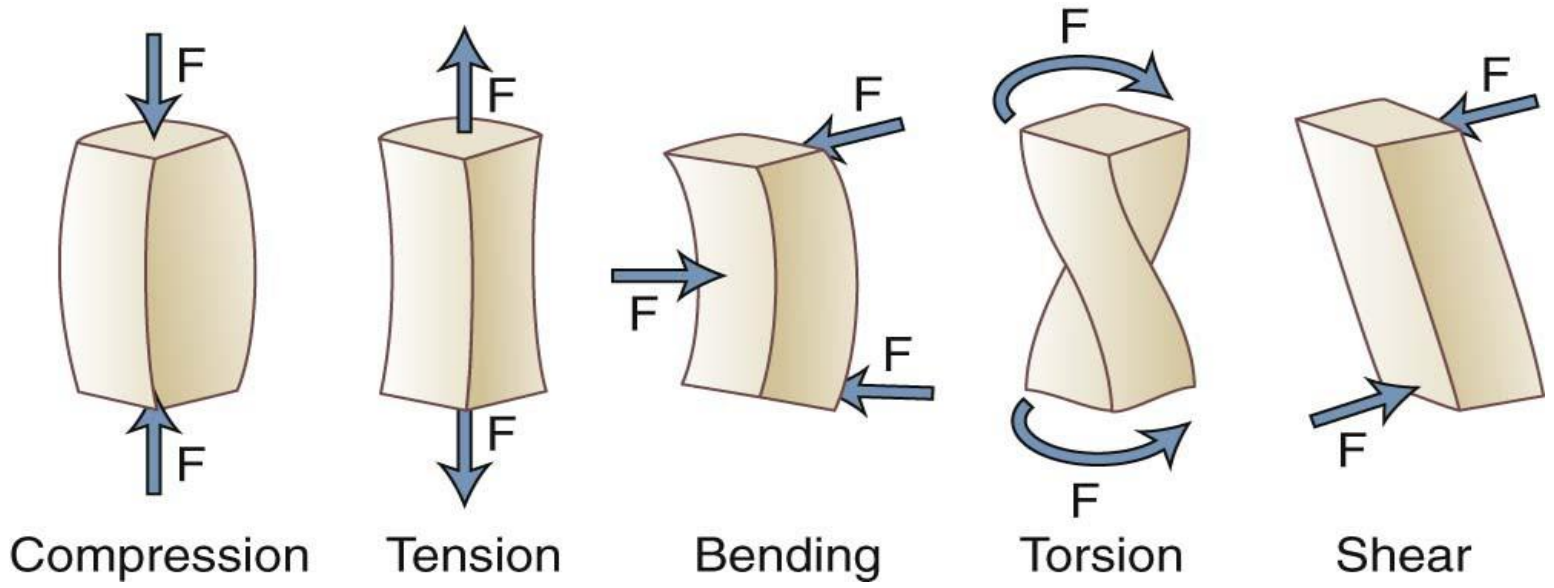
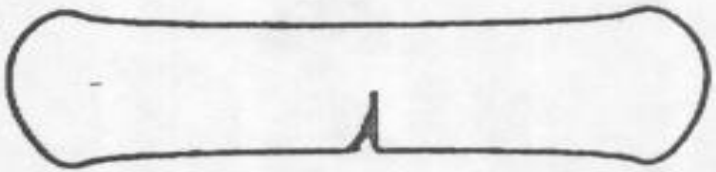
Injury Mechanism –
Force Directions (F) Dictate the Type of Fracture



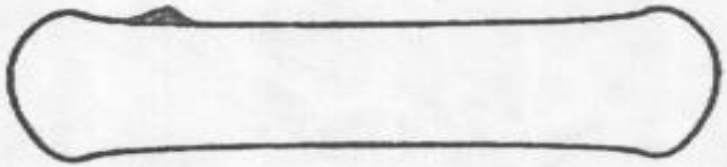
Forces cannot be quantified: i.e. 'how much force needed to cause what type of fracture'

Biomechanical Conditions and Fracture Types

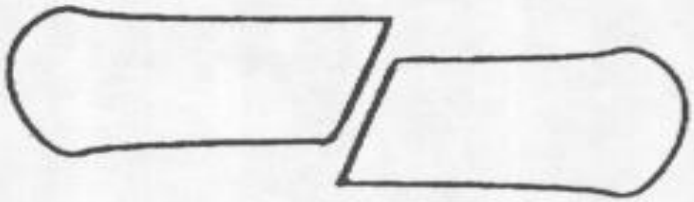
Biomechanical Conditions	Fracture Types
Torsional loading	Spiral/long oblique
Bending load	Transverse/short oblique
Compressive loading	Buckle/impaction
Tension and/or shear loading	Classic metaphyseal lesion
High-energy event	Open and/or comminuted



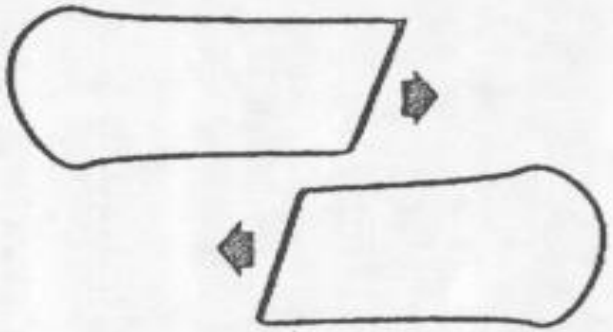
"GREENSTICK" FRACTURE



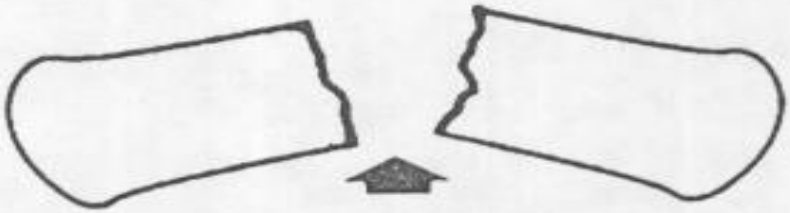
"BUCKLE" FRACTURE



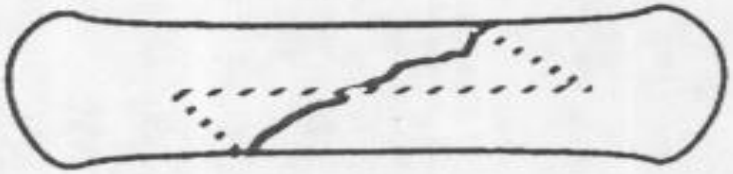
"BAYONET" APPOSITION



"OVERRIDING" POSITION WITH SHORTENING



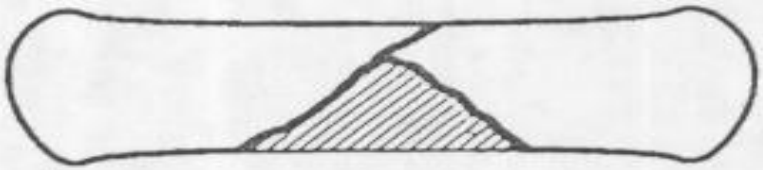
TRANSVERSE FRACTURE with angulation



SPIRAL FRACTURE

OBLIQUE FRACTURE

COMMINUTED FRACTURE



"BUTTERFLY" FRAGMENT

Timetable of Radiologic Healing Changes in Pediatrics Fractures *

Category	Early	Peak	Late
1. Resolution of soft Tissue swelling	2 – 5 days	4 – 10 days	10-21 days
2. Subperiosteal new bone formation	4-10 days	10-14 days	14-21 days
3. Loss of fracture line definition	10-14 days	14-21 days	
4. Soft callus	10-14 days	14-21 days	
5. Hard callus	14- 21 days	21 – 42 days	42 – 90 days
6. Remodeling	3 months	1 year	2 year to physeal closure

* Repetitive trauma may prolong categories 1,2,5,and 6

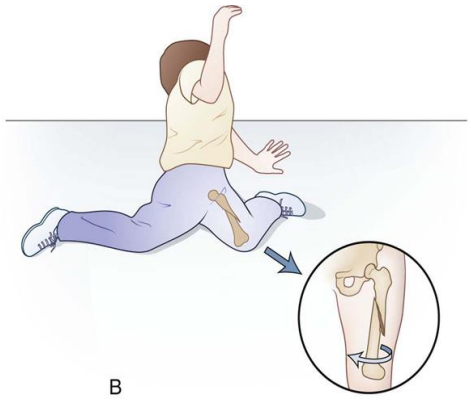
Torsional Load --

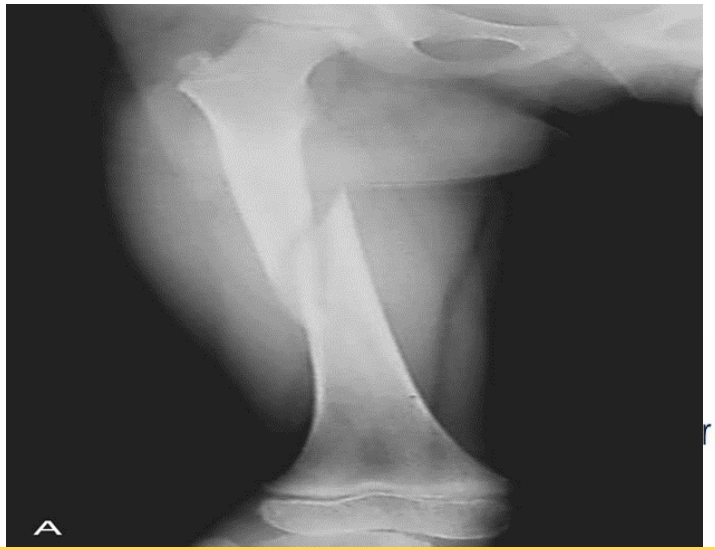
Spiral Fracture of Femur

2 1/2 year old with history of running, tripped over object, fell with leg twisted outward

20 month old playing with sibling in bed, got leg twisted in blanket, fell with leg tangled in blanket

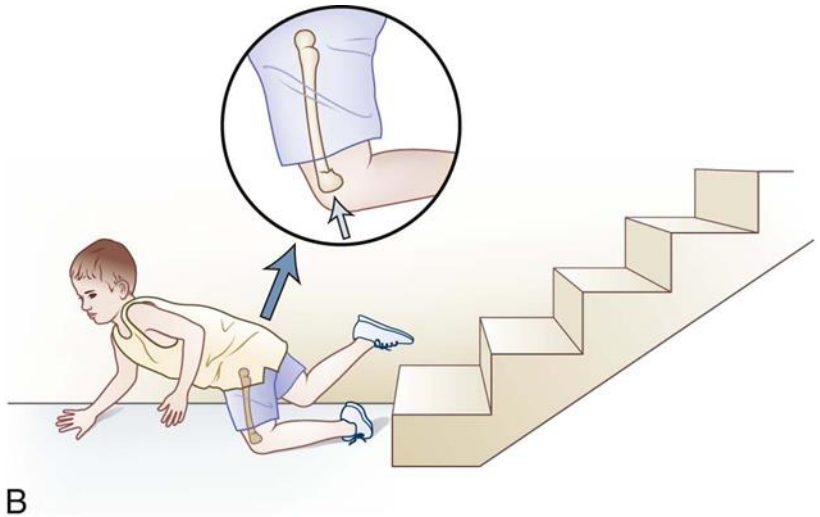
2 month old with acute swelling of leg after a diaper change





Compression / Axial Loading -- Transverse Femur Fracture

9 month old crawls off of the bed and lands on knee



Acute, transverse, distal meta-diaphysis femur fracture

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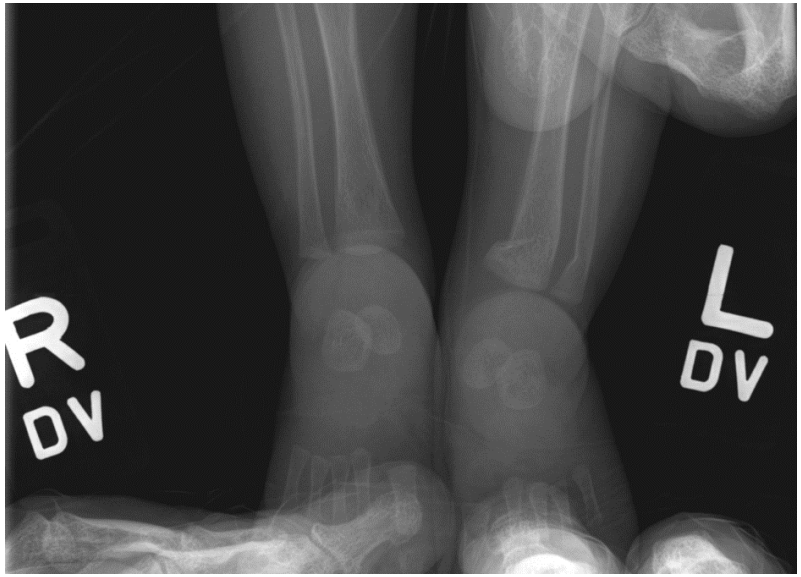
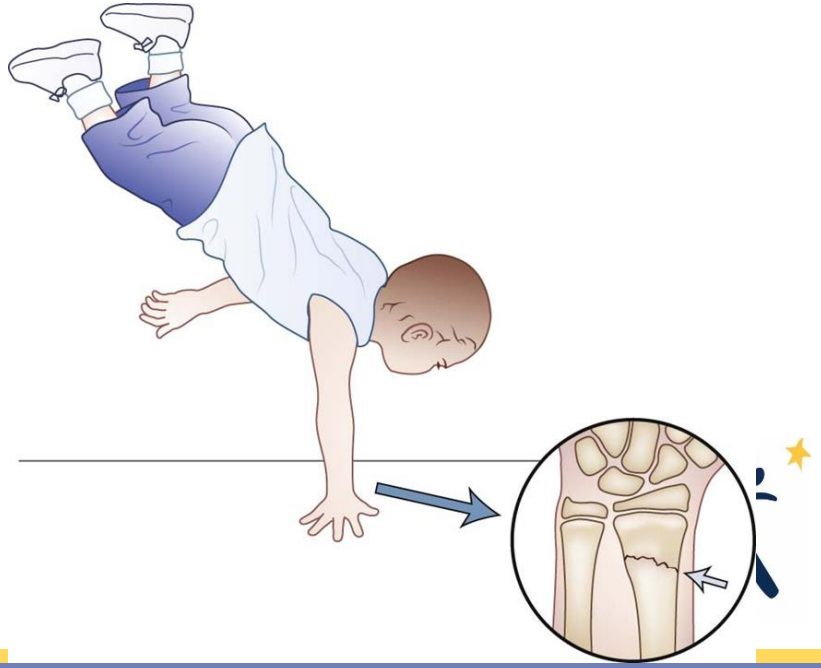
Axial Load – Distal Long Bone Fractures

15 month presents with a limp. Her Johnny Jump up is too long.



3 year old falls at playground



Differential Diagnosis

Non-accidental trauma

Osteogenesis imperfecta

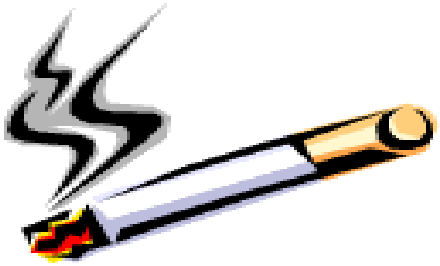
Osteopenia of prematurity

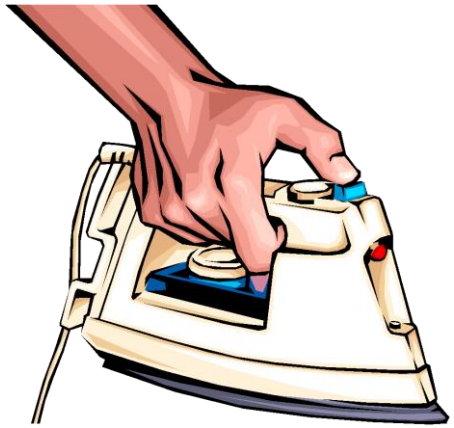
Rickets

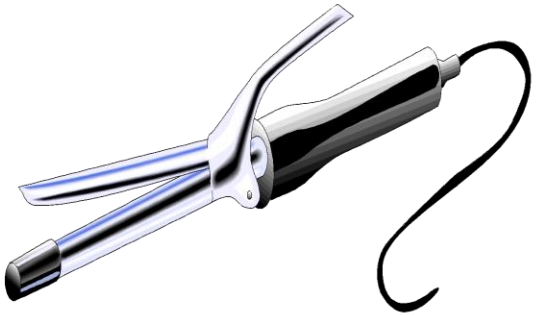
Osteomyelitis

Copper deficiency (nutritional, Menkes disease)

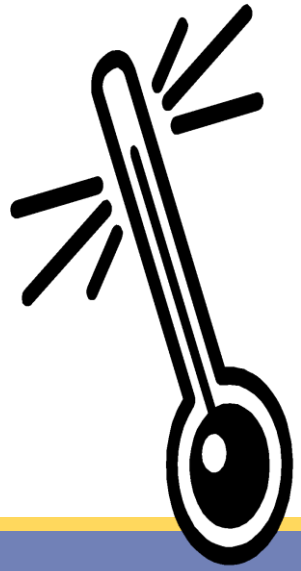
Demineralization from paralysis







Burns



Burns

Patterns

History!

Scene investigation critical!

Degree of burn a factor of :

- skin thickness,
- Temperature
- Solid/liquid/gas
- length of contact

Perineum and extremities are most common areas of abusive burns

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Burn Classification

First Degree	Superficial Partial-Thickness	Epidermal layer damage only (local redness)
Second Degree	Superficial to Deep Partial-Thickness	Dermal layer damage (blistering to scarring)
Third Degree	Full Thickness	Subcutaneous layer damage
Fourth Degree	Full Thickness	Muscle, fat, burn layer damage

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Temperature vs Time

Water Temperature	Time to partial- and full-thickness burns
111.2 °F	~6 hours (superficial)
130 °F	10 sec
135 °F	4 sec
140 °F	1 sec
149 °F	0.5 sec

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History Regarding Burn Injuries

- Anatomic location
- Explanation of the injury
- Location of child
- Witnesses to injury?
- Child and caregiver's reaction to injury
- Prior injuries?
- Source of injury
- Date/time of injury
- Presence/absence of clothing
- Time from injury to presentation for care
- Developmental level of child

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Level of water results in uniform demarcation line

Flexing results in apposition of skin surfaces and burn protection

Surface contact protects skin from hot water

Immersion burns often result in typical patterns that give clues to mechanism of injury

JOHN A. CRAIG, M.D.
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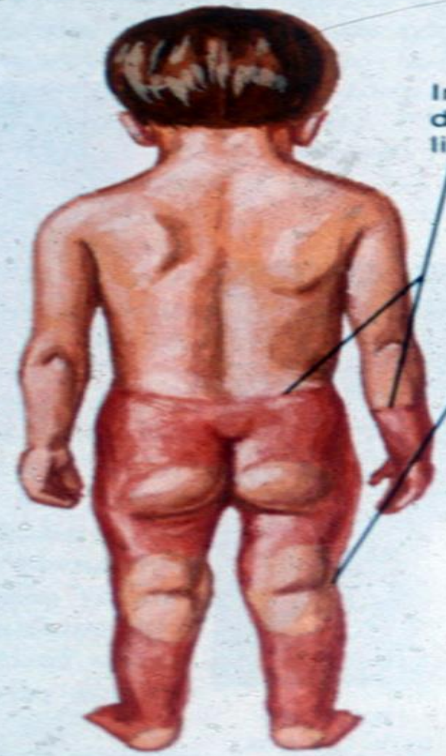
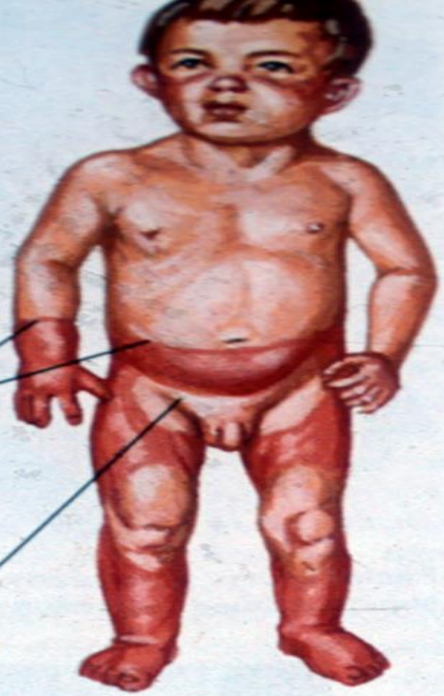


Immersion demarcation line

Areas of skin spared by flexion



Typical immersion burn. Uniform degree of injury with interspersed protected areas

Scald or splash injury from liquids usually results in single burn that diminishes in intensity from point of contact

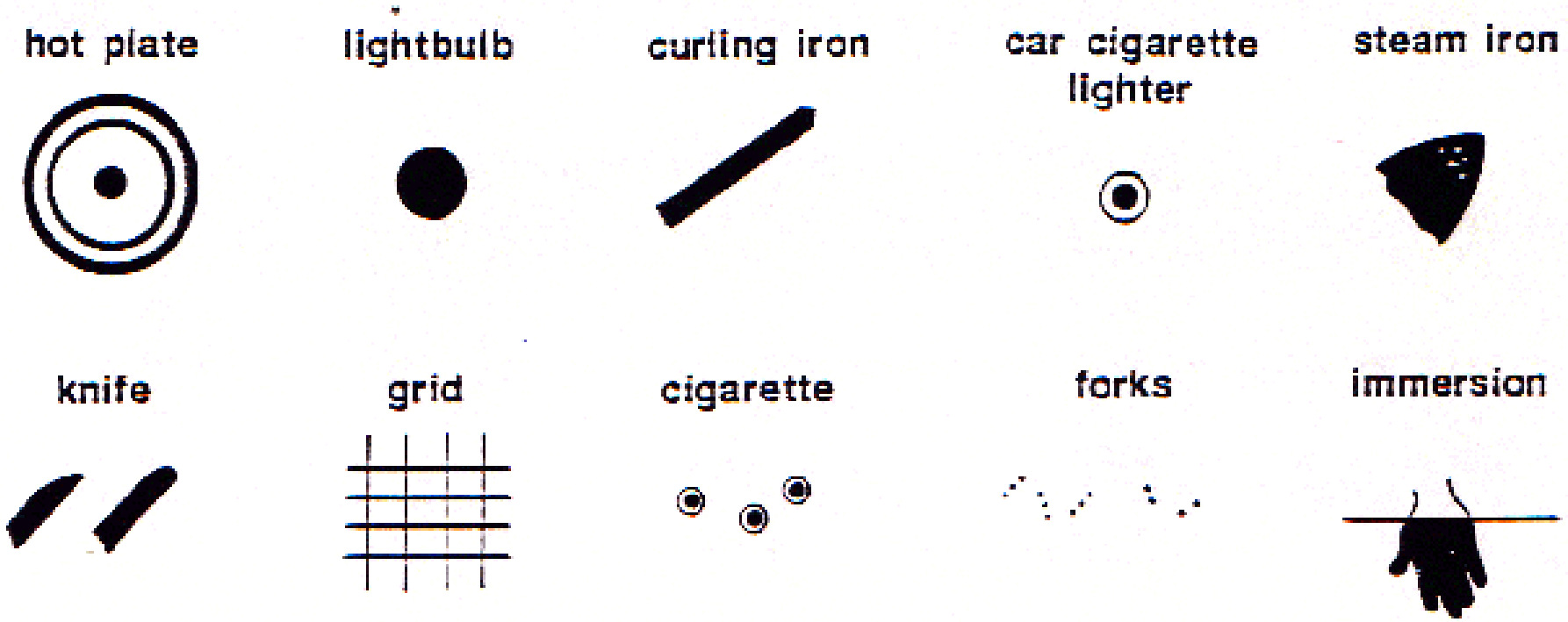


Figure 12.6. Marks From Burns
SOURCE: Johnson (1990). Reprinted by permission of W. B. Saunders.

Abdominal Trauma

Second most common cause of death in fatal abuse

Mortality in accidental injury – 21%

Mortality in non-accidental trauma injury – 53%

- delay in care
- false HPI
- non-communicative child

Blunt trauma; deceleration trauma

Often, NO external sign of injury

Requires high index of suspicion to diagnose

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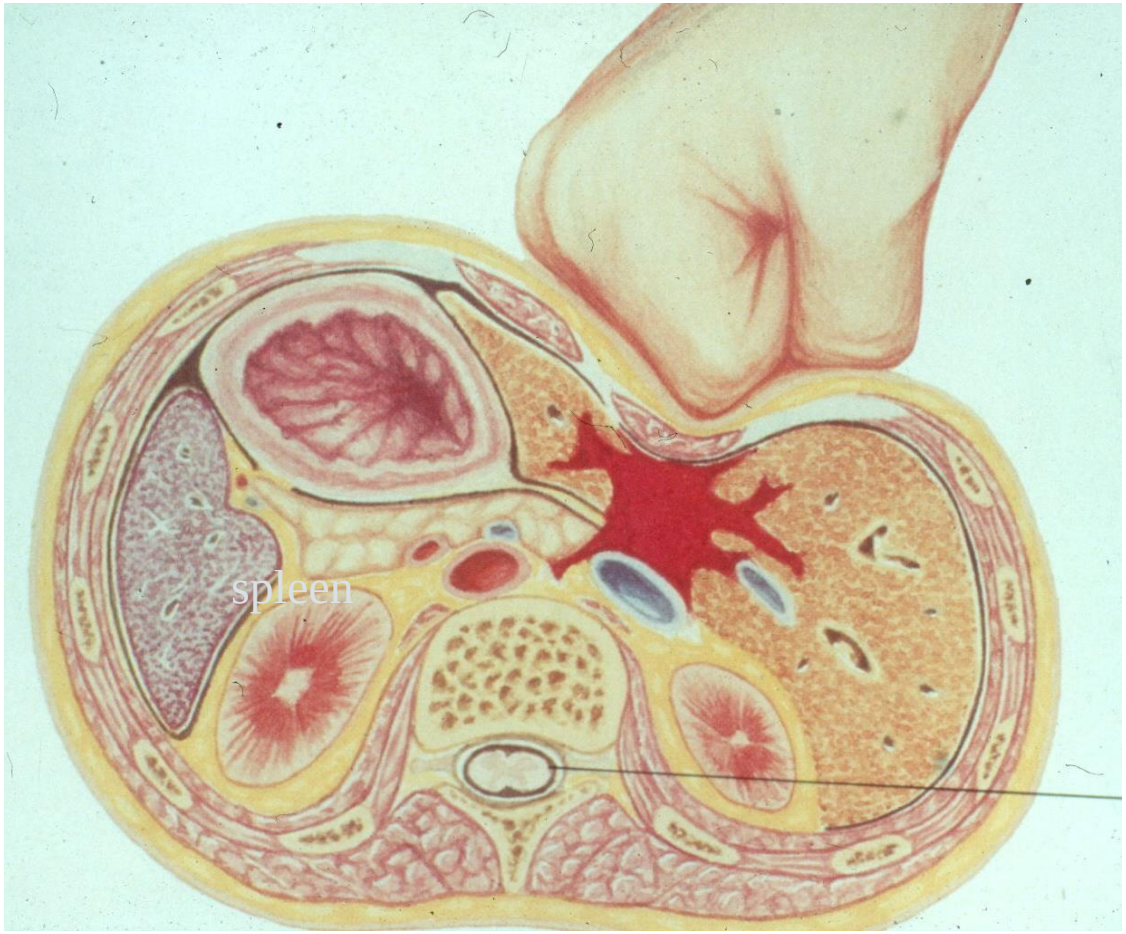
Mechanism: Blunt Force



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Questions?


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