

INITIAL EVALUATION OF THE PEDIATRIC TRAUMA PATIENT

Rio Grande Trauma Conference

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Disclosures

- I have no financial affiliations to disclose

Objectives

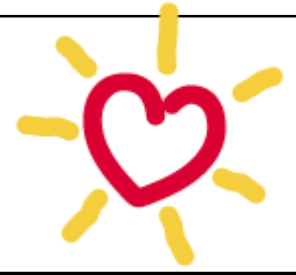
- Review current pediatric trauma statistics at UMC/EPCH
- Understand why children are not small adults
- Discuss tools to evaluate the pediatric trauma patient
- How to perform an initial evaluation of the pediatric trauma patient
- Discuss special considerations during initial evaluation

Introduction

- Trauma is the number one cause of morbidity and mortality in children.
- 1 in 4 children sustain an unintentional injury requiring medical care each year.
- An estimated 17.4 million children do not have access to a pediatric trauma center within 60 minutes.



2018 Pediatric Trauma Statistics



Level	Number of Activations	Percentage of Total Activations
Full (Level 1)	88	15%
Limited (Level 2)	95	16%
Consultation (Level 3)	400	68%
Direct Admits	7	1%
Total	590	100%

Pediatric Mechanism of Injury

Mechanism of Injury	Percentage
Falls	40%
MVC	19%
Assaults	5%
Auto vs Pedestrian	4%
Burns	3%
GSW	2%
MCC	1%
SW	1%
Other (animal, water, machinery, sports)	20%

Pediatric Admissions By Age Group

Age	Admitted	ISS > 15
0-2	120	11
3-5	89	11
6-8	78	8
9-11	50	6
12-14	90	9
15-17	84	10
Total	511	55

**79 pts not admitted (post ED Home, LAMA, Burn Center, Mental Health/Psychiatric Hospital and Morgue)



Children are
NOT
small adults



Children are not small adults

- Larger body surface area to body mass ratio
- Higher respiratory rate
- Less fluid reserve
- Less circulating volume
- Less fat, more elastic connective tissue, pliable skeleton
- Developmental vulnerabilities

Pediatric Normal Vital Signs

Age Group	Heart Rate	Respirations	Systolic BP
Preterm	120 - 180	50 - 70	40 - 60
Newborn (0 to 1 Month)	100 - 160	35 - 55	50 - 70
Infant (1 to 12 Months)	80 - 140	30 - 40	70 - 100
Toddler (1 to 3 Years)	80 - 130	20 - 30	70 - 110
Preschool (3 to 6 Years)	80 - 110	20 - 30	80 - 110
School Age (6 to 12 Years)	70 - 100	18 - 24	80 - 120
Adolescents (12+ Years)	60 - 90	14 - 22	100 - 120

Threshold by Age of Systolic Blood Pressure Indicating Hypotension

Age	Systolic Blood Pressure
Term neonates (0 to 28 days)	Less than 60 mm Hg
Infants (1 to 12 months)	Less than 70 mm Hg
Children 1 to 10 years (5th blood pressure percentile)	Less than $70 + (\text{age in years} \times 2)$ mm Hg
Children >10 years	Less than 90 mm Hg



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PINK	6-7kg
RED	8-9kg
PURPLE	10-11kg
YELLOW	12-14kg

WHITE	15-18kg
BLUE	19-23kg
ORANGE	24-29kg
GREEN	30-36kg

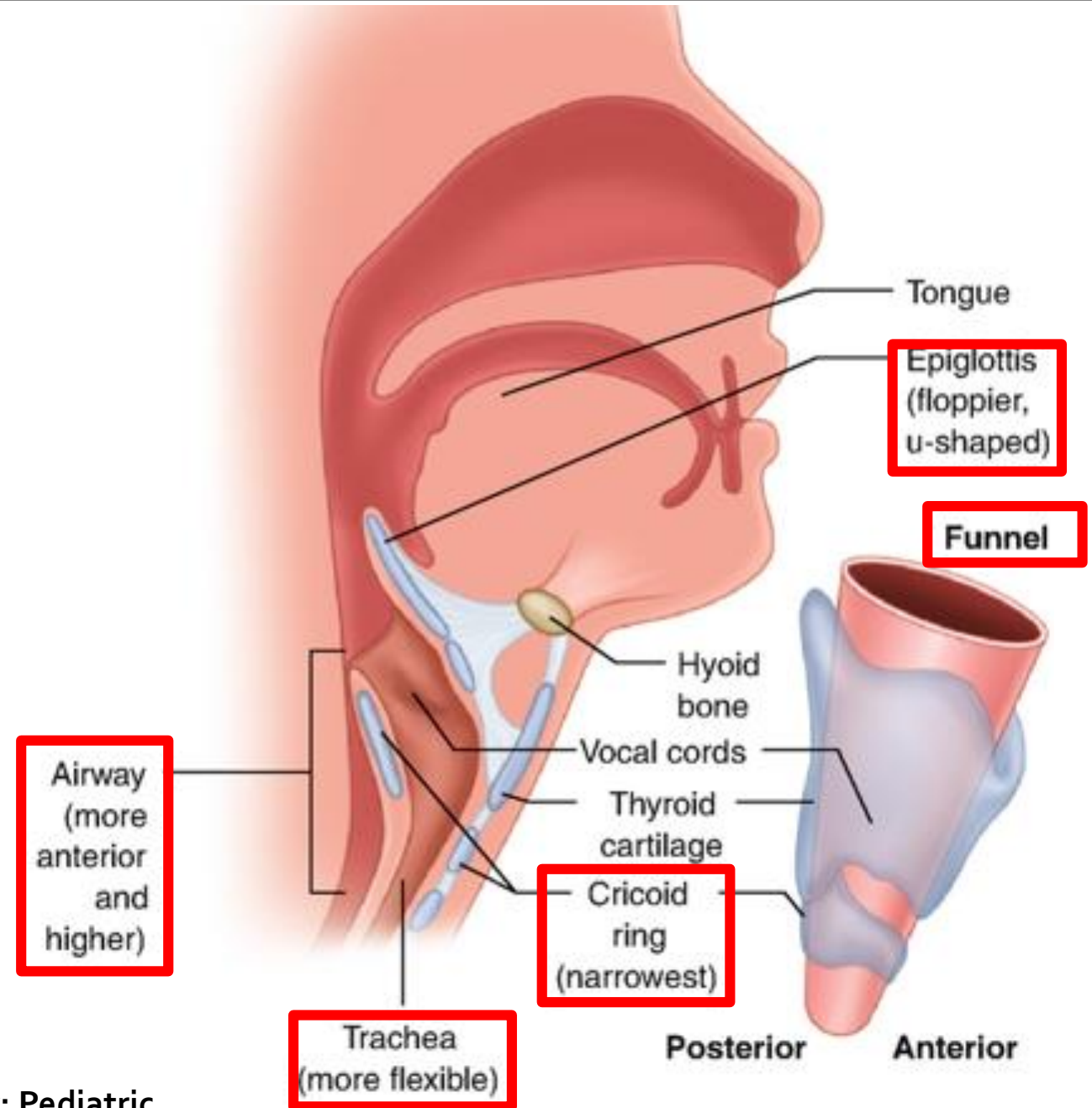
The Trauma Evaluation

- Airway
- Breathing
- Circulation
- Disability
- Exposure
- Family Presence



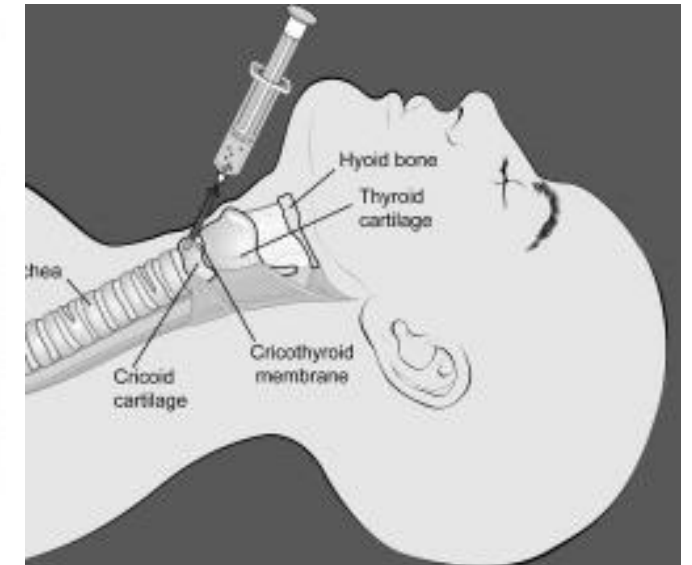
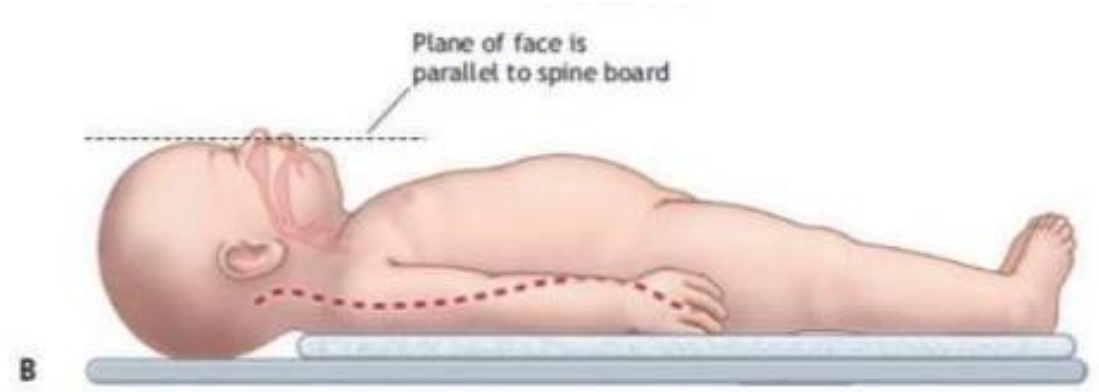
Airway

- Larger occiput
- Smaller airway
- Larger tongue
- Floppy epiglottis
- Vocal cord slanted
- Larynx is higher and more anterior



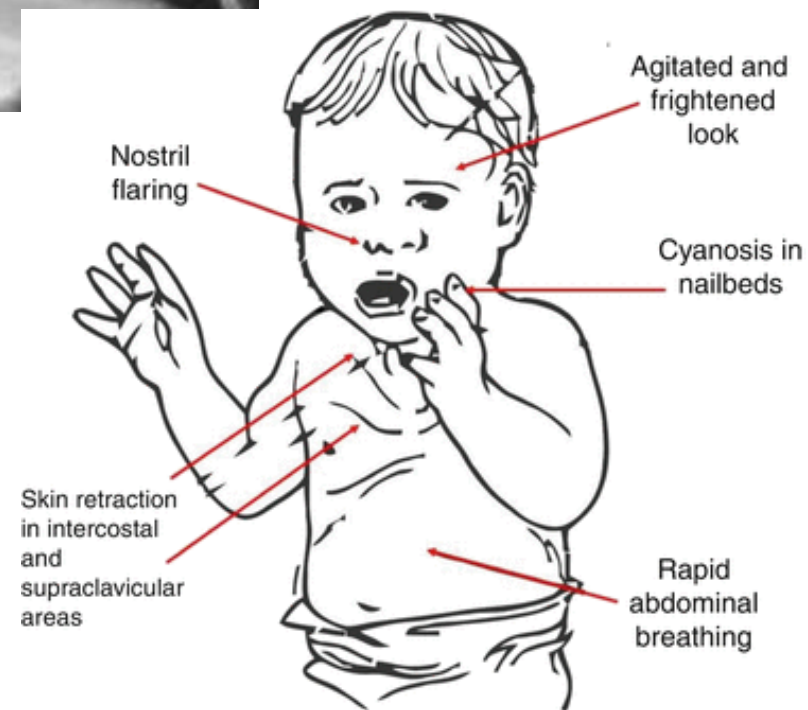
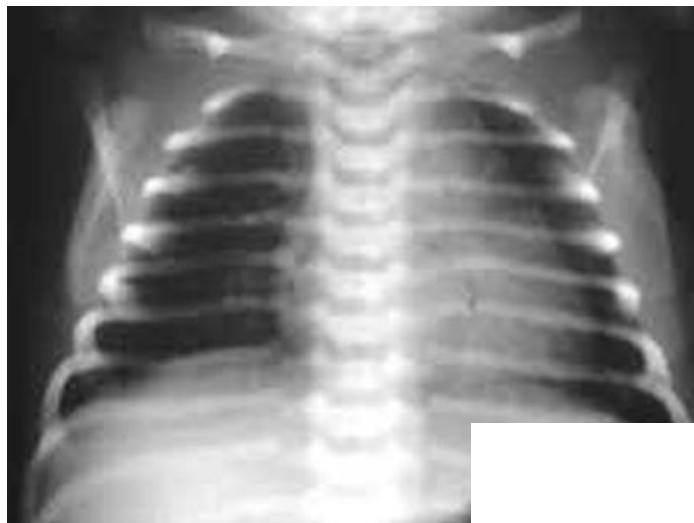
Airway

- Jaw thrust - maintain c-spine precautions
- BVM
- LMA
- Needle cricothyroidotomy – jet insufflation
- Surgical cricothyroidotomy: age > 12 years
- Intubation



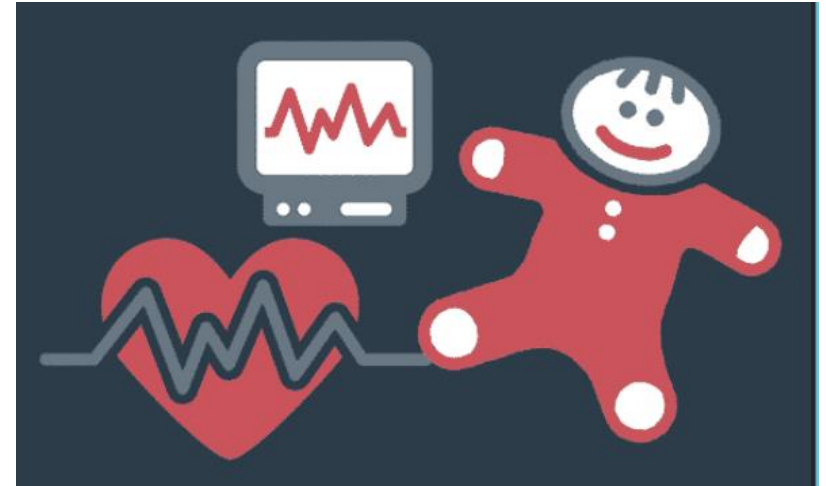
Breathing

- Hypoventilation → bradycardia → cardiac arrest
- Rib position more horizontal
- Abdominal musculature use
diaphragm use
- Fewer type 1 muscle fibers
- Higher oxygen demand =
higher respiratory rates



Circulation

- Check perfusion
 - Capillary refill
 - Peripheral pulses
- No utility of permissive hypotension in pediatric trauma
 - Do not equate pediatric blood loss to that of adult
 - Total blood volume = 75-80 ml/kg
 - Initial fluid bolus = 20 ml/kg NS
 - Blood bolus: 10 ml/kg PRBC
- Tachycardia is an EARLY marker of hypovolemia
- Hypotension is a LATE identifier



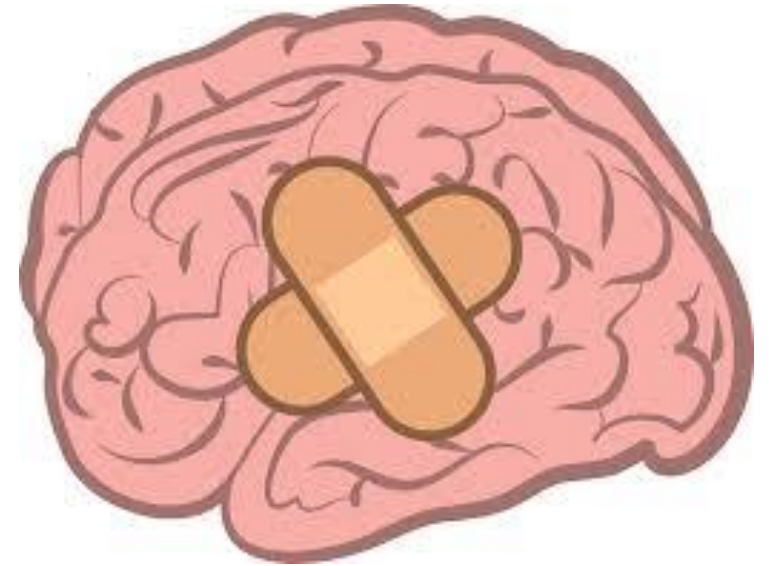
Shock Index Pediatric-Adjusted

SIPA = maximum heart rate/minimum systolic blood pressure

Age	SIPA	Risk of blunt injury if SIPA is elevated
4–6 years	>1.22	22.0%
7–12 years	>1.00	25.1%
13-16 years	>0.90	32.0%

Disability

- Check hypoglycemia
- Quick neurologic assessment
 - Alert
 - Responsive to verbal/painful stimuli
 - Unresponsive
 - Pupillary exam
 - Gross movement of all 4 extremities
- Glasgow coma scale for pediatrics



Head Injury

- GCS 13-15: Mild
- GCS 9-12: Moderate
- GCS <8: Severe

Glasgow Coma Scale- Eye

Infant (<2 year)	Pediatric (>2 year)	Adult	Score
Spontaneous	Spontaneous	Spontaneous	4
Voice	Voice	Voice	3
Pain	Pain	Pain	2
None	None	None	1

Glasgow Coma Scale- Verbal

Infant (<2 years)	Pediatric (>2 years)	Adult	Score
Coos, babbles	Appropriate word/ phrase	Oriented	5
Irritable but consolable	Disoriented/ converses	Confused	4
Persistent cries/ screams	Inappropriate word	Inappropriate	3
Moans/grunts to pain; restless	Incomprehensible sounds	Incomprehensibl e	2
None	None	None	1

Glasgow Coma Scale- Motor

Infant (<2 year)	Pediatric (>2 year)	Adult	Score
Spontaneous	Obeys	Obeys	6
Localizes pain	Localizes pain	Localizes pain	5
Flexion-withdrawal	Flexion-withdrawal	Withdraws	4
Flexion/decorticate	Flexion/decorticate	Abnormal flexion (decorticate)	3
Extension/decerebrate	Extension/decerebrate	Abnormal extension (decerebrate)	2
None	None	None	1

Exposure

- Promptly evaluate for external signs of injury
- **WARM THE ROOM, WARM THE PATIENT**
- Higher basal metabolic rate and surface area
 - Higher oxygen consumption
 - Higher respiratory rates and heart rates
 - Larger surface area to body mass ratio = greater heat loss



Secondary Survey

- Once the primary survey is adequately assessed
- Perform a detailed head to toe exam
- Let's revisit pediatric vital signs ...

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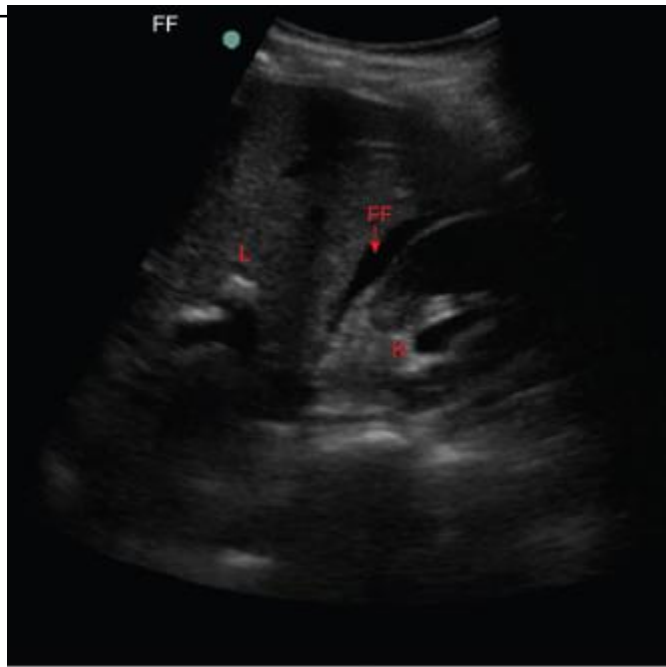
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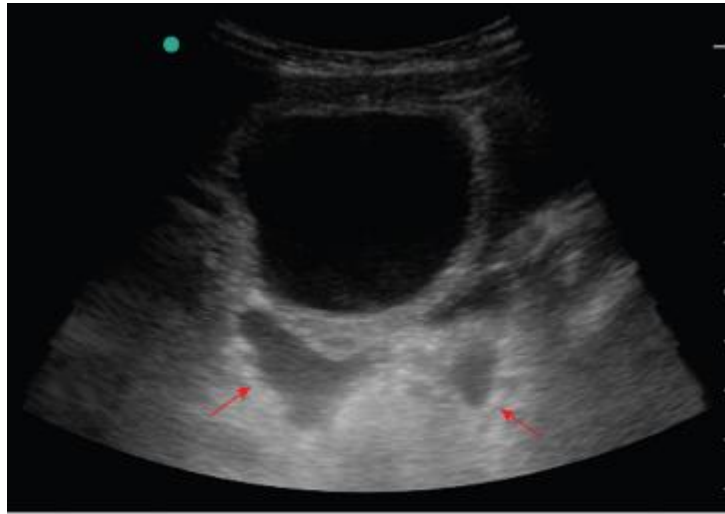
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Adjuncts

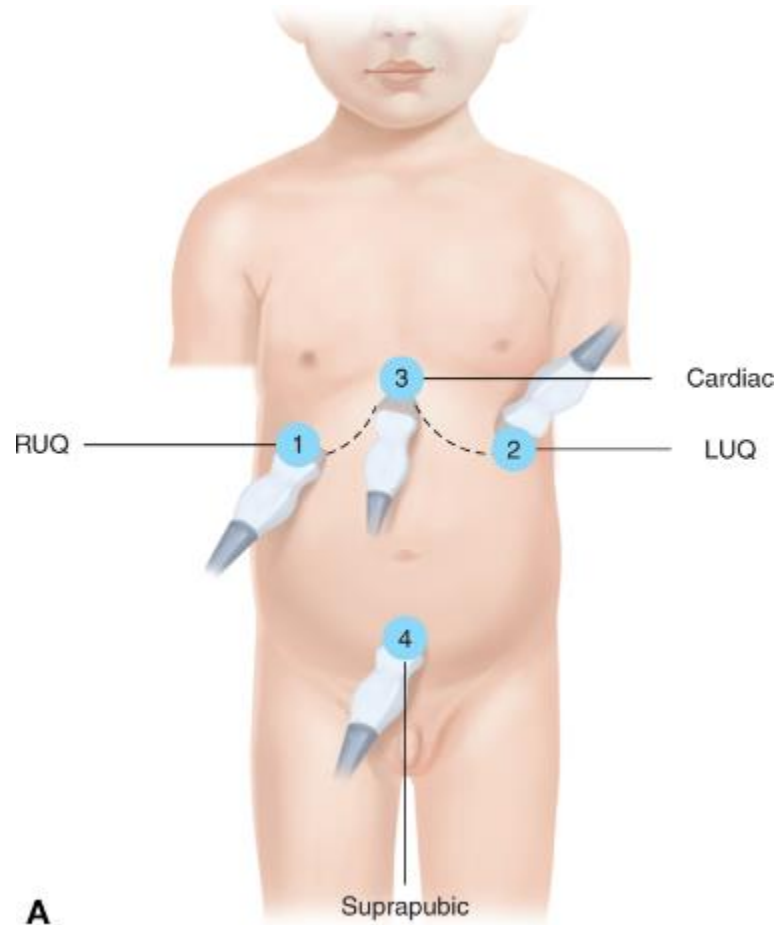




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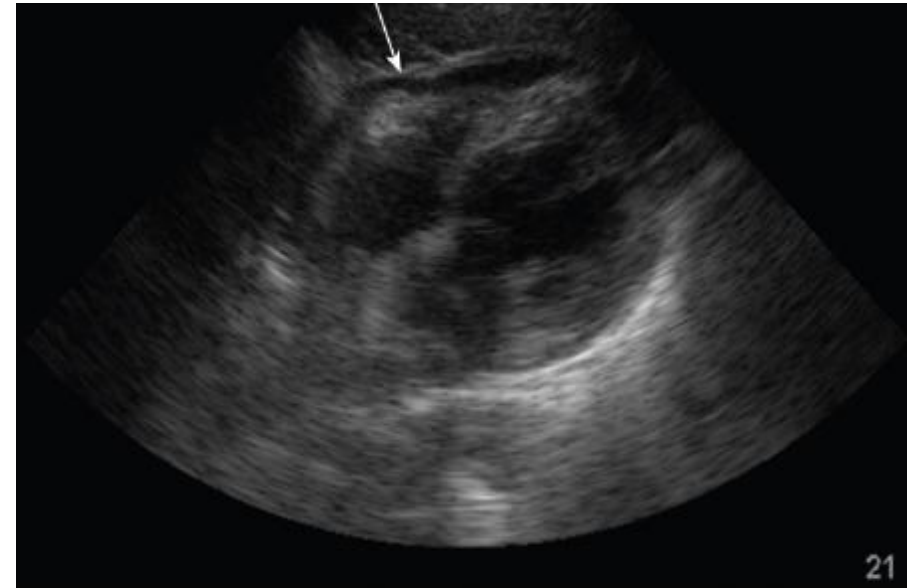


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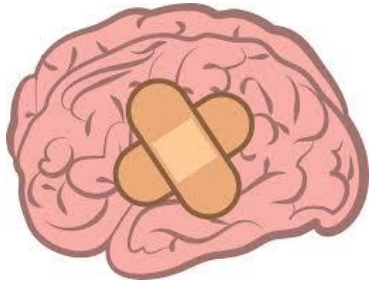
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Common Traumatic Injuries



- Thinner/more flexible skull
- Disproportionately larger head
- C -spine injury usually higher

- Ribs/sternum more elastic
- Underlying injury without outward signs



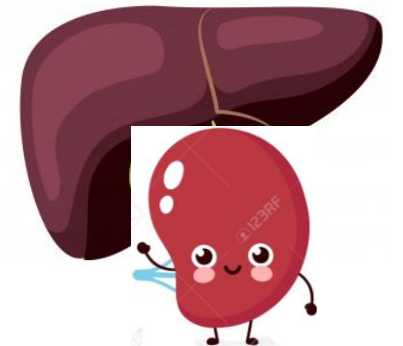
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Radius/ulnar/femur most common

- Splint/reduce

- Thin wall
- Decreased AP diameter
- Increased lordosis
- Proportionately larger spleen/liver
- Organs below the rib cage
- Kidney more anterior/less fat



Special Circumstances

- Non accidental trauma
 - Child maltreatment refers to acts of commission (deliberate or intentional inflicted injury referred to as child abuse or non accidental trauma (NAT) or omission in children under 18 years of age
 - 674,000 children classified as victims of maltreatment in 2017
 - Estimated 1,720 child deaths from maltreatment in 2017, 11% increase from 2013
 - Look for sentinel injuries: injuries suspicious for physical abuse
 - Apply clinical screening vigilantly and follow up with appropriate laboratory testing, radiographs, and appropriate consulting services

Non Accidental Trauma

- A thorough history and physical is key
- Delay in seeking care
- At risk social factors in the immediate family
- Lack of correlation between history and observed injury
- Note interactions/affect/responses of caretakers
- Injury of mechanism inconsistent with appropriate development
- Note Bruising patterns (frenulum, torso, ear, neck, jaw, cheek, eyelids, subconjunctiva, patterned bruising related to an object)
- Note fracture patterns (Ribs, Femur, Humerus)

Children are not small adults



THANK YOU!