

Unique aspects of pediatric trauma

Unique aspects:

- **MULTISYSTEM INJURIES**
 - Kids tend to have ALL of their organ systems injured in blunt trauma
- **SUDDEN DETERIORATION:**
 - Their tendency is to compensate for a long time, and then to decompensate suddenly
 - **THE MOST SERIOUS INJURIES ARE BLUNT INJURIES TO THE BRAIN**
 - **APNEA, HYPOVENTILATION AND HYPOXIA OCCUR 5 TIMES MORE FREQUENTLY than hypovolemia and hypotension**

Psychology is very different: 60% will have personality changes 1 year after severe multisystem trauma
Evidence shows: quality of life is good, even after disabling injury; so resuscitate aggressively

- **ANATOMY:**
 - **Small bodies:** therefore all injuries from blunt impact are more severe
 - **Large heads:** therefore a greater proportion of head injury
 - **Soft bones:** thus, force is transmitted to internal organs; fewer rib fractures and more pulmonary contusions. When fractures are present, assume the force was truly massive.
 - **Surface area is greater as compared to body volume;** heat loss occurs at a greater rate

BROSELOW PEDIATRIC EMERGENCY TAPE: relates body length to estimates of weight, fluid resuscitation needs, drug doses, and all kinds of useful stuff.

Airway:

- **Posterior pharynx buckles anteriorly with hyperextension of the neck;**
- **Thus, its better to have the head in a neutral position. The “sniffing” position doesn’t work.**
- **This is accomplished by elevating the body; so, put something under them, some sort of mat.**
- **The larynx is funnel-shaped, so secretions accumulate**
- **Nasopharynx is fragile, nasopharyngeal airways are usually dangerous**
- **Infant trachea is 5cm long; grows to 7 cm by 18th month**
- **A straight laryngoscope is used**
- **The under-10s need a cuffless tube – the cricoid ring is the narrowest part of the airway and forms a natural cuff**
- **ATROPINE IS NEEDED FOR INTUBATION; there is a massive vagal response with a blood pressure drop in response to anaesthetic agents and intubation. Plus, it happens to reduce secretions.**

PEDIATRIC RAPID SEQUENCE INDUCTION:

- **0.1 - 0.5mg of atropine**
- **NORMOTENSIVE = 0.3mg/kg midazolam**
- **HYPOTENSIVE = 0.1mg/kg midazolam**
- **SUX: 2mg/kg if less than 10kg, 1mg/kg if more than 10kg**
 - more sux is needed for kids who weigh less
- **the younger they are, the easier the tube is to dislodge when moving them, eg. when the head is turned, or when the kid is moved to and from the CT table**

Breathing:

- the younger they are, the faster they breathe.
- Infants breathe at 30-40 times per minute
- There is more barotrauma with aggressive bagging: alveoli are more fragile
- Chest tubes need to be TUNNELLED because of the thinner chest wall

Circulation and Shock:

Normal bottom limit of systolic blood pressure:

$$70 + 2 \times \text{age}$$

- When a child is shocked, there are few signs.
- Poor perfusion is the earliest sign
- Next, the pulse pressure becomes narrower (below 20mmHg)
- Tachycardia may be a late sign
- Low urine output and hypotension are very late signs – loss of about 45% of blood volume
 - Normal urine output is 2 ml/kg/hr for the first year of life
 - It does not reach adult rate of 0.5mg/kg/hr until the adolescent has stopped growing

CIRCULATING VOLUME = 80ml per kg.

- First, BOLUS THEM WITH 20ml per kg three times. (3 to 1 rule applies)
 - o The first bolus should elicit some response
 - o When starting the third bolus, also give blood.
- There should be some LASTING return to hemodynamic normality
- If there is no response or only a transient response, get them to the operating theatre

Chest trauma:

- If there is chest injury, in 2/3rds there will also be other organ injury
- Mediastinum is more mobile: susceptibility to tension pneumothorax is greater
- Aortic and tracheobronchial injuries are less common

Abdominal trauma:

- Stressed crying children swallow air. Distended abdomens need NG decompression.
- Seat belt injury = ruptured hollow viscus, and especially bladder with lap belts
- Solid organ injuries frequently DO NOT need operative management, but hollow organ injuries need to be repaired quickly.
- CT Abdomen is the diagnostic gold standard; FAST is not far behind
- DPL should only be performed by the surgeon

INDICATION FOR LAPAROTOMY:

- Transfusion needs exceeding 50% of the kids blood volume in the first 24 hrs

Head trauma:

- Head injury is MORE LIKELY to cause brain injury in kids, because
 - o Skull is softer
 - o Brain is softer (more water content)
 - o Subarachnoid space is smaller
 - o Cerebral blood flow is greater
- hypotension is the single greatest risk factor, followed by hypoxia
- bulging fontanelles may occur without coma
- vomiting and amnesia may not mean head injury
- persistent or worsening vomiting DOES need a head CT
- any seizure activity = head CT
- GCS is useful; use the modified GCS for the under 4s

Pediatric verbal response:

- 5 = appropriate, social smiling
- 4 = cries, but consolable
- 3 = cries, inconsolable
- 2 = restless, agitated
- 1 = none

Spinal cord trauma

- Uncommon in the very young
- Ligaments and joint capsules are more flexible
- Vertebral bodies are wedged anteriorly, tend to slide forward with flexion
- Facet joints are flat
- Head is larger: angular momentum forces applied to the upper neck are greater
- C-spine xrays are complicated with “pseudosubluxation” – C2 is anteriorly displaced on C3, which is normal and occurs in 40% of the under-7s
- Pseudosubluxation can be reduced by having the neck in a neutral position
- There may be an abnormal-looking gap between the dens and the anterior arch
- Skeletal growth centres may resemble fractures
- SCIWORA: spinal cord injury without radiographic abnormalities: up to 2/3rds of them!
 - o Immobilize w/ the spine if there is ANY DOUBT.

Musculoskeletal injuries

- Long bones of children bleed less than in adults
- Multiple fractures in varying stages of healing = abuse
- Supracondylar knee or elbow fractures = vascular compromise of the growth plate

The abused child

- Homicide is the most common cause of injury-death in the first year of life
- DISCREPANCY BETWEEN HISTORY AND INJURY: MECHANISM DOESN'T MAKE SENSE
- Long time passing between injury and presentation
- Repeated trauma
- History changes between guardians
- History of hospital or doctor shopping
- Parents fail to comply with medical advice or leave the child
- Bruises or fractures in different stages of healing
- Perioral, perianal, genital injuries
- Long bone fractures in the under 3s
- Ruptured internal viscera without antecedent blunt trauma
- Multiple subdurals without skull fractures
- Retinal hemorrhages
- Bizarre wounds, eg. cigarette burns, sharply demarcated second and third degree burns