



Multi System Trauma In Children



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Kids are not just small adults





The priorities are same as that of the adult.





Unique characteristics

- Size & shape : smaller body mass-greater force applied per unit body area
- Skeleton: more pliable – internal organ damage -without overlying bony #
- Equipment : appropriate size





Common Mechanisms



- Pedestrian struck
- Automobile occupant
- Fall from a height
- Fall from a bicycle





Criteria for transfer to trauma centre

- Multi-system
- Unstable
- Axial skeleton #
- Neurovascular injury
- Acute cord injury
- Complicated TBI
- Low trauma score





Trauma Scores



- Pediatric Trauma Score (PTS)
 - Accurate predictor injury severity
 - -4 to 12
 - : <8 increased mortality




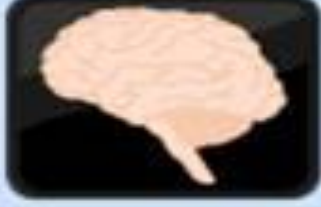

PTS: Components

1. Weight
2. Airway
3. Systolic BP
4. Level of Consciousness
5. Fracture
6. Cutaneous





Primary survey

	Airway	Maintain airway with cervical spine control.
	Breathing	Assess breathing and ventilation. Apply high flow O ₂ .
	Circulation	Assess circulation with haemorrhage control.
	Disability	Check neurological status.
	Exposure/ Environment	Complete assessment of the patient but prevent hypothermia.





Secondary Survey

- History (AMPLE)
 - A: Allergies
 - M: Medications currently Used
 - P: Past illnesses/pregnancy
 - L: Last meal
 - E: Events/environment related to the injury
- Head-to-toe evaluation of the trauma patient
- Remove them from backboard as quickly as possible to decrease pressure ulcers and back pain
 - Patients put on backboard by Emergency Medical Services to help with transport
- Images and lab studies
- Transition to definitive care





Airway

- Smaller in diameter, shorter in length
- Epiglottis – long, floppy, narrow
- Large occiput-flexion
- Narrowest portion –below vocal cords
- Larynx – Anterior & caudal
- Large tongue





CHILD

Proportionately larger head

Infants are obligate nose breathers

Larger, more flaccid tongue

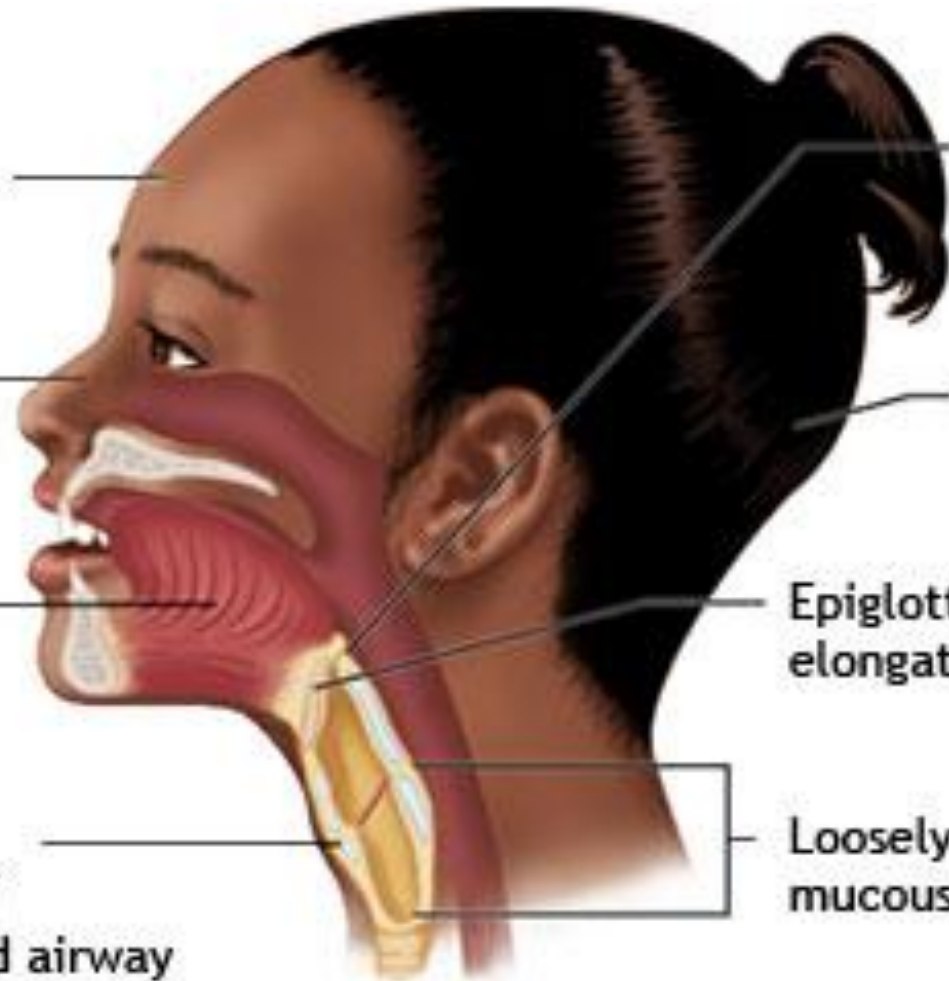
Cricoid cartilage narrowest part of the funnel-shaped airway

Larynx more superior and anterior

Proportionately larger occiput

Epiglottis more cephalad, elongated, and flexible

Loosely attached mucous membranes

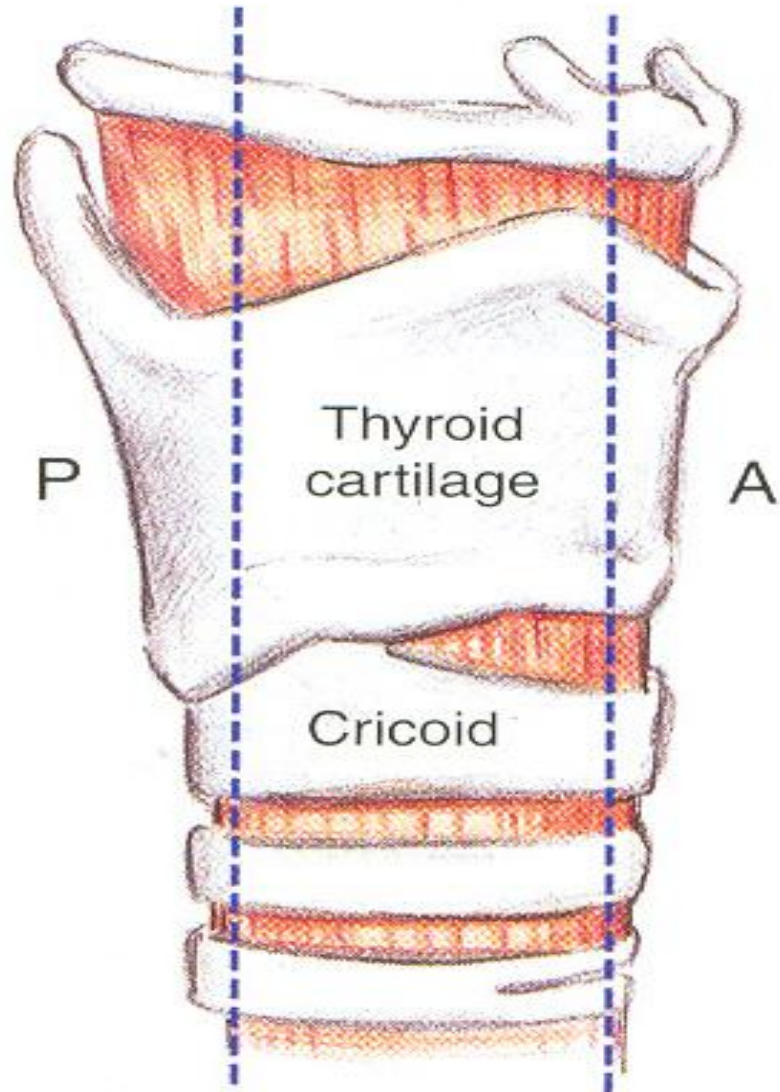


Infants and young children rely on the diaphragm to breathe more than adults do.

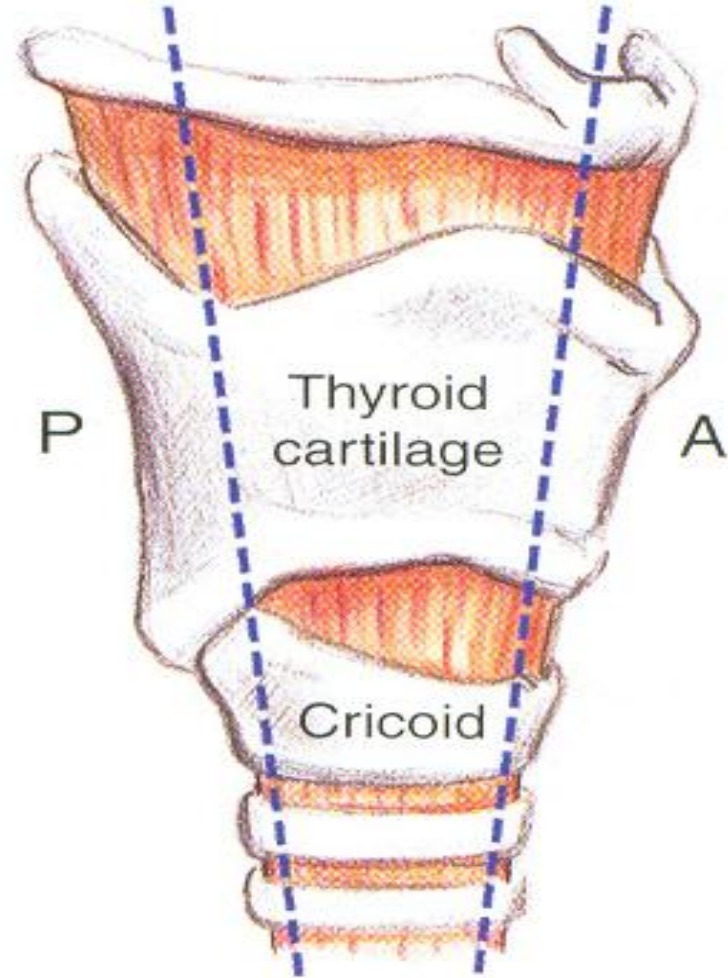




A



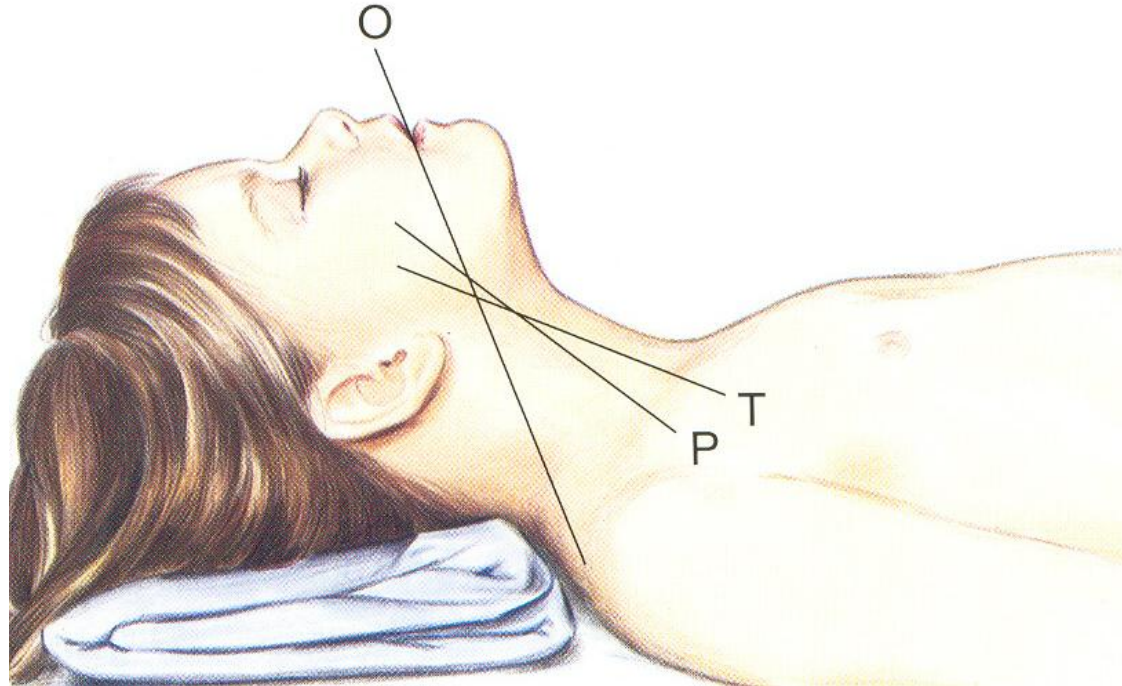
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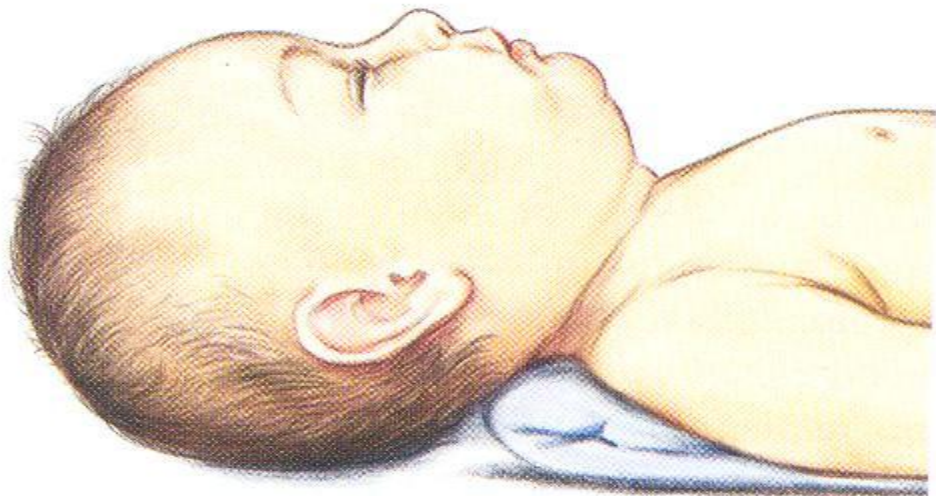
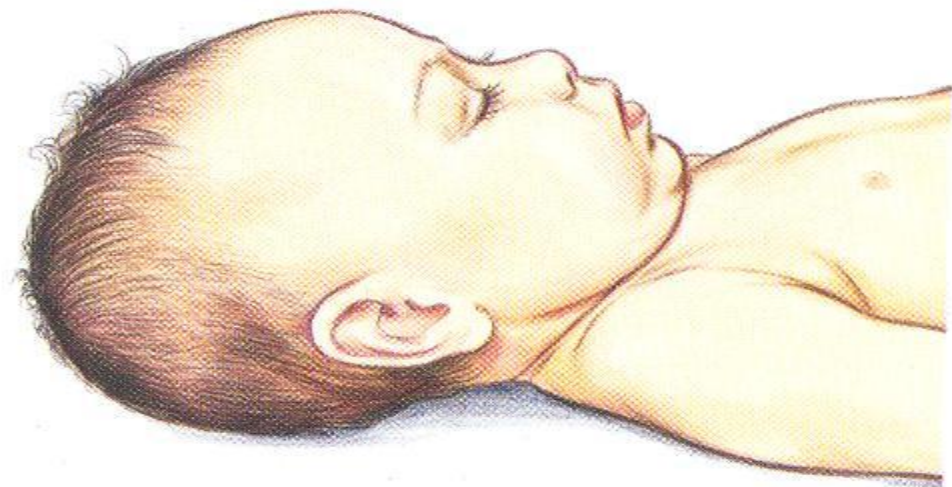


Airway management

- Oxygenation
- Oral airway
- Intubation

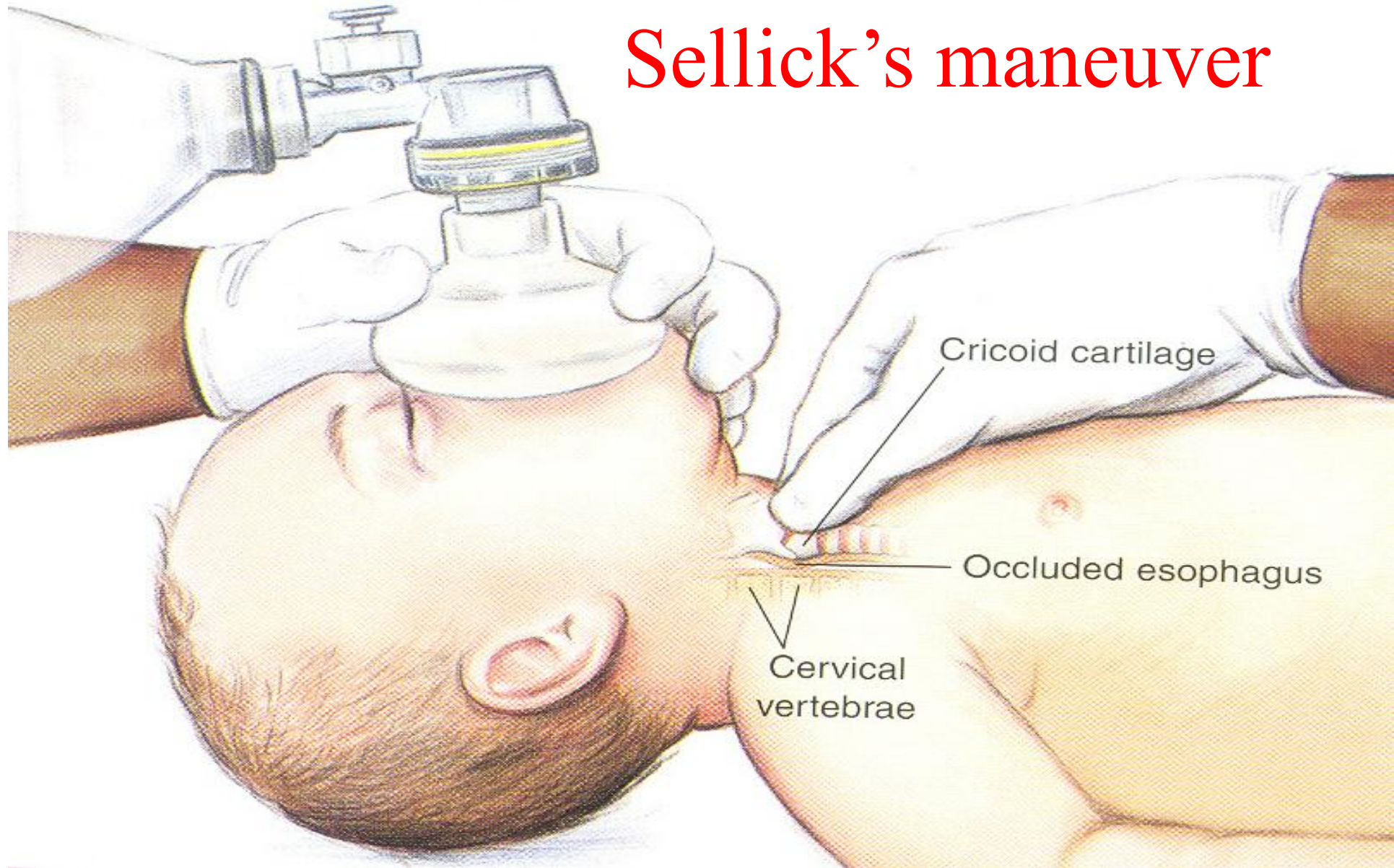








Sellick's maneuver

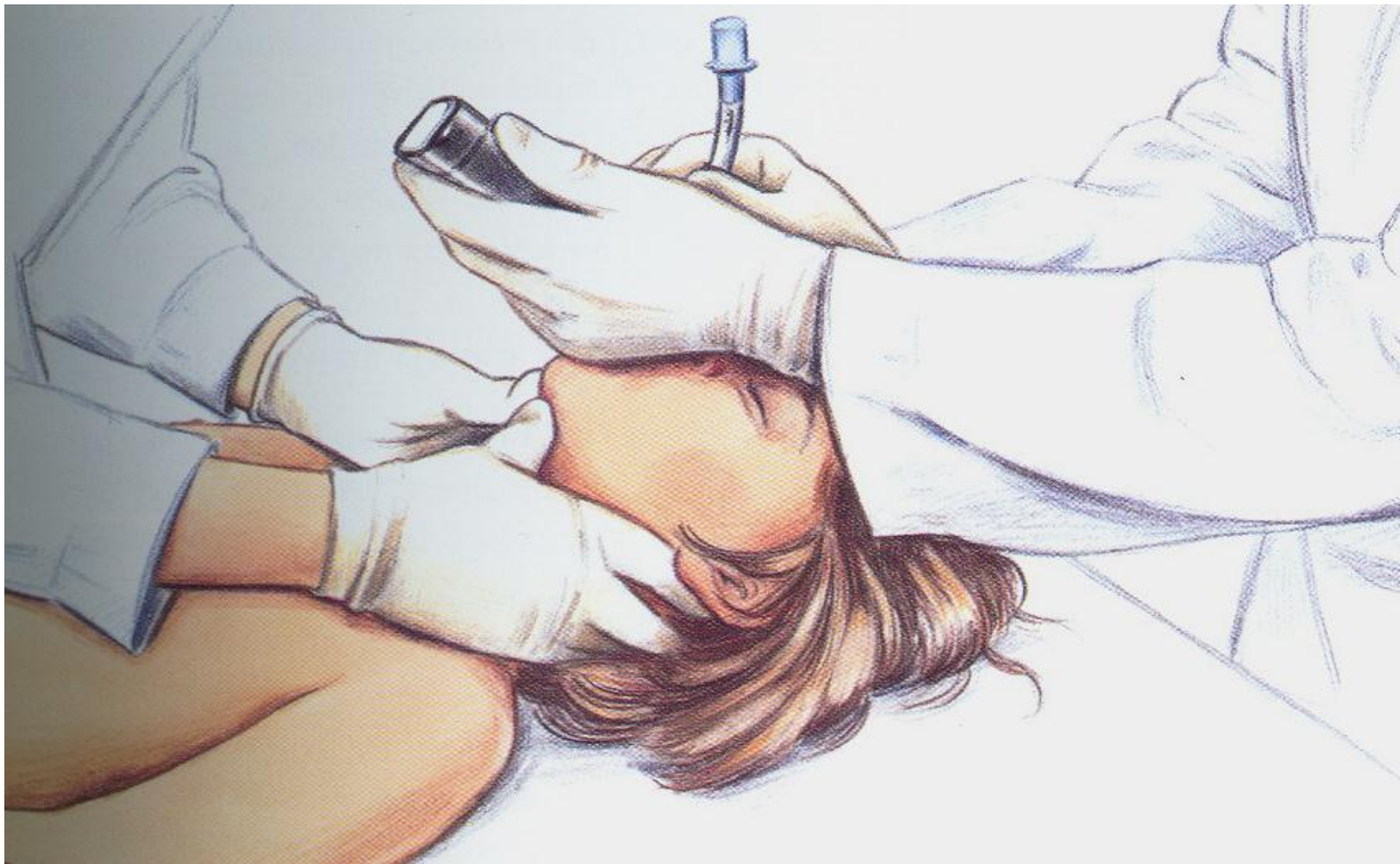




Difficulty in maintaining tube position

- Uncuffed tube
- Short trachea







Endotracheal intubation Indications



- Severe brain injury
- Airway not patent
- Exhibiting signs of ventilatory failure
- Significant hypovolemia
- Requires operative intervention





Breathing & Ventilation

- Respiratory rate
- Volume
- Hypoventilation-respiratory acidosis
- Caution – bicarbonate
- Tube thorocostomy





Circulation



- Recognize hemodynamic changes
- Tachycardia and poor skin perfusion are early signs of shock

System	Mild Blood Volume Loss (< 30 %)	Moderate Blood Volume Loss (30 % to 45 %)	Severe Blood Volume Loss (> 45 %)
Cardiovascular	Increased heart rate; weak, thready peripheral pulses; normal systolic blood pressure (80-90 + [2 × age in years]); normal pulse pressure	Markedly increased heart rate; weak, thready central pulses; absent peripheral pulses; low normal systolic blood pressure (70-80 + [2 × age in years]); narrowed pulse pressure	Tachycardia followed by bradycardia; very weak or absent central pulses; absent peripheral pulses; hypotension (< 70 + [2 × age in years]); widened pulse pressure (or undetectable diastolic blood pressure)
Central nervous system	Anxious; irritable; confused	Lethargic; dulled response to pain ¹	Comatose
Skin	Cool, mottled; prolonged capillary refill	Cyanotic; markedly prolonged capillary refill	Pale and cold
Urine output ²	Low to very low	Minimal	None





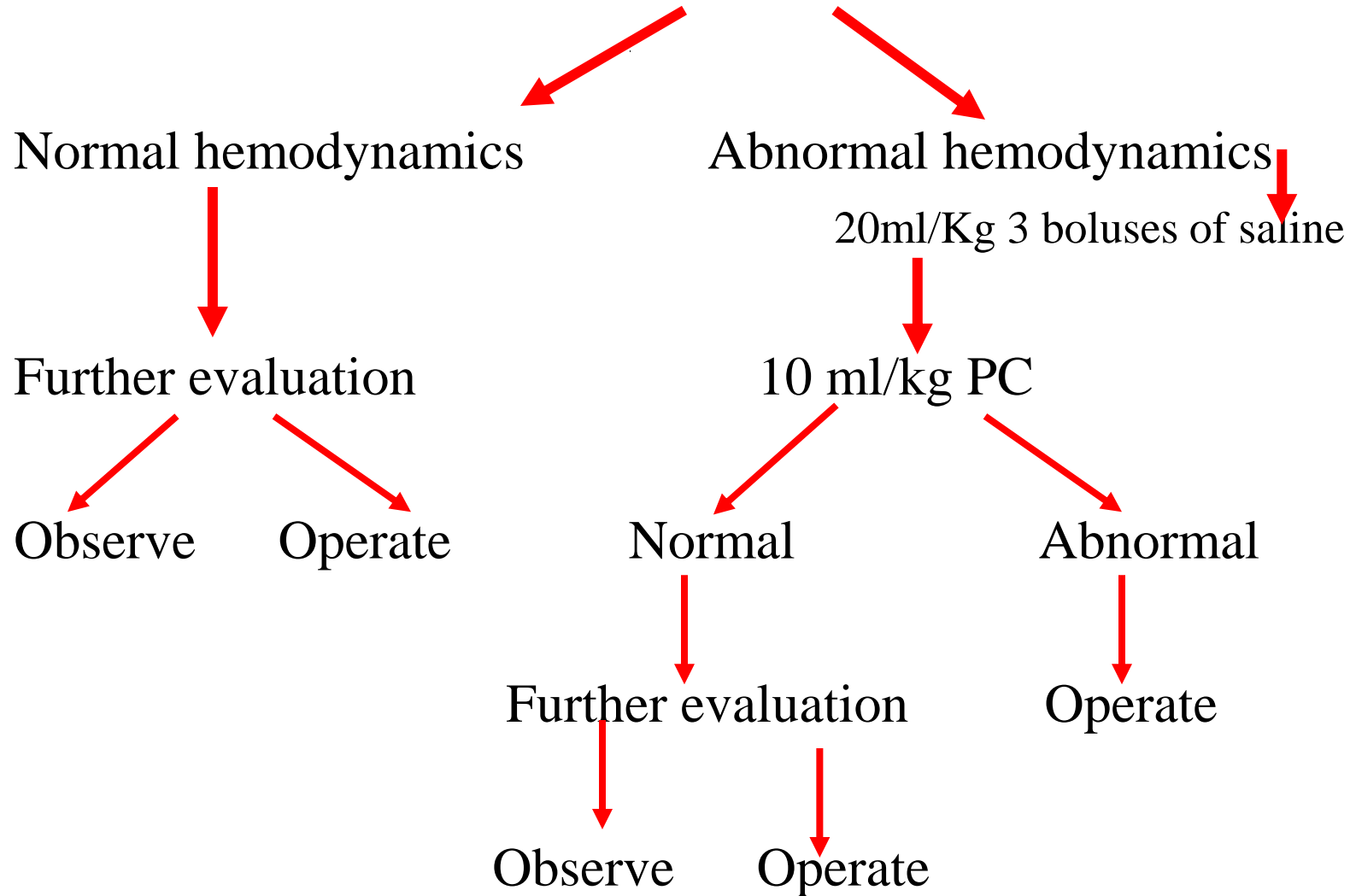
Venous access

- Peripheral venous access
- Avoid femoral venous access
- Intraosseous - < 6 yrs of age





Fluid bolus





Blood

- Packed RBC's
- Type specific / O-negative
- Warmed





Haemodynamic normality

- Slowing of the HR (130/min)
- Return of normal skin color
- Increased warmth of extremities
- Improving GCS
- Increasing sys. BP (>80 mm Hg) $90+2 \times \text{age in years}$
- Urinary output of 1-2 ml/Kg/hour
- Increase in Pulse pressure





Thermoregulation

- Refractory to treatment
- Prolongs coagulation times
- Affect CNS
- Overhead heat lamps or heaters or thermal blankets





Thoracic injuries



- Rib # - severe injury force
- Compliant chest wall
- Lung & Cardiac contusion
- Aortic transection
- Diaphragmatic rupture





Abdominal trauma

- Gastric distention
- 'FAST'
- Don't delay for CT – to keep radiation as low as possible





Head injuries

- Open Fontanelle, Suture lines
- Don't allow hypotension
- GCS =?
- Subarachnoid Space offers less protection – due to less buoyancy
- Adequate and rapid restoration of blood volume and hypoxia mandatory





Verbal- Score (<4years)

- Appropriate words/ smiles = 5
- Cries but consolable = 4
- Persistently irritable = 3
- Restless, agitated = 2
- None = 1





Spine

- Flexible interspinous ligaments and joint capsules
- Anteriorly wedged vertebrae
- Flat facet joints
- Larger head – accounts for injuries from occiput to C3





X-ray

- Pseudo subluxation : more pronounced by flexion of the cervical spine
- ‘SCIWORA’ - up to 12% of injuries are missed
- Take normal side
- Treat when in doubt





Musculoskeletal trauma



- History
- Blood loss
- Early splinting
- Child abuse





Prevention



- Analyze : local injury surveillance – injury data
- Build : local coalitions – Hospital community partnerships
- Communicate : the problem – injuries are preventable
- Develop : prevention activities – create safer environment
- Evaluate : the interventions – ongoing injury surveillance





Remember

- Same priority like an adult
- Unique anatomic & physiologic changes
- Early surgical intervention





Thank you

