

PAEDIATRIC TRAUMA

Liverpool Hospital does not have paediatric ICU facilities, therefore seriously injured children are to be given definitive primary treatment here and then transferred to Westmead for further care. Transfer can be arranged by ringing the paediatric ICU registrar on 9633 6083 or 9633 6104

The injured child differs from the injured adult in many respects

1. **Size and shape** - a child is a smaller target, hence the force is dissipated over a smaller area.
2. **Skeleton** - the bones are incompletely ossified and are hence more elastic. Internal organs can therefore be damaged without overlying bony fracture.
3. **Surface area** - the surface area: volume ratio is higher, thus heat loss is greater and hypothermia develops more quickly.

PRIMARY SURVEY

AIRWAY

The cervical spine tends to passively flex in children due to the relatively large head, closing off the pharynx. This is best prevented by supporting the head in the 'sniffing' position whilst protecting the cervical spine. In the infant the larynx may be difficult to visualise because the tongue is relatively large, and in children the larynx has a more antero-caudal angle making cannulation difficult. The trachea is 5cm long in an infant, growing to 7cm by the age of 18 months.

Guedel Airway - should not be inserted backwards then rotated - this can damage soft tissues. Insert directly using a tongue depressor as a guide.

Cricothyroidotomy - is rarely indicated. Needle cricothyroidotomy is the preferred method, but is a temporising technique.

BREATHING

Because of the elasticity of the ribs, there may be significant lung injury without overlying fractures. Smaller sized chest tubes are available for children, but the rule of inserting the largest size possible still applies.

CIRCULATION

Children have an increased physiological reserve and may therefore be shocked with only subtle changes in vital signs. The primary response is tachycardia, but tachycardia is also caused by anxiety and pain. Vital signs vary with age

	Pulse (range)	BP Systolic (minimum)	Resp.Rate
Infant	95 - 175	70 - 80	30 - 40
Pre-school	80 - 140	80	25 - 35
Older child	70 - 120	90	20 - 25
Adolescent	60 - 100	100	15 - 20

For fluid resuscitation the initial fluid bolus is 20ml/kg of crystalloid, which can be repeated 3 times, ie up to 80ml/kg.

If blood transfusion is necessary, 10ml/kg of blood should be given initially. If a child with a suspected liver or spleen injury requires blood in excess of this figure for haemodynamic stability, an immediate laparotomy should be considered.

Venous access may be difficult in children, so consider and **intraosseous infusion**. It is indicated in a child of six years or younger in whom attempted cannulation has failed twice.

The preferred site is the anterior tibial plateau, 2-3cm below the tibial tuberosity. If the tibia is fractured, the inferior part of the femur, 3cm above the external condyle is an alternative. An intraosseous needle (available in Emergency and Theatre), is inserted at right angles to the bone, bevel up. Aspiration of marrow confirms correct placement. Crystalloids, blood products and all drugs except Bretylium can be administered.

HYPOTHERMIA

Studies conducted in the United States and here at Liverpool Hospital have shown that hypothermia (defined as a core temperature less than 35°C) affects approximately 20% of seriously injured patients.

It has further been shown that patients who develop core temperatures of between 32°C and 35°C have an increased mortality, and that those whose core temperatures fall below 32°C are unlikely to survive.

Hypothermia is more common

- In females
- As the severity of the injury increases
- With burns
- Children

CAUSES

The reasons why patients develop hypothermia are

- Exposure at the scene
- Exposure in Emergency during assessment
- Administration of IV fluids at below body temperature
- Impaired thermoregulation due to anaesthesia

PREVENTION

Prevention of hypothermia is an important part of the resuscitation, and the following measures to prevent hypothermia should be instituted

- Monitor core temperature
- Minimum necessary exposure for a full examination. Cover the patient afterwards
- Pre-warm IV fluid in a warming cabinet
- Give blood through a warmer. Tinfoil is a good option
- Use warm blankets and 'space blankets'

CHEST TRAUMA

The child's chest wall is very compliant so energy may be transmitted to intrathoracic structures without causing rib fractures.

Tension pneumothorax, haemopneumothorax and flail segments are not well tolerated, due to the mobility of the mediastinal structures.

Bronchial injuries and diaphragmatic ruptures are more common than in adults, great vessel injuries are less common.

ABDOMINAL TRAUMA

Almost all children who are anxious will swallow air, so the stomach should be decompressed prior to examination.

The indications for DPL and interpretation of the results are the same as for adults. Ringers lactate should be infused at a rate of 10ml/kg up to a maximum of 1000ml. CT scanning may be preferable if the child is haemodynamically stable.

Injuries to the liver and spleen can often be managed conservatively, but the decision rests with the surgical VMO.

HEAD TRAUMA

Children generally recover better than adults, but children 3 years have worse outcomes than older children.

Unlike adults, infants **can** become hypotensive from blood loss due to head injury.

An open fontanelle will bulge when ICP rises.

Most children vomit after a head injury.

The Glasgow Coma Scale was not developed for use in children. Paediatric modifications have been proposed, but none is ideal.

SPINAL CORD INJURY

Rare in children, but more commonly associated with no radiographic abnormality.

