PAEDIATRIC TRAUMA GUIDELINE

1. Key messages

The Victorian State Trauma System provides support and retrieval services for critically injured patients requiring definitive care, transfer and management via the *Specialist trauma transfer guidelines*. This paediatric trauma guideline provides evidence-based advice on the initial management and transfer of paediatric major trauma patients who present to Victorian health services with injuries.

This guideline is intended for use by frontline clinical staff that provide early care for major trauma patients outside of a major trauma service (MTS); however, access to this resource is not restricted to any one group. These management guidelines provide up-to-date information for frontline healthcare clinicians.

These guidelines align with the *Victorian inter-hospital major trauma transfer guidelines* and provide the user with accessible resources to effectively and confidently provide early care for critically injured paediatric patients. The guideline is evidence-based, has followed the AGREE methodology for guideline development and is auspiced by the Victoria State Trauma Committee.

Clinical emphasis points

- Initial assessment of a seriously injured child should follow the same structured approach as that of adult assessment; life-threatening injuries should be rapidly identified and managed.
- Delayed management of the obstructed airway and inadequate fluid resuscitation are two of the most preventable causes of death in paediatric patients.
- Intubation should not be attempted by an inexperienced clinician.
- Endotracheal intubation must be verified with CO2 detection.

- The necessity of frequent reassessment cannot be overemphasised.
- The family of the child with a significant trauma requires appropriate support and explanation.
- The main goal of early care is to ensure optimum resuscitation in the emergency setting as well as activation of the retrieval network, with timely transfer to an appropriate facility.
- Specific actions to implement updated guidelines in the workplace environment are essential to ensure they are utilised in the best way possible.
- For all paediatric trauma patients, PIPER is the first point of call to initiate early retrieval and transfer (1300 137 650). PIPER will coordinate connection to the paediatric trauma line and retrieval services as required.
- It is key to ensure the level of care is maintained from primary facility throughout the retrieval to reach the MTS.

Victorian State Trauma System

Paediatric Trauma Guideline

RAUMA VICTORIA

Make early contact with PIPER for advice and to initiate retrieval.

Early Activation

- Gather vital information
- Ensure safety using PPE
- Activate Trauma Team
- Set up to receive patient
- Designate roles
- Perform calculations based on estimated weight or Broselow tape guide
- Predetermine age / weight specific interventions
- Call for help early

Primary Survey

AIRWAY / C SPINE:
- Protect Airway
- Maintain neutral alignment
- Airway adjuncts as necessary
- Maintain full spinal precautions

BREATHING:
- Apply oxygen
- Assess the chest
- Ventilate as necessary
- SpO_2 monitoring
- $ETCO_2$ monitoring

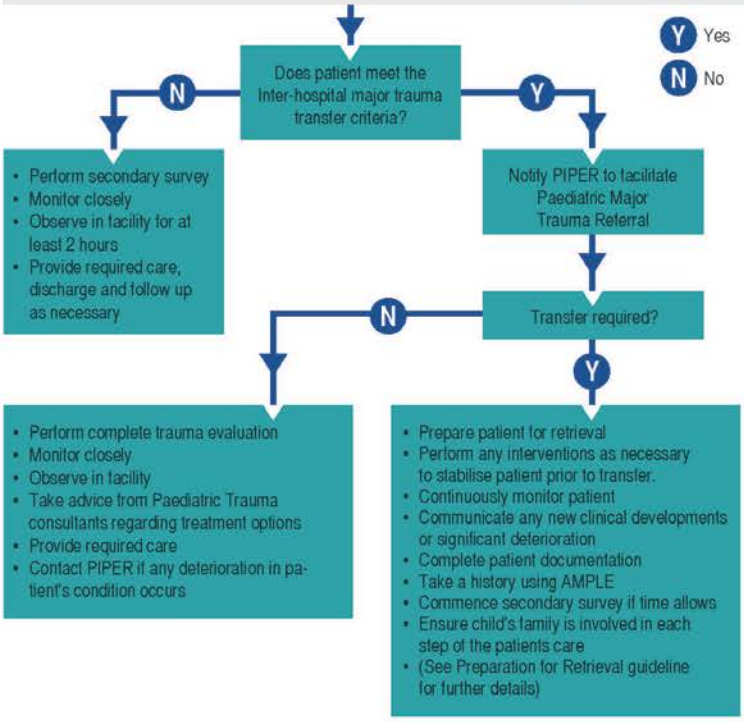
CIRCULATION:
- Insert peripheral IV cannula x 2
- If difficult, insert Intraosseous
- Take bloods
- Assess HR / BP / skin perfusion

DISABILITY:
- Assess level of consciousness using AVPU
- Check pupils
- Check BSL

EXPOSURE / ENVIRONMENT:
- Fully expose patient
- Ensure normothermia

ADJUNCTS:
- Consider FAST scan in adolescents > 50kg
- X rays: Lat c spine, Chest, Pelvis

Only an experienced clinician should attempt intubation in a young child. Prior to attempting intubation, always have a plan for managing a difficult airway or failed intubation.



Paediatric Vital Signs Major Trauma Criteria

Age	Term - 3 mths	4-12 mths	1-4 yrs	5-12 yrs	12+ yrs
HR	<100 or >180	<100 or >180	<90 or >160	<80 or >140	<60 or >130
RR	>60	>50	>40	>30	>30
BP sys	<50	<60	<70	<80	<90
$Sp0_2$	<90%				
GCS	<15				

Calculations

- Estimate the amount of fluid bolus at 20 mL / kg of 0.9% NaCl
- Estimate the child's weight using the following:
  - **Age 0-1:** weight = (age / 2) + 4
  - **Age 1-5:** weight = (age x 2) + 8
  - **Age 6-12:** weight = (age x 3) + 7
- Estimate the depth of the Endotracheal tube insertion:
  - **Neonates:** 10cm
  - **Infants < 1yr:** 11cm
  - **Children over 1yr:** length (cm) = (age / 2) + 12

Considerations

Pain Assessment

Use an age appropriate pain assessment tool to evaluate the child's pain level.

Analgesia

Administer analgesia appropriate to level of pain and reassess post intervention.

Paediatric Sub-guidelines

Traumatic Brain Injury
- Use the modified GCS to assess neurological state in children.
- Seizures are common in children after head injury: maintain inline c-spine immobilisation and nurse in reverse Trendelenburg position

Spinal Trauma
- Significant spinal injury may still occur without fracture

Burns

Total Body Surface Area (TBSA)
- Use the Lund and Browder method for assessing TBSA in children accurately

Resuscitation fluid
- For burns with TBSA over 10 per cent.
- Modified Parklands formula of 3 - 4 mL x TBSA % x kg = __mL / 24 hrs.
- 50 per cent is administered in the first eight hours post injury, and 50 per cent given in the following 16 hours.

Maintenance fluid
- In addition to resuscitation fluid, the recommended maintenance fluid is: 0.9% NaCl (potassium chloride supplements may be required).
- Use the following formulae to calculate normal daily fluid requirements in children up to 30kgs:
  - **Up to 10kgs:** 100ml/kg/day
  - **10 - 20 kgs:** 1000mls plus 50ml/kg/day for each kg over 10kgs
  - **20 - 30 kgs:** 1500mls plus 20ml/kg/day for each kg over 20kgs.

PIPER
Paediatric Infant Perinatal Emergency Retrieval

1300 13 76 50 Statewide 24 hours

Version 1.0 | 22-10-2014

AMBULANCE VICTORIA

3. Introduction

Trauma continues to be the leading cause of morbidity and mortality in the paediatric population. In Victoria there are around 2,000 trauma related presentations to the Royal Children's Hospital, the paediatric Major Trauma Service (MTS), each year either through direct admission or via inter-hospital transfer. Between 100 and 150 of them are defined as major trauma. This encompasses about 80 per cent of all paediatric major traumas in Victoria.[i] [ii]The percentage of major trauma among paediatric (<16 years) patients remains low, at 4.5 %.[iii]

Children are vulnerable to injury for a variety of reasons. As they are developing they tend to be clumsy and can easily fall; they have poor judgement and little awareness of potential harms. Their ill-considered actions, such as reaching for a hot saucepan, can lead to injury. As children reach adolescence they may engage in risk-taking behaviour with little regard for the consequences of their actions. Motor vehicle accidents account for almost half of the fatalities in children.

Being aware of the differences between adult and paediatric patients is essential in managing paediatric major trauma. The sequence of concurrent assessment and actions are the same. The approach relates directly to the anatomical and physiological differences and the injury pattern that could be caused relative to the mechanism of injury.[iv] Children have a smaller body mass, therefore, for example, in a car accident, a greater force of energy is applied and transmitted to a body that has less fat, connective tissue and closer internal organs, leading to a high frequency of multiple injuries.[v] The skeleton of a child is not mature and is less resilient, therefore it is less able to absorb the kinetic forces applied during a traumatic event, leading to significant internal injuries without obvious external signs. Lack of fracture does not indicate absence of underlying injury. In addition, children have a higher relative body surface area the younger they are, meaning they can rapidly become hypothermic. This can in turn complicate physiological responses to concomitantly occurring metabolic derangements, leading to severe coagulopathy and cardiovascular collapse.[vi] It is also key to note that the relative size of the head in children must be considered in both airway and cervical spine management.

Clinicians working outside of the paediatric MTS are often not as familiar with paediatric emergency management as they may be with adults. This may lead to a delay in children receiving appropriate initial care. This interval can have an adverse effect on both morbidity and mortality. It has been shown that younger and more seriously injured children have better outcomes when they are managed at a specialist trauma facility within a children's hospital.[vii] It is therefore encouraged that early engagement and specialist consultation is sought when faced with a paediatric trauma patient. In Victoria, the Paediatric Infant Perinatal Emergency Retrieval (PIPER) service is available to retrieve critically injured children from referral hospitals and provide safe, expert, emergency inter-hospital retrieval. The earlier contact is made with PIPER, the earlier a retrieval team can be dispatched to the hospital to provide immediate assistance.

All paediatric trauma patients must receive a rapid and systematic primary and secondary survey, just the same as in adult care. The main goal is to ensure optimum resuscitation in the emergency setting as well as activation of the retrieval network, with timely transfer to an appropriate facility.

4. Early activation

Emergency medical services should notify the receiving hospital that a paediatric trauma patient is on their way. This information may be crucial to managing a severely injured patient and can allow for communication to vital members of the response team as well as time to prepare the department for the patient's arrival.

Once notification has been received it is important to:

1. Gather vital information from the notifier using the MIST mnemonic:

   M **M**echanism of injury

   I **I**njuries found or suspected

   S **S**igns: respiratory rate, pulse, blood pressure, SpO_2, GCS or AVPU

   T **T**reatment given[viii]

   Obtaining an estimation of the patient's weight from the treating paramedics is useful at this stage, where possible.

   It is important to note any vehicle restraints or protective clothing worn.

2. Activate the trauma team and available support departments (medical imaging, pathology). In small health service settings this may only consist of a clinician and a nurse. Ensure adequately trained personnel with experience in paediatric resuscitation are present. Additional staff may be gathered from wards or on call. It may be necessary to utilise the skills of all available resources including emergency response personnel in the initial trauma management.
3. Allocate roles and specific tasks to the team. Ensure effective communication between all parties involved in managing the trauma. Use closed-loop communication to ensure accuracy in information shared between staff. Repeat instructions, make eye contact and provide feedback. Misinterpreted information may lead to adverse events.
4. Prepare the trauma bay to receive the patient. Prepare and check equipment, documentation and age-appropriate medications.
5. Make sure necessary resuscitation equipment is available and easily accessible in a range of sizes.
6. Estimate the child's weight using the following formulae:
   - Age 0-1: weight = (age/2)+4
   - Age 1-5: weight = (agex2)+8
   - Age 6-12: weight = (agex3)+7

   and calculate:
   - the amount of fluid bolus at 20 mL/kg
   - the endotracheal tube size (age / 4) + 4 (use ½ size down if using microcuff ETT where available)
   - the depth of endotracheal tube insertion
     neonates: 10cm
     infants <1yr: 11cm
     children over 1yr: length (cm) = (age/2) + 12
   - drug doses that are likely to be needed.

7. If the weight is not known, or cannot be accurately estimated, Broselow tape and trolleys/bags may be useful tools. Ensure the tape is rolled out on the receiving bed, ready to use.
8. Personal protective equipment is vital in the care of trauma patients. Ensure all staff involved in patient care are wearing gloves, aprons and eye protection. Lead aprons should be available where xrays are taken in the resus room.

All paediatric major trauma will require transfer to the Royal Children's Hospital. Early consultation with PIPER is essential (phone PIPER on 1300 137 650.)

- Early retrieval activation ensures access to critical care advice and a more effective retrieval response.
- Early activation and timely critical care transfer improves clinical outcomes for the patient.

If you are undecided, call PIPER, who can provide expert guidance and advice over the phone and /or link to the Royal Children's Hospital as required.

5. Primary survey and early management

Use a systematic approach based on the ABCDE survey to assess and treat the acutely injured child. The goal is to identify and manage any immediate threat to life and to identify any potential threats.

The following vital signs should be utilised to identify a need for escalation in patient management and further consultation regarding management.

PAEDIATRIC VITAL SIGNS OF MAJOR TRAUMA					
AGE	**0 – 3 Months**	**4-12 Months**	**1-4 Years**	**5-12 Years**	**12 + Years**
RR (breaths/min)	>60	>50	>40	>30	>30
HR (beats/min)	<100 or >180	<100 or >180	<90 or >160	<80 or >140	<60 or >130
BP sys (mmHg)	<50	<60	<70	<80	<90
SpO2 (%)	<90	<90	<90	<90	<90
GCS	<15	<15	<15	<15	<15

The heart rate, respiration rate, blood pressure and oxygen saturation should be recorded at 15 minute intervals or more frequently if indicated. Monitoring of peripheral perfusion and temperature should also be undertaken.

To measure blood pressure correctly, the cuff should be two-thirds of the length of the medial aspect of the upper arm. A cuff that is too narrow will overestimate, and a cuff that is too wide will underestimate the blood pressure.

All monitoring should be maintained until the retrieval team arrives.

A baseline ECG should be taken prior to transfer if time permits and facilities exist.

Airway with cervical spine protection

Continuous monitoring of airway patency is essential throughout management. Deterioration can be sudden: it is essential to have emergency airway equipment always available.

Assess the airway while protecting the cervical spine. Children have a head which is disproportionately larger than their neck and bodies. When placed flat on a firm surface the size of the head tends to force the neck into flexion losing the desired neutral spine position and potentially obstructing the airway. A towel or thoracic elevation device should be placed under the shoulders to raise them 2-4cm and rest the head in a neutral position. This should be on the hospital bed prior to moving from the ambulance trolley.

(see section on cervical spine management or Royal Children's Hospital Cervical Spine Clinical Practice Guideline http://www.rch.org.au/clinicalguide/guideline_index/Cervical_Spine_Assessment/)

Assess for airway stability

If the child is stable and the airway is patent, continue to provide oxygen via a non-rebreather mask at 10 L/min.

If the child is unstable, examine for signs of possible airway obstruction (use of accessory muscles, cyanosis, visible swelling of the tongue/pharynx or neck, facial trauma, any obvious foreign bodies in the oral cavity).

Listen for any upper-airway noises such as stridor.

Attempt simple airway manoeuvres if required

Open the airway using jaw thrust (NOT chin lift/head tilt)

Suction the airway under direct visualisation if excessive secretions are present. Remove any visible foreign bodies from the mouth and pharynx with gentle suction. Do not attempt to remove foreign bodies lodged in the laryngeal inlet with a finger swipe, as this may push the foreign body distally, causing complete obstruction.

Insert an appropriately sized oropharyngeal airway (OPA) if required; remove it if the child gags on insertion. Size by measuring from angle of mandible to level of the central incisors.

For all children: Insert OPA under direct vision, concave side down, using a tongue depressor.

*Secure the airway if necessary (treat airway obstruction as a **medical emergency**)*

Consider intubation early if any of the following apply:

ongoing airway obstruction is present despite OPA	neurologically flaccid, decerebrate/decorticate posturing
adequate ventilation using a bag valve mask is not possible	a requirement for definitive airway protection
an inhalation injury	unresponsive to pain OR GCS < 8

Consider use of LMA or 2-person bag/mask ventilation if ventilation is difficult

Only an experienced clinician should attempt intubation in a young child, unless the procedure is required to save life.

Prior to attempting intubation, always have a plan for managing a difficult airway or failed intubation.

Ketamine is a sensible anaesthetic agent in the context of trauma to maintain BP during induction[ix].

Apnoeic oxygenation should be used during intubation[x].

Endotracheal insertion MUST be verified by CO2 detection, either by capnography (preferably) or a colour change method. Once CO2 detection is confirmed, capnography (end-tidal CO2) should be monitored continuously during transport.

If you are unable to intubate a child whose airway is inadequate:

- Send urgently for expert help – an ICU consultant or registrar if unavailable, ENT surgeon or anaesthetist or anaesthetic registrar if available.
- Use a jaw thrust (NOT chin lift/head tilt) and gentle oropharyngeal suction to clear the airway using airway adjuncts, such as an OPA.
- Give oxygen via a facemask and monitor its effect.

If the child has inhaled a foreign body, or has a partly transected trachea or larynx, and is breathing adequately while partly obstructed, DO NOT try to intubate (which may fail and/or worsen the condition) but give oxygen by mask.[xi] Allow the child to stay in the most comfortable position to breathe (sitting if necessary). Any child with a significant neck injury will have concerns regarding spinal trauma but airway management takes precedence, so the distressed child must be allowed to maintain position of comfort.

Reassure the child and family and stay with the child until expert help arrives.

If the airway is completely inadequate (SaO2 persistently <80 or patient arrested and definitive airway otherwise impossible), consider:

- needle cricothyroidotomy (may be used to gain time prior to surgical cricothyroidotomy)
- surgical cricothyroidotomy (need expert assistance)

See RCH trauma manual for detailed instructions:
http://www.rch.org.au/paed_trauma/manual/21_Airway_procedures/

Maintain full spinal precautions if indicated

Suspect spinal injuries in all multi-trauma patients. In-line immobilisation should be followed by the rapid and gentle application of a properly fitted one-piece collar. If this is not possible (infants/distressed patients), manual in-line stabilization may be preferred in these circumstances.

Breathing and ventilation

The chest wall in a child is very elastic; significant internal injury may be present in the absence of any obvious, external injuries.

Administer high-flow oxygen

Apply a face mask with 10 L/min of oxygen via a non-rebreather mask. Titrate to maintain saturations >95%

Assess the chest

Measure the respiratory rate and work of breathing.

Look for any intercostal recession, accessory muscle use or nasal flaring. Observe the chest movement. Note: infants are mainly diaphragmatic breathers. They do not move their chest walls significantly during normal adequate breathing. Children with airway obstruction may have chest wall movement without significant air movement i.e. tidal volume

Listen for any expiratory 'grunting'.

Auscultate the chest for air entry/ breath sounds.

If breathing is inadequate first clinically exclude a tension pneumothorax (progressive accumulation of air in the pleural space under pressure, compressing the lung on the side of the pneumothorax, but also on the contralateral side.)

Tension pneumothorax diagnosis:

- Hypoxia.
- Severe respiratory distress.
- Shift in mediastinum or trachea to contralateral side.
- Distended neck veins.
- Absent or decreased breath sounds.
- Hyper-resonance to percussion.
- Tachycardia with peripheral vasoconstriction and in hypotensive shock.

Treatment requires urgent needle thoracocentesis in the 2nd intercostal space-mid-clavicular line -on the same side as the pneumothorax. For instructions on how to perform see RCH trauma manual:
http://www.rch.org.au/paed_trauma/manual/21_Airway_procedures/

There is a 10 - 20 % chance of causing a pneumothorax if thoracocentesis is attempted and the child does not have a pneumothorax. This procedure must be followed up by chest x-ray.

Commence positive pressure ventilation using an anaesthetic circuit if the patient is spontaneously ventilating**.**

In children, a spontaneously ventilating patient is not able to be adequately oxygenated with a standard Laerdel bag due to inability to overcome the lip valve. Laerdal self-inflating bags do not deliver positive pressure ventilation and should only be used if the patient is apneic or bradypnoeic.

Insert a large oro-gastric tube (NOT naso-gastric tube) to treat gastric dilatation.

Consider intubation by skilled operator.

For critical chest injuries (open pneumothorax/flail segment/pulmonary contusions requiring first aid see RCH trauma guidelines at http://www.rch.org.au/paed_trauma/manual/17_Chest_Injury_/)

Record the oxygen saturation (SpO_2)

Measure saturation and maintain it above 95%.

Circulation with haemorrhage control

Blood pressure in children and adolescents is maintained until late in haemorrhagic shock due to their vigorous sympathetic and vasoconstrictive response.[xii]

Assess circulation and perfusion

Measure the heart rate, central capillary refill time and blood pressure and observe the child's skin colour.

Consider a low or high respiration rate or deteriorating mental state as a marker of inadequate circulation.

Insert two peripheral intravenous (IV) cannulas as large as practicable

As the IV is inserted take blood for glucose, full blood exam, cross-match, urea electrolytes and creatinine, lipase, liver function tests and blood gas if available. Troponin should also be performed if any signs of chest trauma.

If intravenous access is difficult, obtain intraosseous access. Bone marrow aspirated from the IO can be used to X match blood and test BSL. Inform the laboratory that the specimen is taken from an IO. All medications and blood products can be safely administered through the IO line. Monitor IO continuously for signs of subcutaneous extravasation of fluids ("tissuing") or failure of any kind. If this occurs, cease IO fluid administration and assess for compartment syndrome.

If circulation is inadequate (CRT >3secs, tachycardic, hypotensive, cool peripheries etc) administer a fluid bolus of 20 mL/kg of 0.9% normal saline.[xiii]

Inspect for any signs of haemorrhage and apply direct pressure to any bleeding wounds. Consider the potential for significant internal bleeding related to the mechanism of injury.

If circulation continues to be unstable, repeat the fluid bolus using 20 mL/kg normal saline. If the response is inadequate, administer a bolus of packed red blood cells of 20 mL/kg. Preference is given to fully cross-matched blood, but if it is not available then use type-specific blood. O-negative blood should only be used for exsanguinating haemorrhage. Arrange fresh frozen plasma and platelets if the anticipated loss is greater than 40 mL/kg.

Consent should be obtained from caregiver where possible

Discuss with RCH haematologist on call via PIPER.

Arrange early reassessment and surgical review.

Local blood supply times will vary depending on services available. Minimise the delay in blood provision by contacting the local laboratory early in the trauma presentation.

Minimum cross-match requirements for major trauma patients are:

Infants:	2 units
Small child:	4 units

Large child: 6 units

Contact with PIPER, if not already done, should be initiated at this stage.

Consider the possible cause of hypovolaemia not responsive to fluid therapy.

Stop sources of bleeding:

- Bleeding wounds-- >external compression
- Displaced femur fracture-->splinting
- Pelvic fracture--> pelvic binder (sheet or towel wrapped tightly around the entire pelvis to "close the book").

Maintenance fluid: If the child is stable after initial resuscitation, then the recommended fluid is 0.9% sodium chloride.

Use the following formulae to calculate normal daily fluid requirements in children up to 30kgs:

•Up to 10kgs – 100ml/kg/day

•10-20 kgs – 1000mls plus 50ml/kg/day for each kg over 10kgs

•20-30 kgs – 1500mls plus 20ml/kg/day for each kg over 20kgs

Hypoglycaemia may be present in injured infants. Correct this with 5 mL/kg of 10% dextrose (0.5g/kg) IV, followed by a glucose infusion (NaCl + 5% or 10% dextrose) at 'maintenance' rates. Never give large volume infusions of 5% or 10% dextrose in water, as hyponatremia may occur.

Disability: neurological status

Avoid secondary brain injury by treating and preventing hypoxia and hypotension.

Assess level of consciousness

Perform an initial AVPU assessment (Alert, responds to Voice, responds to Pain, Unresponsive).

Assess the child's mental state by observing their best response to a parent/caregiver. Frightened children may not respond to an unfamiliar adult. If no response, assess response to pain by squeezing one ear lobe hard and observing the best response to that stimulus. Particularly, note their posture.

Check the pupillary response to light. Note the initial assessment findings and the time, as well as whether the child was moving all limbs. This is critical information for the treating neurosurgeon at the MTS.

Test blood sugar levels

Monitor glucose regularly to ensure that any alterations in level of consciousness are not related to a metabolic cause. Refer to the Traumatic Brain Injury guideline in the case of a child with a traumatic head injury.

Exposure/environmental control

Remove all clothing from the child and assess to ensure there are no other obvious, life-threatening injuries present. A log roll can be considered at this stage or be left until the secondary survey.

Hypothermia is common among injured children and may result in acidosis, hypoglycaemia, increased oxygen consumption and decreased oxygen delivery, coagulopathy and haemodynamic instability.

Monitor the child's temperature via repeated tympanic/axillary measurements. Rectal monitoring is only necessary in intubated patients with a hypothermic injury (ie cold water drowning)

Keep the patient normothermic by means of external warming, passive re-warming with blankets and a warm environment. If available, the use of a forced air-warming machine is recommended.

Maintain modesty where possible (cover with sheet etc.)

6. Secondary survey

The secondary survey is only to be commenced once the primary survey has been completed and any life-threatening injuries have been treated. If during the examination any deterioration is detected, go back and review the primary survey.

History

An adequate history taken from family members, bystanders or emergency personnel of the events surrounding the injury can assist with understanding the extent of the injury.

Use the AMPLE acronym to assist with gathering pertinent information:

A **A**llergies

M **M**edication

P **P**ast medical history including tetanus status

L **L**ast meal

E **E**vents leading to injury[xiv]

Immunisation status: Immunisation history is important information - check that the child's status is up to date, primarily tetanus.

Head-to-toe examination

This is a systematic and careful review of each part of the injured child to look for less clinically critical and/or occult injuries.

Neurological exam

A focused neurological assessment using the Glasgow Coma Scale (GCS) should be performed. As many of the assessments for an adult patient would not be appropriate for infants, the GCS was modified slightly to form the paediatric GCS for children younger than 4. This assessment should include a description of the patient's level of consciousness as well as assessments of pupillary size and reactivity, gross motor function, and sensation. Document findings and reassess at frequent intervals.

Tips:

Beware developmentally delayed children may not normally have age-appropriate responses. Enlist a care-giver's assistance where possible. Ask parent – "is child behaving normally?"

Assess sensation as "gentle tickle" rather than painful stimuli in a frightened child

Only use painful stimuli where there is no response to light touch.

Refer to Appendix 1: *Paediatric GCS.*

Head and face

Inspect the scalp. Look for any bleeding or lacerations. Significant volumes of blood may be lost with scalp lacerations or haematomas. External compression using only dressing/bandage needs to be applied during the primary survey. Manual compression is not recommended as it may force blood back into the extradural space. Peri orbital bruising, haemotympanum and/or mastoid bruising is indicative of a base of skull fracture; however, mastoid bruising will only occur 12–24 hours post injury.[xv]

Assess the fontanelles in infant. A bulging fontanelle may be a sign of raised intracranial pressure.

Gently palpate for any depressions or irregularities in the skull. If a penetrating object remains lodged, do not remove it.

Examine the eyes for any foreign body, subconjunctival haemorrhage, hyphaema, irregular iris, penetrating injury or contact lenses.

Examine the ears for any bleeding or blood behind the tympanic membrane, as well as any cerebrospinal fluid (CSF) leak. The attempt to detect CSF versus other fluid at this stage is irrelevant as any fluid leak requires tertiary referral and a diagnostic workup. The nature of the fluid cannot be determined clinically.

Examine the nose for any deformities, bleeding, nasal septal haematoma, and CSF leak. If any fluid leak is present, do not pack the nose; apply an external bolster.

Examine the oral cavity and pharynx for any lacerations or degloving injuries to the gums, lips, tongue or palate.

Inspect the teeth, noting if any are loose, missing or fractured.

Test eye movements, vision and hearing, using quick bedside tests only such as counting fingers and repeating whispered numbers.

Examine the jaw for any pain or trismus.

Neck and Spine

Examine the neck. Ensure another colleague maintains manual in-line stabilisation while the collar is removed and throughout the examination. If the child is unable to comply with the cervical collar, it is safer to remove it. Combative children need senior assessment as to whether the collar is required. If the senior clinician deems cervical spine immobilization is required, then use manual in-line stabilization and reassurance from a parent/caregiver. Alternatively, sedation (likely a general anaesthetic) may be required. Two piece collars may be better tolerated than one piece collars and are less likely to cause pressure areas.

Occipital-cervical dissociation is more prevalent in the under 8 age group and is not made stable by applying a collar. In the setting where the patient is intubated, unconscious or

there is a high suspicion of this type of c-spine injury – lateral bolsters can be applied (eg rolled up towels on each side of the patient's head.) **Sandbags/tape should NOT be used.**

Children will often hold their own necks in a position of comfort if a significant injury has occurred.

Gently palpate the cervical vertebrae over the posterior midline. Note any cervical spine pain, tenderness or deformity.

Check the soft tissues for bruising, pain and tenderness.

Complete the neck examination by observing the neck veins for distension and palpating the trachea and checking the carotid pulse; note any deviation of the trachea or crepitus.

Back

Log roll the patient. Maintain in-line stabilisation throughout. Inspect the entire length of the back noting any bruising and lacerations.

Paediatric spinal injuries are often characterized by injury at multiple levels. Note any bruising over the back or abdomen (seatbelt) as these may help target subsequent spinal investigations.

Palpate the spine for any tenderness or steps between the vertebrae.

Buttocks and perineum

Look for any soft-tissue injury such as bruising, bleeding or lacerations.

Rectal exam in rectal trauma should only be performed by the surgeon undertaking definitive care, not in the peripheral ED. Rectal exam is not indicated in any other scenario.

Chest

Inspect the chest, observing movements (excursion/symmetry). Look for any bruising, lacerations, penetrating injury or tenderness.

Palpate for tenderness or deformity of the clavicles, ribs and sternum. Note any surgical emphysema.

Auscultate and percuss the lung fields; note any abnormality or lack of breath sounds, wheezing or crepitation.

Auscultate the heart sounds (presence and quality), palpate the apex beat (strength and location).

Abdomen

Inspect the abdomen looking for distension, bruising, laceration or penetrating injury. Palpate for areas of tenderness, especially over the liver, spleen, kidneys and bladder. Auscultate the bowel sounds (absence, normalcy).

Note any abdominal distension on serial examinations.

Examine the pelvis. Gently palpate for any tenderness. **Do not aggressively spring the pelvis**. Any additional manipulation may exacerbate haemorrhage.[xvi] Apply a binder if a pelvic fracture is suspected. If no pelvic binder is available or suitable for the size of the child, apply a sheet binder (see primary survey).

Genitalia

Inspect for soft-tissue injuries such as bruising or lacerations. Note any priapism that may indicate a spinal injury. Do not perform an internal exam.

Limbs

Look for spontaneous movement first (or on command.) Painful stimuli should only be used if no response to non-painful stimuli. Note any inequalities with limb response to stimulation and document these findings.

Inspect all the limbs and joints. Palpate for bony and soft-tissue tenderness and check joint movements, stability and muscular power. Note any bruising or lacerations and evidence of muscle, nerve or tendon damage. Look for any deformities, penetrating injuries or open fractures.

Consider splinting and elevation at this stage if injuries found in order to assist with pain control and to aid with circulation.

Look for any signs of compartment syndrome – ie loss of distal pulses, pale, cold limb etc.

Examine the sensory and motor function of any nerve roots or peripheral nerves that may have been injured. Instruct – “make a fist”, “make a star”, “hold a key”. A detailed sensory exam in a small child is challenging and may need to be repeated several times.

7. Additional points for early management

Trauma imaging
Analgesia
In-dwelling catheter
Orogastric tube
Antibiotics
Tetanus immunisation
Reassess

Trauma imaging

Consider diagnostic imaging if indicated and available.

Three standard x-rays that should be considered routinely in major trauma:

- lateral C-spine
- chest
- pelvis (the desire to protect a child’s reproductive organs should not outweigh the risk of significant morbidity from a missed pelvic injury. Any abdominal/lower limb/spinal trauma, all true multitrauma patients (ie MCA/MBA with suspected multi-system trauma etc), all intubated patients or if the patient is difficult to assess they must have a plain pelvic radiograph. Always safer to do the radiograph if unsure.)

These xrays are basic tests for major injuries. Full monitoring should be continued while obtaining the xrays. Xrays are ideally done in the resuscitation room while the child is supervised by emergency staff.

FAST (Focused Assessment with Sonography for Trauma) scan: evidence suggests there is little value in paediatrics due to the risk of false reassurance, particularly when conducted by

an inexperienced clinician. It may be useful only in structurally adult adolescents. The presence of free fluid in the abdomen on FAST does NOT mandate laparotomy. The absence of free fluid on FAST does NOT rule out significant intra-abdominal bleeding, therefore limiting its application.

eFAST (**Extended** FAST) scanning in children is helpful in diagnosing acute haemo/pneumothorax and haemopericardium when used by a skilled clinician.

Further imaging should only take place after discussion with PIPER.

The patient's transfer to a definitive centre of care should not be delayed to await further imaging.

Analgesia

Injured children may require analgesia once their life-threatening problems have been rectified. Untreated or under-treated pain following trauma leads to multiple complications such as hypoventilation, reduced oxygenation, increased stress response, increased cardiac output and muscle tension and rigidity. In the emergency department, pain score documentation and management in children is suboptimal [xvii] and therefore requires additional focus.

Assessing pain in children can be difficult. An injury that is considered to be painful in an adult can reasonably be expected to be painful in a child. Children may respond by becoming quiet rather than crying. A developmentally acceptable pain assessment tool should be used. The tool should be explained to the child in a way that they can understand. If a child cannot utilize the provided scales the caregiver/clinician must attempt to assess the child's pain in the context of their behaviour.

For patients aged one month up to seven years, a behavioural pain scale such as the FLACC Scale should be used.[xviii]

Refer to Appendix 2: *FLACC Scale for pain assessment.*

For verbal patients aged 4-5 up to 10–12 years, the Faces Pain Scale should be used.

Refer to Appendix 3: *Faces pain scale.*

For children aged over 7 years who are verbal and numerate, a numeric rating scale should be used.

Refer to Appendix 4: *Numeric pain scale.*

Parents can also have useful input into the level of pain their child may be in. Take this into consideration when assessing pain.

Pain in children can be assisted by reducing fear and anxiety through having a parent or caregiver present, explaining what is happening in simple terms, reducing noise factors and managing injuries with splinting, traction, immobilisation, positioning and dressings.

Appropriate analgesics should be administered after determining the pain scale. The choice of which analgesia to use is directly related to this. It should be monitored for effectiveness and titrated accordingly.

Refer to Appendix 5: *Paediatric analgesia management table.*

Intramuscular injections are not recommended for analgesia in children with trauma. They are painful, feared by children, act slowly and have unreliable effects once administered. Intranasal fentanyl is the preferred opiate prior to IV access being obtained.

Consider prophylactic antiemetic administration (recommend ondansetron or granisetron), especially if retrieval and transfer is likely. Metoclopramide should be used with caution especially in adolescent females.

In-dwelling catheter

Placement of an in-dwelling catheter should be considered in severely injured patients/intubated patients/suspected pelvic injuries. Monitoring urine output is useful in managing a critically injured child as it is one of the best measures of core perfusion. Urine output can help guide appropriate fluid resuscitation. Intravascular volume and response to treatment can be measured using heart rate and urinary output.

Early consultation with paediatric surgeon if difficulty with insertion of the catheter.

A urinalysis should be performed to check for blood.

Once inserted, urine output should be measured hourly. The desired urine output is:

- infants: 2 mL/kg/hr.
- children: 1 mL/kg/hr.[xix]

Orogastric tube (OGT)

Insertion of an orogastric tube should be considered in all trauma patients. Even in relatively minor abdominal injuries, gastric dilatation can occur, complicating ventilation, and predisposing to vomiting or regurgitation.

After insertion, verify correct placement in the stomach.

All patients undergoing a CT scan should have consideration of an OGT in order to decrease the risk of vomiting. Not all patients will require an OGT, there is a need to balance co-operation in maintaining c-spine control with risk of aspiration.

All intubated patients must have an orogastric tube.

OGT should always be considered prior to transferring a child.

Patients should be kept nil orally in the initial post-resuscitation phase of injury.

Never insert a nasogastric tube in a child with a head injury without expert consultation.

Antibiotics

Antibiotics should be administered for any injury with an open fracture. Review allergies prior to administration. Consider cephazolin 50mg/kg max 2g.

Tetanus immunisation

If an open wound is present, it should be cleaned and treated surgically if appropriate. If a wound is contaminated, tetanus immunoglobulin may be needed.

Refer to Appendix 6: *Recommended tetanus schedule following wounds.*

Reassess

The importance of frequent reassessment cannot be overemphasised. A patient should be re-evaluated at regular intervals because deterioration can be rapid. This will be evident in vital signs and level of consciousness. If in doubt, repeat ABCDE.

The priorities for further investigation and treatment may now be considered and a plan for definitive care established.

8. Planning and communication

For effective management of trauma, an identifiable leader should direct the resuscitation, assess the priorities and make critical decisions.[xx] Good communication between the trauma team members is vital, as is ensuring that local senior staff are aware and can provide additional support as required.

Once the initial assessment and resuscitation is underway, is it important to plan the next stages in management. Priorities for care must be based on sound clinical judgement, patient presentation and response to therapies provided. Awareness of limitations in resources as well as training in the emergency field is vital. If escalation of care to senior staff is warranted, then do so early: do not wait until the patient deteriorates.

Frontline clinical staff should initiate contact with PIPER early in the management of the patient or, more importantly, as soon as it is evident that the patient's injuries meet the major trauma transfer criteria or the patient may have sustained injuries beyond the local capabilities and resources. PIPER can be contacted at any time to offer and coordinate clinical advice.

PIPER coordinators can facilitate a three-way conversation between the referral health service, specialist clinical resources and PIPER consultant to discuss the best and timely management of the patient.

The decision of when to transfer an unstable patient should ideally be made by the transferring and receiving clinicians in collaboration with the retrieval service. Clear communication is crucial: the transmission of vital information allows receiving clinicians to mobilise resources whereas the lack of such information can delay definitive care. Information should be conveyed in both verbal and written (via the patient record) form and should include the patient's identifying information, relevant medical history, pre-hospital management and emergency department evaluation and treatment (including procedures performed and imaging obtained). All imaging should be sent with the patient. Electronic transfer alone is unreliable.

Complete and clear verbal communication of information among individuals is facilitated by the use of the acronym "ISBAR". The following are stated:

I **I**dentify: Who are you and what is your role in the management of the patient? (Use at least three patient identifiers)

S **S**ituation: Current situation of the patient

B **B**ackground: The clinical background/context

A **A**ssessment: What the problem is

R **R**ecommendation: What would you recommend? Identify risks – patient and occupational health and safety. Assign and accept responsibility/accountability.[xxi]

It is important that **additional communication** with the PIPER coordinator is initiated whenever there is:

1. Significant deterioration in:
    - respiratory status
    - oxygenation
    - heart rate
    - blood pressure
    - conscious state
2. Major clinical developments such as abnormal results of diagnostic tests and appearance of new clinical signs
3. The need for major interventions prior to the retrieval team arriving (for example, intubation or surgery). This will ensure the retrieval team is prepared and the patient receives the appropriate care en route.

9. Retrieval and transfer

An exhaustive clinical workup and interventions are not always necessary or appropriate prior to transfer. Stabilisation and management of life-threatening problems and instigation of measures to prevent deterioration en route, are essential aspects of early care. Delaying transfer to obtain laboratory results or imaging studies may simply delay access to definitive treatment. Such studies may be repeated at the receiving facility.

In liaison with PIPER clinicians, interventions to stabilise the patient prior to retrieval personnel arriving should be commenced. PIPER will coordinate the retrieval and will evaluate the practicality and clinical needs involved in transferring the patient from the source hospital. Once retrieval staff arrive on scene, be prepared to give a thorough handover. Retrieval staff will assess the patient prior to transfer and may make changes to care in order to ensure the patient is safe during transfer.

The use of a transfer checklist can help to ensure that important information is not omitted and the patient is prepared accordingly.

10. Guideline Implementation

These guidelines are designed to push for quality improvement using evidence-based practice across the entire care pathway. They aim to achieve consistent advancement in people's health and lead to access of good-quality care.

Putting these guidelines into practice benefits everyone; this includes the staff directly involved in patient care, those involved in managing the health facility, local healthcare organisations and members of the public. It can help to monitor service improvements, demonstrate that high-quality care is being provided and also highlight areas for improvement.

One of the most difficult aspects of working with guidelines is how best to implement them into routine daily practice. Many of us provide patient care according to usual routines ('how it's always been done') instead of looking at developments and change in practice to reflect the latest evidence-based research. Barriers to implementation can include organisational constraints, such as a lack of time, obstructive opinions of key people who may not agree with the evidence or do not want to change their practice, and lack of leadership to effect change. Additionally, there may be a perceived poor sense of competence by staff who question their skills.

In order for change to be effective there must be an identified need, a willingness to adapt and promote current practices, a driving force behind it and acceptance from all levels, be it individual, team or organisational.[xxii] For these guidelines to be successfully implemented, the following is recommended.

High-level support and clear leadership

Successful implementation plans have a person on the board, such as a medical director, who drives the implementation agenda forward as well as a clear implementation policy approved at the highest level.

A nominated lead for the organisation

One person should be identified who is responsible for driving the education and development of these guidelines into practice. They should be involved in coordinating, disseminating and monitoring the implementation as well as for arranging educational events to promote the use of these guidelines in the workplace. The responsibility for this could be included into an existing role such as that of the clinical governance manager or anyone involved in quality assurance.

A multidisciplinary forum

The multidisciplinary forum should have decision-making powers and report to the chief executive or senior managers of the organisation. New guidelines should be reviewed after they are published and their relevance to the organisation assessed. A clinical lead for each guideline should be identified and steps taken to disseminate to the appropriate personnel. Implementation is most effective if a wide range of disciplines are involved in the forum.

A local policy

Organisations should have a clear, structured policy in place for implementing new guidelines. This policy should be endorsed at the highest level of management and be available for all.[xxiii]

What can you do as an individual?

Become a project champion. One way to begin implementation in your workplace is to take the initiative and volunteer to represent your department. Review these guidelines and compare them with the current ones you have in place. Note any changes to practice that need to be addressed in order to standardise your organisation with current best practice.

In staff meetings, bring up the idea of implementation and seek feedback from other staff members on the best way to do this. Collaborate with colleagues across all boards and emphasise the importance of team communication and cohesion. Print handouts, send out links to workmates and arrange for flowchart posters to be placed in relevant areas.

If you have a clinical educator at your site, inform them of the current updates and discuss ways they can influence training and provide moulage-based simulation scenarios. Often training with the staff you work with on a regular basis can help to foster communication and a real sense of teamwork.

Speak with your organisation about placing access to the *Victorian trauma guidelines* on your intranet to allow easy access to the site.

Visit <www.trauma.reach.vic.gov.au>, which will be updated regularly. It contains learning modules and moderated remote tutorials.

As always, your feedback is encouraged. If you have any comments or suggestions, or would like to share how you have adopted these guidelines into your practice, we would appreciate your thoughts.

Appendix 1: Paediatric Glasgow Coma Scale <4 years

Paediatric Glasgow Coma Scale	
Assessed response	**Score**
Best eye response	
Spontaneously	4
To verbal stimulation or touch	3
To painful stimulation	2
No response to pain	1
Best verbal response	
Appropriate words or social smile, fixes, follows	5
Cries but is consolable, less than usual words	4
Persistently irritable	3
Moans to pain	2
No response to pain	1
Motor	
Spontaneous or obeys verbal commands	6
Localises to stimuli	5
Withdraws to stimuli	4
Flexion abnormal (decorticate)	3
Extension abnormal (decerebrate)	2
No response to pain	1
TOTAL	**/15**

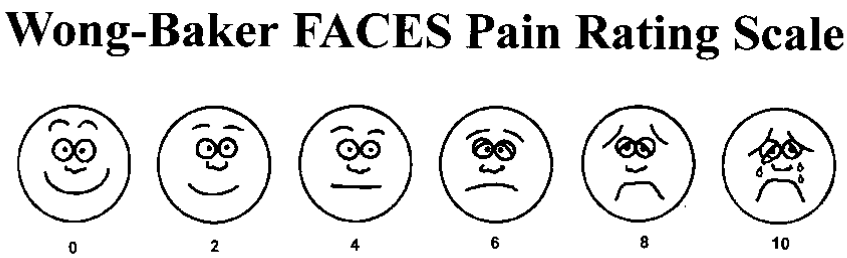
Available from: http://www.rch.org.au/clinicalguide/guideline_index/Head_Injury_Guideline/#Glasgow

Appendix 2: FLACC scale for pain assessment

FLACC SCALE – University of Michigan Health System			
Face	0 No particular expression or smile	1 Occasional grimace or frown, withdrawn, disinterested	2 Frequent to consent quivering chin, clenched jaw
Legs	0 Normal position or released	1 Uneasy, restless, tense	2 Kicking or legs drawn up
Activity	0 Lying quietly, normal position, moves easily	1 Squirming, shifting back and forth, tense	2 Arched, rigid or jerking
Cry	0 No cry (awake or asleep)	1 Moans or whimpers, occasional complaint	2 Crying steadily, screams or sobs, frequent complaints
Consolability	0 Content, relaxed	1 Reassured by occasional touching or being talked to, distractible	2 Difficult to console or comfort

Available from: http://www.rch.org.au/uploadedFiles/Main/Content/anaes/Pain_assessment.pdf

Appendix 3: Faces Pain Scale



Explain to the child that each face is for a person who feels happy because they have no pain (hurt) or sad because they have some or a lot of pain.

Face 0 is very happy because he doesn't hurt at all

Face 2 hurts just a little bit.

Face 4 hurts a little more.

Face 6 hurts even more.

Face 8 hurts a lot.

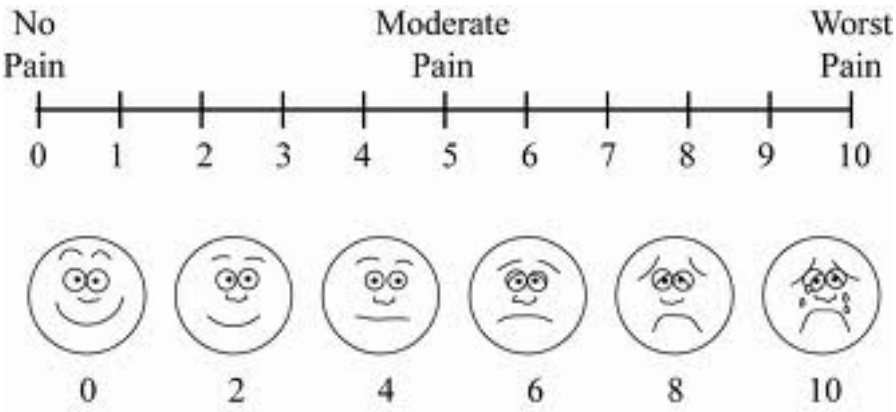
Face 10 hurts as much as you can imagine, although you don't have to be crying to feel this bad.

Ask the child to choose the face that best describes how he is feeling.

This rating scale is recommended for people age 3 years and older.

Available from: http://www.rch.org.au/uploadedFiles/Main/Content/anaes/Pain_assessment.pdf

Appendix 4: Numeric pain scale



Available from: http://www.rch.org.au/uploadedFiles/Main/Content/anaes/Pain_assessment.pdf

Appendix 5: Paediatric analgesia management table

Paediatric analgesia management table					
Drug	**Dose**	**Route**	**Pain severity**	**Comments**	**Adverse effects**
Non-opioids					
Paracetamol	15–20 mg/kg/dose 4–6 hourly (maximum dose 90 mg/kg/day or 4 g/day adult)	0/PR/IV	Mild to moderate	Opioid sparing effect. Review dose after 48 hours	Risk of hepatic impairment if prolonged use and/or high doses
Ibuprofen	10 mg/kg/dose 6–8-hourly (Maximum dose generally 600mg)	0	Mild to Moderate to severe	Caution if low BP or hypovolaemia. Opioid sparing effect. Least gastric irritating NSAID. Not for children under 3 months	Renal impairment, higher risk if hypotensive. Platelet dysfunction (not appropriate in haemorrhaging pt)
Ketamine	0.25-0.5mg/kg	IV	Severe	Dissociative anaesthetic. V effective analgesic where opiates are inadequate	Diplopia,nystagmus; emergence reaction (hallucination, delirium, confusion, irrational behaviour)
Opioids					
Codeine (if oxycodone not available)	0.5–1 mg/kg/dose, 4–6-hourly (maximum dose 60 mg)	0 / PR	Mild to moderate	10 per cent of the population unable to metabolise. Do not give IV	Constipation and respiratory depression
Oxycodone (use 1st oral)	0.1–0.2 mg/kg/dose, 6-hourly	0 /PR	Moderate	Do not give administer with codeine	Respiratory depression
Morphine	0.05–0.2 mg/kg/dose, 2–4-hourly	IV	Moderate to severe	Give in increments, such as 20 mcg/kg, titrate to effect	Respiratory depression and hypotension
Fentanyl	0.5–1 mcg/kg/dose	IV	Moderate to severe	Give in increments, titrate to effect	Respiratory depression and bradycardia
	First dose: 1.5mcg/kg/dose	IN *			

	2nd dose 10 minutes post: 0.75 – 1.5 mcg/kg				

Adapted from: Bevan C & Officer C, editors. Royal Children's Hospital Paediatric Trauma Manual.2004. The Royal Children's Hospital: Melbourne. Pg. 234.

*IN: Intranasal administration if there is no suspicion of base of skull fracture.

Consider options for local anaesthesia including femoral nerve block by skilled clinicians

Appendix 6: Recommended tetanus schedule following wounds

History of tetanus vaccination		Type of wound	Tetanus vaccine booster	Tetanus Immunoglobulin
3 or more doses	< 5 years since last dose	All wounds	No	No
	5–10 years since last dose	Clean minor wounds	No	No
	5–10 years since last dose	All other wounds	Yes	No
	> 10 years since last dose	All wounds	Yes	No
< 3 doses or uncertain		Clean minor wounds	Yes	No
< 3 doses or uncertain		All other wounds	Yes	Yes

A combination vaccine should be used in order to boost community protection against pertussis.

Please note that CDT and Tetanus Toxoid are no longer available.

<8 years old DTPa – IPV (Infanrix – IPV).

>8 years old dTPA (Boostrix).

Can use a diphtheria / tetanus toxoid vaccine (ADT) if pertussis vaccination is contraindicated.

Available from: http://www.rch.org.au/clinicalguide/guideline_index/Managament_of_tetanusprone_wounds/

11. Paediatric burns sub-guideline

Overview

The principles of managing burns in children are similar to those for adults. The airway should be secured and circulation restored by controlling fluid loss and initiating fluid resuscitation to maintain global tissue perfusion. Assessment following the basic principles of primary and secondary survey as described previously should be followed. However, it is important to note the following differences between children and adults in regards to burns:

Children have a higher body surface area to body weight ratio, which means they have a higher metabolic rate, have greater evaporative water loss and have a greater propensity for heat loss.[xxiv] It is important to monitor body temperature especially during first aid, if extensive burns are present. The younger the child, the quicker they may become hypothermic.

A child's skin is much thinner than an adult's. A thermal injury is much more likely to result in a deeper burn than in an adult.

Burn depth assessment in a child is often more difficult due to their thinner skin. Colour changes in burned skin are not always the same as in adults.

Children require burns resuscitation fluid at a lesser TBSA percentage than adults (10% in children as opposed to 20% in adults).

Assessment

General assessment will follow the same principles of primary and secondary survey.

Airway and Breathing assessment

Airway assessment remains a vital part of the primary survey. The airway is narrower in children and therefore obstruction will occur at a lesser degree of oedema than in adults. Repeated evaluation of airway patency is vital.
Assess for presence of stridor, black discolouration of lips/perioral area/ sooty saliva/ presence of soot in oropharynx or any signs of inhalation injury. Sputum is less evident in young children who cannot expectorate. Again, ensuring a provider who is experienced in paediatric airway management is on hand is vital. Consider early intubation when inhalation injuries exist or where there are external facial and neck burns.
Asthma is relatively common in children and inhalation of smoke will frequently lead to bronchospasm.
Immobilise the spine if associated trauma.

Carbon monoxide poisoning should be considered if an inhalation injury is present, especially in an enclosed space. In such instances, high-flow O2 should be provided.

Beware of circumferential chest burns, as an escharotomy may be required to improve ventilation.

Measuring TBSA

The rule of nines may be inaccurate in small children. Aside from the TBSA differences, children have proportionately smaller hips and legs and larger shoulders and heads.

Accurate TBSA estimation is essential for adequate fluid resuscitation. Using the adult rule of nines charts may seriously under- or overestimate the size of the burn wound and lead to insufficient or excessive fluid administration. The paediatric Lund and Browder chart (modified rule of nines chart) should be used to enable accurate calculations. Beware overestimation occurs when simple erythema is included.

Refer to Appendix 1: *Paediatric Burns Assessment Ruler*

Refer to Appendix 2: *Burn Depth Characteristics*

Fluid requirements

Assessment of fluid status in a child must take place early. Children have good compensatory mechanisms that aid in maintaining their circulation in spite of a fluid deficit. Little warning of immediate collapse is given; hypotension is a very late sign.[xxv] More reliance must be placed therefore on the subtle signs of hypovolaemia and inadequate circulation such as:

the general appearance of the child (assess for lethargy, drowsiness, decreased conscious state etc.)

vital signs (tachycardia and prolonged central capillary refill time)

decreased urine output

skin colour and skin temperature (assess for pallor/cool peripheries, low core temperature)

Management

Principles of management focus on securing the airway and maintaining an adequate circulation via fluid administration.

Airway: Ensure the airway is patent and secure. Have a provider experienced in paediatric airway management on hand if possible.

Breathing: Apply high flow oxygen if suspicion of an inhalation injury and consider the possible need for chest escharotomy if circumferential chest wall burns are present.

Circulation: IV cannulation is essential in burns greater than 10% TBSA management. If peripheral venous access is difficult then central or intraosseous insertion should be obtained and/or central access considered.

Fluid administration:

Fluid administration consists of three components:

- Initial fluid to treat initial peripheral circulatory failure (shock) if present, plus
- Fluid to replace that loss from burnt tissues (burn resuscitation), plus
- Maintenance fluids

Initial fluid: The presence of initial peripheral circulation failure (shock) is not expected unless presentation is delayed. See primary survey section for resuscitation of the hypovolaemic patient

Fluid loss from burnt tissues: In children, fluid resuscitation should take place in burns that have a TBSA over 10 per cent. To replace fluid lost from the burnt tissues, fluid administration should follow the modified Parklands formula of

3–4 mL × TBSA% × kg= ____ mL/24 hours.
Use Hartmann's solution where available or normal saline. Fifty per cent of the total is administered in the first eight hours post injury, and 50 per cent given in the following 16 hours. This is a guide only. Effect of resuscitation fluids must be assessed regularly and changes made accordingly. Particular attention should be paid to urine output maintaining >1ml/kg/hr.

Maintenance fluid: Maintenance fluid should be added over and above the Parklands formula.

The recommended maintenance fluid is 0.9 per cent Normal Saline (Note: this differs from Vic Burns recommendations of 0.45% plus 5% Dextrose, currently under review and due to align with Trauma Victoria). Potassium chloride supplements may be required.

Use the following formulae to calculate normal hourly fluid requirements in children up to 30kgs:

- Up to 10kgs – 100ml/kg/day
- 10-20 kgs – 1000mls plus 50ml/kg/day for each kg over 10kgs
- 20-30 kgs – 1500mls plus 20ml/kg/day for each kg over 20kgs

Urine output: should be monitored frequently to assess the adequacy of resuscitation. Goal urine output is 1 mL/kg/hr., or as close as possible. In dwelling catheter is recommended in patients undergoing fluid resuscitation.

First Aid: Leave any clothing that is adhered to underlying skin. Immediately cooling burns with cool running tap water helps to reduce the severity of tissue damage and relieve pain. Cool wounds for 20 minutes total (with running water if possible). This can be done in increments if hypothermia is a concern (ie 5min blocks.) First aid is effective for up to 3hrs post injury. Apply saline-soaked gauze to the affected areas, changing it regularly if free-flowing water is not accessible.

Dressing: If the patient is being transferred to the burns unit within six hours, cover the wound with plastic cling film. It should be applied longitudinally (to allow for swelling) rather than circumferentially, which may have a tourniquet-like effect. If none is available and/or the patient is unlikely to be transferred to the burns unit within six hours, cover with a clean and dry non-adherent dressing such as paraffin gauze or silver dressing. Do not use hydrogels or burnaid on children – they may cause peripheral shut down due to hypothermia.

For detailed dressing instructions, refer to the *Victorian state burns clinical practice guidelines*.

Escharotomy: if circulation to limbs is compromised by burns, escharotomies may be required. Burns to the the chest/abdominal region may compromise chest excursion and trunk escharotomies should be considered. Early consultation is required prior to intervention.

Refer to Appendix 3: *Initial management of severe burns.*

Appendix 1: Paediatric burns assessment ruler

Paediatric Burns Assessment Ruler

CONTACT DETAILS

The Royal Children's Hospital Melbourne
Trauma Advice Line
(03) 9345 4701

Age: _____

Sex: M ○ F ○

Height: _____ cms

Weight: _____ kgs

Date of Burn: / /

Mechanism of injury:

_____

_____

_____

_____

_____

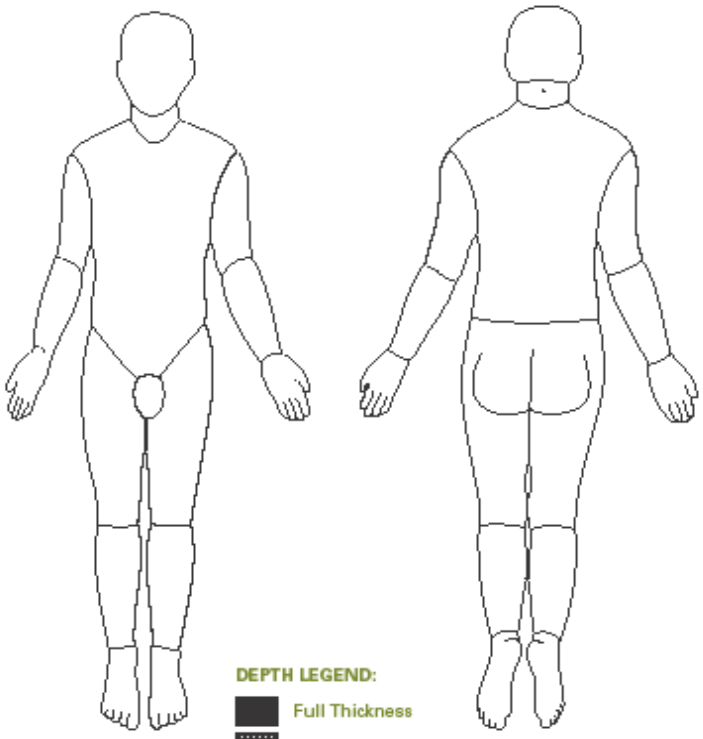
Associated injuries:

_____

_____

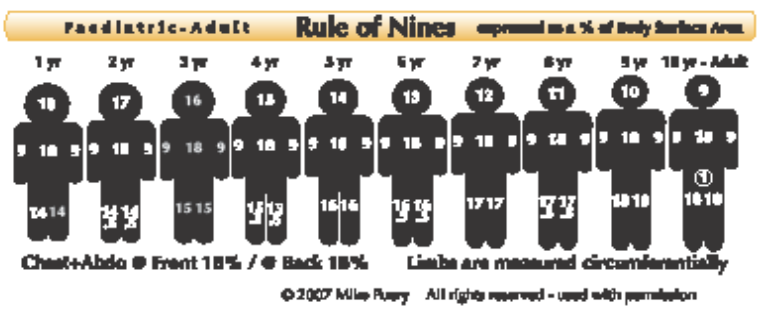
_____

_____



DEPTH LEGEND:

- Full Thickness
- Deep Dermal
- Mid Dermal
- Superficial Dermal



Estimated fluid (Parkland's)

4mls x TBSA% x Kg = mls/24hrs

Estimated Fluid required: _____mls

Total fluid since burn: _____mls

Maintenance fluids in children

Maintenance fluids should also be added over and above the Modified Parklands formula for children weighing less than 30kgs 5% Dextrose and 1/2 Normal Saline used for maintenance fluid

Up to 10kgs 100ml/kg/day

10 – 20kgs
1000mls plus 50ml/kg/day for each kg over 10kgs

20 – 30 kgs
1500mlsplus 20ml/kg/day for each kg over 20 kgs

Oral fluids should be encouraged to supply maintenance fluids if the patient is stable and conscious, and no interventions are planned

Last Updated: 08 May 2012

Available from:http://www.vicburns.org.au/downloadable-posters.html

Appendix 2: Burn depth characteristics

Burn Depth Characteristics

CONTACT DETAILS

Alfred Hospital
1800 ALFRED

The Royal Children's Hospital Melbourne
(03) 9345 5522
Contact: Burn Registrar

	Superficial Epidermal eg sunburn '1st degree'	Superficial Dermal Thickness (partial) '2nd degree'	Mid Dermal Thickness (partial) '2nd degree'	Deep Dermal Thickness (partial) '2nd degree'	Full Thickness '3rd degree'
					
PATHOLOGY	Involves epidermis only	Involves epidermis and upper dermis, most adnexal structures intact	⟷	Involves epidermis and significant part of dermis, only deeper adnexal structures intact	Epidermis, dermis and cell adnexal structures destroyed
APPEARANCE	Dry and red, blanches to pressure. No blisters.	Pale pink. Smaller blisters. Wound base blanches with pressure.	⟷	Blotchy red or pale deeper dermis where blisters have ruptured	White waxy charred. No blisters. No capillary refill
SENSATION	Maybe painful	Increased sensation Very painful and tender	⟷	Decreased sensation	No sensation
CIRCULATION	Normal, increased	Hyperaemic Rapid capillary refill.	⟷	Sluggish capillary refill	Nil
COLOUR	Red, warm	Pink	⟷	White/Pale pink/ Blotchy red	White/Charred/ Black
BLISTERS	None or (days) later or desquamation	Yes (within hours of injury)	⟷	Early—usually large blisters which rupture rapidly and slough	Epidermis & dermis destroyed, no blistering
HEALING TIME	Within seven days	7-14 days	⟷	Over 21 days	Does not heal spontaneously
SCARRING	No scar	Colour match defect. Low risk of hypertrophic scarring	⟷	High risk (up to 80%) hypertrophic scarring	Wound contraction Heals by secondary intention

⟷ In the range between Superficial Dermal Thickness (partial) '2nd degree' and Deep Dermal Thickness (partial) '2nd degree'

Last Updated: 08 May 2012

Available from: http://www.vicburns.org.au/downloadable-posters.html

Appendix 3: Initial management of severe burns

Available from: http://www.vicburns.org.au/downloadable-posters.html

12. Paediatric spinal trauma sub-guideline

Overview

Injuries to the spinal cord in paediatric patients are fortunately rare; however, they may be a component of multitrauma injuries or associated with traumatic brain injury. Spinal cord injury (SCI) in children is often the result of a road traffic accident, significant fall or mishap around water.

The spinal cord can be injured by transection, distraction, compression, bruising, haemorrhage or ischemia of the cord or by injury to blood vessels supplying the cord. These injuries can all result in permanent cord injury and may be complete or incomplete.

Concussion of the spinal cord can result in temporary loss of function for hours to weeks. Complete spinal cord injury presents with complete spinal cord dysfunction and frequently spinal shock and may indicate an irreversible injury. Incomplete injury indicates some sparing of spinal cord motor and or sensory function.

Management in the acute phase of injury is focussed on stabilisation and safe transfer to a facility offering advanced spinal care for children. The priorities for safe transfer include: preventing further injury to the spinal cord and bony structures; supporting the patient's physiological functions when required; and protective manoeuvres for other injuries sustained; and protecting skin integrity.

Assessment

Primary assessment does not vary greatly from the standard model. The most immediate priorities and the primary threat to life are hypotension and hypoxia, which must be treated with appropriate intervention and management.

Airway, breathing and circulation assessments in the **primary survey** in SCI patients are unchanged from paediatric trauma assessment.

Secondary survey assessment should include assessment of sensory level and documentation of apparent motor deficits. These are crucial to communications with retrieval services and the Major Trauma Service providing subsequent further management of the patient.

Considerations

Two important outcomes of an SCI are neurogenic shock and spinal shock.

Neurogenic shock is seen in SCI at 6th thoracic vertebrae or above, typically occurring within 30 minutes of injury and lasting six to eight weeks following injury. It is a result of the loss of vasomotor and sympathetic nervous system tone or function. Its critical features are hypotension, bradycardia and poikilothermia (inability to maintain a constant core temperature independent of ambient temperature.)[xxvi] Bradycardia in cervical cord injury may be spontaneous or provoked by artificial stimulation (eg pharyngeal suction) of tissues whose sensory functions are via the vagus and glossopharyngeal cranial nerves.

Spinal shock is a combination of loss of and decreased reflexes and autonomic dysfunction that accompanies SCI. Skeletal and smooth muscles are therefore flaccid from hours to weeks.

Significant spinal injury may still occur without fracture. **SCIWORA** (**S**pinal **C**ord **I**njury **W**ith**o**ut **R**adiographic **A**bnormality) is an outdated term, but refers to a patient sustaining significant spinal injury without bony fractures. Therefore, a "normal" x-ray and CT does not exclude spinal injury. This occurs in children, predominantly less than eight years of age, and may be the result of lax ligamentous support and immature bony structures or cord ischemia due to vascular injury or hypoperfusion.

This may occur in 1% to 10% of all child spinal injury presentations.

Triage and transfer

Ambulance services should transport paediatric major trauma patients and suspected major trauma patients directly to the Royal Children's Hospital when travel time is less than 45 minutes.

In Victoria, the Paediatric Infant Perinatal Emergency Retrieval (PIPER) service is available to retrieve critically injured children from referral hospitals and provide safe, expert, emergency inter-hospital retrieval. The earlier contact is made with PIPER, they earlier assistance can be dispatched to the hospital.

Management

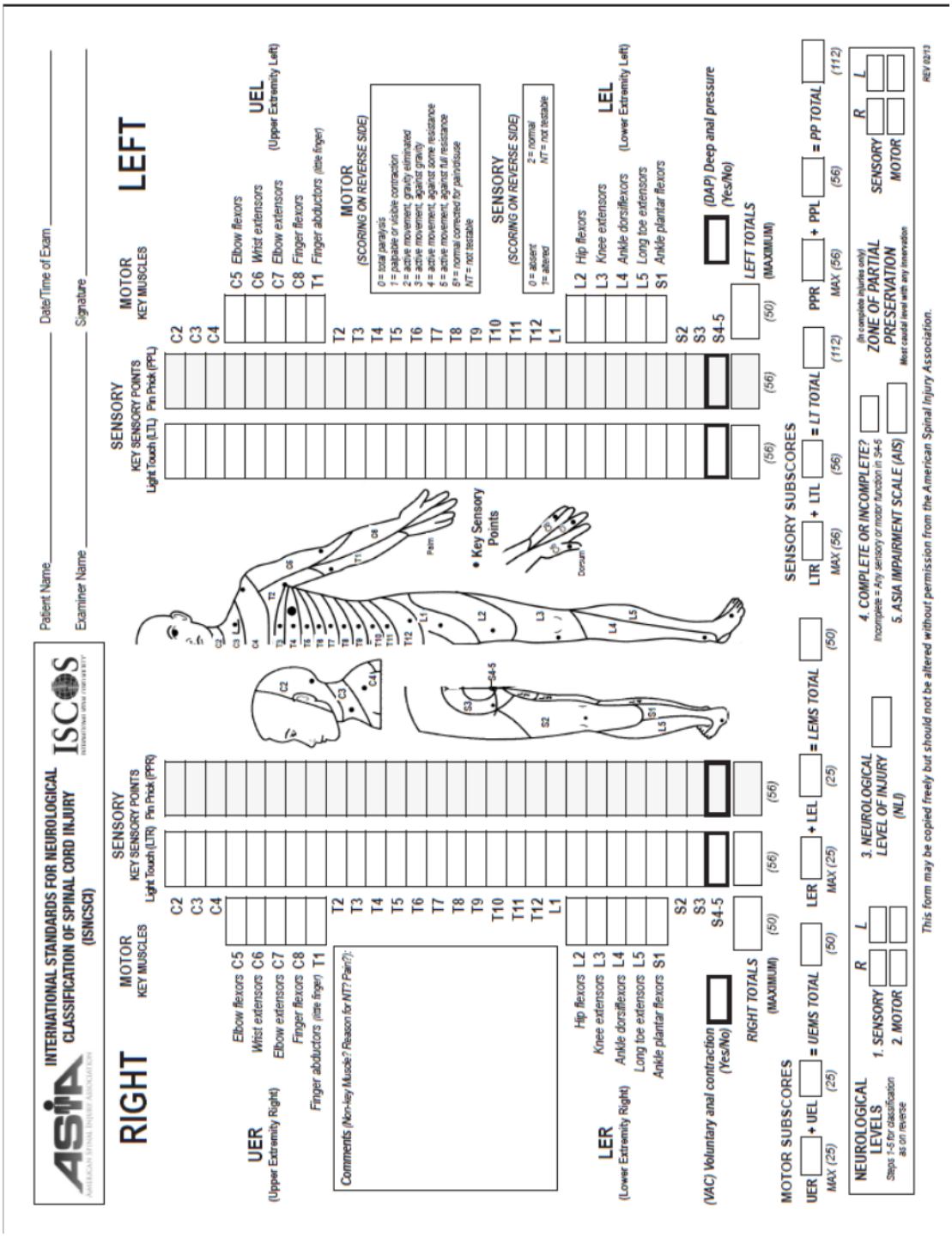
Fluid resuscitation may be commenced at 10–20 mL/kg to replace relative hypovolaemia.

Atropine and adrenaline may assist in managing bradycardia in the first instance.

Bradycardia and hypotension may be significant. This is a highly specialised area of management. In any patient where SCI is suspected, and specifically in any patient manifesting signs of spinal shock – PIPER should be contacted without delay to provide specific assistance with inotropes/vasoactive agents and /or sedation.

Refer to Appendix 1: *American Spinal Injury Association classifications of spinal cord injury.*

Appendix 1: American Spinal Injury Association Classifications of Spinal Cord Injury.



Muscle Function Grading

0 = total paralysis
1 = palpable or visible contraction
2 = active movement, full range of motion (ROM) with gravity eliminated
3 = active movement, full ROM against gravity
4 = active movement, full ROM against gravity and moderate resistance in a muscle specific position
5 = (normal) active movement, full ROM against gravity and full resistance in a functional muscle position expected from an otherwise unimpaired person
5* = (normal) active movement, full ROM against gravity and sufficient resistance to be considered normal if identified inhibiting factors (i.e. pain, disuse) were not present
NT = not testable (i.e. due to immobilization, severe pain such that the patient cannot be graded, amputation of limb, or contracture of > 50% of the normal range of motion)

Sensory Grading

0 = Absent
1 = Altered, either decreased/impaired sensation or hypersensitivity
2 = Normal
NT = Not testable

Non Key Muscle Functions (optional)

May be used to assign a motor level to differentiate AIS B vs. C

Movement	Root level
Shoulder: Flexion, extension, abduction, adduction, internal and external rotation **Elbow:** Supination	C5
Elbow: Pronation **Wrist:** Flexion	C6
Finger: Flexion at proximal joint, extension. **Thumb:** Flexion, extension and abduction in plane of thumb	C7
Finger: Flexion at MCP joint **Thumb:** Opposition, adduction and abduction perpendicular to palm	C8
Finger: Abduction of the index finger	T1
Hip: Adduction	L2
Hip: External rotation	L3
Hip: Extension, abduction, internal rotation **Knee:** Flexion **Ankle:** Inversion and eversion **Toe:** MP and IP extension	L4
Hallux and Toe: DIP and PIP flexion and abduction	L5
Hallux: Adduction	S1

ASIA Impairment Scale (AIS)

A = Complete. No sensory or motor function is preserved in the sacral segments S4-5.

B = Sensory Incomplete. Sensory but not motor function is preserved below the neurological level and includes the sacral segments S4-5 (light touch or pin prick at S4-5 or deep anal pressure) AND no motor function is preserved more than three levels below the motor level on either side of the body.

C = Motor Incomplete. Motor function is preserved below the neurological level**, and more than half of key muscle functions below the neurological level of injury (NLI) have a muscle grade less than 3 (Grades 0-2).

D = Motor Incomplete. Motor function is preserved below the neurological level**, and <u>at least half</u> (half or more) of key muscle functions below the NLI have a muscle grade ≥ 3.

E = Normal. If sensation and motor function as tested with the ISNCSCI are graded as normal in all segments, and the patient had prior deficits, then the AIS grade is E. Someone without an initial SCI does not receive an AIS grade.

** For an individual to receive a grade of C or D, i.e. motor incomplete status, they must have either (1) voluntary anal sphincter contraction or (2) sacral sensory sparing <u>with</u> sparing of motor function more than three levels below the motor level for that side of the body. The International Standards at this time allows even non-key muscle function more than 3 levels below the motor level to be used in determining motor incomplete status (AIS B versus C).

NOTE: When assessing the extent of motor sparing below the level for distinguishing between AIS B and C, the ***motor level*** on each side is used; whereas to differentiate between AIS C and D (based on proportion of key muscle functions with strength grade 3 or greater) the ***neurological level of injury*** is used.

ASIA
AMERICAN SPINAL INJURY ASSOCIATION

INTERNATIONAL STANDARDS FOR NEUROLOGICAL CLASSIFICATION OF SPINAL CORD INJURY

ISCOS

Steps in Classification

The following order is recommended for determining the classification of individuals with SCI.

1. Determine sensory levels for right and left sides.
The sensory level is the most caudal, intact dermatome for both pin prick and light touch sensation.

2. Determine motor levels for right and left sides.
Defined by the lowest key muscle function that has a grade of at least 3 (on supine testing), providing the key muscle functions represented by segments above that level are judged to be intact (graded as a 5).
Note: in regions where there is no myotome to test, the motor level is presumed to be the same as the sensory level, if testable motor function above that level is also normal.

3. Determine the neurological level of injury (NLI)
This refers to the most caudal segment of the cord with intact sensation and antigravity (3 or more) muscle function strength, provided that there is normal (intact) sensory and motor function rostrally respectively.
The NLI is the most cephalad of the sensory and motor levels determined in steps 1 and 2.

4. Determine whether the injury is Complete or Incomplete.
(i.e. absence or presence of sacral sparing)
*If voluntary anal contraction = **No** AND all S4-5 sensory scores = **0** AND deep anal pressure = **No**, then injury is **Complete**.*
*Otherwise, injury is **Incomplete**.*

5. Determine ASIA Impairment Scale (AIS) Grade:
Is injury <u>Complete</u>? **If YES, AIS=A** and can record ZPP (lowest dermatome or myotome on each side with some preservation)
NO ↓
Is injury Motor <u>Complete</u>? **If YES, AIS=B**
NO ↓ (No=voluntary anal contraction OR motor function more than three levels below the motor level on a given side, if the patient has sensory incomplete classification)

Are <u>at least</u> half (half or more) of the key muscles below the <u>neurological</u> level of injury graded 3 or better?
NO ↓ **AIS=C**
YES ↓ **AIS=D**

If sensation and motor function is normal in all segments, AIS=E
Note: AIS E is used in follow-up testing when an individual with a documented SCI has recovered normal function. If at initial testing no deficits are found, the individual is neurologically intact; the ASIA Impairment Scale does not apply.

Available from: http://www.asia-spinalinjury.org/elearning/ASIA_ISCOS_high.pdf

13. Paediatric traumatic brain injury sub-guideline

For detailed assessment and management see RCH Head injury guideline

Overview

The principles of management of traumatic brain injury (TBI) in children are similar to those in adults. Secondary brain injury may be prevented by avoiding hypoxaemia and/or hypotension. In addition, maintenance of adequate ventilation (maintaining mild hypocarbia) to maintain cerebral perfusion is essential.

Assessment following the basic principles of primary and secondary survey as described previously should be followed; however, it is important to note the following.

- It is often difficult to ascertain whether there was a period of loss of consciousness. Loss of consciousness may be brief and not witnessed by anyone.
- Seizures are common in children after a head injury. A seizure within one hour of injury does not carry the same risk as in an adult.[xxvii] In general, if the child makes a full and rapid recovery following then there is no need for administration of anticonvulsant medication.

Children are more likely to receive a head injury than adults as:

They have a larger head surface area to body weight ratio, causing the head to be the centre of impact in falls.

- The immature brain is more predisposed to injury.
- The skull that protects the brain is thinner therefore fractures are more common; however, serious injury can occur without a skull fracture. There is also more risk of damage to the brain from penetrating injuries.
- Large volumes of blood may be lost with scalp lacerations/wounds. The young child may become hypovolaemic with large intracranial bleeds, which is not seen in older children/adults.[xxviii]

Advice and Retrieval

Expediting transfer to an appropriate trauma facility is the goal in management. Consider consultation with PIPER for the following scenarios early to obtain specialist neurosurgical paediatric advice regarding management and the need for possible retrieval.

- Moderate head injury with ongoing drowsiness or vomiting and / or unexplained confusion lasting for more than 4 hours
- All severe head injuries
- Deteriorating conscious level (especially motor response changes)
- Focal neurological signs
- Seizure without full recovery
- Definite or suspected penetrating injury
- Cerebrospinal fluid leak
- Child requiring care beyond the comfort level of the hospital.

Primary Survey Assessment

The assessment of a small child with a TBI is often very difficult. It is recommended that specialist consultation with PIPER takes place early.

- ABC: ensure that the child's airway/cervical spine, breathing and circulation are secure and adequate.
- Disability: Close attention to the neurological response is vital using the modified paediatric GCS as described earlier. Rapidly assess the neurological status as well as pupil size, reaction and equality. Check the blood sugar level.

Once the assessment has taken place, decide on the severity of the head injury in order to guide investigations and management.

Refer to Appendix 1: *How to assess severity of head injury.*

Management

Management principles focus on maintaining cerebral perfusion and adequate ventilation in order to prevent secondary brain injury.

Severe Head Injury

Early neurosurgical advice is vital.

Ensure patent airway and cervical spine immobilisation.

Intubate and ventilate the child who is unresponsive, has a GCS <8, is unable to protect their airway or has any hypoventilation or respiratory irregularity. Once performed, it is vital to provide adequate sedation and muscle relaxation to prevent coughing and agitation.

Care needs to be taken with selection of anaesthetic agents to maintain BP and cerebral perfusion pressure while minimising ICP spikes at time of intubation. Ketamine is the agent of choice in most circumstances.

Mechanical ventilation must be monitored to maintain end-tidal CO2 to 32-35mmHg. Hypercarbia (>45mmHg) and extreme hypocarbia (<30mmHg) must be avoided.

Prevent a rise in ICP

Consider measures to decrease ICP in consultation with PIPER:

Maintain oxygenation: aim for pO_2 > 80 mmHg/sats >95%.

Control PaCO2 (end-tidal) to 32-35mmHg

Optimise BP through infusion of crystalloids or vasopressors (e.g. Noradrenaline) if necessary.[xi] Head trauma most often occurs in polytrauma, so hypovolaemia is common and must be corrected first.

Position the patient with their head up 20–30 degrees and midline neutral to avoid jugular compression and promote adequate drainage of CSF to minimise ICP rises. Beware of obstructing venous drainage with a collar that is to tight.

Use the reverse Tredelenburg position:

Provide sufficient analgesia via careful titration. Head injured children are often more sensitive to opioids.

Osmolar therapy such as mannitol or hypertonic saline can temporarily reduce ICP allowing time to definitive management. Consider Mannitol 0.5–1 g/kg/IV over 20-30 minutes or hypertonic saline NaCl 3% 3ml/kg over 10-20minutes IV (should only be given after neurosurgical consultation and if signs of imminent herniation are present).

If the patient has ongoing convulsions, do not administer benzodiazepines as the associated respiratory depression can raise ICP. Ongoing seizures post traumatic brain injury require a general anaesthetic and intubation/ventilation.

CT scanning

All severely brain injured patients will require transfer to an MTS. The decision to conduct a CT prior to retrieval is dependent on timing of retrieval, clinical status/deterioration and the ability of the referring hospital to safely scan the patient. CT scanning must be discussed with the PIPER in the first instance.

CT scanning is the preferred method of imaging. This may be difficult in a child and should be a decision made in conjunction with senior staff in the context of a severe head injury.

CT scanning should only be undertaken when the patient is cardiovascularly stable and must be fully monitored and accompanied by medical staff at all times.

Indications for CT scanning are:

- GCS under 9
- neurological deterioration, drowsiness or confusion (GCS 9–13)
- persistent headache, vomiting (>4 times)
- focal neurological signs (pupil inequality, change in reactivity such as dilated pupils and unreactive on one side, hemiparesis involving the limbs on one side)
- skull fracture – known or suspected
- penetrating injury – known or suspected
- post traumatic seizures (except a brief(<2 min) convulsion occurring at the time of impact)
- In infants under 1 year, presence of a bruise, swelling or laceration of more than 5cm on the head should raise concern of underlying brain injury. All infants should have CT scan discussed with PIPER prior to proceeding, given the deleterious effects of radiation in this age group.

Appendix 1: How to assess severity of head injury

HOW TO ASSESS SEVERITY OF HEAD INJURY:	
Minor	• No loss of consciousness • Up to one episode of vomiting • Stable, alert conscious state • May have scalp bruising or laceration **Normal examination otherwise**
Moderate	• Brief loss of consciousness at time of injury • Currently alert or responds to voice • May be drowsy • Two or more episodes of vomiting • Persistent headache • Up to one single brief (<2min) convulsion occurring immediately after the impact • May have a large scalp bruise, haematoma or laceration **Normal examination otherwise**
Severe	• Decreased conscious state – responsive to pain only or unresponsive • Localising neurological signs (unequal pupils, lateralising motor weakness) • Signs of increased intracranial pressure: ▪ Uncal herniation: Ipsilateral dilated non-reactive pupil due to compression of the oculomotor nerve ▪ Central herniation: Brainstem compression causing bradycardia, hypertension and widened pulse pressure (Cushing's triad) ▪ Irregular respirations (Cheynes-Stokes) ▪ Decorticate: arms flexed, hands clenched into fists, legs extended, feet turned inward ▪ Decerebrate: head arched back, arms extended by the sides, legs extended, feet turned inward • Penetrating head injury • CSF leak from nose or ears

Available from:
http://www.rch.org.au/clinicalguide/guideline_index/Head_Injury_Guideline/#Severe_Head_Injury

Trauma Victoria

The Victorian State Trauma System (VSTS) facilitates the management and treatment of major trauma patients in Victoria. The VSTS aims to reduce preventable death and permanent disability and improve patient outcomes by matching the needs of injured patients to an appropriate level of treatment in a safe and timely manner.

The system aims to have the right patient delivered to the right hospital in the shortest time.

One of the best ways to facilitate this is to provide an education resource to all clinicians.

Trauma Victoria is a statewide education initiative directed towards clinical staff (doctors, nurses, allied health, paramedics) who provide early patient care for major trauma outside of a MTS.

Guidelines are in place to support awareness of **key aspects of the trauma system** and early trauma care and include **specialist trauma transfer** guidelines.

A web-based learning management system provides modules to support each of the principle guideline areas. Skills tutorials on key trauma procedural interventions will also be accessible.

Moderated remote tutorials will be offered in the future. Clinicians will join a multisite, multiparty videoconferenced meeting room for tutorials and discussions on relevant trauma subjects. It will allow local practitioners to tap into specialised clinical knowledge and to develop their learning to the fullest extent.

Regional simulation and team training will also be supported via a remote expert facilitator and will involve regional and subregional simulation trainers. It will build capacity among simulation trainers to enhance local trauma team training programs.

Facilitated visits will also be arranged whereby medical, nursing and allied health staff may be placed for brief rotations with a MTS in order to increase their experience and familiarity in major trauma management. The aim is also to promote the development of clinical relationships between organisations.

Created by Adult Retrieval Victoria on behalf of the Victorian State Trauma System.

To receive this document in an accessible format phone Acute Programs on 9096 7741.

Authorised and published by the Victorian Government, 50 Lonsdale St, Melbourne.

AGREE II score sheet – Paediatric trauma guideline

Domain	Item	AGREE II Rating						
		1 Strongly Disagree					7 Strongly Agree	
		1	2	3	4	5	6	7
Scope and purpose	The overall objective(s) of the guideline is (are) specifically described.						x	
	The health question(s) covered by the guideline is (are) specifically described.						x	
	The population (patients, public, etc.) to whom the guideline is meant to apply is specifically described.							x
Stakeholder involvement	The guideline development group includes individuals from all the relevant professional groups.						x	
	The views and preferences of the target population (patients, public, etc.) have been sought.						x	
	The target users of the guideline are clearly defined.							x
Rigor of development	Systematic methods were used to search for evidence.						x	
	The criteria for selecting the evidence are clearly described.						x	
	The strengths and limitations of the body of evidence are clearly described.						x	
	The methods for formulating the recommendations are clearly described.							x
	The health benefits, side effects and risks have been considered in formulating the recommendations.							x
	There is an explicit link between the recommendations and the supporting evidence.						x	
	The guideline has been externally reviewed by experts prior to its publication.							x
	A procedure for updating the guideline is provided.							x

Domain	Item	AGREE II Rating						
		1 Strongly Disagree					7 Strongly Agree	
		1	2	3	4	5	6	7
Clarity of presentation	The recommendations are specific and unambiguous.							x
	The different options for management of the condition or health issue are clearly presented.						x	
	Key recommendations are easily identifiable.						x	
Applicability	The guideline describes facilitators and barriers to its application.						x	
	The guideline provides advice and/or tools on how the recommendations can be put into practice.							x
	The potential resource implications of applying the recommendations have been considered.							x
	The guideline presents monitoring and/ or auditing criteria.						x	
Editorial independence	The views of the funding body have not influenced the content of the guideline.							x
	Competing interests of guideline development group members have been recorded and addressed.							x
Overall Guideline Assessment	Rate the overall quality of this guideline. 1- Lowest possible quality 7- Highest possible quality						**x**	
Overall Guideline Assessment	I would recommend this guideline for use.	Yes		Yes, with modifications			No	
		x						

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