



EARLY TRAUMA CARE GUIDELINE



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1. Key messages

The Victorian State Trauma System (VSTS) provides support and retrieval services for critically injured patients requiring definitive care, transfer, and management. This early trauma care guideline provides evidence-based advice on the initial management and transfer of major trauma patients who present to Victorian health services with severe injuries.

This guideline is developed for all clinical staff involved in the care of trauma patients in Victoria. It is intended for use by frontline clinical staff that provide early care for major trauma patients; those working directly at the Major Trauma Service (MTS) as well as those working outside of a MTS.

These guidelines provide the user with accessible resources to provide early care effectively and confidently for critically injured patients. They provide up-to-date information for frontline healthcare clinicians. The guideline has followed the AGREE II methodology for guideline development and is under the auspice of the Victorian State Trauma Committee (VSTC)(1).

Clinical emphasis points:

- A trauma team approach with a focus on communication, role delegation and implementation of clinical guidelines and practices is key to good trauma care.
- Primary survey and initial management of a trauma patient is used to detect and treat actual or imminent life threats and prevent complications from these injuries.
- Optimising resuscitation in the emergency setting and early notification to the retrieval network helps to promote timely transport to an appropriate facility.
- A balanced approach to fluid resuscitation until bleeding can be controlled.
- Adequate temperature control with avoidance of hypothermia is essential.
- Titrated narcotic analgesia is the initial approach to pain management in trauma.
- Adult Retrieval Victoria (ARV) is the first point of call to initiate retrieval and transfer in the adult trauma patient.



2. Rapid Reference Guideline

This page is being held to contain an updated one-page summary of the guideline, intended for real-time clinical access and use.

It will be sent as an out of session document for final revision.



3. Introduction

Victorian hospitals treat more than 4,000 major trauma patients each year, and this number is steadily increasing each year, with over 70% receiving definitive care at an appropriately designated trauma service. Of these, 40% of patients meet major trauma criteria requiring an intensive care admission, and three-quarters of these patients are mechanically ventilated(2).

The majority of trauma in Victoria is predominantly blunt trauma. Falls, motor vehicle accidents, motorbike accidents, pedestrian impacts and incidents involving pedal cyclists are the most common mechanisms of injury.

In recent years there has been an increase in the number of major trauma patients aged over 65 years. This represents approximately one-third of all major trauma cases. The incidence of falls less than 1m is rising in this age group, with head injuries being the most common serious injury sustained in this demographic (2). The annual incidence rate of paediatric major trauma patients (aged younger than 16 years) remains low, at 13 per 100,000 in 2021-2022 (2).

The first hospital attended was a MTS, The Austin Hospital (for spinal care) or a metropolitan neurological service (MNS) for 51% of major trauma patients in 2021-2022. Further, the percentage of major trauma patients receiving definitive care at an MTS, the Austin for spinal, or a MNS was 74.6% in 2021-2022 (2).

Patients who meet major trauma criteria outlined in the Major Trauma Advice and Inter-hospital Transfer Guidelines should be stabilised at the referral health service and discussed with ARV within 60 minutes of arrival to arrange for transfer to a major trauma service. ARV provides clinical advice on the management and stabilisation of major trauma patients and coordinates subsequent retrieval and transfer if required.

The Review of Trauma and Emergency Services (RoTES) report underpins much of the Victorian State Trauma System and strongly advocated and specified the following in response to the general team approach to early management of major trauma patients:

“The multidisciplinary trauma team approach to trauma resuscitation and stabilisation is one recommended by several bodies (ACS, 1993; NRTAC, 1993). All hospitals designated to receive trauma patients must have a formal organised response to the initial reception and management of trauma patients. The establishment of a trauma team is crucial to this. Clarifying the roles and responsibilities of each member of the team enables an optimally coordinated approach during resuscitation, when many tasks must be carried out simultaneously. Trauma team members should comprise the most skilled clinicians available to fulfil each roll within the team. Clinicians should, therefore be sourced from throughout the hospital”(3).

On occasions paramedics may play an active role in the trauma team within rural or regional facilities where availability of experienced and skilled hospital staff may be limited.

4. Early activation

Emergency medical services responding to the scene will notify the receiving hospital that a trauma patient is on their way. This may be a major, metropolitan, or regional trauma service or sometimes an urgent care service, depending on distance, facilities available and the patient’s condition. Notification information is 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. On certain occasions a notification to ARV might occur before the patient reaches the first medical facility, this can be initiated by the medical facility or the incoming emergency medical service.

The following sequence of actions should take place upon initial notification:

1. Gather vital information from the notifier using the IMIST mnemonic:(4, 5)
 - I** Identification: Who are you and what is your role? Patient identifiers – name, age, sex.
 - M** Mechanism: Presenting problem, how it happened.
 - I** Injuries: specific injuries that have been found or potential to exist.
 - S** Signs: vital signs, such as HR, RR, BP, Temp, BGL, GCS, etc.
 - T** Treatment and Trends: treatment administered and patient's response to treatment, trends in vital signs.
2. Set up the trauma bay to receive the patient, including equipment checks, documentation, medications and resuscitation equipment.
3. 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. 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.
4. Ensure clear communication between all parties involved in managing the trauma. Use closed-loop communication, which ensures accuracy in information shared between response staff. Repeat instructions, make eye contact and provide feedback. Misinterpreted information may lead to adverse events. Designation of roles and specific tasks to staff can help to maintain a structured approach based on teamwork.
5. Ensure all staff involved in patient care are wearing gloves, aprons and eye protection. Personal protective equipment is vital in the care of trauma patients.

If there is no prior notification of the patient, then rapid activation of the trauma team request must take place and any additional resources notified. If it is anticipated that transfer to a major trauma service will be required, early retrieval activation is essential, **phone ARV on 1300 368 661**.

- Early retrieval activation ensures access to critical care advice and a more effective retrieval response which leads to improved clinical outcomes for the patient (6).

If you are undecided, call the ARV coordinator, who can provide expert guidance and advice over the phone or via tele or videoconference, and link to a major trauma service as required.

Ambulance handover

On arrival at the emergency department, a structured handover is provided by the paramedics to the treating team, using the IMIST-AMBO format (5). The timing of the handover will be dependent on patient clinical stability and requirements. If the patient is stable, it may be best to perform the handover before placing the patient on a trolley. If the patient is unstable or critically unwell, it may be necessary for the patient to be transferred to the trolley so the



team can continue management and intervention, while the team leader receives the handover.

Reception and resuscitation

Ensure the patient is correctly identified and appropriate patient identification labels applied.

The reception and resuscitation of major trauma patients involves simultaneous assessment and management, with multiple activities occurring in parallel. Resuscitation follows the standard ABCDE approach, with some modifications based on recognising and treating immediate life threats that are unique to trauma patients and preventing secondary complications.

The response to resuscitation will vary depending on the injuries sustained, the treatment administered or omitted as well as other factors such as the patient's age and medical comorbidities. Ongoing resuscitation is guided by the response to treatment and the need for definitive management.

Assessment must also be made of medical conditions and comorbidities that may have preceded or contributed to the patient sustaining an injury, especially in elderly patients. Cardiac or neurological events leading to syncope or falls are common events that predispose to injury in older patients.

5. Primary survey

The primary survey is the initial assessment and management of a trauma patient. It is conducted to detect and treat actual or imminent life threats and prevent complications from these injuries. A systematic approach using ABCDE is used (7). If a group of clinicians are assembled to perform the initial assessment, there will be multiple simultaneous activities occurring and resuscitation does not always proceed in a purely linear, sequential fashion.

On arrival to the emergency department, the patient should have full non-invasive monitoring applied, and initial management including:

- ECG monitoring.
- Non-invasive blood pressure cuff.
- Oxygen saturation probe.
- The patient's temperature should be recorded.
- Removal of the patient's clothes is encouraged so that they can be fully assessed.
- Oxygen should be applied to achieve saturation of 94-98%(8).



The primary survey of a trauma patient involves (9, 10):

Catastrophic Haemorrhage

Airway – with cervical spine control

Breathing

Circulation **including** control of exsanguinating external haemorrhage

Disability

Exposure

In single responder settings these may need to be addressed in a linear or sequential fashion; however, when a team is assembled, these elements may be addressed simultaneously. The term 'survey' is somewhat misleading in that it implies that only assessment is occurring; however, each phase requires simultaneous **assessment** for, and **management** of, any life threats detected.

Control of exsanguinating external haemorrhage

Failure to recognise and control large-volume external haemorrhage significantly increases mortality. Obvious large volume external blood loss must be managed as an immediate priority in the field and on arrival of the patient into the emergency department, with the aim being to control life-threatening external haemorrhage (11, 12).

Airway with cervical spine protection

An assessment of airway patency and stability should be performed during the primary survey and a plan for airway management instituted if required. Unless the patient is in cardiac arrest, immediate securing of the airway with endotracheal intubation is rarely required upon arrival of a major trauma patient.

Life threats

The following airway life threats must be assessed and managed:

- Airway obstruction.
- Vomit, blood, dislodged teeth. Remove with suction.
- Blunt or penetrating neck injury.
- Consider early endotracheal intubation if neck wounds or haematomas are causing the airway obstruction or if there is an airway disruption.

Caution: Rapid-sequence intubation in patients with blunt or penetrating neck injuries carries the risk of total loss of airway patency upon administration of sedative and/or muscle relaxant medication.

- Reduced conscious state.
- This can lead to hypoventilation and/or airway obstruction and hypoxia

Assess for airway stability:

- Attempt to elicit a response from the patient.



- Look for signs of airway obstruction (use of accessory muscles, paradoxical chest movements and see-saw respirations).
- Listen for signs of upper-airway noises and breath sounds. Are they absent, diminished, or noisy?

Assess for soiled airway

If the patient has vomit, blood, or excessive secretions on their airway, these should be removed with suction. If there is excessive bleeding into the airway that cannot be removed with suction, it may be necessary to manage the patient on their side to allow drainage of blood from the mouth or nose, while maintaining C spine immobilisation. Patients can be placed on their side by performing a log-roll manoeuvre.

If this is insufficient consideration should be given to sitting the patient upright. The risk of potential spinal injury must be weighed against the potential for complete airway obstruction or choking from aspirated blood. If there is uncertainty about the safety of this, a senior doctor with airway experience should be involved or the ARV clinician can be contacted for advice or for telehealth review of the situation.

Attempt simple airway manoeuvres if required:

- Open the airway using a chin lift and jaw thrust.
- Suction the airway if excessive secretions are noted or if the patient is unable to clear their airway independently.
- Insert an oropharyngeal airway (OPA)/nasopharyngeal airway (NPA) if required.

Care should be taken to not extend the cervical spine.

Caution: NPA should not be inserted in patients with a head injury in whom a base of skull fracture has not been excluded (13, 14).

If the patient is already intubated, document the size and position of the endotracheal tube, including lip level, end-tidal carbon dioxide trace, cuff pressure and any intubation difficulty (or Mallampati score). Where possible, delegate ongoing airway management to an airway doctor/nurse and continue the initial assessment.

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

Consider intubation early if there are any signs of:

- A decreased level of consciousness, unprotected airway, uncooperative/combatative patient leading to distress or further risk of injury.
- A pending airway obstruction, indicated by signs such as a stridor or hoarse voice.

Maintain full spinal precautions if indicated

Suspect spinal injuries in all poly-trauma patients. Ensure a cervical collar, head blocks or in-line immobilisation is maintained throughout patient care.

Breathing and ventilation

Life threats:

- Tension pneumothorax.



- Massive haemothorax.
- Open pneumothorax.
- Flail chest and Pulmonary contusions.
- Tracheobronchial injury.

Oxygen administration

Administer oxygen to achieve oxygen saturations between 94-98%.

Assess the chest

The chest should be fully exposed and inspected:

- Note respiratory rate / effort / SpO₂.
- Look for open wounds / penetrating wounds / tracheal deviation
- Observe any bruising / deformity / abnormal chest movements, e.g., Intercostal & / or supraclavicular in-drawing.
- Palpate: Tenderness, crepitus, surgical emphysema.
- Auscultate chest for bilateral air entry, additional noises.

Rapid, shallow ventilation occurs in chest injury as well as developing hypoxia. All patients with chest injuries have a high oxygen demand and therefore supplemental oxygen should be supplied until injury is excluded or effectively managed. Make sure to check the back also as life threatening injuries may be otherwise undetected. Immediately after detection of any life-threatening injuries, interventions need to occur to prevent further deterioration.

A mobile chest x-ray should be performed in the resuscitation bay at the earliest opportunity and performed with a pelvic and lateral neck x-ray during the primary and secondary survey.

The chest should be auscultated for breath sounds, the most reliable location being in the axillae.

If a tension pneumothorax is detected, management should include:

- Emergent decompression using a 14G needle in the second intercostal space in the mid-clavicular line. This is completed if equipment and skilled personnel for finger thoracostomy is not immediately at hand (15).
- Finger thoracostomy with blunt dissection and digital decompression through the pleura. This is an essential step for pleural decompression. Decompression of the pleural space is a primary goal during the reception and resuscitation of the haemodynamically unstable patient with a haemothorax and/or pneumothorax (16).
- Intercostal catheter insertion. Finger thoracostomy should be followed by the insertion of an intercostal catheter connected to an underwater seal drain as a secondary priority that can be completed at a later stage.

Note: Finger thoracostomies require definitive ongoing management with an ICC unless the patient is positive pressure ventilated.



Record the oxygen saturation (SpO₂) and ETCO₂ if available.

This will provide trends for the patient as well as being a precursor to any change in condition or deterioration.

Circulation with haemorrhage control

Assess circulation and perfusion

Circulation assessment in major trauma focuses on detecting and managing shock, or reduced tissue perfusion. The most common cause of shock in a major trauma patient is hypovolaemic shock from blood loss. Blood loss may be external/visible, and therefore compressible, or internal/concealed and non-compressible.

Assess:

- Pulse – Quality/ rate/ regularity
- Skin – colour / cap refill time / temperature
- BP
- JVP – raised/ flattened.
- Perform eFAST scan looking specifically for evidence of pericardial tamponade or pneumothorax.

Intravenous access

Insert two large-bore peripheral intravenous (IV) cannulas. If access is difficult consider a central or intraosseous insertion if the equipment/skills are available.

eFast scan

In experienced hands **eFAST (Extended Focused Assessment with Sonography in Trauma)** has a high sensitivity and specificity (17). It supplements physical examination for detecting intra-abdominal injury(18). In the hypotensive patient, eFAST should be performed as part of the primary survey. In penetrating trauma to the torso an eFAST should be performed in all cases. In patients who are haemodynamically stable the eFAST may be delayed until the secondary survey if resources do not permit.

Control of exsanguinating external haemorrhage

Control of external haemorrhage usually requires firm compression bandaging with combine pads applied over the wounds, and firm crepe bandages applied circumferentially over the affected areas. Several layers may be required. Haemostatic dressings may be of use if available. Uncontrolled limb haemorrhage requires placement of an arterial tourniquet. This should not be removed until surgical haemorrhage control is achieved.

Causes include major amputations, severe crush injuries, open fractures, massive de-gloving injuries, or multiple deep lacerations, especially of the scalp. Where external haemorrhage is identified an attempt must be made to control it using direct pressure, elevation and/or tourniquets (if available).



Smaller injuries (for example, puncture wounds) that are bleeding excessively should be managed by direct, local pressure over the wound with 10 cm × 10 cm gauze squares folded in half and folded again to make a 5 cm × 5 cm gauze pad, and placed over the wound with firm, single digit pressure. This will control haemorrhaging better than loosely applied, large absorbent pads. It is helpful to take photos of the wounds and injuries to assist with ongoing management plans at the receiving facility.

It is best to avoid suturing or stapling wounds closed prior to transfer, unless the haemorrhaging cannot be controlled with direct pressure. If wounds are closed purely for haemostasis, this must be documented in the clinical record and communicated to the receiving team as they may need to be re-opened and/or explored on arrival at a receiving hospital.

Disability

Assess level of consciousness:

- Perform an initial Glasgow Coma Scale (best eye opening, motor response and verbalisation).
- Check pupil size and reactivity.

Test blood sugar levels

Ensure that any alterations in level of consciousness are not related to a metabolic cause.

Exposure and environment

By the end of the primary survey the patient should have been fully exposed to ensure no injuries posing an immediate life threat are overlooked. Consideration must be given with respect to their age, gender, and culture. All patients should be exposed appropriately and sequentially, exposing one body region at a time whilst attempting to preserve patient dignity. Prior to exposing a patient, the patient should be informed, and consent should be gained.

Trauma patients are prone to hypothermia, so upon completion of the primary survey deliberate measures to prevent this should be taken. Application of external warming devices such as Bair Huggers / warmed blankets are encouraged if the patient is even mildly hypothermic. Hypothermia in the trauma patient is associated with poorer outcomes and linked to deterioration of clotting abilities with increased blood loss.

6. Secondary survey

The secondary survey is performed once the patient has been resuscitated and stabilised. It involves a more thorough head-to-toe examination, and the aim is to detect other significant but not immediately life-threatening injuries. If during the examination any deterioration is detected, go back, and reassess the primary survey.

History

Taking an adequate history from the patient, bystanders or emergency personnel of the events surrounding the injury can assist with understanding the extent of the injury and any possible other injuries (19).



Use the **AMPLE** acronym to assist with gathering pertinent information:

- A** Allergies
- M** Medication
- P** Past medical history including tetanus status
- L** Last meal
- E** Events leading to injury

Head-to-toe examination

During this examination, any injuries detected should be accurately documented and any required treatment should occur, such as covering wounds, managing non-life-threatening bleeding, and splinting of fractures.

Head and face

- Inspect the face and scalp. Look for any lacerations or bruising, including mastoid or periorbital bruising which may be indicative of a base of skull fracture. Gently palpate for any depressions or irregularities in the skull.
- Look in the eyes for any foreign body, subconjunctival haemorrhage, hyphaema, irregular iris, penetrating injury or contact lenses.
- Assess the ears for any signs of CSF leak, bleeding, or blood behind the tympanic membrane.
- Check the nose for any deformities, bleeding, nasal septal haematoma, or cerebrospinal fluid leak.
- Look in the mouth for any lacerations to the gums, lips, tongue, or palate. Note any swelling which may indicate inhalation injury. Inspect the teeth – are any loose, fractured or missing.
- Test eye movements, pupillary reflexes, vision, and hearing.
- Palpate the bony margins of the orbit, maxilla, nose, and jaw.
- Inspect the jaw for any pain or trismus.

Neck

- A plain lateral neck x-ray may be indicated when assessing a poly-trauma patient but if normal does not clear the C spine. This is particularly relevant in the intubated patient.
- To examine the neck the cervical collar should be opened, and the head supported with manual in-line stabilisation throughout the exam. Three staff members are normally required to conduct a neck examination safely.
- Gently palpate the cervical vertebrae. Note any cervical spine pain, tenderness, or deformity. Check the soft tissues for bruising, pain, and tenderness.
 - Note the following:
 - Trachea (midline or deviated): The trachea may deviate away from the side of a tension pneumothorax.
 - Wounds: blunt or penetrating injuries, size, and depth.



- Subcutaneous emphysema: The presence indicates an airway disruption such as a laryngeal fracture or pneumothorax.
- Larynx: Laryngeal tenderness or crepitus; this may indicate an underlying laryngeal fracture. Caution: firm palpation may disrupt a fractured larynx leading to total airway obstruction.
- Veins: Look for distension – neck vein distension may be seen in tension pneumothorax or pericardial tamponade (a late and peri-arrest sign).
- Oesophagus: To assess the oesophagus, ask the patient to swallow. An oesophageal injury may be suspected if the patient has pain or difficulty swallowing.

Re-apply the cervical collar carefully after examining the neck. The cervical spine will generally be cleared after transfer to a major trauma service and specialist assessment.

Chest

The chest should be palpated for rib tenderness and subcutaneous emphysema. The entire thorax must be palpated including the supraclavicular fossae, right and left ribs and both axillae. A hand can be slid posteriorly along a supine patient to check for occult blood loss; however, a formal examination of the back of the chest occurs when the patient is log rolled.

- Auscultate the lung fields; note any percussion abnormality, lack of breath sounds, wheezing or crepitations.
- Check the heart sounds: apex beat and presence and quality of heart sounds.

Abdomen

Inspect the abdomen. Palpate for areas of tenderness especially over the liver, spleen, kidneys, and bladder. Look for any bruising, lacerations, or penetrating injuries. Document seat belt marks.

- Check the pelvis. Perform a pelvic x-ray if there is any suspicion of injury. Gently palpate for any tenderness. **Do not spring the pelvis.** Any additional manipulation may exacerbate haemorrhage (20). Apply a binder if a pelvic fracture is suspected even if low clinical suspicion.
- Auscultate bowel sounds.
- Inspect the perineum and external genitalia for bruising or haemorrhage.

Limbs

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

- Examine sensory and motor function of any nerve roots or peripheral nerves that may have been injured.
- Assess distal colour, warmth, movement, sensation, and capillary refill.



Back

Log roll the patient. Try to do this once. It can be achieved at the time of patient transfer when you have the most personnel to do it safely. Maintain in-line stabilisation throughout. Inspect the entire length of the back noting any deformity, bruising and lacerations.

- Palpate the spine for any tenderness or steps between the vertebrae. Include a cervical examination at this stage.
- A digital rectal examination should be performed only if a spinal injury suspected.

Buttocks and perineum

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

Genitalia

Inspect for soft-tissue injuries such as bruising, lacerations or burns. Note any priapism that may indicate a spinal injury.

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

7. Planning and communication

For a trauma team to run effectively there must be an identifiable leader who will direct the resuscitation, assess the priorities, and make critical decisions. Good communication between the trauma team members is vital, as is ensuring that local senior staff are aware and can provide additional support if required.

Once the initial assessment and resuscitation is underway, it is important to plan the next steps in immediate management. Priorities for care must be based on sound clinical judgement, patient presentation, and response to therapies. 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 in the patient care episode. Do not wait until the patient deteriorates to ask for assistance.

Frontline clinical staff should initiate contact with ARV early in the patient care pathway or, more importantly as soon as it is identified that the patient meets the inter-hospital trauma transfer criteria or may have sustained injuries beyond the clinical skill set of the emergency department or urgent care service. ARV can be contacted at any time throughout the patient care episode to offer or coordinate clinical advice and consultation.

ARV coordinators can facilitate a three-way conversation between the referral health service, specialist MTS and the ARV consultant to discuss the best, 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 needed resources while the inadvertent omission 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 any procedures performed and imaging obtained).

It is important that additional communication with the ARV coordinator is initiated when there is:

1. Significant deterioration in:
 - Conscious state.
 - Blood pressure.
 - Heart rate.
 - Respiratory status.
 - Oxygenation.
2. Major clinical developments such as significantly abnormal diagnostic tests or 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, the patient receives the appropriate care enroute and the patient is referred to the correct facility.

8. Early management

Airway management

If there is potential that the patient's airway may deteriorate, then intubation prior to retrieval should be discussed with the ARV coordinator.

Always have emergency airway equipment available.

Fluid resuscitation

Avoidance of hypovolaemia in trauma is a cornerstone of management. A balanced approach to fluid replacement is important, especially in establishing early treatment goals (21, 22). Permissive Hypotension is a recognised fluid resuscitation plan, it acknowledges the goal of end organ perfusion whilst avoiding haemodilution. Therefore, perfusion targets are patient dependent, however, acceptance of values below normotension are appropriate. If in any doubt, always call ARV for further guidance (9, 23).

Resuscitation goals:

- The main goal of fluid resuscitation in trauma is to preserve vital organ function until bleeding can be controlled.
- The assessment of hypovolaemic shock is difficult during the early phase of major trauma care. The clearest signs of end-organ hypoperfusion include decreased urine output, acidosis, altered conscious state and elevated lactate level.
- In immediate trauma care aim for a blood pressure above 80-90 mmHg systolic, with a MAP of 50-60mmHg, until bleeding has been controlled in the setting of no clinical evidence of traumatic brain injury (TBI) (7). In the presence of likely TBI, GCS<8, a MAP of more than 80mmHg is recommended.



- Blood pressure goals for penetrating trauma or uncontrollable haemorrhage are generally lower than for blunt trauma in the absence of a major head injury. (SBP values less than 90 mmHg may be acceptable if cerebral perfusion is maintained – that is, if conscious state is normal.) Early consultation about such patients is required (7, 21, 22).

If possible, all blood/fluid administered to a major trauma patient should be warmed with a fluid warmer.

The main causes of shock in trauma patients are summarised below:

- Hypovolaemic shock – from obvious external blood loss or concealed internal blood loss.
 - External haemorrhage.
 - Chest – massive haemothorax.
 - Abdominal/pelvic cavities.
 - Retroperitoneum.
 - Femoral fracture.
- Obstructive shock – due to impaired filling or obstructed outflow to/from the heart.
 - Tension pneumothorax/haemothorax.
 - Pericardial tamponade.
- Cardiogenic Shock – direct trauma to cardiac tissue
 - Causes of obstructive shock in trauma include:
 - Ventricular rupture
- Distributive Shock – due to relative hypovolaemia, pathological redistribution of intravascular volume
 - Neurogenic shock, a subset of distributive shock, occurs due to loss of sympathetic vascular tone, which may occur in spinal lesions at or above the sixth thoracic vertebral level.

Crystalloid fluids

Initial treatment of hypovolaemia with crystalloid fluids (normal saline) is acceptable, however should be administered in small bolus volumes, targeting the permissive hypotension values, with an initial maximum volume of 1000-1500ml. If perfusion targets are not met, contact ARV for further support (7, 24).

Colloids

Colloids are not generally recommended in the early treatment of major trauma (7, 9).

Blood products

After initial resuscitation, administration of packed red blood cells (PRBC) is advised. If greater than two units of PRBC are required, specialist consultation is recommended via ARV to guide



ongoing resuscitation. The use of a balanced transfusion protocol (PRBC, plasma, platelets) is advised.

Where massive transfusion is required (more than five units of blood in under four hours), blood product administration should be guided by the *Critical bleeding massive transfusion guideline* published by the National Blood Authority (25). Urgent blood products can be organised for delivery via AV or the ARV team prior to departure.

Analgesia

Titrated narcotic analgesia is the initial approach to pain management in trauma. Intravenous administration is the most effective route. Administer as per local protocols and titrate to effect. Analgesia should be administered prior to wound or fracture care as treatment and dressing of wounds or fractures can be particularly painful.

Prophylactic antiemetic administration prior to transfer and retrieval is recommended.

Fractures and dislocations

Limb fractures - closed:

- Assess and record neurovascular status.
- Straighten/align the limb.
- Apply a splint in an anatomical position.
- Continue to regularly monitor neurovascular status.
- If neurovascular compromise is evident arrange an urgent orthopaedic consultation or retrieval/transfer.

Limb fractures - open:

- As per closed limb fractures above.
- Administer IV antibiotics (flucloxacillin or cephazolin).
- For grossly contaminated wounds or delayed presentation (more than eight hours) use piperacillin + tazobactam or ticarcillin + clavulanate (26). For patients with a penicillin allergy, consult ARV.
- Perform a simple emergency department wound cleanse by removing any easily identified foreign objects or contamination (do not actively wash out the wound).
- Apply a saline-soaked gauze dressing and bandage then leave it intact.
- Organise an immediate orthopaedic consultation or activate urgent transfer/retrieval.

Note: if definitive management occurs more than six hours after injury the likelihood of chronic infection is significantly increased, therefore **immediate** transfer to a destination where early definitive management can be undertaken is imperative.



Joint dislocation:

- Joint dislocation may be associated with a fracture or may be mistaken for a juxta-articular fracture – always obtain an x-ray before management.
- Neurovascular structures are at risk. Always assess and record the findings including time of injury.
- Reduce dislocated joints if possible and splint.
- Monitor the patient's neurovascular status after reduction.
- An open dislocation requires the same antiseptic precautions as an open fracture.
- Arrange immediate orthopaedic consultation.

Prevent hypothermia

Preventing hypothermia is a vital aspect of trauma care. It is important to maintain normothermia (27). Ensure the patient does not lose excess heat due to exposure or wounds. Ensure all wounds are covered.

Administer warmed IV fluids; cover the patient with extra warm blankets as well as keeping the room warm (a general guide is that if clinical staff are comfortable, it's likely to be too cold for a trauma patient). If available, the use of a forced air-warming machine is encouraged (27). Ensure wound care is attended to prior to commencement. Avoid moist dressings when using a forced air-warming machine due to evaporative cooling effects.

- Re-assess the patient and room temperature at regular intervals while awaiting the retrieval team.

In-dwelling catheter

A urinary catheter should be inserted, and urine output measured hourly. The desired urine output for adults is 0.5–1.0 mL/kg/hr. Consider utilising a leg bag for urine containment as this is easier to package and reduces the risk of pressure area development.

- A urinalysis should be performed also to check for blood. Discoloured, brown urine may indicate myoglobinuria, a sign of rhabdomyolysis.

Monitoring

Continuously monitor the heart rate, respiration rate, blood pressure, oxygen saturation and ETCO₂ at 15-minute intervals or more frequently if indicated. Utilise electronic monitoring if available. All monitoring should be continued and documented until the retrieval team arrives. A baseline ECG should be taken prior to transfer if time permits and facilities exist.

Glasgow Coma Scale

A focused neurological assessment using the Glasgow Coma Scale should be performed. This 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 the findings and reassess at frequent intervals.



Best response	Eye opening	Verbal response	Motor response
1	Does not open eyes	Makes no sounds	Makes no movements
2	Opens eyes in response to painful stimuli	Incomprehensible sounds	Extension to painful stimuli (decerebrate response)
3	Opens eyes in response to voice	Utters inappropriate words	Abnormal flexion to painful stimuli (decorticate response)
4	Opens eyes spontaneously	Confused, disoriented	Flexion or withdrawal to painful stimuli
5	N/A	Oriented, converses normally	Localises painful stimuli
6	N/A	N/A	Obeys commands

Pathology tests

Pathology tests should be taken for FBE (full blood examination), UEC (urea, electrolytes, and creatinine) and glucose. Bedside/point-of-care testing is useful. Serial blood gas assessment of pH and lactate levels provides good monitoring of tissue oxygenation, circulatory status, and response to resuscitation.

Coagulation studies and group and crossmatch should be taken if there is a high index of suspicion for major injuries requiring further care. Isolated results from single blood tests may be misleading and results should be considered in the context of the whole patient and trended results where available.

X-ray or FAST scan

Baseline chest, pelvis and lateral neck x-rays are performed in the primary survey or early secondary survey. Consider further diagnostic imaging if available and indicated. Do **not** transport an unstable trauma patient to an imaging facility unless absolutely essential.

- Consider the need for eFAST (Extended Focused Assessment with Sonography in Trauma) if available. eFAST is used primarily to detect the presence of fluid (presumed to be blood) in four areas – pericardial, perihepatic, perisplenic and pelvic. It is more accurate than any physical examination finding for detecting intra-abdominal injury. It should only be carried out by staff who have been trained to do so.
- In haemodynamically stable patients, eFAST is delayed until the secondary survey and is ideally performed by a second operator while the remainder of the secondary survey is completed.



Naso/orogastric tube (N/OGT)

All patients should be kept nil orally in the initial post-resuscitation phase of injury. The potential for a base of skull fracture in poly-trauma should be considered as a relative contraindication in the decision to insert an NGT (28). An OGT may be inserted following consultation and under direct visualisation.

Wound care

In a major trauma patient, early wound closure (pre-transfer) is not a priority.

- Remove gross contamination and irrigate the wound.
- Gain haemostasis through pressure and elevation where possible.
- Simple dressings with saline, gauze, combine and moderate compression bandages are generally adequate.
- Do not routinely administer antibiotics for wound care.
- Suture simple wounds if time allows.

Tetanus immunisation

Tetanus immunisation should be updated in the case of significant or contaminated wounds. Tetanus immunoglobulin should be given to patients who have not received a complete primary immunisation (29).

Antibiotics

Routine IV antibiotic administration is not recommended in major trauma, however, is indicated in open fractures (see limb fractures above).

Reassess

The importance of frequent reassessment cannot be overemphasised. Patients should be re-evaluated at regular intervals as deterioration in a patient's clinical condition can be swift. This will be evident in their vital signs and level of consciousness.

If in doubt, **repeat <C>ABCDE.**

9. Retrieval and transfer

It is important to note that an exhaustive clinical workup and intervention is not always necessary or appropriate prior to transfer. Stabilisation and ensuring life-threatening problems are addressed, as well as taking measures to prevent deterioration enroute, are essential aspects of early care. Delaying transfer to obtain laboratory results or imaging studies may delay access to definitive treatment. Often such studies must be repeated at the receiving facility regardless.

In liaison with ARV clinicians, interventions to stabilise the patient prior to retrieval personnel arriving should be commenced. ARV will coordinate the retrieval and will evaluate the practical and clinical needs involved in transferring the patient from the referral 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.



Adult Retrieval Victoria recommends the IMIST-AMBO method of handover for facilitating health professional communication and ensuring clarity and completeness (5).



10. Appendix 1: AGREE II Score Sheet – Early trauma care guideline

AGREE II Score Sheet: Early Trauma Care Guideline

Domain	Item	AGREE II Rating						
		1 <i>Strongly Disagree</i>	2	3	4	5	6	7 <i>Strongly Agree</i>
Scope and purpose	1. The overall objective(s) of the guideline is (are) specifically described.							X
	2. The health question(s) covered by the guideline is (are) specifically described.							X
	3. The population (patients, public, etc.) to whom the guideline is meant to apply is specifically described.							X
Stakeholder involvement	4. The guideline development group includes individuals from all the relevant professional groups.						X	
	5. The views and preferences of the target population (patients, public, etc.) have been sought.							X
	6. The target users of the guideline are clearly defined.							X
Rigor of development	7. Systematic methods were used to search for evidence.							X
	8. The criteria for selecting the evidence are clearly described.						X	
	9. The strengths and limitations of the body of evidence are clearly described.						X	
	10. The methods for formulating the recommendations are clearly described.						X	
	11. The health benefits, side effects and risks have been considered in formulating the recommendations.							X
	12. There is an explicit link between the recommendations and the supporting evidence.							X
	13. The guideline has been externally reviewed by experts prior to its publication.							X
Clarity of presentation	14. A procedure for updating the guideline is provided.							X
	15. The recommendations are specific and unambiguous.						X	
	16. The different options for management of the condition or health issue are clearly presented.							X
	17. Key recommendations are easily identifiable.							X

Domain	Item	AGREE II Rating						
		1 <i>Strongly Disagree</i>	2	3	4	5	6	7 <i>Strongly Agree</i>
Applicability	18. The guideline describes facilitators and barriers to its application.							X
	19. The guideline provides advice and/or tools on how the recommendations can be put into practice.							X
	20. The potential resource implications of applying the recommendations have been considered.							X
	21. The guideline presents monitoring and/ or auditing criteria.							X
Editorial independence	22. The views of the funding body have not influenced the content of the guideline.							X
	23. Competing interests of guideline development group members have been recorded and addressed.							X
Overall Guideline Assessment	1. Rate the overall quality of this guideline.	1 <i>Lowest possible quality</i>	2	3	4	5	6	7 <i>Highest possible quality</i>
Overall Guideline Assessment	2. I would recommend this guideline for use.	Yes	Yes, with modifications			No		
		X						



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