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 traumatic brain injury guideline provides 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 provides 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 effectively and confidently provide early care for critically injured patients. They provide up-to-date information for front-line healthcare clinicians. The guideline is evidence based, has followed the AGREE II methodology for guideline development and is under auspice of the Victorian State Trauma Committee (VSTC).

Clinical emphasis points:

- Traumatic brain injury is a significant cause of mortality in Australia.
- Primary and secondary insults can result in significant injury and early management to prevent further brain injury should begin at the scene.
- Minimising secondary brain injury is best achieved by avoiding periods of hypoxia or hypotension. Maintaining adequate ventilation and cerebral perfusion is essential.
- Early activation of the retrieval process is crucial once it is identified that the patient has suffered a major trauma.
• Time to definitive care at a neurosurgical specialist centre is crucial and ultimately may influence patient outcomes.
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.

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**Victorian State Trauma System Guideline**

**Traumatic Brain Injury**

Make early contact with ARV for advice from the major trauma services and to initiate retrieval.

**Key Points**

- **Prevention of secondary brain injury.**
  - It is essential to prevent secondary brain injury by maintaining oxygenation and cerebral perfusion.
  - Aim for:
    - SpO₂: 94 - 98%
    - ETCO₂: 35 - 40mmHg
    - Systolic BP > 110mmHg

- **Signs of deterioration**
  - Early:
    - Confusion
    - Vomiting
    - Agitation
  - Late:
    - Dilated pupils
    - Seizure activity
    - Decrease in GCS by 2 or more.
    - Cushing's response (tachycardia and hypertension).

**Management Considerations**

**Rapid deterioration:**

If there are clinical signs of deterioration and impending herniation, contact ARV for advice regarding what to initiate:

- Hyperventilate, aiming for an ETCO₂ of 30 mmHg. Monitor the response with ETCO₂, readings and or ABG.
- Consider decompressive maneuvers such as Mannitol 20% hypotonic saline.
- Emergency burr hole craniectomy may be necessary where time to definitive care is prolonged.

**Anticoagulation and head trauma:**

Patients on anticoagulants or hematoma treatment may deteriorate rapidly due to extension of their bleed. Reversal agents should be considered early.

- Contact haematologist via ARV.

**Anticoagulants**

- Phenprocoumon or Livarotracinam is indicated in the early stage following to severe TBI to reduce the incidence of seizures.

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**Early Activation**

- Gather vital information
- Activate Trauma Team
- Designate roles
- Set up to receive patient
- Ensure safety using PPE

**Primary Survey**

- **AIRWAY / C-SPINE**
  - Assess airway stability & protect as needed
  - Early intubation for GCS ≤8
  - Maintain full spinal precautions if suspected injury

- **BREATHING**
  - Identify & treat life threats
  - Assess RR, work of breathing, SpO₂, and symmetry
  - Oxygen therapy to maintain SpO₂: 94 - 98%
  - Aim for ETCO₂: 35 - 40mmHg if intubated

- **CIRCULATION**
  - Identify & control any bleeding
  - Insert x 2 large bore IV cannulas
  - Assess HR/Cap ReBil/EBP & aim for SBP ≥110mmHg
  - Initial management of hypovolaemia - crystalloid fluids, 20mL/kg

- **DISABILITY**
  - Assess level of consciousness - AVPU
  - Check pupils
  - Check BSL - Avoid hypoglycaemia
  - Log roll

- **EXPOSURE / ENVIRONMENT**
  - Fully expose patient
  - Ensure normothermia

- **ADJUNCTS**
  - FAST scan
  - X-rays: Chest, Pelvis
  - 12 lead ECG
  - Analgesia
  - Bloods - FBE, X-match, U&E, Lactate, ABG
  - Oesophageal tube if intubated
  - AMPLE pneumonic

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**Does patient meet potential major trauma criteria for inter-hospital transfer?**

- **N**
  - Manage cervical spine using NEXUS criteria
  - Obtain history & perform secondary survey
  - Monitor vital signs closely
  - GCS:3/3/2 & pupillary reaction
  - Observe in facility for at least 4 hours from time of injury
  - Provide required care, discharge and follow up as necessary

- **Y**
  - Notify ARV to conduct care assessment
  - Does patient meet potential major trauma criteria?
  - **N**
    - Perform complete trauma evaluation
    - Monitor vital signs closely for signs of deterioration
    - Frequently reassess ABCD
    - Imaging as required
    - Seek advice from ARV coordinators regarding treatment options
    - Make early contact if any deterioration in patient's condition occurs

- **Y**
  - Prepare patient for retrieval & definitive care
  - Perform interventions as necessary to stabilise patient prior to transfer
  - Avoid anticoagulants
  - Closely monitor vital signs, GCS and pupillary reaction
  - Ensure clear, accurate and concise documentation
  - If intubated, ensure adequate paralysis & sedation
  - Imaging as required if time and safety allows
  - Communicate with ARV any new clinical developments or significant deterioration
  - Communicate with & support family and friends

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**ARV**

**Adult Retrieval Victoria**

**1300 36 86 61 Statewide 24 hours**

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26/07/2017 | Version 2.0 | Not applicable to Paediatric patients | Contact us: Trauma.Victoria@ambulance.vic.gov.au
3. Introduction

Head injury is a common feature of major trauma and patients with a moderate or severe head injury have a higher mortality as well as a higher morbidity, with victims often being left with a permanent neurological disability. The percentage of major trauma patients who have sustained a serious head injury has remained consistent since 2011-12, and accounted for 6.8% of hospitalised major trauma patients in 2015-16 (State of Victoria, Department of Health and Human Services, 2017).

The mechanism of injury, however, has changed for this group of patients. Motor vehicle crashes accounted for 27.6% of severe head injuries in 2015−16 compared with 20.9% in 2011-12. The decrease in severe head injuries could be attributed to improvements in injury prevention including reduced speed limits, speed reduction campaigns and improved car design such as airbags and anti-lock braking systems. Pedestrians and pedal-cyclists comprised 17.6% of severe head injury cases in 2015−16 compared with 19.1% in 2011-12. In contrast the percentage of major trauma patients with a severe head injury sustained by elderly patients in a low-fall mechanism has increased from 17.3% in 2011–12 and to 15.8% in 2015−16 (State of Victoria, Department of Health and Human Services, 2017).

In patients with multisystem injuries, the head is the most frequently injured part of the body. Many incidents of traumatic brain injury (TBI) occur in rural areas where access to medical services is limited and a delay in definitive care may occur. It is important for health professionals working in these isolated areas to be aware of how to manage acute patients to prevent any secondary injury.

Patients presenting with TBI can be a challenging group to deal with. They are often confused and combative, which can make assessments and even the most basic clinical tasks difficult and time consuming.

TBI is generally classified according to the Glasgow Coma Scale (GCS). A GCS score of 13−15 is considered a mild injury; 9−12 is considered a moderate injury, and 8 or less as a severe TBI. The GCS is universally accepted as a tool for TBI classification because of its simplicity, reproducibility and predictive value for overall prognosis. However, its use may be limited by confounding factors such as intoxication and ongoing medical treatment such as sedation and/or paralysis.

There are two types of brain injury: primary and secondary.

**Primary injury** occurs at the moment of the traumatic incident and reflects the mechanical events in the brain at that instant. There may be gross disruption of brain tissue that is not preventable. Common mechanisms include direct impact, rapid acceleration/deceleration, penetrating injury and blast waves.

**Secondary injury** can occur minutes, hours, days or even weeks after the initial injury and the damage can be averted or lessened by appropriate clinical management. Causes of secondary brain injury include haematoma, contusion, diffuse brain swelling, systemic shock and intracranial infection.

Hypoxia and/or hypotension in a moderate to severely injured brain, even briefly, can have a harmful impact on outcome and survival. A single systolic blood pressure (SBP) of under 90 mmHg is associated with a 150% increase in mortality. Action to prevent secondary brain
injury must commence at the scene of the accident and continue through all stages of care. It is important to remember that this is not about complex, specialist care but about applying basic principles in support of the injured brain.

A patient who has suffered a severe head injury should be assessed and managed as a major trauma patient. Patients with TBI should be assumed to have a spinal fracture until proven otherwise and appropriate precautions taken to immobilise the spine until injury can be excluded. The aims of treatment are to prevent further brain injury, treat the underlying condition, minimise symptoms and optimise neurological and functional recovery.

4. Early activation

Emergency medical services should notify the receiving hospital that a trauma patient is on their way. This information may be crucial to the management of the 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** Mechanism of injury.
   - **I** Injuries found or suspected.
   - **S** Signs: respiratory rate, pulse, blood pressure, SpO₂, GCS or AVPU.
   - **T** Treatment given.

2. 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.

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 good 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. Designate roles and specific tasks to staff and maintain an approach based on teamwork.

5. Set up the trauma bay to receive the patient, including equipment checks, documentation, medications and resuscitation equipment.

If it is anticipated that transfer to an MTS will be required, early retrieval activation is essential (phone Adult Retrieval Victoria (ARV) on 1300 368 661).

- 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 the ARV coordinator, who can provide expert guidance and advice over the phone or via tele/videoconference and link to an MTS as required.
5. Primary survey

Use a systematic approach based on ABCDE⁶ to assess and treat an acutely injured patient. The goal is to manage any life-threatening conditions and identify any emergent concerns, especially in a neurotrauma patient who may present with other multisystem injuries.

**Airway with cervical spine protection**

**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, see-saw respirations).

Listen for any upper-airway noises, breath sounds. Are they absent, diminished or noisy? Noisy ventilations indicate a partial airway obstruction by either the tongue or foreign material.

**Assess for soiled airway**

Haemorrhage, vomiting and swelling from facial trauma are common causes of airway obstruction in patients with TBI. These should be removed with suction.

**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. Prolonged suctioning can lead to an increase in intracranial pressure (ICP) so be mindful to limit duration.
  - Insert an oropharyngeal airway (OPA) if required.

If the airway is obstructed, simple airway-opening manoeuvres should be performed as described above. Care should be taken to not extend the cervical spine.

**Caution:** Nasopharyngeal airways (NPA) should not be inserted in patients with a head injury in whom a base of skull fracture has not been excluded.⁷

**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 GCS <9 (severe TBI), unprotected airway, uncooperative/combative patient leading to distress or further risk of injury.
- Hypoventilation, hypoxia or a pending airway obstruction: stridor, hoarse voice.

Assist ventilation with a bag and mask while the airway clinician is setting up for intubation. It is vital that intubation is carried out by a person skilled in airway management. Intubation may cause a transient increase in ICP, which may lead to secondary brain injury. Attempts at
Intubation can also invoke hypoxia. Preference is given to performing a rapid sequence induction with sedation and paralysis.

*Maintain full spinal precautions if indicated*
Suspect spinal injuries in polytrauma patients, especially where TBI is involved. Ensure cervical collar, head blocks or in-line immobilisation is maintained throughout patient care.

**Breathing and ventilation**
Assessing for adequate ventilatory effort is essential in the early stages of TBI.

*Oxygen administration*
Administer oxygen to achieve oxygen saturations between 94-98%.

*Record the oxygen saturation (SpO₂)*
Adequate oxygenation to the brain is an essential element in avoiding secondary brain injury. Monitor the SpO₂ and maintain it between 94-98%. Saturations below this range is associated with poorer outcomes.

*Assess the chest*
Count the patient’s respiration rate and note the depth and adequacy of their breathing. Auscultate the chest for breath sounds and assess for any wheeze, stridor or decreased air entry. Be mindful that thoracic injuries may have also occurred.

**Circulation with haemorrhage control**

*Assess circulation and perfusion*
Check heart rate and blood pressure.

*Maintain an SBP greater than 110 mmHg in order to sustain cerebral perfusion and prevent further brain injury*¹⁰
A slow, forceful pulse may indicate intracranial hypertension and impending uncal herniation.

Inspect for any signs of external haemorrhage and apply direct pressure to any wounds. Consider the potential for significant internal bleeding related to the mechanism of injury, which may lead to signs and symptoms of shock.

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

Commence fluid resuscitation as indicated.

If signs of shock are present, establish a cause and treat aggressively with IV fluid to raise the blood pressure and improve cerebral perfusion. Hypotension is not generally associated with isolated head injury. If hypotension is present, identify the cause.
Disability: neurological status

Assess level of consciousness
An AVPU assessment (Alert, responds to Voice, responds to Pain, Unresponsive) should be completed along with a check of pupillary response and size. A more detailed neurological assessment using the GCS will be performed in the secondary survey.
Refer to Appendix 1: Adult neurological observations chart.

Test blood sugar levels
Ensure that any alterations in the patient’s level of consciousness are not related to a metabolic cause.

Exposure/environmental control
Remove all clothing from the patient and assess to ensure there are no other obvious, life-threatening injuries present.
Keep the patient normothermic through passive re-warming with blankets and a warm environment.

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 reassess the primary survey.
Cervical spine, chest and pelvic x-rays may be performed as part of the early assessment of a major trauma patient, where available and the patient condition allows.

History
Taking an adequate history from the patient, bystanders or emergency personnel of the events surrounding the injury can assist with predicting other damage that may have occurred. Emphasis should be placed on understanding the mechanism, initial level of consciousness and any concurrent injuries noted. Note any history of drugs or alcohol prior to and at the time of injury.
Use the AMPLE acronym to assist with gathering pertinent information:
A  Allergies
M  Medication (especially anticoagulants, antiplatelet agents etc.)
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 fractures. A detailed neurological examination forms an important part of the secondary survey and can assist with guiding management and assessing the need for transfer.

*Neurological assessment*

**Assess the patient’s level of consciousness**

A baseline GCS should be taken to accurately assess the patient’s neurological status. It is the universally accepted gold standard for assessing disturbances in a patient’s conscious state in the adult population. The best eye opening, verbal and motor response is taken and given a score out of 15. Limb response to commands or painful stimulation is used to detect asymmetry between the right and left sides. Differing levels of GCS determine the severity of the TBI, as mentioned earlier. Note whether the patient is agitated or combative.

**Assess the pupils**

Pupils should be examined for their response to light and their symmetry. Note if the reaction is brisk, sluggish or unreactive. A difference of greater than 1 mm is considered abnormal.

Document the findings on the observation chart and reassess frequently.

**Glasgow Coma Scale**

<table>
<thead>
<tr>
<th>Best response</th>
<th>Eye opening</th>
<th>Verbal response</th>
<th>Motor response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Does not open eyes</td>
<td>Makes no sounds</td>
<td>Makes no movements</td>
</tr>
<tr>
<td>2</td>
<td>Opens eyes in response to painful stimuli</td>
<td>Incomprehensible sounds</td>
<td>Extension to painful stimuli (decerebrate response)</td>
</tr>
<tr>
<td>3</td>
<td>Opens eyes in response to voice</td>
<td>Utters inappropriate words</td>
<td>Abnormal flexion to painful stimuli (decorticate response)</td>
</tr>
<tr>
<td>4</td>
<td>Opens eyes spontaneously</td>
<td>Confused, disoriented</td>
<td>Flexion or withdrawal to painful stimuli</td>
</tr>
<tr>
<td>5</td>
<td>N/A</td>
<td>Oriented, converses normally</td>
<td>Localises painful stimuli</td>
</tr>
<tr>
<td>6</td>
<td>N/A</td>
<td>N/A</td>
<td>Obeys commands</td>
</tr>
</tbody>
</table>
Head and face
Inspect the scalp. Look for any bleeding or lacerations. Do not probe the scalp and be cautious when examining as bone fragments and fractures may be present. Gently palpate for any depressions or irregularities in the skull. If a penetrating object remains lodged, do not remove it.

Lacerations can bleed profusely; control bleeding with direct pressure and bandaging. If this is not controlling the bleeding, consider temporary closure with staples or suturing. The wound will need to be thoroughly irrigated at a later stage.

Inspect the face. Look for any lacerations or bruising. Periorbital bruising and/or mastoid bruising is indicative of a base of skull fracture; however, mastoid bruising will only occur 12–24 hours post injury.12

Look in the eyes for any foreign body, subconjunctival haemorrhage with no posterior limit, hyphema, irregular iris, penetrating injury or contact lenses.

Assess the ears for any bleeding or blood behind the tympanic membrane, as well as any cerebrospinal fluid (CSF) leak.

Check the nose for any deformities, bleeding, nasal septal haematoma or CSF leak. If a CSF leak is present, do not pack the nose; apply a bolster. To determine whether any clear fluid is CSF, the easiest method is to sample the fluid onto filter paper: if there is a formation of two rings (the ‘halo’ sign) this indicates the presence of CSF. Glucose should also be detected in the fluid, helping to differentiate it from mucus.

Look in the mouth for any lacerations to the gums, lips, tongue or palate.

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

Test eye movements, vision and hearing.

Palpate the bony margins of the orbit, maxilla, nose and jaw.

Inspect the jaw for any pain or trismus.

Neck
Inspect the neck. Ensure another colleague maintains manual in-line stabilisation while the hard collar is removed and throughout the examination. Cervical fractures are an increased risk in patients with a head injury. Replace the cervical collar after examination of the neck.

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

Check the soft tissues for bruising, pain and tenderness.

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

The patient will need to be log rolled to complete the examination. This can be combined with the back examination.

Chest
Inspect the chest, observing movements. Look for any bruising, lacerations, penetrating injury or tenderness.

Palpate for clavicle or rib tenderness.
Auscultate the lung fields; note any percussion, lack of breath sounds, wheezing or crepitations.
Check the heart sounds: apex beat and the 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.
Check the pelvis. Gently palpate for any tenderness. **Do not spring the pelvis.** Any additional manipulation may exacerbate haemorrhage. Apply a binder if a pelvic fracture is suspected.
Auscultate bowel sounds.
Inspect the perineum and external genitalia.

Limbs
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, lacerations, muscle, and 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.

Back
Log roll the patient. Maintain in-line stabilisation throughout. Inspect the entire length of the back and buttocks noting any bruising and lacerations.
Palpate the spine for any tenderness or steps between the vertebrae.
Digital rectal examination should be performed only if a spinal injury is suspected. Note any loss of tone.

Buttocks and perineum
Look for any soft-tissue injuries such as bruising or lacerations.

Genitalia
Inspect for soft tissue injuries such as bruising or lacerations. Check the urethra for any bleeding. 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 as soon as it is identified that the patient meets the major trauma transfer criteria or may have sustained injuries beyond the clinical skill set of the hospital or urgent care centre. 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 referring health service, specialist clinical resources and an ARV consultant to discuss the best, timely management of the patient.

**Indications for ARV consultation and/or transfer to a major trauma service**

**Neurological deficits:**

- Deterioration of neurological status (two points on the GCS), seizures, increasing headache, new central nervous system signs.
- Persistence of headache, vomiting, confusion or other neurological disturbance (GCS 9–13) > 2 hours post admission; no fracture.
- GCS < 9 post resuscitation.

**Skull fracture:**

- Skull fracture with confusion, decreased conscious state, seizure, focal neurological signs (pupil inequality, change in reactivity such as dilated pupils, pupils unreactive on one side, hemiparesis of the limbs) or any other neurological signs and symptoms.
- Open skull fracture.
- Depressed skull fracture.
- Suspected base of skull fracture, for example, blood and/or clear fluid from the nose/ear, periorbital haematoma, mastoid bruising.

**Abnormal CT scan findings:**

- Intracranial haematoma.
- Cerebral swelling.
- Aerocele (a cavity or pouch swollen with air).
- Midline shift.

Patients who are on anticoagulants such as warfarin who sustain a TBI should also be discussed with ARV regarding transfer to a metropolitan neurosurgical service due to their increased bleeding susceptibility.

Isolated neurotrauma in older people

Patients over 65 years of age who have sustained their injury in a low (< 1 m) fall, and who present with isolated neurotrauma as described by the above criteria, may be referred via ARV for management at a metropolitan neurosurgical service (as an alternative to an MTS). Once it has been identified that the patient requires specialist services, arrangements can be made for transfer to a definitive neurosurgical centre for evaluation and management. This can occur concurrently with the stabilisation 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 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 en route and is referred to the correct facility.

8. Early management

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Traumatic Brain Injury
Intubation should occur if the patient is unable to maintain an adequate airway, oxygen saturation over 95% or has a GCS under 9. It is essential to avoid hypoxia and hypercapnia. Hyperventilation should be avoided, except in unusual circumstances in which prior consultation via ARV is advised. Aim to keep the end-tidal carbon dioxide (ETCO₂) reading around 35–40 mmHg. Blood gas analysis should be used to assist setting ventilation parameters (if available). ETCO₂ monitoring (if available) should also be used to assess respiratory status and the adequacy of ventilation. Always have emergency airway equipment by the bedside.

**CT scan/x-ray/FAST**

**CT scan**

CT scanning is the preferred method of imaging if available and should be performed early in the severe to moderate TBI group. Except for an uncomplicated minor head injury, ideally all patients with a significant head injury should have a CT scan. If it appears that the patient will require transfer to an MTS, the decision as to whether to conduct a CT prior to retrieval must be considered. In virtually all situations the CT scan will be repeated upon admission to the MTS, therefore whether the imaging will alter care in the early stages may be debatable. Any critical trauma patient must be very carefully monitored and attended while in the CT scanner.

Definite indications for CT scanning are:

- GCS under 9 after resuscitation.
- Neurological deterioration such as two or more points on the GCS; hemiparesis.
- Drowsiness or confusion (GCS 9–13 persisting > 2 hours).
- Persistent headache or vomiting.
- Focal neurological signs (pupil inequality, change in reactivity such as dilated pupils of unreactive on one side, hemiparesis of the limbs).
- Skull fracture – known or suspected.
- Penetrating injury – known or suspected.
- Age over 50 years following trauma due to increased risk of injury in the elderly.
- Post-operative assessment such as emergency burr hole evacuation.
- Seizures.
- Other risk factors such as chronic liver disease or the use of anticoagulants.

**X-ray**

Where CT facilities do not exist, the use of plain skull x-rays is controversial but may provide important information. They should not delay a retrieval consultation or transfer. If performed, the views required are lateral, anteroposterior and Towne’s and a view tangential to the point of impact to show a depressed fracture.

Ensure cervical spine x-rays or CT scans are performed.

**FAST**

Consider the need for FAST if available and if staff are trained in its use. In haemodynamically stable patients, FAST can be delayed until the secondary survey and is ideally performed by a second operator while the remainder of the secondary survey is completed.

**The intoxicated patient with head trauma**

Difficulties arise with accurate assessment of the GCS in patients who present with potential head trauma and intoxication due to alcohol or prescribed or illicit medications. The reliability of the GCS can be made problematic, particularly in the eye-opening component. Assuming that an altered conscious state is due only to intoxication is particularly risky and places the patient and clinician at risk.\(^15\)

CT imaging of the brain and cervical spine is recommended in all patients who are intoxicated and have signs of an injury to the head. Agitated patients with signs of head injury may require sedation and intubation to facilitate appropriate management with CT imaging. CT of the facial bones may also be required where there is evidence of facial injuries.

Intoxicated patients without signs of head injury should be observed until they are clinically not intoxicated. If there is still doubt in relation to a brain/spine injury at this stage based on clinical examination then CT imaging should be performed.

High-risk groups for intracranial injury include chronic alcoholics, older people and any patient on anticoagulation. These patients are at risk of missed chronic and acute on chronic subdural haematomas.\(^16\)

While these patients can be challenging to care for in the emergency department, it is vital to maintain close observation and prevent any further injury from occurring. Consultation with regional hospitals, trauma services or ARV may be appropriate to obtain advice or where necessary to arrange transfer or retrieval.

**Anticoagulation and head trauma**

Any patient who is taking an anticoagulant such as warfarin or other oral anticoagulants (dabigatran, rivaroxaban, apixaban) is at high risk of developing a significant intracranial
haemorrhage from minor head injury mechanisms. CT imaging of the brain should be performed on all patients with a history of head injury.

Platelet inhibitor therapy (aspirin (e.g. Astrix, Cartia), dipyridamole (Asasantin, Persantin), clopidogrel (Iscover, Plavix), prasugrel (Effient), ticagrelor (Brilinta)) also increases the risk for haemorrhagic injuries but to a lesser degree.

These patients often have significant comorbidities also, all of which will have a direct impact on surgical and intensive care decision making and treatment. The effects of anticoagulation and antiplatelet drugs may require their reversal, with consideration of the risks of exacerbation of the underlying condition.

Where intracranial haemorrhage is present, patients on anticoagulation medication may deteriorate because of extension of their bleed leading to mass effect, brain compression and herniation. In these patients, reversal of medications should be commenced with appropriate reversal agents. Consultation with ARV should take place prior to administration.

For immediate reversal of anticoagulation in patients with bleeding due to warfarin, prothrombin complex concentrates (Prothrombinex-VF in Australia) are preferred over fresh frozen plasma (FFP). The dose for prothrombin complex concentrates is 35–50 units/kg IV. This aims to achieve complete reversal of an excessive INR within 15 minutes. The dose for life-threatening bleeding should be the maximum 50 units/kg.\(^1\)

Fresh frozen plasma (FFP) is not routinely needed in combination with prothrombin complex concentrates (PCC) unless there is life-threatening bleeding. If life-threatening bleeding is present the dose of FFP is 150–300 mL by IV infusion. Where Prothrombinex-VF is unavailable the dose for FFP is 15 mL/kg IV infusion. Time is required for determining the patient’s blood type (or use group AB plasma), thawing of the product and subsequent infusion.

Vitamin K is essential for sustaining the reversal achieved by PCC or FFP. IV administration produces a more rapid response than oral administration in the short term. The dose is 5–10 mg IV.

Specialist haematological advice should be sought for guidance on reversal of anticoagulation due to new novel anticoagulants such as dabigatran, rivaroxaban and apixaban. For such patients, consult with MTS emergency, trauma and haematology staff via ARV.

Idarucizumab is a monoclonal antibody fragment which binds free and thrombin-bound dabigatran and neutralises its activity, resulting in complete reversal of the anticoagulant effect. Its effect is immediate and lasts for 24 hours\(^1\).

The complete dose of 5g should be given as two consecutive IV infusions over 5-10 minutes each. As it is a fairly new drug on the scene, its availability is limited and in Victoria is only located at The Alfred and Royal Melbourne Major Trauma Services (MTS). In consultation with ARV and the MTS, there may be the possibility of prearranged reversal agents being taken to site for administration by retrieval staff in urgent situations.
**Patient positioning**

In the initial acute resuscitation it is best to maintain the patient in a supine position. If there is a delay in transferring the patient to a metropolitan neurological service and the patient has an adequate volume and hypotension is not an ongoing problem, nor are there concerns for thoracolumbar injury then consideration can be given to adjusting the position. Elevating the head of the bed by 30% while maintaining a neutral spine alignment has been shown to reduce ICP without significantly changing cerebral blood flow.\(^{19}\) It also aids in promotion of venous drainage.

**Seizure Prophylaxis**

Anticonvulsants are indicated in the early stages following moderate to severe TBI in order to reduce the incidence of seizures. Recurrent seizures may increase ICP as well as place a large metabolic demand on damaged brain tissue that in turn may aggravate secondary brain injury. Effectiveness in reducing seizure activity has been shown up to the first week post injury.\(^{20}\)

Phenytoin is recommended to decrease the incidence of early post traumatic seizures (within 7 days of injury) when the overall benefit is thought to outweigh the complications of such treatment. At the present time there is insufficient evidence to recommend Levetiracetam (Keppra) compared with Phenytoin regarding efficacy in preventing early post traumatic seizures and toxicity.\(^{21}\)

In patients with prolonged seizures, midazolam or diazepam should be administered in addition to phenytoin. Ongoing seizure activity increases the likelihood of secondary brain injury.

**Pathology tests**

In a ventilated patient, arterial blood gasses (ABG) provide important information, especially in an intubated patient. Ventilation targets should be based on blood gas analysis and adjusted accordingly, aiming for a PaCO\(_2\) of 35–40 mmHg and a SaO\(_2\) 94-98%.

Lab tests should be taken for FBC (full blood count), UEC (urea electrolytes and creatinine) and glucose as a baseline. Consider taking a group and cross-match as well if the patient is involved in a trauma presentation with a high index of suspicion for further injuries. Coagulation studies should be done if there is a possibility of intracranial haemorrhage or if the patient is on anticoagulation.

**Thermoregulation**

Prevention of thermal extremes is the goal in initial management of TBI. A rise in core body temperature is common in the first few days after injury, which can then increase the likelihood of secondary brain injury due to a rise in ICP and carbon dioxide production. Hypothermia should also be avoided as it may aggravate acute traumatic coagulopathy. Recent studies have looked at induced mild hypothermia (32–35 °C) in severe TBI, cooling the patient as soon as possible post presentation to the emergency department.
Hypothermia may be beneficial for an injured brain as it may be neuroprotective and assists in reducing ICP and cerebral metabolic demands. At this point, there is no conclusive evidence to support its mainstream use and trials are currently underway.

**Analgesia**
For patients suffering a head injury, analgesia should be carefully considered. The drug of choice will be considerate upon clinical signs, the need for analgesia and the provider’s skilled decision making. When using opiates it is important to adequately monitor the patient’s neurological status; titrate the dose so it is effective in pain management but also so that it does not make determining the GCS almost impossible. Short-acting agents are the best choice; avoid continuous infusions at this stage. Pupil size and reactivity can be affected by the administration of opiates and barbiturates, therefore they become unreliable. When assessing GCS keep this in mind.

Providing a dark and quiet environment can also help an agitated patient though this is not often able to be achieved in the emergency environment.

Consider antiemetics at this stage, especially if transfer and retrieval is likely.

**Sedation**
Drowsy, confused or agitated TBI patients should not be sedated in the initial resuscitation. It makes assessment of their GCS difficult and can alter their response to examination, complicating assessment and diagnosis.

In a ventilated patient, however, paralysis and sedation are essential to management. Appropriate sedation may lower ICP by reducing metabolic demand. Further beneficial effects of sedation include a reduction in hypertension and tachycardia as well as improved patient–ventilator synchrony. Propofol has become a widely used sedative with neurological injuries as it has a rapid onset and short duration of action that allows the provider to evaluate the neurological response when required. It has been shown to depress cerebral metabolism and oxygen consumption, therefore having a neuroprotective effect.

**Monitoring**
SBP should remain above 110 mmHg and Sp02 between 94-98% to avoid secondary brain injury. Monitoring of the heart rate, respiration rate, blood pressure and oxygen saturation should take place at 15-minute intervals or less if indicated. All monitoring should be maintained until the retrieval team arrives. A baseline ECG should be taken if time permits and facilities exist prior to transfer.

**Wound care**
Initial management of the wound in the emergency department is aimed toward controlling bleeding with either bandaging or direct external pressure. If bleeding is unable to be controlled, then stapling or suturing the wound may be required as a form of temporary closure. Discussion with ARV and a neurosurgical specialist should take place to guide treatment.
In a patient with a moderate to severe TBI with an open wound, it is best to leave definitive treatment to the care of the neurosurgical facility upon transfer. The wound will require exploration and debridement.

**In-dwelling catheter**
A urinary catheter should be inserted in the patient with a severe head injury and urine output measured hourly. A urinalysis should be performed also to check for blood. The desired urine output for adults is 0.5–1.0 mL/kg/hr.

**Nasogastric tube**
All patients should be kept nil orally in the initial post-resuscitation phase of injury. The placement of a nasogastric tube in head injury cases is controversial due to the risk of possible intracranial insertion. In suspected base of skull fractures or with any maxillofacial injuries, insertion should be avoided until the patient is transferred to the neurosurgical centre. Alternatively, an orogastric tube can be placed under careful direct visualisation.

**Tetanus immunisation**
Tetanus prophylaxis should be administered in any penetrating brain injury patients.23

**Antibiotics**
Antibiotic prophylaxis should occur in all cases of open and penetrating injuries as well as when there is suspicion of any base of skull fractures. The risk of local wound infections is particularly high in patients with a penetrating injury due to the presence of contaminated foreign objects such as skin, hair and bone fragments.24 The prophylactic use of antibiotics where there is a CSF leak leading to possible meningitis remains controversial. Consultation with the ARV clinicians and neurosurgical specialists is advised.

**Steroids**
Studies have determined that steroids should no longer be used in the acute management of TBI.

**Reassess**
The importance of frequent reassessment cannot be overemphasised. Deterioration in a patient’s neurological status can be swift, leading to devastating further secondary brain injury if not caught in time. Patients should be re-evaluated at regular intervals as guided by the clinician. GCS ideally should be performed every 15/60 in moderate to severe head injury cases. If in doubt about any aspect of patient care, repeat ABCDE.

**Additional management points for the rapidly deteriorating patient**
The Neurosurgical Society of Australasia maintains a set of recommendations for managing a deteriorating patient in remote and rural locations. Treatment guidelines are based on time to definitive care and have been adapted for use.
If considering the below, contact ARV to speak with a trauma service and neurosurgical specialist for advice.

Each of the above recommendations will be discussed in the following section.

Assume brainstem herniation
Assume brainstem herniation in an unresponsive (comatose) patient with:
- Bilateral dilated unresponsive pupils or unilateral dilated unresponsive pupils and
- Abnormal extension (decerebrate posturing) or no motor response to painful stimuli.

If signs of herniation
Hyperventilate at a rate of 20 breaths per minute, aim for an ETCO$_2$ of 30 mmHg. Monitor the response with ETCO$_2$ readings or ABG.

Hyperventilation
Hyperventilation to a PaCO$_2$ of 30 mmHg helps lower ICP by causing cerebral vasoconstriction and lowering cerebral blood flow. Prolonged hyperventilation may actually produce cerebral ischemia and so it should be used in moderation and for as short a duration as possible. This therapy can be instituted by a doctor in situations where impending uncal herniation is present. Ideally, consultation via ARV with a trauma service and neurosurgeon prior to hyperventilation therapy is recommended.

Osmotherapy
Intravenous solutions that exert an osmotic effect, such as mannitol 20% and hypertonic saline solution (> 1.5%); have been the mainstay of treatment for many years. Cautious use of these therapies is advised and should only be considered as a rescue intervention when signs of herniation are present or rapid neurological deterioration is evident. There is little evidence at this stage to state which therapy has a better outcome in patients with severe TBI. The decision as to which treatment is used may reflect the availability of each and the preference of the specialist neurosurgeon.

Mannitol 20%: This should be administered at a dose of 0.25–1 g/kg given intravenously as a bolus over 20 minutes. Its effect will be exerted in around 20–40 minutes. Monitoring of fluid balance as well as renal function is important. Be aware that it can cause a precipitous drop in blood pressure once administered and the patient may require inotropic support to maintain a SBP > 110 mmHg.

Hypertonic saline: This may be used as an alternative to mannitol. Administer at a dose of 6–8 mL/Kg of 3% solution or 4 mL/Kg of 7.5% solution, given as a bolus. As above, close monitoring of output, serum sodium and blood pressure should be undertaken.

A large IVC should be inserted as well as an In–dwelling catheter in order to closely monitor fluid output and response to therapy.

Burr hole evacuation
Emergency burr hole craniotomy may be necessary where time to definitive care is prolonged. This procedure is especially important in a patient who is rapidly deteriorating and does not respond to non-surgical measures.

The decision to conduct burr hole evacuation is based on:
- Estimated transfer time.
- Clinical state – level of consciousness, pupillary size and light reflex.
- Rate of deterioration.
- CT scan (if available) or x-ray of skull.
- Level of surgical experience and range of neurosurgical equipment available at the regional hospital.
- Further guidance and a step-by-step procedure can be found in the resources section under *The management of acute neurotrauma in rural and remote locations*.

### 9. Retrieval and transfer

Transfer and retrieval response will be managed according to patient need following clinical consultation.

It is important to note that an exhaustive clinical workup and interventions are not always necessary or appropriate prior to transfer. Stabilisation and ensuring life-threatening problems are addressed, as well as taking 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. Often such studies must be repeated at the receiving facility.

Hospitals with neurosurgical facilities should manage neurotrauma patients requiring critical care support. All health services are advised to avoid patient deterioration during inter-hospital transfer by the timely and proactive movement of such patients to an MTS. Currently in Victoria, trauma neurosurgical specialist facilities are located at the Royal Melbourne, the Royal Children’s and The Alfred hospitals.

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 practicality and clinical needs involved in transferring the patient from the source hospital. Once retrieval staff arrives 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.

DHHS recommends the IRMIST-AMBO method of handover for facilitating health professional communication and ensuring clarity and completeness.
10. **Appendix 1: Adult neurological observations chart**

<table>
<thead>
<tr>
<th>RECORD No.</th>
<th>NEUROLOGICAL OBSERVATION CHART</th>
<th>DATE</th>
<th>TIME</th>
<th>EYES CLOSED BY SWELLING C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LOCUS</strong></td>
<td>Spontaneous</td>
<td></td>
<td></td>
<td>Eyes closed by swelling C</td>
</tr>
<tr>
<td></td>
<td>To speech</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>To pain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>None</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>COMA SCALE</strong></td>
<td>Oriented</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Confused</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inappropriate words</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Incomprehensible sounds</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>None</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>BASE RESPONSE</strong></td>
<td>Obey commands</td>
<td></td>
<td></td>
<td>Usually record the best arrival response</td>
</tr>
<tr>
<td></td>
<td>Localise pain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Flexion to pain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Extension to pain</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| + | 1 | 240 | 310 | 380 |
| - | 2 | 230 | 220 | 210 |
|   | 3 | 210 | 200 | 190 |
|   | 4 | 180 | 170 | 160 |
|   | 5 | 150 | 140 | 130 |
|   | 6 | 120 | 110 | 100 |
|   | 7 | 100 | 90  | 80 |
|   | 8 | 70  | 60  | 50 |
|   | 9 | 50  | 40  | 30 |
|   | 5 | 30  | 20  | 10 |

<table>
<thead>
<tr>
<th>PUPILS</th>
<th>Right</th>
<th>Size Reaction</th>
<th></th>
<th>Left</th>
<th>Size Reaction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>LIMB MOVEMENT</th>
<th>Arms</th>
<th></th>
<th>Legs</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal power</td>
<td>Mild weakness</td>
<td>Severe weakness</td>
<td>Spastic flexion</td>
<td>Extension</td>
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</tbody>
</table>
### 11. Appendix 2: AGREEII Score Sheet – Traumatic Brain Injury Guideline

<table>
<thead>
<tr>
<th>Item</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scope and purpose</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>The overall objective(s) of the guidelines were clearly described.</td>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td>X</td>
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</tr>
<tr>
<td>The health question(s) covered by the guidelines were clearly described.</td>
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<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>The population/patient group(s) for whom the guidelines should apply were clearly described.</td>
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<tr>
<td>The methods used to search for evidence were clearly described.</td>
<td></td>
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<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>The strengths and limitations of the body of evidence were clearly described.</td>
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<td></td>
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<td></td>
<td></td>
<td>X</td>
<td>X</td>
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<tr>
<td>The criteria for selecting the evidence are clearly described.</td>
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<td>X</td>
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</tr>
<tr>
<td><strong>Stakeholder involvement</strong></td>
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<td>X</td>
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<tr>
<td>The views and preferences of the target population or patient group(s) have been systematically considered.</td>
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<tr>
<td>The views and preferences of other relevant groups have been systematically considered.</td>
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<tr>
<td><strong>Quality of development</strong></td>
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<td>X</td>
</tr>
<tr>
<td>The methods for formulating the recommendations were clearly described.</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>The health benefits, side effects and risks have been clearly considered in formulating the recommendations.</td>
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<td></td>
<td></td>
<td>X</td>
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</tr>
<tr>
<td>The recommendations are specific and measurable.</td>
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<td>X</td>
<td>X</td>
</tr>
<tr>
<td>The recommendations are feasible.</td>
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<tr>
<td>The recommendations are acceptable.</td>
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<td>X</td>
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<tr>
<td>The recommendations are balanced.</td>
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<td>X</td>
<td>X</td>
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<tr>
<td>The recommendations are limited to what is known.</td>
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<td></td>
<td></td>
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<td>X</td>
<td>X</td>
</tr>
<tr>
<td>The gaps in the evidence are clearly identified.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>The recommendations have been externally reviewed by experts prior to publication.</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>The recommendations have been internally reviewed by a multidisciplinary group.</td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<td>X</td>
<td>X</td>
</tr>
<tr>
<td>The authors have explained how the guidelines have been developed.</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>The process for updating the recommendations is described.</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>The implementation of the guidelines is clearly described.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>The guidelines are clearly presented.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>The different options for management of the condition or health issue are clearly presented.</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td>X</td>
<td>X</td>
</tr>
<tr>
<td>The guidelines are easy to identify.</td>
<td></td>
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<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

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**Note:** The score sheet provides a framework for assessing the quality of guidelines. Each item is rated on a scale from 1 (Not Adequate) to 7 (Strongly Agree), with specific criteria for each rating. The table above is a simplified version to illustrate the structure and evaluation criteria.
<table>
<thead>
<tr>
<th>Domain</th>
<th>Item</th>
<th>AGREE II Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applicability</td>
<td>16. The guideline describes facilitators and barriers to its application</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>17. The guideline provides advice and/or options on how the recommendations can be implemented</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>20. The guideline presents monitoring and auditing criteria</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>21. The guideline presents monitoring and auditing criteria</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>23. The organization took into account the context of the guideline</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>24. The organization took into account the context of the guideline</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>25. The overall quality of this guideline</td>
<td>2</td>
</tr>
<tr>
<td>Overall Guideline Assessment</td>
<td>1. Rate the overall quality of this guideline.</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>2. I would recommend this guideline for use</td>
<td>2</td>
</tr>
</tbody>
</table>
12. References


14 Victorian State Trauma Registry Focus Report. Elderly Major Trauma Patients. VSTORM. Nov 22, 2012


