Trauma

- Abdominal trauma
- Burns
- Chest injuries
- Crush injury
- Electric shock
- Eye injury
- Fluid injection injury
- Hypovolaemic shock
- Limb injury
- Pain management
- Pelvic injury
- Post submersion
- Pre-hospital trauma by-pass
- Spinal injury
- Taser® incidents
- Trauma in pregnancy
- Traumatic brain injury (TBI)
Penetrating and blunt trauma to the abdomen can produce significant and life-threatening injuries. Many abdominal injuries may appear insignificant, making it extremely difficult to predict severity. The close proximity of organs within the torso makes distinguishing between abdomen, chest and pelvic injuries difficult. Associated injuries outside that cavity should be considered in all patients.[1]

**Blunt abdominal trauma**

Blunt trauma results in compression and shearing forces injuries. Compression forces are those that result in abdominal organs and blood vessels being crushed between solid objects. Shearing forces cause tearing and rupture of solid organs and blood vessels at multiple sites.

**Penetrating trauma**

The extent of vessel and organ damage, including haemorrhage, due to penetrating trauma is dependent on the mechanism (e.g. stab wound vs gunshot wound). Many of these patients will require formal surgical exploration and repair. Apparently small entry wounds may mask significant internal injury.[2]

Regardless of the mechanism, catastrophic deterioration can develop quickly and unexpectedly. All penetrating injuries despite the assessed level of penetration, or actual size of the wound, should be treated as serious and potentially life threatening.

**Children**

Due to their physique, children are particularly susceptible to abdominal trauma. In comparison to adults, their relatively large abdomen is poorly protected by lower ribs and pelvis and children may present with few external signs of trauma.[3]

### Clinical features

Features may be obvious but in some presentations unexplained shock may be the only sign of severe abdominal trauma.[2] Signs and symptoms include:

- ALOC
- Dyspnoea
- Abdominal pain/discomfort, guarding and tenderness on palpation
- Hypovolaemic shock
- Abdominal bruising (Cullen’s sign and Grey Turner sign), distension (can be a late sign and difficult to determine)
- Shoulder tip pain (Kehr’s sign)

### Risk assessment

- Significant abdominal injuries may present with little external evidence of trauma or a trivial pattern of injury and or mechanism.[1]
- Fluid resuscitation – minimal fluid therapy to achieve a systolic BP 90 mmHg or perfusion of vital organs[4]
- Refer to specific CPG for abdominal trauma in head-injured or pregnant patient.

### Additional information

- Pattern bruising such as Cullen’s and Grey Turner’s sign may take hours or days to develop.
- Trauma that presents with eviscerated bowel should be covered with moist sterile pads or cling wrap.
Pregnant patient: Manage as per CPG:
- Trauma in pregnancy

Standard Cares

Shocked?

- IV access
- Analgesia
- Antiemetic
- FAST
- Maintain normothermia
- Manage any other injuries concurrently

Shocked with TBI?

Consider:
- IV access
- IV fluid (SBP 100–120 mmHg)
- Pelvic binder
- FAST
- Blood

Transport to hospital
Pre-notify as appropriate

Note: Officers are only to perform procedures for which they have received specific training and authorisation by the QAS.
Clinical features

Depth of burn

Accurate burn-depth assessment can be difficult, as most burns usually have a mixture of different depths. Burn depth assessment has implications in guiding treatment, but lengthy assessment in the pre-hospital setting is not required.

<table>
<thead>
<tr>
<th>Depth</th>
<th>Appearance</th>
<th>Sensation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superficial</td>
<td>Erythema, brisk cap refill</td>
<td>Painful</td>
</tr>
<tr>
<td>Superficial dermal</td>
<td>Moist, reddened with blisters, brisk cap refill</td>
<td>Painful</td>
</tr>
<tr>
<td>Deep dermal</td>
<td>White slough, reddened and mottled, sluggish or absent cap refill</td>
<td>Painful</td>
</tr>
<tr>
<td>Full thickness</td>
<td>Dry, charred, whitish Absent cap refill</td>
<td>No Pain</td>
</tr>
</tbody>
</table>

Risk assessment

Ensure safety for self and bystanders.

**Life threats**

Respiratory compromise can manifest quickly in airway and inhalational burns. Early endotracheal intubation is required to ensure airway patency.

Consider the possibility of an airway or inhalational burn if there is the presence of:

- Facial/oral burns
- Singed nasal hair
- Carbonaceous sputum
- Tachypnoea, stridor, hoarseness

Hypovolaemia does not manifest from burns acutely but develops over many hours. The presence of circulatory shock in the early stages of a burn implies an associated injury (e.g. blast injury).

Features of carbon monoxide and cyanide toxicity should be sought if the patient was trapped in an enclosed fire with the potential for significant smoke inhalation.

Circumferential burns to the torso may restrict ventilation, requiring urgent surgical intervention.

**Limb threats**

Deep dermal and full thickness burns cause inelastic dead tissue, referred to as eschar. Circumferential burns may compromise limb vascular supply leading to ischaemia if untreated. Limbs with circumferential burns are at risk of vascular compromise.
**Estimation of surface area affected**

The total area burnt can be estimated with the rule of nines, or the more complicated, but more accurate, Lund Browder burn chart.[6] Do not include skin with just isolated erythema. The area over the patient’s palm can also be used to approximate 1% body surface area. Rule of nines and Lund Browder burn chart estimation charts are below:

![Figure 1 – Rule of nines](image1)

![Figure 2 – Lund Browder chart](image2)

<table>
<thead>
<tr>
<th>AREA</th>
<th>AGE 0</th>
<th>AGE 1</th>
<th>AGE 5</th>
<th>AGE 10</th>
<th>AGE 15</th>
<th>ADULT</th>
</tr>
</thead>
<tbody>
<tr>
<td>A: half of head</td>
<td>9.5</td>
<td>8.5</td>
<td>6.5</td>
<td>5.5</td>
<td>4.5</td>
<td>3.5</td>
</tr>
<tr>
<td>B: half of one thigh</td>
<td>2.75</td>
<td>3.25</td>
<td>4</td>
<td>4.5</td>
<td>4.5</td>
<td>4.75</td>
</tr>
<tr>
<td>C: half of one leg</td>
<td>2.5</td>
<td>2.5</td>
<td>2.75</td>
<td>3</td>
<td>3.23</td>
<td>3.5</td>
</tr>
</tbody>
</table>
**Additional information**

- Burns requiring management in dedicated burns unit\(^b\)
  - Partial thickness burns > 20% all ages or > 10% in < 10 year old and > 50 year old
  - Full thickness burns > 5%
  - Burns involving face, eyes, ears, hands, feet, genitalia, perineum or overlying a major joint
  - All inhalational burns
  - All significant electrical burns
  - Burns in people with significant co-morbidities (e.g. heart failure)

- IV fluids should not be administered to patients with significant facial, neck or upper chest burns with high potential for airway or ventilation compromise before the airway is formally secured at hospital. Large amounts of fluids increase the risk of interstitial oedema and tissue swelling, potentially increasing the difficulty of endotracheal intubation.\(^s\)

- Hypothermia must be avoided in major burn injury.\(^s\)

- In the paediatric population, consider non-accidental injury as a mechanism for burn injuries.\(^s\)

- Escharotomies are surgical incisions through burnt eschar to release tissue pressure in circumferential limb or thoracic burns. They are best performed in hospital by electrocautery as the wounds tend to bleed. They may be necessary in the pre-hospital environment in situations where there is imminent limb or ventilatory compromise.\(^s\)
Standard Cares

Evidence of airway burn, inhalation injury or circumferential thoracic?

- Yes
  - Consider:
    - Oxygen
    - IPPV
    - Early airway assessment

- No
  - Haemodynamically unstable?
    - Yes
      - Consider:
        - Other injury (e.g. blast, cyanide toxicity)
        - IV fluid
        - Continue to reassess airway
    - No
      - Pain?
        - Yes
          - Consider:
            - Active cooling (first 20 min only)
            - Analgesia
            - Midazolam
            - Ketamine
        - No
          - Protect against hypothermia
            - Consider:
              - Active cooling (first 20 min only)
              - Cling wrap
              - Burnaid dressing only if < 10% BSA kids, < 20% BSA adult

- Transport to hospital
  - Pre-notify as appropriate

Note: Officers are only to perform procedures for which they have received specific training and authorisation by the QAS.
Half of all trauma deaths have some form of chest injury. Although most thoracic trauma in Australia results from blunt forces,\(^1\) penetrating injuries are on the increase.\(^2\)

Life threatening injuries may not be initially apparent and the mechanism of injury is important in guiding further investigation (e.g. rib fractures suggest significant force with possible underlying organ damage). Lack of obvious fractures doesn’t exclude injury especially in a paediatric patient.

**Clinical practice guidelines**

**Clinical features**

- Depends on mechanism, injuries sustained
- Penetrating trauma:
  - entry and exit wound
  - external bleeding may be evident
- Blunt trauma:
  - contusion/abrasion
  - haemotoma
  - obvious rib fracture

**Signs suggesting life-threatening conditions:**

- Unequal air entry and/or crackles
- Asymmetrical or paradoxical chest wall movement
- Surgical emphysema
- Chest hypomobility
- Bubbling or sucking wounds
- Extreme tachypnoea
- Tracheal shift
- Hypotension
- Altered conscious state
- Jugular venous distension
- Muffled heart sounds
- Cardiac dysrhythmias.

**Risk assessment**

- Over-zealous IPPV may precipitate a tension pneumothorax, especially in an intubated patient.\(^3\)
- Chest pain in trauma can be due to ischaemia, but blunt trauma to the heart can precipitate ECG changes as seen in myocardial contusion.\(^4\)
- Consider the possibility of cardiac arrest after trauma.
- Penetrating trauma to thorax may appear minor, but life-threatening injury can be sustained (e.g. aortic or ventricular laceration, pneumo or haemothorax). All wounds are treated as life threatening no matter the size or perceived depth.

**Additional information**

**Common features:**

- pleuritic pain, shallow respirations and postural splinting
- reduced or absent breath sounds (pneumothorax), crepitus/subcutaneous emphysema
- hypoxia, tachypnoea
Standard Cares

Signs of tension pneumothorax?

Y

Thoracic decompression:
- Needle
- Pneumocath
- Thoracostomy

N

Shock?

Y

Stabilise mechanical injuries
Manage as per CPG:
- Shock

N

Consider:
- Oxygen
- IV access
- Analgesia
- Antiemetic
- IV fluid
- Stabilise mechanical injuries
- FAST

Transport to hospital
Pre-notify as appropriate

Note: Officers are only to perform procedures for which they have received specific training and authorisation by the QAS.
Crush injuries include simple crush injury, compartment syndrome and crush syndrome. There are many causes ranging from isolated limb injuries, multisystem trauma, envenomation, drug and toxin exposure, heat stroke, burns and some bacterial/viral infections.[1]

**Crush injury** – localised tissue injury that occurs when a compressive force is applied.[2]

**Compartment syndrome** – compromised perfusion to tissues within an anatomical compartment due to increased pressure within that compartment. Left untreated, this can lead to tissue necrosis, permanent impairment and crush syndrome.[3]

**Crush syndrome** – is a systemic condition that results from injuries sustained by compressive forces sufficient in duration and pressure to cause widespread ischemia and necrosis to soft tissue.[4] Ischaemia of the muscle leads to increased permeability of cell membranes and the release of potassium, enzymes, and myoglobin into the systemic circulation. Crush syndrome is characterised by rhabdomyolysis, lactic acidosis, hyperkalaemia, renal failure, shock, dysrhythmias and death.[4]

The development of crush syndrome is TIME and PRESSURE dependent. Crush syndrome can develop over a short time period where the compressive force is large and, conversely, over long periods where compressive forces are relatively small.[1]

**Clinical features**

Common presentations of compartment and crush syndrome:
- Fracture (especially tibial),[5] severe soft-tissue injury, prolonged limb compression
- Fluid infusion, arterial puncture and haemorrhage
- Envenomation
- Electric shock/burns
- Surgical repair of muscle hernia
- Constriction by casts, circumferential dressings, clothing

Co-morbidities associated with increased risk:
- Diabetes
- Hypothyroidism
- Bleeding disorders/anticoagulation

**Compartment syndrome** is characterised by:[6]
- Palpable tension or swelling of an anatomical compartment
- Pain disproportionate to the injury
- Pain on passive stretching of muscles within the anatomical compartment
- Paraesthesia of skin and paresis of muscles supplied by nerves traversing the compartment
- Pallor of skin over the compartment
- Pulses diminishing as the condition develops is common, but normal peripheral pulses and capillary filling is not uncommon.
**Clinical features (continued)**

*Crush syndrome* is characterised by:[1]

- Compartment syndrome
- Haemodynamic instability
- Reperfusion injuries leading to:
  - Lactic acidosis and hyperkalaemia
  - Dysrhythmias
  - Myoglobinemia leading to renal failure
- Shock
- Hypothermia

**Risk assessment**

- Compressive force removal:[2]
  - Anticipate the development of crush syndrome following removal of compressive force.
  - Anticipate hypovolaemic shock post removal of compressive force.
  - Chest involvement requires immediate release of compressive force.
- Hypothermia is a potential risk for patients suffering crush injuries.[3]

**Additional information**

- Compartment syndrome is a surgical emergency. If not diagnosed quickly and treated appropriately it is associated with a high morbidity. Management includes surgical decompression of the affected muscle compartment by fasciotomy and, in the case of circumferential burns, escharotomy.[5]

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**Flowchart**

- **Standard Cares**
  - Evidence of hyperkalaemia on ECG?
    - Y: Manage as per CPG: Hyperkalaemia
    - N: Compressive force in situ?
      - Y: Control compressive force release
      - N: Consider in trapped patients:
        - Tourniquet
      - Consider:
        - Analgesia
        - IV fluids (20 ml/kg prior to release)
  - Transport to hospital
    - Pre-notify as appropriate

**Note:** Officers are only to perform procedures for which they have received specific training and authorisation by the QAS.
Clinical features (continued)

- Trauma:
  - burns
  - fractures
  - entry and exit wounds
  - secondary injuries due to falls
  - compartment syndrome

Risk assessment

- Safety is paramount.
- The patient must not be approached until the scene is declared safe by appropriate agency/organisation or personnel.

Additional information

- Lightning strikes may cause respiratory and cardiac arrest (usually asystole) with fixed dilated pupils. Despite this, resuscitation should be initiated, as it is often successful (mortality 30%).
Standard Cares

Ensure scene safety

Cardiac arrest?

Unconscious?

Consider:
- C-spine injuries
- IV access
- Analgesia
- 12-Lead ECG
- IV fluid
- Dysrhythmia treatments
- Burns treatment

Manage as per CPG:
- ALOC

Consider:
- C-spine injuries
- Manage as per CPG: Resuscitation

Transport to hospital
Pre-notify as appropriate

Note: Officers are only to perform procedures for which they have received specific training and authorisation by the QAS.
Eye injuries are common and may be serious despite a benign appearance. All patients with suspected eye trauma and patients who have an ALOC should have their eyes assessed and basic eye protection precautions implemented.

General management principles include:
- Irrigation with water or saline for chemical or biological fluid exposure, foreign body or thermal burns
- Protect eye with shield (cardboard cone or styrofoam cup)
- Antiemetic
- Position patient head up

Clinical features (continued)
- Penetrating eye injury:
  - abnormally shaped or collapsed globe
  - obvious laceration or presence of prolapsed tissue
  - hyphema
- Blunt eye injury:
  - orbital injury
  - traumatic mydriasis
  - hyphema
  - occasionally retinal detachment
- Retinal detachment:
  - can occur spontaneously or months after an injury
  - history of light flashes
  - presence of floating black specks
  - curtain-like narrowing of peripheral vision
- Flash burns:
  - history of unprotected exposure to welding flash or sun lamp
  - pain develops several hours following exposure
  - foreign body sensation within the eyes
  - redness and photophobia

Risk assessment
- Nil in this setting
Additional information

- With most eye injuries the priority is initial stabilisation of the patient, protection of the eye and transport to an appropriate facility (preferably one with an ophthalmologist).
- If possible, patients with eye injuries should have a visual acuity test completed:
  - Test one eye at a time.
  - Initially test the patient's ability to count fingers (question patient on clarity of vision).
  - Should the patient be unable to complete this, test for hand motion, or light perception.
  - Do not delay initial treatment to perform visual acuity test.
- Administration of an antiemetic following penetrating or blunt eye injury is highly recommended. Vomiting significantly increases intraocular pressure and should be avoided.
  - It is recommended that ondansetron is used in these circumstances especially if opioid pain relief is given.
  - It is highly recommended that medications such as maxolon are avoided, due to the risk of dystonic reactions occurring and perpetuating the injury.
- Routine padding of eyes is no longer recommended. If padding is used, it must not place pressure on the globe. **Do not** pad an eye with a penetrating injury.
- Reducing time for irrigation following chemical exposure is beneficial.
- Patients transported by air may have special requirements. Consult with receiving facility or QCC as to flight restrictions.
- When flushing eyes, place injured/damaged eye down and flush from medial aspect.
- Eye injuries associated with capsicum spray should be irrigated until pain subsides.
- Preferred positioning for patients with eye injuries is supine with head elevated.

**Standard Cares**

**Blunt or penetrating?**

- **Y**
  - Leave penetrating item in place and protect the eye with a raised shield (e.g. cardboard cone)
  - Do not pad the eye

- **N**
  - Irrigate the eye and both lids with H₂O or sodium chloride 0.9% for ≥ 30 minutes
  - If capsicum spray, continue irrigation until pain subsides

**Chemical exposure?**

- **Y**
  - Irrigate eye with H₂O or sodium chloride 0.9% for < 15 minutes
  - If foreign body present, attempt removal with a moist cotton bud

- **N**
  - Remove contact lens

**Transport to hospital**

Pre-notify as appropriate

**Note:** Officers are only to perform procedures for which they have received specific training and authorisation by the QAS.
The high pressure injection of a fluid such as hydraulic oil, grease, or paint constitutes a medical and surgical emergency.[1] This requires rapid access to appropriate specialist surgical review. The injury is frequently worse than it will initially appear and paramedics must have a high level of suspicion.

After the initial injection, the fluid travels in a stream until resistance (e.g. from muscle or bone) is encountered.[2] The fluid then rapidly disperses in all directions along tissue planes, potentially causing traumatic dissections and compressing neurovascular bundles, leading to vascular spasm, ischaemia and thrombosis.[1] Furthermore, the presence of the fluid and subsequent tissue oedema, can cause a pressure build up, reducing perfusion and resulting in a form of compartment syndrome.[6]

Two additional issues are the chemical composition of the fluid, which can have cytolytic properties, and infection, which can occur during the injection, or subsequent to the tissue damage and ischaemia.[1]

Due to the initially benign symptoms, these injuries are often complicated by a delay to seek medical assistance, often several hours. Without adequate treatment there is a high rate of amputation.[1]

### Clinical features

- The point of entry may look very small and may not bleed.
- The area of injury will usually be on the working surface of the hand, however it may be located on any body area.[3]
- Initially, the patient may not complain of pain but may have a feeling of numbness, or increased pressure within the affected part.

### Clinical features (continued)

- Damage in the early stage is normally related to the physical injury as well as damage from the chemicals in the injected material.
- The affected body part will progressively become increasingly irritated, with the patient complaining of throbbing pain.

### Risk assessment

- If the fluid is a smaller hydrocarbon compound such as white spirit or kerosene, local anaesthetics should be avoided as they will potentiate the effects and therefore must NOT be administered.[4]
- With larger sized compounds such as those typically used as hydraulic mineral oils, the higher viscosity usually results in less penetration but is often more difficult to remove.[4]

### Additional information

- Intact skin can be penetrated by pressures of 7 bar (~1000 psi), but this requires direct contact. Much higher pressures exist within industrial machinery, such as paint guns and hydraulic lines, where infiltration of subcutaneous tissues can occur when the liquid is fired from a distance.[6]
- Dependent upon the entry pressure, injected fluid can travel a significant distance from the initial site of entry, resulting in more widespread tissue damage.
Standard Cares

Provide ongoing appropriate patient assessment

- Clean and cover wound
- Elevate and splint the affected limb

Consider:
- Analgesia
- Other injuries (e.g. compartment syndrome)

Transport to hospital
Pre-notify as appropriate

Note: These patients require urgent transfer to medical facilities with surgical capability. There are some situations where, due to the isolation of the patient, the clinician may wish to liaise with QCC via the regional ambulance communication centre for advice about the transfer.

Note: Officers are only to perform procedures for which they have received specific training and authorisation by the QAS.
Clinical practice guidelines

Hypovolaemic shock

This CPG deals with hypovolaemic shock. Other sources of shock are dealt with in the relevant CPGs.

Acute haemorrhage, secondary to trauma, is the major cause of hypovolaemic shock. However, non-haemorrhagic causes must be considered, i.e. GI losses, environmental exposure and neglect.

Blood loss can be ‘hidden’ and not immediately apparent i.e. pelvic injury, ruptured ectopic pregnancy or GI haemorrhage or intracranial bleeding in children.

Awareness of the clinical features of shock is of paramount importance, as early recognition of hypovolaemia can be life-saving. Assessment of volume status extends beyond the vital signs and requires a comprehensive review of the patient. ‘Treat the patient, not the vital signs.’

Clinical features

- CVS:
  - pale, cool peripheries, with or without being clammy
  - tachycardia > 100 bpm or bradycardia < 60 bpm
  - decrease pulses peripherally
  - capillary refill > 3 seconds
  - SBP < 100 mmHg

  Note: Elderly may not be tachycardic. BP pseudonormalis. Fit/young patients may have normal vital signs and be very volume depleted.

- NEURO:
  - initially quiet with decreased alertness
  - confusion/agitation
  - obtundation (mental blunting)

  Note: Be cautious interpreting ALOC as being due to substance misuse or alcohol.

Hypotensive trauma patients may not be secondary to haemorrhage – consider other causes (i.e. obstructive shock (tension pneumothorax tamponade) SCI or toxins – See Trauma CPG).

Risk assessment

- Nil in this setting

Clinical features (continued)

Other clinical features

- Blood Loss Signs
  - 15% (750 mL in 70 kg)
    - Minimal or no tachycardia response
    - Blood pressure changes do not usually occur
  - 15–30% (750 mL–1500 mL)
    - Tachycardia
    - Narrow pulse pressure
    - Minimal – moderate drop in blood pressure
  - > 30% (> 1500 mL)
    - Tachycardia
    - Hypotension
    - Peripheral hypoperfusion
    - Altered level of consciousness
  - > 40% (> 2 L)
    - Haemodynamic compensation at its limit
    - Decompensation imminent
Standard Cares

Haemorrhagic/traumatic

- Control haemorrhage
- Oxygen
- IV access
- IV fluid
  (SBP 100 – 120 mmHg)
- Maintain normothermia

Associated traumatic brain injury?

Y
- Control haemorrhage
- Oxygen
- IV access
- IV fluid
  (Target: palpable radial pulse)
- Maintain normothermia

N
- Oxygen
- IV access
- IV fluid
  (SBP ≥ 90 mmHg, PR < 100 bpm)

Non-haemorrhagic

Transport to hospital
Pre-notify as appropriate

Note: Officers are only to perform procedures for which they have received specific training and authorisation by the QAS.
Limb injuries can be very painful and visually distressing for a patient. As such, they can distract the patient and the clinician from more serious injuries in a multitrauma situation. Gaining a good history of the event to assess the mechanism of injury, and completing a thorough primary and secondary survey are always essential.

Clinical features

A fracture should be suspected if one or more of the following are present:

- Pain
- Swelling
- Bruising
- Loss of function
- Deformity
- Bony crepitus

Where communication is difficult (e.g. young children or dementia patients) the reluctance to move a limb may be the only sign of a fracture.

Note: soft tissue injuries can include all but the latter two presentations.

Suspect neurovascular damage if there is poor distal perfusion, or reduced distal sensation or movement.

Risk assessment

- Appropriate analgesia is very important.
- Procedural sedation (ketamine) may be required when managing complicated injuries (e.g. grossly displaced compound, compromised vascular supply).
- Limb immobilisation should generally be in near-anatomical position.
Note 1: Open wounds/compound injuries should be washed out with 1–2 litres of normal saline following adequate analgesia.

Note 2: Crush injuries to limbs should be treated as per crush injury CPG.

**Standard Cares**

- Patient shocked?
  - Y: Manage as per CPG:
    - Shock
    - Traction and splinting
    - Analgesia
  - N: Consider:
    - Analgesia
    - Positioning
    - Immobilisation

- Limb poorly perfused?
  - Y: Consider:
    - IV access
    - IV fluid
    - Analgesia
    - Procedural sedation
    - Re-alignment, traction and immobilisation

- Transport to hospital
  - Pre-notify as appropriate

Note: Officers are only to perform procedures for which they have received specific training and authorisation by the QAS.
Pain is an unpleasant sensory and emotional experience that is potentially associated with tissue damage.\(^1\) It is individual and subjective and is influenced by factors such as culture, previous experiences, belief, mood and ability to cope. There are therefore no definitive clinical signs of pain.

Effective pain management involves the use of an appropriate pain assessment tool, especially when managing patients who are unable to effectively communicate (people with an altered level of consciousness or language barriers, those who are developmentally delayed, children or the elderly, etc.)\(^2\)

There are two major categories of pain management:

- Non-pharmacological techniques (should always be considered)
  - appropriately inform patient
  - reassurance
  - distraction
  - posturing
  - positioning
  - heat or cold therapy
  - splinting
- Pharmacological
  - paracetamol, methoxyflurane, GTN, morphine, fentanyl, ketamine, lignocaine.
  - Consider giving combination pharmacological therapy.

Pain management will not prevent the diagnosis of conditions or injuries and, therefore, should be implemented for all patients.

### Clinical features

- History of potentially painful condition/injury
- Self reported pain
- Distress
- Pallor, muscle tension/guarding, sweating
- Dilated pupils
- Nausea/vomiting
- Increased heart rate, respiratory rate and blood pressure
- Signs and symptoms specific to underlying cause.

### Additional information

#### Wong-Baker FACES Pain Rating Scale \(^3\)

Point to each face using the words to describe the pain intensity. Ask the child to choose a face that best describes their own pain and record the appropriate number.


#### Visual Analogue Score \(^4\)

No pain

\[0 \quad 1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \quad 7 \quad 8 \quad 9 \quad 10\]

Pain as bad as it could be
Consider non-pharmacological pain management techniques:

- Splinting
- Psychological support
- Heat or cold therapy
- Consider specific injury/condition management

Consider most appropriate pharmacological strategy:

- Paracetamol
- Methoxyflurane
- Morphine
- Fentanyl
- Ketamine
- Antiemetic

Transport to hospital
Pre-notify as appropriate

Pain alleviated?

Note: Officers are only to perform procedures for which they have received specific training and authorisation by the QAS.
Pelvic injuries are potentially life threatening and require early identification and management.

The pelvis is extremely vascular with many blood vessels situated close to the pelvic bones. Pelvic fractures may cause disruption of these blood vessels and subsequent internal haemorrhage, shock and death.\[1\]

The paediatric pelvis is more compliant, making it less likely to fracture, but the force is transmitted to the underlying organs. In most instances considerable force may be required to fracture the pelvic bones, therefore associated intra-abdominal and pelvic organ injuries should always be considered.\[1\]

The application of circumferential pelvic binders in patients with suspected pelvic fractures can reduce fractures and stabilise the pelvic ring which will help to decrease active bleeding.\[2\]

Pelvic trauma should be suspected in all patients with significant mechanism of injury and, in particular, in patients with haemodynamic instability after trauma.

Clinical features

Common mechanisms of injury resulting in pelvic fracture include:

- traffic, pedestrian and motorcyclist collisions
- falls from heights
- crush.

Signs and symptoms of pelvic trauma include:

- pain
- bruising:
  - scrotal or vulval bruising
  - flanks (retroperitoneal)
- bleeding:
  - urethral meatus (urethral/prostate/bladder injury)
  - vaginal (vagina/uterus/bladder injury)
  - rectal (bowel perforation)
- pelvic asymmetry/shortening of limb
- decrease of lower limb pulses
- reduced or absent sensation or power in lower limbs
- haemodynamic instability and shock

Ultrasound investigation (FAST scan) may reveal free fluid in the pelvis.\[3\]

Note: Pelvic springing is not to be performed. Springing of the pelvis may disrupt sacral clots and cause further haemorrhage. In addition to this, clinical assessment of the pelvis has a low sensitivity for diagnosing pelvic fractures.\[4\]

Risk assessment

- Nil in this setting
Standard Cares

Evidence of shock/haemodynamic compromise?

Y

- Apply pelvic binder
  Manage as per CPG:
  - Shock
  Consider:
  - Other injuries
  - Analgesia
  - FAST

N

Consider:
- Other injuries
- Analgesia
- FAST

Transport to hospital
Pre-notify as appropriate

Note: Officers are only to perform procedures for which they have received specific training and authorisation by the QAS.
Clinical practice guidelines

Post submersion refers to survival post submersion/immersion where potential or actual respiratory compromise has occurred. Presentations may be asymptomatic, with only a history or mechanism of submersion to respiratory and cardiovascular compromise deteriorating to cardiac arrest.

Secondary complications post submersion includes noncardiogenic pulmonary oedema, aspiration pneumonia and anoxic encephalopathy.

A clear history regarding the circumstances surrounding the patient’s presentation should be gained, including time frames, mechanism of trauma or medical conditions such as intoxication, seizure, stroke or ACS that may have precipitated the submersion.

Clinical features

Neurological:
- ALOC
- confusion
- agitation

Cardiovascular:
- dysrhythmias (usually associated with hypothermia, unless patient has an underlying cardiac condition)
- hypotension
- cardiac arrest

Respiratory:
- dyspnoea
- non-cardiogenic pulmonary oedema
- ARDS
- aspiration pneumonia
- respiratory arrest

Clinical features (continued)

Other clinical features include:
- spinal injury
- vomiting and nausea
- hypothermia.

Risk assessment

• All post submersion patients should be transported to hospital for assessment, due to the potential for developing complications such as pulmonary oedema and aspiration pneumonia. These conditions may occur in patients with few initial symptoms or a normal initial vital sign survey.
• Hypothermia can occur as a secondary result of submersion or through evaporative heat loss after rescue.
• Spinal immobilisation in all patients with significant mechanism of injury or GCS < 15.
• Gastric tubes should be considered in all intubated post-submersion patients especially children (to alleviate diaphragmatic splinting and secondary gastric distention).

Additional information

• Ensure treatable underlying conditions (e.g. overdose, hypoglycaemia, seizure and/or trauma) are managed concurrently.
• If the patient is hypothermic, with no pulse and apnoeic, manage as a hypothermic cardiac arrest.
Cardio/respiratory arrest?

**Manage as per CPG:**
• Resuscitation

**ALOC and/or SpO₂ ≤ 90%?**

**Y**

**Consider:**
• Oxygen
• IPPV
• PEEP
• IV access
• Gastric tube
• Analgesia
• Antiemetic
• Correct reversible causes
• Maintain normothermia

**N**

**Transport patient to hospital**

*Pre-notify as appropriate*

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The trauma bypass clinical practice guideline is designed to identify trauma patients who require transport to a Major Trauma Service. Three elements should be considered for the triage of major trauma patients in Queensland:\cite{1}

- Vital signs
- Mechanisms of injury
- Patterns of injury

### Vital signs

<table>
<thead>
<tr>
<th></th>
<th>NEONATE First 28 days</th>
<th>INFANT 1–12 months</th>
<th>CHILD 1–8 years</th>
<th>OLDER CHILD 9–14 years</th>
<th>ADULTS &gt; 14 years</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Conscious state</strong></td>
<td>ALOC</td>
<td>ALOC</td>
<td>ALOC</td>
<td>ALOC</td>
<td>ALOC</td>
</tr>
<tr>
<td><strong>Respiratory rate</strong></td>
<td>&lt; 40 or &gt; 60</td>
<td>&lt; 20 or &gt; 50</td>
<td>&lt; 20 or &gt; 35</td>
<td>&lt; 15 or &gt; 25</td>
<td>&lt; 10 or &gt; 30</td>
</tr>
<tr>
<td><strong>SpO₂ (room air)</strong></td>
<td>&lt; 95%</td>
<td>&lt; 95%</td>
<td>&lt; 95%</td>
<td>&lt; 95%</td>
<td>&lt; 95%</td>
</tr>
<tr>
<td><strong>Heart rate</strong></td>
<td>&lt; 100 or &gt; 170</td>
<td>&lt; 90 or &gt; 170</td>
<td>&lt; 75 or &gt; 130</td>
<td>&lt; 65 or &gt; 120</td>
<td>&gt; 120</td>
</tr>
<tr>
<td><strong>Systolic BP</strong></td>
<td>N/A</td>
<td>&lt; 60 mmHg</td>
<td>&lt; 70 mmHg</td>
<td>&lt; 80 mmHg</td>
<td>&lt; 90 mmHg</td>
</tr>
</tbody>
</table>

**Table 1: Abnormal vital signs**

Vital signs are determined by one or more of the patient’s vital signs being abnormal, as outlined in the table above.

### Mechanism of injury criteria

Triage by mechanism of injury has limited accuracy, however it may help detect significant occult injury. High-risk mechanism include:

- Ejected from vehicle
- Fall from height ≥ 3 metres
- Involved in an explosion
- Involved in a high impact RTC with incursion into the occupant’s compartment
- Involved in a vehicle rollover
- Involved in an RTC in which there was a fatality in the same vehicle
- Entrapped for > 30 minutes

### Injury pattern criteria

- Injuries to the head, neck, chest, abdomen, pelvis, axilla, or groin that:
  - are penetrating
  - sustained from blasts
  - involve two or more of those regions
- Limb amputation above the wrist or ankle.
- Suspected spinal cord injuries.
- Burns in adults > 20%, or in children > 10%, or other complicated burn injury including burn injury to the hand, face, genitals, airway, or respiratory tract.
- Serious crush injury.
- Major compound fracture, or open dislocation with vascular compromise.
- Fractured pelvis.
- Fractures involving two or more of the following: femur, tibia, or humerus.
Procedure:

- If any of the vital signs criteria or patterns of injury criteria are present, the patient should be transported to a Major Trauma Service if there is one within 45 minutes road transport time.
- If a Major Trauma Service is > 45 minutes road transport time, the patient should be transported to the highest hospital level Regional Trauma Service if there is one within 45 minute road transport time.
- If the nearest Regional Trauma Service is > 45 minutes road transport time the patient is to be taken to the closest local hospital. Under these circumstances the Queensland Clinical Coordination Centre (QCC) must be notified via the regional Ambulance communication centre to ensure consideration for early secondary transport.
- If any of the mechanisms of injury criteria are present, paramedics are to take into account the potential for occult major trauma and consider transporting the patient as per the above procedure.
- If none of the triage criteria are met, the patient should be transported to the nearest appropriate facility.

Special note: If a Major Trauma Service is within 45 minutes road transport time, it should be the preferred destination if the patient fits the criteria as stated above – even if this means bypassing a Regional Trauma Service which may be closer.

Transporting patients directly to specialist facilities

Patients with the following injuries should be transported directly to the appropriate facilities offering specialist services, providing it is within 45 minutes road transport time:

- Adults with > 20% body surface area or complicated burns to the Royal Brisbane and Women’s Hospital.
- Children with > 10% body surface area or complicated burns to the Royal Children’s Hospital.
- Patients with spinal injuries with neurological deficit to the Princess Alexandra Hospital.
- Patients with amputations to a major trauma service.
Additional information [1]

Major trauma services are provided at:
- The Royal Brisbane and Women’s Hospital
- The Royal Children’s Hospital (paediatric patients ≤ 14 years only)
- Princess Alexandra Hospital
- Mater Children’s Hospital (paediatric patients ≤ 14 years only)
- Gold Coast Hospital
- The Townsville Hospital

Regional trauma services are provided at:
- The Tweed Hospital
- Logan Hospital
- Ipswich Hospital
- Toowoomba Hospital
- Caboolture Hospital
- Redcliffe Hospital
- Nambour Hospital
- Hervey Bay Hospital
- Bundaberg Hospital
- Rockhampton Hospital
- Mackay Base Hospital
- Cairns Base Hospital
- Mt Isa Hospital

Special Note:

Use of retrieval team [2]

Paramedics should consider the use of a medical retrieval team for patients who are trapped or require interventions beyond the scope of the treating paramedics.

Pre-hospital medical retrieval teams should not unnecessarily delay the transport of the patient to a definitive treatment medical facility. Refer to local work instructions regarding the availability of pre-hospital medical retrieval teams.

Traumatic cardiac arrest

If the patient has life threatening injuries and suffers a cardiac arrest immediately before or during transport, the patient should be transported to a Major Trauma Service if within 15 minutes road transport time. If transport time to a Major Trauma Service is > 15 minutes, consider transport to the nearest appropriate hospital.
Standard Cares

Is this a major trauma (identified by the above criteria)?

Transport to local hospital

Can patient be transported to a Major Trauma Service (MTS) within 45 minutes drive time?

Transport to Major Trauma Service (MTS)

Can patient be transported to a Regional Trauma Service (RTS) within 45 minutes drive time?

Transport to Regional Trauma Service (RTS)

Transport patient to closest hospital and request regional communication centre notifies QCC

Note: Officers are only to perform procedures for which they have received specific training and authorisation by the QAS.
**Clinical features**

**Impaired motor function:**
- Diaphragmatic ventilation
- Paralysis
- Flaccidity
- Abnormal posturing

**Impaired sensory function:**
- Local or generalised paresthesia/anaesthesia
- Loss of proprioception

**Impaired autonomic function:**
- Hypotension
- Bradycardia
- Thermoderegulation
- Priapism

Consider neurogenic versus spinal shock.[2]

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**Risk assessment**

- Always consider spinal injury in the unconscious patient (especially cervical spine).[3]
- The extrication board is to be used as an immobilisation device only and not a restraint device.
- Patients with SCI are high risk for concomitant trauma particularly TBI and haemorrhagic shock.[1]
- KED/NEIJ devices are inappropriate where rapid extrication is required for patients with life threatening injury and/or vital sign alteration.[4]

In such circumstance, use MILS with all appropriate resources for extrication.
Additional information

Canadian C-spine rule (CCR) has been developed for the clinical clearance of the cervical spine, without need for diagnostic imaging, in alert and stable trauma patients. CCR was considered superior to NEXUS Low risk criteria with respect to sensitivity and specificity for cervical-spine injury.\(^5\)

Studies have found that paramedics can apply the CCR reliably, without missing any important cervical spine injuries.\(^6\)

However CCR does not take into account:
- Painful distracting injury or
- Intoxication (alert could include intoxication).

Clinical judgement should still take precedent.

All patients with dangerous mechanisms and distracting injuries are to have C-spine immobilised.
Standard Cares

Spinal immobilisation

Hypotensive and bradycardic

Consider neurogenic shock:
- FAST
- IV fluid
- Inotropic support
Hypotensive and tachycardiac

Consider:
• Analgesia
• Antiemetic

Transport to hospital
Pre-notify as appropriate

Consider:
• IV fluids
• FAST

Note: Officers are only to perform procedures for which they have received specific training and authorisation by the QAS.
Taser® is a brand name of one of a number of weapons in the general category of ‘conducted energy devices’ and is currently the only one in use by the QPS. They are a ‘less than lethal’ use of force option that may assist officers resolve incidents involving violent people. The Taser® is a hand held, neuro-muscular disruption device capable of incapacitating a person through the application of an electrical current.

The Taser® has two main capabilities:

- Propelled wired darts embed in the targeted person, followed by a short duration high voltage electrical pulse, which affects the sensory and motor functions of the nervous system (probe mode).
- Direct contact of the Taser® to the body, or clothing of a person (drive-stun mode).

**Clinical features**

- Taser® have the potential to cause strong muscle contractions and the potential for serious secondary injury including:
  - fractures
  - spinal injuries
  - head injuries
  - soft tissue injuries
  - hyperthermia.
- Death immediately following Taser® use has been reported. Follow standard resuscitation guidelines.

**Risk assessment**

- Ensure safety precautions are taken at all times.
- Ensure the wires from the Taser® have been disconnected or cut from the probes.

**Probe removal**

To remove the probes, one hand should be used to stabilise the skin around the probe and the other hand should be used to grasp the probe firmly and pull straight out in a rapid motion. Do not attempt to pull the probes out by the wires, as they are very fragile and will easily break. The process is usually painless due to the electrocautery effect on the surrounding tissue.

Once removed the probes should be:

- inspected to see they are intact, with the straightened barbs still attached to the probe body.
- separated, or removed from the copper coated wires. (These wires are thin and can be cut by scissors or will break easily if pressure is applied).
- disposed of in a sharps container.

Probes should not be removed if embedded in:

- eyes
- genitals
- face or neck.

Manage as per foreign body/penetrating injury and transport to medical facility.

Transport is indicated in patients where:

- probes cannot be removed
- the patient requires a psychiatric evaluation
- assessment of injuries (other than probe injuries) is required
- the patient is affected by substances other than alcohol.

Tasered patients can be left in the care of QPS if they do not meet the above indications for transport and their 12-Lead ECG and BGL are within normal limits.
Standard Cares

Ensure safety issues are considered
*Disconnect probes/wire from device*

- 12-Lead ECG
- BGL

Consider:
- EEO
- Removal of probes
- Manage injuries

Transport to hospital
*Pre-notify as appropriate*

*Note: Officers are only to perform procedures for which they have received specific training and authorisation by the QAS.*
Risk assessment

Important physiological changes occur in pregnancy which impact on maternal and fetal risk in trauma.

Maternal risk
- Blood volume increases approximately 45% approaching term – this relative hypervolaemia can mask haemorrhagic shock. Up to 35% of maternal blood volume can be lost before signs of haemorrhagic shock appear.[1]
- The diaphragm rises approximately 4 cm in the later stages of pregnancy, with a reduction in residual lung volume.[1] There is a relative reduction in respiratory reserve in these patients.
- Delayed gastric emptying and the displacement of intra-abdominal organs by the growing fetus increases the risk of aspiration.[1]

Fetal risk
- Maternal hypovolaemia at any stage, can cause fetal harm. Adequate maternal blood volume must be maintained in the traumatised pregnant patient.
- In the first trimester the uterus resides within the bony pelvis, protecting it from direct trauma. Beyond the first trimester, there is increased risk to fetus from direct trauma.

Clinical practice guidelines

Trauma in pregnancy

Version 1.0 – September 2011

Risk assessment

Important physiological changes occur in pregnancy which impact on maternal and fetal risk in trauma.

Maternal risk
- Blood volume increases approximately 45% approaching term – this relative hypervolaemia can mask haemorrhagic shock. Up to 35% of maternal blood volume can be lost before signs of haemorrhagic shock appear.[1]
- The diaphragm rises approximately 4 cm in the later stages of pregnancy, with a reduction in residual lung volume.[1] There is a relative reduction in respiratory reserve in these patients.
- Delayed gastric emptying and the displacement of intra-abdominal organs by the growing fetus increases the risk of aspiration.[1]

Fetal risk
- Maternal hypovolaemia at any stage, can cause fetal harm. Adequate maternal blood volume must be maintained in the traumatised pregnant patient.
- In the first trimester the uterus resides within the bony pelvis, protecting it from direct trauma. Beyond the first trimester, there is increased risk to fetus from direct trauma.

Clinical features

Specific trauma related injuries of pregnancy
- Premature labour
- Placental abruption:
  - Shearing forces from deceleration injuries can separate the placenta from the underlying uterine wall, causing an abruption. It occurs in 1–5% minor trauma in pregnancy and in 20–50% major trauma.[1] Importantly it can have a delayed manifestation 24–48 hours after the initial injury.
- Uterine rupture:[2]
  - Uterine rupture is a rare but devastating traumatic complication. It should be suspected if there is maternal shock, difficulty defining the uterus on palpation or if there are easily palpable fetal parts.
- Feto-maternal haemorrhage[1]
  - Feto-maternal haemorrhage refers to the spread of fetal blood into the maternal circulation which can lead to Rhesus sensitisation in the mother. This has implications for further pregnancies.

Trauma affects approximately 7% of pregnancies and can cause premature labour, placental abruption, feto-maternal haemorrhage and fetal demise.[1] Even seemingly minor injuries can be dangerous.

Approximately half of the trauma experienced in pregnancy is secondary to motor vehicle accidents, with falls, assaults and burns occurring less frequently.[2]
Definitive care

The seriously traumatised pregnant patient requires a multidisciplinary approach, including an urgent obstetric opinion and possibly a caesarean section.

Pregnant patients suffering minor trauma are typically monitored in the labour ward for a minimum of four hours to detect occult placental abruption.[1]

Anti-D immunoglobulin is administered to Rhesus-negative mothers to prevent feto-maternal isoimmunisation.[1]

Additional information

- Maternal heart rate can be expected to increase by 15–20 beats per minute in the later stages of pregnancy.[1]
- Maternal BP lowers by 10–15 mmHg during the 2nd trimester and tends to normalise at term.[1]
- Position pregnant patients with left lateral tilt to avoid aorto-caval compression.
- Consider mechanism of injury including:
  - direct abdominal trauma
  - improper application of lap belt.
- A focused obstetric history should include:
  - gestational age
  - presence of fetal movements
  - PV loss.

Standard Cares

Position to left lateral tilt

Consider resuscitation
- IV fluid
- Pelvic binder
- Antiemetic
- C-Spine immobilisation
- FAST
- Blood
- Analgesia

Consider:
- Potential for shock (pregnancy may mask signs/symptoms in patient)
- Pelvic binder
- IV Fluid
- FAST
- C-spine immobilisation
- Antiemetic
- Analgesia

Evidence of shock?

Y

N

Transport to hospital
Pre-notify as appropriate

Be prepared for:
- Spontaneous delivery

Be mindful of:
- Placenta abruption
- Uterine rupture resulting from traumatic injury
- Managing associated traumatic injuries

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Clinical practice guidelines

Clinical features (continued)

- Abnormal vital signs
  - Bradycardia and hypertension (Cushing’s reflex) is a sign of raised ICP and suggests imminent brain herniation.\(^4\)
  - Hypoxia or hypotension have important prognostic implications and receiving facilities should be informed of this.\(^3\)
  - Excluding hypoglycaemia is essential.

Risk assessment

- Any episode of hypoxia or hypotension in the setting of TBI will significantly increase morbidity and mortality.\(^6\)
- Hyper or hypoventilation of patients causing abnormal CO\(_2\) levels will also impair brain perfusion (hyperventilation causes hypocapnoeic vasoconstriction; hypoventilation causes hypercapnoeic vasodilatation and raised intracranial pressure (ICP)).\(^5\)
- It is important to avoid raised ICP from impaired venous return, by ensuring constricting tapes, ties or collars are loosened from around the neck and the patient is positioned head-up to 30 degrees if possible.\(^6\)

Clinical features

- External evidence of head injury:
  - scalp abrasion, laceration, haematoma, complaining of headache
  - obvious depressed skull fracture/open head injury
  - blood from ears or nose (suggestive of base of skull injury)
  - brain matter on view is an extremely poor prognostic sign
- ALOC/focal neurology
  - reduced GCS (Patients may be agitated and appear intoxicated.)
  - unilateral weakness, seizure, unequal/reactive/dilated pupils

Traumatic brain injury (TBI) is a significant cause of morbidity and mortality in Australia, with over 22,000 people admitted to hospital per annum. The most common causes of injuries are falls, motor vehicle accidents and assault.\(^1\)

The goal of pre-hospital care is to reduce secondary brain injury due to hypoxia, abnormal carbon dioxide levels or hypotension.

In areas where it is available, pre-hospital rapid sequence intubation using muscle relaxants may be beneficial.\(^2\) Intubation of patients without muscle relaxants, except in arrest, is harmful to TBI patients, and is not indicated.\(^6\)
Management

Pre-hospital
- Support oxygenation and ventilation to prevent hypoxia.
- Use appropriate IV fluid and control of haemorrhage (e.g. fracture splints/pelvic binders, external pressure) to prevent/treat hypotension.

Additional information
- Some areas may participate in trials assessing the impact of hypothermia in TBI. Except in these situations, the goal is to achieve normothermia.
- ‘Cold’ intubation in the GCS3 patient is extremely predictive of a poor outcome.

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