

H01: Principles of Major Trauma

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Introduction

Trauma is one of the leading causes of death worldwide. In Canada, trauma is the leading cause of death in people under age 45 and accounts for approximately 16,000 deaths per year. Despite advances in trauma resuscitation, hemorrhage, shock, and coagulopathy remain the main drivers of preventable death after trauma and are responsible for over 40% of all trauma-related deaths.

Initiation of "damage control resuscitation" in the out-of-hospital environment has the potential to reduce complications associated with hemorrhage by intervening at the point of injury and preventing or limiting the development of 'Acute Coagulopathy of Trauma-Shock' (ACoTS). Adopted from damage control surgery, damage control resuscitation prioritizes rapid definitive hemorrhage control, permissive hypotension (in select patients), the minimal use of crystalloid fluid, and timely delivery of balanced blood products.

Essentials

- Rapidly obtain definitive hemorrhage control.
- Maximize tissue oxygenation.
- Prevent or limit the development of hypothermia.
- Minimize the use of crystalloid fluid for volume replacement.
- Initiate rapid conveyance to an appropriate lead trauma hospital or utilize clinical pathway.

Referral Information

- Triage according to the [Pre-hospital Triage and Transport Guidelines for Adult and Pediatric Major Trauma](#) decision tool, including Physiological Criteria, Anatomical Criteria, Mechanism of Injury Criteria, and Special Considerations.

General Information

- Assessment and stabilization should follow the CABCDE pattern: Circulation, airway, breathing, circulation, disability (neurologic status), exposure.

Interventions

First Responder

- Control external bleeding
 - → [D02: Bleeding](#)
 - → [PR03: Tourniquets](#)
 - → [PR04: Wound packing](#)
- Control suspected internal bleeding
 - → [PR02: Pelvic Binders](#)
- Consider [spinal motion restriction](#) based on clinical indications
- Provide appropriate airway management
 - → [B01: Airway Management](#)
- Prevent further heat loss
- Supplemental oxygen as required
 - → [A07: Oxygen Administration](#)

Emergency Medical Responder – All FR interventions, plus:

- Consider [Auto Launch](#) or [Early Fixed Wing Activation](#); convey urgently
- Consider intercept with additional resources
- Consider analgesia as needed
 - → [E08: Pain Management](#)

Primary Care Paramedic – All FR and EMR interventions, plus:

- Consider IV access with minimal use of crystalloid fluid
 - → [D03: Vascular Access](#)
- Consider permissive hypotension in select patients
 - → [D01: Shock](#)
- Control suspected internal bleeding
 - [Tranexamic acid](#) in cases of shock secondary to blood loss and occult bleeding secondary to hypovolemia

Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

- Consider IV/IO access
 - → [PR12 Intraosseous Cannulation](#)
- Consider anesthesia planning and intubation as required
 - → [PR18: Anesthesia Induction](#)
- Consider analgesia as needed
 - → [E08: Pain Management](#)

Critical Care Paramedic – All FR, EMR, PCP, and ACP interventions, plus:

- Consider point of care ultrasound (POCUS)
- Consider advanced anesthesia planning
- Consider balanced [blood product resuscitation](#)

Evidence Based Practice

General Major Trauma Care

Supportive

- [Acetaminophen IV](#)
- [Fentanyl](#)
- [Morphine](#)
- [Nitrous Oxide](#)
- [NSAIDs](#)
- [ALS](#)
- [Blood Glucose Monitoring](#)
- [ETCO2](#)
- [HEMS](#)
- [Ketorolac \(Toradol\)](#)
- [Mechanical Intraosseous Insertion](#)
- [Optimal Trip Destination](#)
- [Point of Care Lactate](#)
- [Trauma Team Activation](#)
- [Acetaminophen PO](#)

Neutral

- [Ketamine](#)
- [Thermostasis](#)
- [Oxygen](#)
- [IV access](#)
- [Manual Intraosseous Insertion](#)
- [Temperature Monitoring](#)

Against

- [Benzodiazepines](#)

H02: Crush Injuries

Tom Zajac

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Introduction

Crush injuries result from the entrapment of body parts by compressive forces, resulting in physical trauma and ischemia to tissues. These injuries are most commonly discussed in the context of collapsed structures, though crush injuries can occur even from a patient's own body weight.

If significant muscle mass is involved, crush syndrome can develop following the release of the compression; this is a potentially life-threatening, systemic condition. The major factors that lead to the development of crush syndrome include the degree of compressive force, the amount of muscle mass involved, and the duration of the compression.

The onset of crush syndrome occurs following the reperfusion of the injured muscle upon release. This may have both acute and delayed-onset clinical effects. The three main acute concerns are electrolyte imbalances, which may result in cardiac dysrhythmias (predominantly hyperkalemia), hypovolemia, and metabolic acidosis, all of which can cause shock. The delayed-onset effects include renal failure, acute respiratory distress syndrome, coagulopathies, and severe sepsis.

Delayed medical care or inappropriate rescue management, such as the uncontrolled and rapid removal of the compressive force prior to intervention, may result in rapid clinical deterioration and death of the patient.

Essentials

- Pre-treatment of crush injury prior to release of forces is essential. Failure to treat can result in death.
- On advice of ClinCall, begin aggressive fluid management (see PCP interventions below).
- Electrolyte and dysrhythmia management should be undertaken as per license level.
- Provide analgesia as appropriate.

Additional Treatment Information

- Paramedics and EMRs/FRs should consider the possibility of other concurrent injuries beyond the crush, particularly hypothermia and other potential causes of shock.
- Crush injuries that occur in industrial settings, or in the context of a structural collapse or other disasters, can come with significant hazards for rescuers. Scene safety is paramount – consider the risks of confined spaces, carbon monoxide, hypoxic environments, or toxic atmospheres.
- Additional out-of-hospital resources should be sought early.

Referral Information

All patients with crush injuries should be conveyed to the closest appropriate trauma receiving hospital as per local trauma destination guidelines or clinical pathway.

General Information

- Triage according to the [Pre-hospital Triage and Transport Guidelines for Adult and Pediatric Major Trauma](#) decision tool, including Physiological Criteria, Anatomical Criteria, Mechanism of Injury Criteria, and Special Considerations

Interventions

First Responder

- Provide supplemental oxygen as required

- → [A07: Oxygen Administration](#)
- Consider hypothermia; protect patient from environment; consider thermal protection, insulation from cold surfaces, and warming blankets as available/appropriate
- Consider application of a tourniquet proximal to the injury site on the extremity, prior to release of the crush force
 - → [PR03: Tourniquets](#)

Emergency Medical Responder – All FR interventions, plus:

- Provide supplemental oxygen to maintain SpO₂ ≥ 94%
 - → [A07: Oxygen Administration](#)
- Coordinate lift with treatments
- [CiniCall consultation recommended](#) prior to tourniquet application and to discuss care planning options.
- Consider waiting until higher licensed paramedic is on scene; prepare for cardiac arrest on release of weight
- Manage pain
 - → [E08: Pain Management](#)

Primary Care Paramedic – All FR and EMR interventions, plus:

- Obtain vascular access where possible
 - → [D03: Vascular Access](#)
- Consider administering normal saline 2 L immediately prior to release of crush force
 - [CiniCall consultation recommended](#) prior to fluid administration and to discuss care planning options.
- Consider continuous [salbutamol](#) therapy
 - [CiniCall consultation required](#) prior to salbutamol administration and to discuss care planning options.

Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

- Obtain vascular access where possible
 - → [PR12: Intraosseous Cannulation](#)
 - → [PR13: External Jugular Cannulation](#)
- Correct electrolyte disturbances
 - [Calcium chloride](#)
 - [Sodium bicarbonate](#)
 - [CiniCall consultation required](#) prior to administration of sodium bicarbonate.
 - Caution: sodium bicarbonate and calcium chloride cannot be administered at the same time through the same IV/IO line

Critical Care Paramedic – All FR, EMR, PCP, and ACP interventions, plus:

- Induce paralysis and facilitate ventilation if required; use [rocuronium](#) for paralysis – [succinylcholine is contraindicated in crush syndrome](#)
- Intravenous dextrose and insulin (IFT to tertiary care [on advice of ETP/EPOS](#))
- [Mannitol](#) 20%: may be considered once ongoing urinary production and output has been verified (IFT to tertiary care [on advice of ETP/EPOS](#); [mannitol is contraindicated in anuric states](#))
- Kayexelate – sodium polystyrene sulfonate (when practical and if prolonged ITF transfer to tertiary care is expected [on advice of ETP/EPOS](#))

Evidence Based Practice

General Major Trauma Care

Supportive

- [Acetaminophen IV](#)
- [Fentanyl](#)

- [Morphine](#)
- [Nitrous Oxide](#)
- [NSAIDs](#)
- [ALS](#)
- [Blood Glucose Monitoring](#)
- [ETCO2](#)
- [HEMS](#)
- [Ketorolac \(Toradol\)](#)
- [Mechanical Intraosseous Insertion](#)
- [Optimal Trip Destination](#)
- [Point of Care Lactate](#)
- [Trauma Team Activation](#)
- [Acetaminophen PO](#)

Neutral

- [Ketamine](#)
- [Thermostasis](#)
- [Oxygen](#)
- [IV access](#)
- [Manual Intraosseous Insertion](#)
- [Temperature Monitoring](#)

Against

- [Benzodiazepines](#)

Limb Amputation/Mangled/Major Hemorrhage

Supportive

- [Hemostatic dressing](#)
- [Pre-alert \(massive transfusion protocol\)](#)
- [Tourniquet \(limb\)](#)

Neutral

- [Direct Pressure](#)
- [Tourniquet \(junctional\)](#)

Against

Extremity Trauma

Supportive

- [Antibiotic \(open fracture\)](#)

Neutral

- [Procedural Sedation](#)

Against

References

1. International Search And Rescue Advisory Group. The Medical Management of the Entrapped Patient with Crush Syndrome 2023 [Link](#)

Practice Updates

- 2022-09-28: changed salbutamol to requiring consultation prior to administration

H03: Head Trauma

Mike Sugimoto

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Introduction

In the out-of-hospital environment, paramedics and EMRs/FRs can encounter three different types of head injuries: scalp injuries; cranial fractures; and traumatic brain injuries. These can occur in isolation, but are commonly associated with each other and are the result of blunt or penetrating trauma to the head. Head injuries are the most common cause of death and severe disability in trauma. Immediate post-injury management can have a profound effect on the patient's long-term prospects for both survival and recovery.

Essentials

- Hypoxia and hypotension, in conjunction with traumatic brain injury, are universally lethal conditions. It is imperative that paramedics and EMRs/FRs work to maintain a normal blood pressure and oxygen saturation.
- Use intravenous fluids to target a mean arterial pressure of at least 80 mmHg (or a systolic blood pressure of at least 110 mmHg).
- Patients must not be hypo- or hyperventilated; paramedics and EMRs/FRs must take all appropriate measures to protect the airway and ensure adequate oxygenation and ventilation at all times, up to and including supraglottic airway devices and endotracheal intubation.
- Seizures and vomiting are common complications of head injuries. Prepare to intervene as necessary.
- Except in the case of isolated penetrating trauma, head injuries are seldom isolated. Identify and manage other injuries concurrently.

Additional Treatment Information

- Select conveyance destinations in accordance with provincial and local trauma triage guidelines or clinical pathway. In general, convey patients to facilities that have neurosurgical capabilities. Consider the use of [Autolaunch](#) or [Early Fixed-Wing Activation](#) where appropriate.
- Endotracheal intubation in head injuries remains fraught. The risk of hypotension and hypoxia in the peri-intubation period is significant and adversely affects mortality. Paramedics electing to intubate patients with traumatic brain injuries must choose an induction strategy with those goals in mind.
- Moderate to severe traumatic brain injuries are often accompanied by injuries to other parts of the body. In these cases, other injuries must not be neglected.
- Temperature control of patients with traumatic brain injuries can be challenging. Although the hazards of hypothermia in the context of trauma are relatively well understood, the injured brain is at equal risk from hyperthermia. Patients should be kept normothermic. If the patient is, or becomes hyperthermic, passive heat loss should be promoted. Do not undertake active cooling.

Referral Information

- Triage according to the [Pre-hospital Triage and Transport Guidelines for Adult and Pediatric Major Trauma](#) decision tool, including Physiological Criteria, Anatomical Criteria, Mechanism of Injury Criteria, and Special Considerations.
- All patients with head trauma should be conveyed to the closest appropriate trauma receiving hospital as per local trauma destination guidelines or clinical pathway.

General Information

- Traumatic brain injuries can be further classified based upon the degree of disability, as measured by the Glasgow Coma Scale:
 - A GCS ≥ 13 is indicative of mild injury
 - A GCS that falls between 9 and 12 is suggestive of a moderate injury

- A GCS ≤ 8 is defined as a severe traumatic brain injury
- “Concussion” is a term that has been used synonymously with “mild traumatic brain injury” but more accurately describes the signs and symptoms experienced by an individual who has suffered a mild traumatic brain injury.
 - Signs and symptoms of a concussion include, but are not limited to: grossly observable loss of coordination; vacant stare; disorientation; delayed or difficult responses to questions; slurred speech; inappropriate emotional responses; and memory deficits. Headache, dizziness, nausea, and vomiting are common. These symptoms may immediately follow the traumatic injury or may take hours to fully evolve.
 - Differentiating between mild traumatic brain injuries that require imaging and hospital evaluation and those that do not is extremely difficult in the out-of-hospital environment and carries significant risk for paramedics and EMRs/FRs. Therefore, as a general rule, patients who are “concussed” – who have experienced an alteration in mental status that may not necessarily be associated with a loss of consciousness – should be conveyed for further evaluation.
- Scalp lacerations are associated with extensive bleeding because the blood vessels of the scalp lack the ability to vasoconstrict as effectively as elsewhere in the body. Direct pressure is usually sufficient to control these types of wounds, but awareness needs to be undertaken as open scalp wounds are occasionally the only indication of deeper, more serious injuries.
- Caution should be exercised in elderly patients or individuals taking anticoagulant medications: relatively minor mechanisms of injury can cause significant (and catastrophic) hemorrhage that may be undetected during the initial assessment.
- The skull is a relatively strong body part and so cranial injuries, including basilar skull fractures, require a significant amount of force. Battle’s sign is a late finding in these patients; its absence does not exclude the possibility of a basilar skull fracture.
- Cerebral herniation is a complication of traumatic brain injury where the rising intracranial pressure begins to push the cerebrum caudally, obstructing the flow of cerebrospinal fluid and compressing the brainstem. Signs include a falling level of consciousness, unilateral pupil dilation and lateral-inferior deviation of the eye on the affected side, paralysis of the arm and leg on the opposite side, and decerebrate posturing. Patients may yawn, sigh, take intermittent deep breaths, or progress to Cheyne-Stokes respirations.
- Trismus is commonly seen following severe traumatic brain injuries. In the majority of cases, these patients can be effectively ventilated using good bag-valve mask techniques, though suctioning can be difficult and adjunct placement may be impossible.
- Mean arterial pressure can be calculated by the formula $([DBP \times 2] + SBP) / 3$, and is in general a more meaningful measure of cerebral perfusion than systolic blood pressure alone.

Interventions

First Responder

- Protect and maintain the patient’s airway; consider potential for vomiting based on level of consciousness; provide supplemental oxygen as required
 - → [A07: Oxygen Administration](#)
 - → [B01: Airway Management](#)
- Control external bleeding
 - → [D02: Bleeding](#)
- Consider spinal motion restriction based on mechanism of injury and physiological abnormalities

Emergency Medical Responder – All FR interventions, plus:

- Provide supplemental oxygen to maintain $SpO_2 \geq 94\%$
 - → [A07: Oxygen Administration](#)
- Where possible, elevate head to 30 degrees from horizontal
- Avoid obstructing venous return in the neck: loosen cervical collars; ties; or other mechanical obstructions around the neck
- Initiate conveyance; consider intercept with additional resources
- Measure capillary blood glucose sample

Primary Care Paramedic – All FR and EMR interventions, plus:

- Obtain vascular access
 - → [D03: Vascular Access](#)
- Maintain blood pressure; target MAP of 85-90 mmHg (or systolic blood pressure of 120 mmHg); do not exceed 2 L total volume fluid administration
- Correct hypoglycemia only if present:
 - → [E01: Hypoglycemia and Hyperglycemia](#)
 - [Dextrose](#) intravenously; target > 4 mmol/L; do not exceed 12.5 g total dextrose and do not use D10W as primary line or for medication administration
- Consider antiemetic
 - → [E07: Nausea and Vomiting](#)
- Consider supraglottic airway device if needed to protect airway or facilitate ventilation
 - → [PR08: Supraglottic Airways](#)

Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

- Control seizures if actively seizing
 - [MIDAZOLam](#)
- Consider sedation if patient is combative and unable to provide appropriate airway management
 - [KetAMINE](#)
- Intubate if necessary
 - → [PR18: Anesthesia Induction](#)
 - Caution: do not allow peri- or post-intubation hypotension or hypoxia; if unable to maintain blood pressure or oxygen saturation, consider placement of supraglottic airway as a temporizing measure
- Ventilate as necessary to maintain SpO₂ ≥ 94%
- Monitor EtCO₂; attempt to maintain EtCO₂ between 35-40 mmHg; do not hyperventilate

Critical Care Paramedic – All FR, EMR, PCP, and ACP interventions, plus:

- Anesthesia:
 - Phase 1
 - Secure airway if required; use an appropriate induction strategy and intubation procedure based on patient and environment specificity
 - [Call ETP prior to paralytic treatment](#); post-call consultation permitted for RSI in emergency situations
 - Phase 2
 - Deep sedation is required; target RASS -5 without complete or burst suppression
 - Propofol is the preferred agent for phase 2 anesthesia
 - Use narcotic analgesia as required
 - Use EEG-guided anesthesia if appropriate
 - Maintain neuromuscular blockade as required
 - Caution not to mask seizure activity
 - [Call ETP prior to paralytic treatment](#) (post-call consultation permitted for RSI in emergency situations)
- Manage hemodynamic instability:
 - Target MAP 80-100 mmHg and systolic blood pressure > 100 mmHg
 - Crystalloid and/or vasopressor administration may be required
 - Consider short-term [phenylephrine](#) administration
 - For long-term support, consider [NOREpinephrine](#)
 - Hypertension associated with traumatic brain injury should generally not be treated in the out-of-hospital setting with anti-hypertensive drugs; if severe hypertension occurs with a sustained systolic blood pressure > 160 mmHg, contact CliniCall for [LABETalol](#) or [hydrALazine](#)
 - [Call ETP prior to administration of LABETalol or hydrALazine](#)
 - If hemoglobin is < 90 g/L, transfuse PRBC if available
- Optimize cerebral venous out-flow:

- Raise head of bed to 30°
- Promote venous drainage (e.g., cervical collars, ETT ties loose, trans-pulmonary PEEP of 0 cmH₂O, trans-pulmonary plateau pressure < 25 cmH₂O)
- Maintain neck neutrality
- If no esophageal balloon in place, set PEEP 5-10 cmH₂O
- Decompress stomach if required
- Mechanical ventilation strategies:
 - BVM with PEEP valve: maintain adequate oxygenation while preserving adequate cerebral venous drainage
 - Ensure oxygenation goals are being met (SpO₂ > 97%, PaO₂ 100-150 mmHg)
 - Ensure ventilation goals are being met (EtCO₂ 35-40 mmHg, PaCO₂ 35-40 mmHg)
 - Minimize Pplats while maintaining ventilation goals
- Control seizure activity:
 - Consider etiology and patient presentation when selecting appropriate agent:
 - [MIDAZOLam](#)
 - [Propofol](#)
 - [Ketamine](#)
 - [Phenobarbital](#)
 - Consider the side effect of hypotension: vasopressors may be required to maintain hemodynamic goals
 - Consider the utility of [phenytoin](#) or [phenobarbital](#) for seizing and seizure prophylaxis; treat based on the etiology, patient presentation, and conveyance context (prophylaxis indicated for penetrating head injuries, depressed skull fractures, or a seizing patient)
- Monitor for signs of raised ICP:
 - ONSD of > 6 mm after patient optimization
 - If > 6 mm treat with osmotic therapy
 - If Na < 150 mEq/L: hypertonic saline or [mannitol](#)/HTS 100 mL every 5-10 minutes with continuous monitoring of ICP
 - If Na > 150 mEq/L: Mannitol 0.5 g/kg with continuous monitoring of ICP
 - Watch for diuretic effects; be prepared to replace volume loss at 1:1 ratio
 - [Call ETP prior to use of hypertonic saline](#)
- Monitor for signs of cerebral herniation:
 - [EVD monitoring](#) if in situ, or maintain intracranial pressure monitoring
 - Neurological exam findings:
 - Unilateral pupillary dilation considered to be related to a rise in intracranial pressure
 - Decorticate or decerebrate posturing
 - Seizure activity
 - With signs of herniation:
 - Osmotic therapy: [hypertonic saline](#) 3-5 mL/kg bolus or [mannitol](#) 1 g/kg
 - [Call ETP prior to use of hypertonic saline](#)
 - Short trial of hyperventilation to PaCO₂ 25-30 mmHg
 - Contact receiving hospital with updated patient status
 - Consider [nimodipine](#) for SAH vasospasm reduction.
- Other monitoring parameters:
 - Maintain normothermia: 36-37.5°C
 - Use fluid warmer for hypothermic patients
 - Institute passive cooling measures and antipyretics for hyperthermic patients
 - Maintain Na⁺ between 140-150 mEq/L
 - Maintain capillary blood glucose between 6-10 mmol/L
- [Arterial or venous blood gas](#) analysis:
 - Adjust mechanical ventilation to ensure adequate oxygenation, appropriate ventilation, and safe ground ventilating parameters
- Consider anti-emetic administration:

- [Dimenhydrinate](#)
- [Metoclopramide](#)
- [Ondansetron](#)
- Other considerations:
 - Avoid steroid use

Evidence Based Practice

Traumatic Brain Injury

Supportive

- [RSI \(CCT\)](#)
- [Plasma infusion](#)
- [Rate control](#)

Neutral

- [Colloid Infusion](#)
- [Fluid Resuscitation](#)
- [Hypertonic Saline](#)
- [Intubation \(CCT\)](#)
- [Mannitol](#)
- [Aggressive Crystalloids](#)
- [Blood transfusion](#)
- [TBI Score](#)

Against

- [Hyperventilation](#)
- [Intubation](#)
- [Rapid Sequence Induction](#)
- [Restricted Crystalloids](#)

References

1. Alberta Health Services. AHS Medical Control Protocols: Adult Head Injury. 2020. [\[Link\]](#)
2. Carney N, et al. Guidelines for the Management of Severe Traumatic Brain Injury, Fourth Edition. 2017. [\[Link\]](#)

Practice Updates

- 2022-09-22: Typographical correction ("hypotension" used where "hypertension" required).
- 2022-04-14: Raised SBP/MAP target to increase patient safety margins.

H04: Eye Injuries

Rob Evans

Updated: May 26, 2021

Reviewed: March 01, 2021

Introduction

Eye trauma can result from wide-ranging causes such as direct eye injury or chemical exposure. These can be life-altering events for patients. Any patient with an eyesight-threatening injury should be conveyed promptly for specialist assessment. Treatment for eye injuries is centred around recognition of the mechanism of injury, the provision of supportive care, and rapid conveyance.

Patients may present with minor symptoms yet still be experiencing injuries with potential long-term consequences.

Out-of-hospital care is centred on recognizing the mechanism of injury, providing supportive care, and rapidly conveying in the case of eyesight threatening trauma. Patients with minor symptoms may still be experiencing injuries with long-term consequences that may not be apparent during out-of-hospital assessment.

Essentials

- In cases of direct eye trauma, cover both eyes and keep the patient at rest.
- Remove contact lenses if present and not adhering to the cornea.
- If condition permits, elevate the patient's head during conveyance.
- Avoid placing pressure on the eye globe while packaging and transferring the patient.
- In cases of chemical exposure, begin irrigation with normal saline while attempting to identify the substance. Bring relevant documentation (e.g., MSDS sheet) with the patient to hospital. Contact CliniCall (1-833-829-4099) for support in managing chemical exposures.
- Provide analgesia and antiemetics as required.

Additional Treatment Information

- Maintain a high index of suspicion for other injuries in the case of direct trauma, including head and spinal injury as well as facial fractures.
- Vomiting increases intraocular pressure; early administration of antiemetics is beneficial.
- Penetrating objects should be left in place and should be stabilized as appropriate.
- If condition allows, assess visual acuity in each eye.
- Do not delay treatment or conveyance to assess visual acuity.

Referral Information

All patients with ocular trauma should be conveyed for specialist assessment.

General Information

- If available, an injured eye should be covered with a rigid shield.
- Patients with eye injuries associated with other facial fractures may have specific considerations for air conveyance if they are being transferred. Associated sinus fractures may result in complications such as pneumocephalus and may present complications when changes in atmospheric pressure occur. Contact CliniCall (1-833-829-4099) for guidance if the patient is undergoing air conveyance as part of care.

Interventions

First Responder

- Keep patient at rest

- Identify source of ocular injury (and chemical substance if appropriate)
- Initiate irrigation with normal saline for chemical injury or other injuries associated with contamination of the eye
 - → [PR05: Patient Decontamination](#)

Emergency Medical Responder – All FR interventions, plus:

- [OnCall consultation required](#) for support in managing chemical exposures
- Cover both eyes with a rigid shield if available and clinically indicated
- Convey patient with head elevated if condition allows
- Administer analgesia:
 - → [E08: Pain Management](#)
 - [Nitrous oxide](#)

Primary Care Paramedic – All FR and EMR interventions, plus:

- Treat or prevent nausea and vomiting
 - [DimenhyDRINATE](#)
- Provide analgesia
 - [Ibuprofen](#)
 - [Acetaminophen](#)

Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

- Provide analgesia
 - [FentaNYL](#)
 - [KetAMINE](#)

Evidence Based Practice

Ocular Trauma

Supportive

Neutral

Against

References

1. Alberta Health Services. AHS Medical Control Protocols: Adult Eye Injury Management. 2020. [\[Link\]](#)
2. Ambulance Victoria. Clinical Practice Guidelines: Ambulance and MICA Paramedics. 2018. [\[Link\]](#)

H05: Spinal Cord and Neck Trauma

Ryan Ackerman

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Introduction

Spinal cord injuries (SCI), while relatively rare, contribute significantly to morbidity and disability among those affected. Spinal motion restriction (SMR) must be undertaken on any patient who is at risk for SCI. Traditional SMR devices, such as cervical collars and rigid immobilization boards, carry risks of their own and should not be applied without a clinical indication to do so.

Contemporary care for potential SCI patients does not need to be an "all or nothing" approach, but instead should be patient centric. At all times the risks of applying SMR should be weighed against its benefits for each individual patient.

Cervical spine injuries are often the sole source of focus; attention must be paid to thoracic and lumbar injuries as well.

Essentials

- The mechanism of injury alone is not an accurate predictor of spinal column/cord injury.
- The NEXUS C-Spine clearance tool may be used for adult patients.
- NEXUS only applies to cervical spine injuries. Thoracolumbar injuries must be assessed separately.
- Factors such as intoxication, altered levels of consciousness, language barriers, and major distracting injuries can all confound the assessment of spinal injuries.
- Only multi-trauma patients or those with new onset neurological impairment require conveyance on a clamshell stretcher.
- Full SMR refers to a cervical collar, foam rolls (without taping of the head), and a clamshell throughout transport regardless of transport time

Additional Treatment Information

- Known risks associated with SMR include: airway compromise; respiratory restriction; pressure ulcers; decreased cardiac output; vomiting/aspiration; increased intracranial pressure; pain; increased scene time; and more complicated ER management.
- Elderly patients (age ≥ 65) are at greater risk for spinal fractures from lower force injuries. Careful attention must be paid to thorough assessment with any trauma above the clavicles.
- Penetrating trauma requires rapid conveyance. SMR has been shown to increase mortality in these patients.
- Early and frequent focused neurological assessments (motor, sensation) may help monitor an evolving injury.
- Spinal cord injuries often require higher perfusion pressures to overcome swelling. Target a systolic BP > 120 mm/hg in patients with clear signs of neurological deficit.

Referral Information

- Triage according to the [Pre-hospital Triage and Transport Guidelines for Adult and Pediatric Major Trauma](#) decision tool, including Physiological Criteria, Anatomical Criteria, Mechanism of Injury Criteria, and Special Considerations.
- All patients with spinal cord and neck trauma should be conveyed to the closest appropriate trauma receiving hospital as per local trauma destination guidelines or clinical pathway.

General Information

- [NEXUS Criteria:](#)
 1. Does the patient have midline tenderness of the cervical spine?

2. Is the patient's level of consciousness altered? (Must be alert and oriented to time, person, place, and event.)
 3. Are there new focal neurological deficits?
 4. Is the patient intoxicated? (Judgement and pain sensation must be intact.)
 5. Is there a major distracting injury significant enough to interfere with their ability to assess pain response when palpating spine?
- If the answer to all five NEXUS questions is "no," SMR is not warranted.
 - Thoracolumbar injuries: If the patient does not require SMR based on the NEXUS criteria but has any of the following findings, do not sit the patient up or raise the head of the stretcher on the assumption that thoracic or lumbar injuries may be present:
 - Fall from height > 3m
 - Axial loading to head or base of spine
 - High speed MVC > 100 km/h
 - Rollover MVC
 - New back deformity, bruising, or bony midline tenderness

Interventions

First Responder

- Apply [spinal motion restriction](#) as clinically indicated
- Supplemental oxygen as required
 - → [A07: Oxygen Administration](#)

Emergency Medical Responder – All FR interventions, plus:

- Initiate conveyance; consider intercept with additional resources

Primary Care Paramedic – All FR and EMR interventions, plus:

- Treat nausea/vomiting:
 - [Dimenhydrinate](#)
- Correct hypo-perfusion/hypotension:
 - → [D03: Vascular Access and Fluid Administration](#)
 - For suspected or confirmed spinal cord injury, target systolic BP of > 120 mmHg

Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

- Secure airway if required
 - → [PR18: Anesthesia Induction](#)

Critical Care Paramedic – All FR, EMR, PCP, and ACP interventions, plus:

- Grading using ASIA scoring.
- Manage hemodynamic instability:
 - MAP > 80-85 mmHg for isolated spinal cord injury
 - Consider balanced fluid administration.
 - Vasopressor administration may be required
 - [Call ETP prior to vasopressor](#)
 - [Phenylephrine](#)
 - [Dopamine](#)
 - [Norepinephrine](#)
 - [Epinephrine](#)
- Respiratory support
 - Signs of impending respiratory failure
 - increasing rate

- decreasing forced vital capacity
- rising PCO₂
- falling PO₂ (late)
- If mechanical ventilation is required, refer to mechanical ventilation procedure guideline
- Arterial or venous blood gas analysis
 - Adjust mechanical ventilation to ensure adequate oxygenation, appropriate ventilation, and safe ground ventilating parameters

Evidence Based Practice

Spinal Injury

Supportive

- [In-line stabilization for intubation](#)
- [C-Spine Clearance](#)
- [Scoop stretcher](#)
- [Self Extrication](#)
- [Leave Helmet in Place](#)

Neutral

- [Steroid](#)
- [Spinal Precautions](#)
- [Short Extrication Devices \(ex: KED\)](#)

Against

- [Long Spinal Immobilization Devices](#)
- [Cervical Collar](#)
- [Immobilization in Penetrating Trauma](#)

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H06: Chest Trauma

Rob Evans

Updated: March 21, 2025

Reviewed: March 01, 2021

Introduction

Management of chest injuries represents a challenge in out-of-hospital care. Common chest trauma injuries seen by paramedics and EMRs/FRs include rib fractures, flail chest, simple pneumothorax, hemothorax, open pneumothorax and tension pneumothorax. Paramedics and EMRs/FRs must maintain a high index of suspicion for underlying life-threatening injuries as many patients may present with initially stable vital signs.

Essentials

- Closely monitor all patients with chest trauma for signs of deterioration, with particular attention to respiratory status. Be prepared to support oxygenation and ventilation as necessary.
- Be suspicious of the potential for underlying torso injuries in cases of high mechanisms. Injuries to the great vessels, diaphragm, abdominal organs, and the myocardium can occur.
- Differentiate between blunt and penetrating mechanisms of injury.
- For open chest wounds, utilize a commercial vented chest seal (preferred) or leave open. If bleeding control necessary, gauze may be used.

Additional Treatment Information

- Sealing of open chest wounds may place patients at risk for a tension pneumothorax.
- Monitor these patients closely and relieve pressure by lifting the chest seal or occlusive dressing if a tension pneumothorax may be developing.
- Entonox is contraindicated in patients with a suspected pneumothorax or inhalation injury.
- Decompression of a suspected tension pneumothorax should be rapidly performed in patients with deteriorating respiratory and hemodynamic status (ACP/CCP).
- Positive pressure ventilation may worsen clinical status in patients with an untreated tension pneumothorax.

Referral Information

- Triage according to the [Pre-hospital Triage and Transport Guidelines for Adult and Pediatric Major Trauma](#) decision tool, including Physiological Criteria, Anatomical Criteria, Mechanism of Injury Criteria, and Special Considerations.
- All patients with chest trauma should be conveyed to the closest appropriate trauma receiving hospital as per local trauma destination guidelines or clinical pathway.

General Information

- Palpation of the chest wall, axilla and neck can be helpful in feeling for the presence of subcutaneous emphysema.
- CPAP is contraindicated in patients with a suspected pneumothorax.

Interventions

First Responder

- Position patient sitting if other injuries permit
- Perform basic airway interventions and be prepared to provide ventilatory support as needed
 - → [B01: Airway Management](#)
- Administer high flow oxygen

- → [A07: Oxygen Administration](#)
- Cover open chest wounds with three-sided occlusive dressing

Emergency Medical Responder – All FR interventions, plus:

- Initiate conveyance; consider intercept with additional resources
- Apply chest seal to open chest wounds

Primary Care Paramedic – All FR and EMR interventions, plus:

- Insert supraglottic airway as indicated to support oxygenation and ventilation
 - → [PR08: Supraglottic Airways](#)
- Consider vascular access
 - → [D03: Vascular Access](#)
- [Tranexamic acid](#) if indicated

Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

- Perform needle decompression in signs of decompensating obstructive shock secondary to a suspected tension pneumothorax
 - → [PR21: Needle Thoracentesis](#)
- Consider advanced airway management as necessary to support oxygenation and ventilation in deteriorating patients
 - → [PR18: Anesthesia Induction](#)
- Manage cardiac dysrhythmias associated with myocardial injury as indicated
 - → [C02: Bradycardia](#)
 - → [C03: Narrow Complex Tachycardia](#)
 - → [C04: Wide Complex Tachycardia](#)
- Administer analgesia as necessary
 - → [E08: Pain Management](#)

Critical Care Paramedic – All FR, EMR, PCP, and ACP interventions, plus:

- Perform ultrasound assessment for pneumothorax
 - Consider [Turkel](#) insertion
- Consider rapid sequence intubation for patients requiring oxygenation and ventilator support
- Secure and manage chest drainage system in the interfacility transfer environment as necessary

Evidence Based Practice

Chest Trauma

Supportive

- [Chest Tube \(CCT\)](#)
- [Ultrasound](#)
- [Needle Decompression](#)

Neutral

Against

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H07: Abdominal Trauma

Ryan Ackerman

Updated: July 15, 2023

Reviewed: March 01, 2021

Introduction

Abdominal trauma is one of the major causes of preventable death. Whether blunt or penetrating, the possibility of intra-abdominal injury must be recognized and treated in a timely fashion.

All types of abdominal trauma carry the risk of significant hemorrhage and infection. Blunt abdominal trauma carries a mortality rate of up to 30% and can prove challenging to assess in the out-of-hospital environment. Penetrating trauma is easier to identify, is more often a true surgical emergency, and has a lower mortality rate than blunt trauma.

For both blunt and penetrating abdominal injury, the mainstays of treatment are virtually the same: rapid recognition and rapid conveyance, gentle patient handling, minimal crystalloid fluids to maintain vital organ perfusion, and early administration of tranexamic acid.

Essentials

- Abdominal distension is often a late sign and is indicative of severe intra-abdominal bleeding.
- Penetrating trauma from the nipple line to the umbilicus may result in both chest and abdominal injuries.
- Early TXA administration for suspected intra-abdominal bleeding is associated with decreased mortality rates.
- Aggressive fluid resuscitation in abdominal trauma is associated with higher mortality rates. Titrate fluid administration to achieve normal mentation, peripheral pulses, or a systolic blood pressure of 80-90 mmHg.

Additional Treatment Information

- Retroperitoneal hemorrhage, often from damage to the kidneys or their supplying vasculature, may be difficult to detect and can produce life-threatening blood loss.
- Eviscerated contents should be covered with moist, sterile dressings with an occlusive layer above.
- Blunt trauma to the abdomen is frequently associated with concurrent pelvic injury.

Referral Information

- Triage according to the [Pre-hospital Triage and Transport Guidelines for Adult and Pediatric Major Trauma](#) decision tool, including Physiological Criteria, Anatomical Criteria, Mechanism of Injury Criteria, and Special Considerations.
- All patients with abdominal trauma should be conveyed to the closest appropriate trauma receiving hospital as per local trauma destination guidelines or clinical pathway.

General Information

- The most common causes of intra-abdominal injuries are motor vehicle collisions followed by stabbing and gunshot wounds.
- Paramedics and EMRs/FRs should pay particular attention to visual clues on inspection prior to palpating. The 'seat belt sign' is a large bruise or abrasion across the lower abdomen and is associated with significant hemorrhage in 25% of patients. Periumbilical bruising, or Cullen's sign, is a late sign indicative of a retroperitoneal hemorrhage. A 'scaphoid' or sunken appearance to the abdomen may indicate diaphragmatic rupture.
- On physical exam, tenderness or rigidity is often a sign of blood or digestive contents in the abdomen resulting in irritation to the peritoneum. Fractures to the lower ribs may suggest splenic or hepatic injuries. Splenic injury often presents with referred pain to the left posterior shoulder while hepatic injuries refer pain to the right posterior shoulder.
- Auscultation of the abdomen in the out-of-hospital trauma setting rarely yields pertinent information.
- Administration of excessive crystalloid fluids has been shown to increase mortality due to hemorrhage and to

increase the risk of secondary abdominal compartment syndrome. When intra-abdominal hemorrhage is suspected or likely based on mechanism of injury or physical exam, crystalloid fluids should only be given when absolutely necessary to restore perfusion to vital organs.

- The application of abdominal junctional tourniquets has been shown to reduce mortality in patients with large vessel hemorrhage of the abdomen and pelvis. In some studies, the benefits of junctional tourniquet application were similar to those achieved through resuscitative endovascular balloon occlusion of the aorta.
- Out-of-hospital use of 'Focused Assessment with Sonography in Trauma' (FAST) has demonstrated a benefit in the early detection of abdominal trauma in both blunt and penetrating injuries. However, while a positive FAST is highly specific for intra-abdominal bleeding, a negative FAST by itself should not be used to rule out injury or hemorrhage.

Interventions

First Responder

- Control external hemorrhage
- Limit patient movement to reduce clot disruption
- Protect against heat loss: foil blanket against the skin; cover with blankets for insulation; consider chemical heating blanket
- Cover extruded bowel or eviscerated abdominal contents with moist, sterile dressings followed by an occlusive layer
- Consider application of T-POD pelvic binder if evidence suggests concurrent pelvic injury
 - [→ PR02: Pelvic Binders](#)
- Correct hypoxemia from diaphragmatic or concurrent thoracic injury
 - [→ A07: Oxygen Administration](#)
 - [→ B01: Airway Management](#)

Emergency Medical Responder – All FR interventions, plus:

- Initiate conveyance; consider intercept with additional resources

Primary Care Paramedic – All FR and EMR interventions, plus:

- Obtain vascular access and correct hypoperfusion
 - [→ D03: Vascular Access](#)
- Consider [tranexamic acid](#)

Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

- Correct hypoxemia from diaphragmatic or concurrent thoracic injury
- Needle thoracentesis as needed for suspected tension pneumothorax
 - [→ PR21: Needle Thoracentesis](#)

Evidence Based Practice

Abdominal Trauma

Supportive

Neutral

- [Direct Pressure](#)

Against

Pelvic Trauma

Supportive

- [Circumferential Sheet](#)
- [Corsette Style Compression Device \(e.g. T-Pod\)](#)
- [External Mechanical Compression Device](#)

Neutral

- [MAST](#)

Against

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H08: Pelvic Trauma

Rob Evans

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Reviewed: March 01, 2021

Introduction

Pelvic trauma represents a serious injury and can be associated with high mortality, being the third most common cause of death in blunt trauma after head and chest injuries. The pelvis is formed by the articulation of the ilium, ischium, pubic bones, and sacrum. The pelvis can be fractured by several different mechanisms. Pelvic fractures are often associated with other major traumatic injuries; careful examination and urgent conveyance are key principles of management in these patients.

Paramedic and EMR/FR management of pelvic trauma includes: early recognition; early application of a pelvic binder; rapid conveyance; and treatment of other associated traumatic injuries.

Essentials

- Pelvic binding is not indicated for an isolated neck of femur (NOF) fracture (aka: hip fracture).
- Paramedics and EMRs/FRs should be highly suspicious of pelvic fractures in all patients who have sustained trauma from a high-energy mechanism.
- Apply a pelvic binder early – pelvic splinting should be considered a hemorrhage control intervention.
- Handle the patient gently. Avoid log rolling if possible and convey using a clamshell.
- Examine the abdomen and pelvis gently. Do not rock pelvis to check stability.

Additional Treatment Information

- Pelvic binders are most beneficial in anterior-posterior pelvic fractures (e.g., open book fractures).
- Tranexamic acid should be considered in all patients with suspected pelvic fractures.

Referral Information

- Triage according to the [Pre-hospital Triage and Transport Guidelines for Adult and Pediatric Major Trauma](#) decision tool, including Physiological Criteria, Anatomical Criteria, Mechanism of Injury Criteria, and Special Considerations.
- All patients with pelvic trauma should be conveyed to the closest appropriate trauma receiving hospital as per local trauma destination guidelines or clinical pathway.

General Information

- The pelvis is typically fractured through one of three primary mechanisms:
 - Anterior-posterior fractures, or open book fractures, occur when force is applied anteriorly to the iliac crests, as might happen in a motorcycle accident where the patient strikes the handlebars
 - Lateral compression fractures occur when force is applied to the sides of the pelvis; side-impact motor vehicle collisions, or pedestrians struck by vehicles, can cause these kinds of forces
 - Vertical shear fractures occur when a patient falls from height and force is transmitted to the pelvis from the lower extremities
- All mechanisms of pelvic fractures can be associated with injury to major blood vessels, viscera, and nerves.

Interventions

First Responder

- Keep the patient warm and prevent further heat loss
- Supplemental oxygen as required

- [→ A07: Oxygen Administration](#)
- Maintain a high index of suspicion for pelvic trauma in patients who have sustained a high mechanism of injury
 - [→ H01: Principles of Major Trauma](#)
- Bind pelvis if indicated using a commercial or improvised pelvic binder
 - [→ PR02: Pelvic Binders](#)

Emergency Medical Responder – All FR interventions, plus:

- Convey urgently in accordance with provincial triage and clinical pathway guidelines
- Consider intercept with additional resources

Primary Care Paramedic – All FR and EMR interventions, plus:

- Consider vascular access
 - [→ D03: Vascular Access](#)
- Consider antifibrinolytics
 - [Tranexamic acid](#)

Critical Care Paramedic – All FR, EMR, PCP, and ACP interventions, plus:

- Consider administration of [blood products](#) if available

Evidence Based Practice

Pelvic Trauma

Supportive

- [Circumferential Sheet](#)
- [Corsette Style Compression Device \(e.g. T-Pod\)](#)
- [External Mechanical Compression Device](#)

Neutral

- [MAST](#)

Against

References

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H09: Extremity Trauma

Neal Carman

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Introduction

Extremity trauma is a common, potentially life-threatening phenomenon. Injuries to the limbs include fractures and bleeding, which should be immobilized and controlled, respectively. Paramedics and EMRs/FRs should endeavour to resolve neurological or vascular compromise wherever possible.

Essentials

- Bleeding from limbs can be life threatening. Control using direct pressure. Apply tourniquets as necessary.
- If a limb is pulseless and severely angulated, it should be repositioned to allow for the restoration of pulses.
- Fractures require stabilization with good splinting practices.

Additional Treatment Information

- Altered sensation, loss of a pulse, or cold and dusky skin in a limb distal to a fracture or dislocation is an indicator of neurological or vascular compromise. This is a limb threatening injury and is time critical.
- The general principles of reducing a fracture are:
 - Provide procedural analgesia ([→ E08: Pain Management](#))
 - Irrigate open wounds with 500 mL to 1 L of saline
 - Apply traction and gentle counter-traction in the line of the limb
 - If required, further manipulation should be done while the limb is still under traction
 - Splint the limb following reduction
- Amputated limb portions should be rinsed with cool sterile saline prior to being wrapped in loose, saline-moistened sterile gauze. The limb can then be placed inside a plastic bag and kept in a cool, protected place while being conveyed with the patient. Do not immerse the amputated limb in water, keep the limb cool, and do not place directly on ice or use dry ice to cool.
- The use of traction splints should be reserved for isolated, closed, mid-third femoral fractures. In major trauma cases, or with multiple injuries, splint the injured leg to the opposite leg (anatomical splinting) and use a clamshell to immobilize.

Referral Information

- Triage according to the [Pre-hospital Triage and Transport Guidelines for Adult and Pediatric Major Trauma](#) decision tool, including Physiological Criteria, Anatomical Criteria, Mechanism of Injury Criteria, and Special Considerations.
- All patients with extremity trauma should be conveyed to the closest appropriate trauma receiving hospital as per local trauma destination guidelines or clinical pathway.

General Information

- Fractures are a condition in which there is a break in the continuity of a bone. It may be caused by direct force or indirect impact. The aging process causes significant changes to the skeletal system; bones become less flexible, more brittle, and more susceptible to fractures. Additionally, pathological conditions such as tumours of the bone, periosteum, cartilage, or other diseases, can also increase the likelihood of fractures.
- Fractures are characterized by deformity, swelling, pain, bruising, crepitus, and instability.
- Fractures are categorized as:
 - Closed; surrounding skin remains intact □
 - Open; disruption in the surrounding skin with or without protruding bone ends
- Dislocations are a separation of two bones where they meet at a joint. In a complete displacement of a bone

end from its normal joint position, the bone sits in an abnormal position. Risks associated with dislocations include trapping, compressing, or tearing of blood vessels and nerves. Dislocations are usually characterized by obvious deformity, pain, swelling, and immobility of the joint.

- Paramedics and EMRs/FRs should exercise a high degree of suspicion with possible knee dislocations (as distinct from patellar dislocations): assume that a significant underlying arterial injury exists requiring careful management.
- Isolated knee or ankle/foot injuries may be evaluated using the [Ottawa Knee Rule](#) and the [Ottawa Ankle Rule](#).
 - Ottawa Ankle Rule (for ankle and/or foot trauma):
 - Bone tenderness at the posterior edge, or tip, of either the lateral or medial malleolus, or
 - An inability to bear weight for four steps (both immediately after injury and in the emergency department), or
 - Bone tenderness at the base of the fifth metatarsal, or
 - Bone tenderness at the navicular.
 - Note: palpate the entire 6 cm distal of the fibula and tibia; "bearing weight" counts even if the patient limps; be cautious in patients under age 18.
 - Ottawa Knee Rule: imaging required if:
 - Patient age ≥ 55 , or
 - Isolated tenderness of the patella and no bone tenderness of knee other than the patella, or
 - Tenderness of the head of the fibula, or
 - The patient is unable to flex the knee to 90 degrees, or
 - The patient is unable to bear weight for four steps (both immediately after injury and in the emergency department), or
 - The patient is unable to transfer weight twice onto each lower limb, regardless of whether they are limping.

Interventions

First Responder

- Control life threatening bleeding
- Direct pressure to sites of obvious ongoing blood loss
- Rapid application of tourniquet for catastrophic extremity injury or significant bleeding uncontrollable through direct pressure
 - → [PR03: Tourniquets](#)
- Consider wound packing to control ongoing bleeding
 - → [PR04: Wound Packing](#)
- Stabilize obvious fractures

Emergency Medical Responder – All FR interventions, plus:

- Consider traction splint for isolated mid-third femoral fracture for prolonged conveyance

Primary Care Paramedic – All FR and EMR interventions, plus:

- Consider vascular access and fluid replacement
 - → [D03: Vascular Access](#)
- Consider [tranexamic acid](#)
- Provide analgesia as required
 - → [E08: Pain Management](#)

Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

- Consider procedural sedation for re-positioning fractures
 - → [PR17: Procedural Sedation](#)

Critical Care Paramedic – All FR, EMR, PCP, and ACP interventions, plus:

- Consider [blood products](#) for significant hemorrhage

Evidence Based Practice

Extremity Trauma

Supportive

- [Antibiotic \(open fracture\)](#)

Neutral

- [Procedural Sedation](#)

Against

Limb Amputation/Mangled/Major Hemorrhage

Supportive

- [Hemostatic dressing](#)
- [Pre-alert \(massive transfusion protocol\)](#)
- [Tourniquet \(limb\)](#)

Neutral

- [Direct Pressure](#)
- [Tourniquet \(junctional\)](#)

Against

References

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2. The Ottawa Rules. [\[Link\]](#)

H10: Burns

Taylor Poirier and Tom Zajac

Updated: April 10, 2025

Reviewed: October 31, 2024

Introduction

Burns result from damage to cellular membranes, leading to extensive injury within the integumentary system. This damage can result in significant fluid loss, increase the risk for infections, and lead to hypothermia. Soft tissue burns may occur due to thermal injuries, chemical exposure, electrical contact, or ionizing radiation. Burns are optimally managed at appropriate trauma-receiving hospitals.

Essentials

- **Airway management and ongoing assessment of airway patency is important.** Burned patients should receive supplemental oxygen. Providers must be aware of the potential for rapid development of airway compromise. Signs of airway burns include cough, voice changes, and soot in the mouth, nose, or in sputum. Consider early advanced airway management in these cases.
- **Decontamination should be performed quickly at the scene where possible.** Remove clothes and flush burns with cool running water or saline for removal of carbonous soot and hydrocarbons (petroleum products). Hair, hands, and face should be cleaned with water and baby shampoo when appropriate. Refer to [PR05 Patient Decontamination](#)
- **15 minutes of cooling in the immediate aftermath of the burn is recommended.** This is inclusive of time bystanders have provided effective cooling measures. Cooling burns immediately following injury reduces the risk of skin graft requirements, long-term scarring, chronic pain, and sensory disturbances. Cooling is also a component of analgesia. Burns should be cooled with cool (not cold) running water wherever possible, which may involve remaining on scene for 15 minutes to access running water. In patients requiring immediate conveyance with immediate life threats, such as face/neck/airway burns or combined blunt/penetrating injuries, using cool saline is appropriate to help limit damage caused by burns.
- **Gel-soaked burn dressings may continue to alleviate pain and provide prolonged cooling,** after initial decontamination and active cooling. Emergency burn dressings are intended to be temporary and will be removed for assessment at the receiving facility.
- **Hypothermia is prevalent in large total-body-surface-area (TBSA) burns due to evaporative losses and cooling therapies.** Monitor for hypothermia and utilize the ambulance heater and blankets over non-burned areas as necessary.
- **Fluid replacement in the initial stage of burn care should be purposeful.** Fluid boluses may be used to correct hypotension but should be charted well, and not be excessive. A TBSA >20% burned is recommended to receive a calculated fluid replacement over the first 24 hours, but this is most accurately calculated in the ED following initial resuscitation and debridement.
- **Estimate the TBSA using the [Burn Chart or Rules of 9's chart](#).** Include only partial and deeper thickness burns. Superficial burns are not included in TBSA calculations. Estimates are intended to inform and communicate severity; they are not an absolute measurement and are reassessed more accurately outside of the acute phase of burn trauma.

Referral Information

- Triage according to the [Pre-hospital Triage and Transport Guidelines for Adult and Pediatric Major Trauma](#) decision tool.
- All patients with burn trauma should be conveyed to the closest appropriate trauma receiving hospital as per local trauma destination guidelines or [Clinical Pathways](#). Isolated burn injuries in the absence of other trauma may be conveyed to regional burn centers when appropriate.

General Information

- Burns are often associated with other forms of trauma, including fractures, complex soft tissue injuries, head trauma, and thoracic/abdominal injuries. It's important to be diligent in assessing for other injuries in patients who experience burns.

- In any fire environment, carbon monoxide is a by-product of combustion and is one of the many chemical products in smoke. Carbon monoxide poisoning should be suspected in any patient who was in an enclosed space. High-flow oxygen hastens the elimination of carboxyhemoglobin and is the hallmark of care. Monitor SpCO where available. [Refer to J02: Carbon Monoxide.](#)
- Hydrogen cyanide is a colorless gas with a faint, bitter, almond-like odor. Sodium cyanide and potassium cyanide are both white solids with similar odors in damp air. Cyanide salts and hydrogen cyanide are used in electroplating, metallurgy, the production of organic chemicals, photography, plastics manufacturing, the fumigation of ships, and some mining processes. Fires involving modern building materials, plastics, and furnishings can also produce large amounts of cyanide, and individuals exposed to the smoke from these fires can have significant cyanide exposures. Refer to [J03: Cyanide.](#)
- **Trauma Services BC defines major burn as any of the following:**
 - > 20% total body surface area (TBSA) partial and/or full thickness, any age.
 - > 10% TBSA partial and/or full thickness, age > 65.
 - > 5% TBSA full thickness, any age.
 - Burns to face, hands, feet, genitalia, or joints.
 - Electrical burns.
 - Chemical burns.
 - Inhalation injury.
 - Burns associated with major trauma.
- The American Burn Association classifies burns as minor, moderate, and major based upon burn depth and size. The traditional 'Fourth degree' classification is still commonly used to describe the most severe burns.
 - **Superficial:** burns involving only the epidermal layer of the skin; they are painful, dry, red, and blanch with pressure. *Previously first degree.*
 - **Superficial partial-thickness:** burns involving the epidermis and superficial portions of the dermis; they are painful, red and weeping, usually form blisters, and blanch with pressure. *Previously second degree.*
 - **Deep partial-thickness:** burns extending deeper into the dermis damaging hair follicles and glandular tissue; they are painful to pressure only, almost always blister, are wet or waxy dry, and display variable colour from patchy white to red. *Previously second degree.*
 - **Full thickness:** burns extending through, destroying the dermis; they are usually painless, and the skin can vary in appearance from waxy white to leathery grey, to charred and black. *Previously third degree.*
 - **Fourth degree:** burns extending through the skin to underlying tissues of the fascia or muscle.

Interventions

First Responder

- Airway management and frequent reassessment:
 - [→ B01: Airway Management](#)
- Provide supplemental oxygen for patients with potential airway burns, inhalation injuries, and exposure risk to carbon monoxide:
 - [→ A07: Oxygen Administration](#)
- Remove burned clothes and decontaminate patient as required
 - [→ J01: Approach to Toxic Exposures](#)
 - [→ PR05: Patient Decontamination](#)
- Cool burned areas for 15 minutes using cool running water wherever possible; this may require remaining on-scene for a prolonged period:
 - In patients with life-threatening injuries where it is not possible to remain on-scene, the use of cool saline may be sufficient to help limit the damage caused by the burn.
 - Avoid cooling the entire patient to prevent hypothermia.
- Apply burn dressings to affected areas.

Emergency Medical Responder – All FR interventions, plus:


- Initiate conveyance; consider intercept with additional resources

- Consider utilization of ambulance heater during conveyance if significant body surface area cooling required
- Pain management. Avoid the use of nitrous oxide when inhalation injury suspected:
 - → [E08: Pain Management](#)
- Estimate total surface area using [Burn Estimation Charts](#)

Primary Care Paramedic – All FR and EMR interventions, plus:

- Obtain vascular access
 - → [D03: Vascular Access](#)
- Evaluate and treat shock if hypotensive:
 - → [D01: Shock](#)

Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

- Early advanced airway management in the presence of airway burns and prolonged conveyance.
-  **CliniCall consultation required prior to intubation of patients with perfusing rhythms.**
 - → [B01: Airway Management](#)
 - → [PR18: Anesthesia Induction](#)
 - → [PR22: Surgical Airways](#)

Critical Care Paramedic – All FR, EMR, PCP, and ACP interventions, plus:

- In cases of prolonged conveyance, calculate fluid maintenance rate:
 - **Initial 8 hours:** (patient weight in kg) x (total burned surface area in %) x 1.5 ml = (volume to be administered over 8 hours)
 - **Following 16 hours:** (patient weight in kg) x (total burned surface area in %) x 1.5 ml = (volume to be administered over the following 16 hours)
 - Fluid boluses should be accounted for in these totals.
 - Adjust based on urine output:
 - Target urine output = 30-50ml/hr
 - Urine output ≤ 30ml/hr increase rate by 20%
 - Urine output ≥ 50ml/hr decrease rate by 20%
 - Ringer's Lactate is the recommended fluid where available.
- Respiratory support for restrictive lung pathology. Consult EPOS in advocating for escharotomy of circumferential torso burns:
 - → [PR29: Mechanical Ventilation](#)
 - → [PR39: Escharotomy](#)
- Cyanide toxicity management.
 - → [J03: Cyanide](#)

Evidence Based Practice

Possible Airway Burns

Supportive

- [Mechanical Ventilation \(CCT\)](#)

Neutral

Against

Electrocution/Electrical Burns

Supportive

- [Narcotic](#)

Neutral

- [12-Lead ECG](#)
- [Cardiac Monitor](#)

Against

Chemical Splash/Burn

Supportive

- [Narcotic](#)
- [Irrigation Skin](#)

Neutral**Against**

Burns (fire/flame)

Supportive

- [Narcotic](#)
- [Nitrous Oxide](#)

Neutral

- [Crystalloid Fluid](#)
- [Wet/hydrogel dressing](#)

Against**References**

1. Alberta Health Services. AHS Medical Control Protocols: Algorithm #5 - Burns. 2020. [\[Link\]](#)
2. BC Emergency Medicine Network. Major Burns Trauma. [\[Link\]](#)
3. Specialist Trauma Advisory Network (STAN). Burn CPGs. [\[Link\]](#)
4. UpToDate. Overview of the Management of the Severely Burned Patient [\[Link\]](#)
5. EMSPEP Database. Burns (fire/flame). [\[Link\]](#)

H11: Electrical Injuries

Ryan Ackerman

Updated: May 25, 2021

Reviewed: March 01, 2021

Introduction

Electrical injuries are typically categorized as either low voltage (< 1,000 volts), high voltage (> 1,000 volts), or lightning injuries. High voltage injuries typically involve subcutaneous fat, muscle, and bones. Current flow, arcs, or flames from the ignition of nearby material may cause injuries. Voltage, amperage, type of current (AC versus DC), path of current flow, and duration of contact all play a role in the severity of the injuries.

Low voltage injuries present with similar patterns but typically have a lesser degree of injury.

Lightning strikes can conduct millions of volts of electricity very rapidly yet often result in lesser physical injury than high voltage contact. Lightning frequently results in cardiorespiratory arrest for which prompt CPR/defibrillation is often successful.

Essentials

Paramedic and EMT/FR safety is critical: do not approach electrical sources or downed power lines until qualified personnel have deemed the scene safe.

- Reverse triage victims of a lightning strike: patients in cardiac or respiratory arrest should be treated first.
- Cardiac arrest is the most immediate threat in both high and low voltage electrical injuries. Follow standard cardiac arrest guidelines.
- Secondary trauma from falls after electrical shock is common.
- Continuous cardiac monitoring is indicated if available.

Additional Treatment Information

- External burn size is a poor indicator of the extent of internal injuries.
- Fluid resuscitation needs are often higher for electrical injuries than for thermal burns.
- High voltage electrical injury patients are at risk for developing rhabdomyolysis which may lead to hyperkalemia. Early fluid resuscitation can limit the associated renal damage.

Referral Information

- Triage according to the [Pre-hospital Triage and Transport Guidelines for Adult and Pediatric Major Trauma](#) decision tool, including Physiological Criteria, Anatomical Criteria, Mechanism of Injury Criteria, and Special Considerations

General Information

- Lightning produces incredibly high voltage and amperage over a very short duration of contact with the patient. In a lightning strike, current tends to flow around the outside of the body, and as a result, internal electrical injuries are rare. The most common injuries sustained in a lightning strike are 'flashover burns', which happen when the direct current heats the skin and vaporizes any moisture on the patient's skin. These burns are typically superficial and rarely require fluid resuscitation.
- Lightning does not need to directly strike the patient to cause injuries. It is common for entire groups of people standing near a lightning strike to be injured. In cases of triaging multiple patients, initial efforts should be focused on those in cardiac or respiratory arrest. Spontaneously breathing patients following a lightning strike have a high likelihood of survival without further intervention. Those in cardiac or respiratory arrest are likely to have good outcomes with prompt resuscitation.
- The extent of injury caused by electrocution is dependent on the following factors:
 1. The type and amount of current (AC vs DC, voltage, and amperage)
 2. The route the current follows through the body
 3. The duration of contact with the energy source

- The most immediate life threat is a cardiac dysrhythmia, usually ventricular tachycardia or ventricular fibrillation. Cardiac arrest following electrocution is generally a result of electrical disruption rather than damage or burns to the myocardium itself. Early, aggressive resuscitation efforts are often successful in restoring cardiac output as these patients are generally younger and healthier.
- Electrical arcing can generate temperatures in excess of 2,500° C. External burns are most often seen at the site of entry and exit and rarely provide an accurate representation of internal injury. Even small entry/exit wounds can be associated with significant internal tissue damage.
- The internal effects of high voltage electrocution can be grave. Muscle tissue, connective tissue, bones, blood vessels, nerves, and organs in the path are all at risk for serious thermal injury. Muscle damage can lead to rhabdomyolysis as muscle cells rupture, spilling myoglobin and potassium into the systemic circulation. Bones may be directly damaged or even fractured by violent sustained muscle contractions. Intravascular coagulation may occur as the current passes through major vessels. This occasionally results in secondary thrombotic events.
- Fluid resuscitation needs in electrical injuries are often higher than for isolated thermal injuries. Fluid volume calculations based on body surface area (BSA) burned are not accurate for electrical burns. An initial normal saline bolus of 5ml/kg followed by 100ml/hour is appropriate for normotensive patients in the out-of-hospital setting. Extended care and inter-facility goals should titrate fluid to achieve a urine output of 0.5-1ml/kg/hour.

Interventions

First Responder

- Ensure scene safe from live electrical power
- Consider spinal motion restriction
- If in cardiac arrest: begin compressions and follow appropriate guidelines for resuscitation
 - [→ N02: Adult Cardiac Arrest](#)
 - [→ M06: Pediatric Cardiac Arrest](#)
- Supplemental oxygen as required
 - [→ A07: Oxygen Administration](#)
- Flush and decontaminate affected area with sterile saline
 - [→ PR05: Patient Decontamination](#)
- Do not cool burns longer than 1-2 minutes, including decontamination time
- Dress injuries as required
- Identify type of current and duration of contact

Emergency Medical Responder – All FR interventions, plus:

- Initiate rapid conveyance and consider intercept with additional resources
- Consider analgesia
 - [→ E08: Pain Management](#)
 - [Nitrous oxide](#)

Primary Care Paramedic – All FR and EMR interventions, plus:

- Obtain vascular access
 - [→ D03: Vascular Access](#)
- Fluid resuscitation: for high voltage injuries (> 1000 Volts), initial bolus of 5 ml/kg followed by 100 ml/hour

Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

- Consider analgesia:
 - [KetAMINE](#)
 - [FentaNYL](#)
- Treat known or suspected hyperkalemia
 - [→ E03: Hyperkalemia](#)

Evidence Based Practice

Electrocution/Electrical Burns

Supportive

- [Narcotic](#)

Neutral

- [12-Lead ECG](#)
- [Cardiac Monitor](#)

Against

Lightning

Supportive

- [Prolonged Resuscitation](#)

Neutral

Against

References

1. Gentges J et al. Electrical injuries in the emergency department: An evidence-based review. 2018. [\[Link\]](#)
2. Ritenour AE et al. Lightning injury: A review. 2008. [\[Link\]](#)
3. Blackwell N. A three year prospective audit of 212 presentations to the emergency department after electrical injury with a management protocol. 2002. [\[Link\]](#)
4. Arnoldo BD et al. Electrical injuries: a 20-year review: 2004. [\[Link\]](#)
5. Alson RL et al. International trauma life support for emergency care providers. 9th ed. 2020.
6. Sanford A et al. Lightning and thermal injuries. 2014. [\[Link\]](#)

H12: Drowning

Rob Evans

Updated: May 26, 2021

Reviewed: March 01, 2021

Introduction

Drowning is a complicated clinical scenario for paramedics and EMRs/FRs. It may involve mild symptoms to situations requiring prolonged resuscitation. Complications of submersion incidents can include atelectasis, pulmonary edema, infection, hypothermia, and trauma. In British Columbia, there are over 50 drowning fatalities every year and an additional 40 near drowning cases requiring hospitalization. At least 20% of survivors experience permanent brain injury as a result of hypoxia, making early and appropriate out-of-hospital management important in promoting favourable outcomes.

Essentials

- **Caution:** Ensure paramedic and EMR/FR safety at all times around water. Wear lifejackets in accordance with High Risk Hazards policies and procedures.
- Cervical spine injury is uncommon in submersion incidents, but paramedics and EMRs/FRs should be alert to the possibility of damage based upon the mechanism of injury.
- All patients, including those with apparently minor injuries or symptoms, should be conveyed for observation due to the risk of developing secondary hypoxemia over subsequent hours.
- The early use of CPAP and/or PEEP can be beneficial for patients with hypoxemia and respiratory distress.
- Paramedics and EMRs/FRs must ensure adequate oxygenation, and prevent both heat loss and aspiration.

Additional Treatment Information

- Hypothermia should be managed in accordance with [→ I01: Hypothermia](#).
- Be suspicious for traumatic injuries based on the history of events leading up to submersion. Apply spinal motion restriction as appropriate.
- Manage cardiac arrest in accordance with resuscitation CPGs, with particular focus on oxygenation and airway management.
- Consider medical causes of cardiac arrest in patients where the mechanism of submersion does not appear to match the clinical presentation or severity of symptoms.
- There is no difference in the management of patients submerged in fresh water versus salt water.
- **Cardiac arrest considerations:**
 - Although survival is uncommon in victims who have undergone prolonged submersion requiring protracted resuscitation, successful resuscitation (with full neurological recovery) has occasionally occurred after prolonged *immersion* in icy water (and in some instances warm water). For this reason, scene resuscitation should be initiated and patients conveyed to the emergency department unless there are obvious signs of death.
 - Patients who have been *submerged* in water for a prolonged time should be evaluated for applicability of the [rapid discontinuation criteria](#).

Referral Information

- CliniCall should be involved for guidance in managing prolonged or special resuscitation situations (e.g., hypothermic submersion). See EMR interventions below.
- Contact CliniCall for assistance in managing patients refusing conveyance with minor symptoms and who are at risk for developing lung injury. See EMR interventions below.

General Information

- Water in the lungs results in alveolar collapse (atelectasis) which leads to a ventilation perfusion mismatch and

impaired gas exchange. Lung injury may take up to six hours to develop following a submersion incident.

- Monitor patients for non-specific symptoms such as productive cough, tachypnea, or mild crackles on auscultation. These can be warning signs of deterioration.
- It is important to differentiate 'immersion' from 'submersion': a submersion involves the whole body, including the airway, being submerged in water. Immersion does not necessarily imply submersion.
- Hypothermia can be present in both situations and it can be difficult to differentiate whether cardiac arrest is due to primary immersion (e.g., hypothermia) or submersion (hypoxemia).
- Swimming Induced Pulmonary Edema (SIPE) is a phenomenon seen in individuals undertaking strenuous surface swimming in cold water (e.g., triathletes or rescue personnel). Symptoms include dyspnea, hypoxemia and possible hemoptysis with a presentation similar to cardiogenic pulmonary edema. Treatment consists of oxygen administration, CPAP, and advanced airway management/mechanical ventilation as needed to correct hypoxemia.

Interventions

First Responder

- Apply spinal motion restriction as indicated based on the mechanism of injury
- Keep the patient at rest
- Position the patient sitting up
- Remove wet clothing and dry the patient
- If the patient is in cardiac or respiratory arrest, immediately commence resuscitation according to the appropriate guideline
 - [→ N02: Adult Cardiac Arrest](#)
 - [→ M06: Pediatric Cardiac Arrest](#)
- Supplemental oxygen as required
 - [→ A07: Oxygen Administration](#)

Emergency Medical Responder – All FR interventions, plus:

- **OniCall consultation required** in the setting of hypothermic cardiac arrest
 - Contact CliniCall early for guidance and treat in accordance with the hypothermic cardiac arrest guideline
- Obtain vital signs and treat hypothermia according to the hypothermia guideline
 - [→ I01: Hypothermia](#)
- Administer supplemental oxygen as indicated
 - [→ A07: Oxygen Administration](#)
- Perform basic airway management and initiate intermittent positive pressure ventilations (IPPV) if required to support failing respirations
 - [→ B01: Airway Management](#)
- Treat associated traumatic injuries according to the relevant practice guideline
- **OniCall consultation required** for assistance in managing patients refusing conveyance with minor symptoms and who are at risk for developing lung injury

Primary Care Paramedic – All FR and EMR interventions, plus:

- Consider Continuous Positive Airway Pressure (CPAP) for management of hypoxemia secondary to pulmonary edema/atelectasis
 - [→ PR09: Continuous Positive Airway Pressure](#)
- Consider placement of a supraglottic airway for ongoing resuscitation according to the resuscitation guideline
 - [→ PR08: Supraglottic Airways](#)
- If providing IPPV, consider application of a PEEP valve to assist with alveolar recruitment and oxygenation
 - [→ PR10: Positive End Expiratory Pressure](#)

Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

- Consider advanced airway management to support ventilation/oxygenation/management of contaminated

airway

- → [PR18: Anesthesia Induction](#)
- If the patient is unconscious, consider placement of a gastric tube to decompress the stomach and facilitate airway management
 - → [PR14: Orogastic Tube Placement](#)

Critical Care Paramedic – All FR, EMR, PCP, and ACP interventions, plus:

- Consider mechanical ventilation to optimize oxygenation and ventilation
- Conduct point of care testing as indicated to guide mechanical ventilation strategy
- Consider invasive temperature monitoring in the setting of hypothermia

Evidence Based Practice

Drowning

Supportive

- [NiPPV](#)

Neutral

- [Prolonged Resuscitation](#)

Against

References

1. Alberta Health Services. AHS Medical Control Protocols. 2020. [\[Link\]](#)
2. BC Injury Research and Prevention Unit. Drowning. 2020. [\[Link\]](#)
3. Michelet P, et al. Acute respiratory failure after drowning: a retrospective multicenter survey. 2017. [\[Link\]](#)
4. Parenteau LM, et al. Joint trauma system clinical practice guideline: drowning management. 2017. [\[Link\]](#)
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H13: Soft Tissue Trauma

Rob Evans

Updated: May 25, 2021

Reviewed: March 01, 2021

Introduction

Paramedics and EMRs/FRs may be called upon to care for patients with a variety of soft tissue injuries related to both minor and major trauma. The term encompasses a broad range of conditions such as contusions, sprains, strains, tendinitis, and bursitis. The most commonly injured soft tissues include muscles, tendons, and ligaments; complex injuries may involve multiple structures. Common causes include falls, sports injuries, motor vehicle collisions, or assaults.

Essentials

- Paramedics and EMRs/FRs should differentiate between acute and chronic injuries. The latter are likely due to overuse or may indicate a chronic pain syndrome. Acute pain is generally < 6 weeks duration. Careful history taking is recommended.
- In acute injuries, maintain a high index of suspicion for an associated fracture or dislocation.
- If a fracture or dislocation is suspected, apply appropriate splinting and convey promptly.
- Assess for neurovascular impairment and convey promptly if present.
- In the case of a head, back, or neck injury, apply spinal motion restriction guidelines as indicated.

Additional Treatment Information

- Primary treatment consists of rest, ice, compression, and elevation.
- If open wounds are associated with the injury, irrigate with sterile saline before applying appropriate sterile dressings.
- Consider paramedic or EMR scope appropriate analgesia as indicated.

General Information

- Conduct ongoing monitoring of neurovascular function and observe for signs of compartment syndrome.
 - The anterior compartment of the lower leg is the most common site for development of compartment syndrome
 - The 6 P's of compartment syndrome are a late sign (pain, pallor, pulselessness, paresthesia, paralysis, and poikilothermia)
- Avoid applying ice packs directly to the skin.
- If the injury involves an ankle, assess using the [Ottawa Ankle Rules](#).
- Patients with minor injuries may meet criteria for a local waiting room pathway upon arrival at destination.

Interventions

First Responder

- Provide/maintain position of comfort
- Assess affected area closely and monitor for signs of neurovascular impairment
- Provide spinal motion restriction if indicated
 - → [H05: Spinal Cord Injuries](#)
- Irrigate any associated wounds with sterile saline and dress with appropriate sterile dressings
- If an associated fracture or dislocation is suspected, provide appropriate splinting
- Apply RICE (Rest/Ice/Compression/Elevation) if applicable to anatomical site of injury

Emergency Medical Responder – All FR interventions, plus:

- Consider analgesia
 - → [E08: Pain Management](#)

Evidence Based Practice

Minor Trauma

Supportive

- [Ice](#)

Neutral**Against****References**

1. Alberta Health Services. AHS Medical Control Protocols. 2020. [\[Link\]](#)
2. Greaves I et al., editors. The trauma care pre-hospital manual. 2018.
3. Campbell JE et al. International trauma life support for emergency care providers. 8th ed. 2016.
4. Ambulance Victoria. Clinical Practice Guidelines: Ambulance and MICA Paramedics. 2018. [\[Link\]](#)

H14: Dental Trauma

Andrew Guy

Updated: June 02, 2021

Reviewed: April 27, 2021

Introduction

Dental trauma is common and often overlooked in the context of more concerning head or neck injuries. While the majority of dental injuries are not time sensitive and can be dealt with on an outpatient basis, some dental injuries can significantly benefit from prompt and appropriate treatment.

Essentials

- A dental avulsion (where the tooth is completely dislodged from the socket) is a true emergency. The chance of tooth survival increases from 85-97% if reimplanted at 5 minutes, and down to 0% after one hour without appropriate steps to preserve or reimplant the tooth.
- The best way to preserve an avulsed tooth is to reimplant it as soon as possible. Patients can do this if they are comfortable with the procedure and there are no airway concerns.
- If a tooth is not reimplanted due to airway concerns, excessive pain, or patient unwillingness, all avulsed teeth (and fragments of fractured teeth) should be preserved and taken with the patient to the emergency department or dentist.
- Avulsed or fractured teeth should be placed in a sealed container or bag and immersed in cool milk if available. The patient's saliva can also be used by having the patient spit into a container. The saliva of a family member or friend may also be used for this purpose.
 - Paramedics and EMRs must ensure that appropriate precautions are taken when asking patients to spit into containers or bags, and that appropriate personal protective equipment is used. Do not collect saliva from an individual who may have an active respiratory tract infection.
 - Save-a-Tooth kits solution (Hank's balanced salt solution) can also be used if the patient has this at home. If none of these products are available, saline solution is acceptable. Plain water should be avoided wherever possible, but is preferable to allowing the tooth to dry out.
- If there are no airway concerns, the patient may also preserve the tooth by keeping it in their mouth, coated in saliva.

Additional Treatment Information

Should a patient decide to reimplant a tooth themselves:

- Avoid handling the tooth by the root.
- Gently clean any dirt or debris with normal saline prior to reimplantation. Do not scrub the tooth.
- Push the tooth into the socket until a click or resistance is felt.
- Hold the tooth in place manually, or bite down on a piece of gauze en route to hospital.

General Information

Simple dental anatomy is useful to understand dental injuries. The tooth consists of the crown and the root. The crown is the portion that sits above the gumline and is visible normally. The root is the portion which anchors the tooth into the socket in the mandible and is not visible. The root is attached by strong periodontal ligaments to the bone. These ligaments are critical to the health of the tooth and important to avoid damage through handling.

The general types of dental injuries are useful to know in order to determine appropriate treatment:

- Dental fracture: The tooth is broken or cracked.
- Dental subluxation: The tooth is loose or has been moved but the root still remains in the socket.
- Dental avulsion: The root of the tooth is completely displaced from the socket.

Note: Pediatric dental avulsions of "baby teeth" are not an emergency and should not be reimplanted. However, it is extremely

difficult for non-specialists to distinguish between permanent and baby teeth. Assume all teeth are permanent until seen by an expert. Paramedics should not attempt to reimplant teeth in patients younger than 16 years of age; in these cases, preserve the tooth, and transport to hospital.

Interventions

First Responder

- Manage the airway as required and address concurrent injuries or clinical problems
- Ensure gentle handling of all avulsed teeth or dental fragments; do not handle by the root.
- Preserve avulsed teeth or dental fragments by immersing them in:
 - Cool milk
 - The patient's own saliva (or the saliva of a friend or family member)
 - Saline
- Do not touch loose or damaged teeth that are still in the socket

Emergency Medical Responder – All FR interventions, plus:

- Ensure teeth stay with the patient on arrival at the emergency department and that triage is aware the patient has a dental injury

Primary Care Paramedic – All FR and EMR interventions, plus:

- Provide analgesia as required for injuries.
 - → [E08: Pain Management](#)
- Consider reimplantation of tooth in socket:
 - Avoid handling the tooth by the root.
 - Gently clean any dirt or debris with normal saline prior to reimplantation. Do not scrub the tooth.
 - Push the tooth into the socket until a click or resistance is felt.
 - Hold the tooth in place manually, or bite down on a piece of gauze en route to hospital.

Evidence Based Practice

Tooth Avulsion

Supportive

- [Hank's Solution](#)
- [Replantation](#)
- [Saline](#)
- [Saliva](#)

Neutral

- [Milk](#)
- [Water](#)

Against

References

1. Fouad AF et al. International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: 2. avulsion of permanent teeth. 2020. [\[Link\]](#)

