

H10: Burns

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Introduction

Burns are the result of damage to cellular membranes, producing widespread injury to the integumentary system. This damage can cause severe fluid loss, place patients at heightened risk for infections, and lead to hypothermia. Soft tissue burns can be caused by thermal injuries, chemical exposure, electrical contact, or exposure to ionizing radiation. The mainstay of treatment for burns involves cooling, fluid resuscitation, and pain management. Burns are optimally managed at an appropriate trauma receiving hospital.

Essentials

- It is critically important to maintain the airway. Burned patients should receive supplemental oxygen; paramedics and EMRs/FRs must be keenly aware of the potential for rapid development of airway compromise, either from upper airway obstruction or pulmonary edema. 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.
- Patients must be decontaminated where applicable. Remove clothes and flush burns with cool running water or saline. Hair, hands, and face should be cleaned with water and baby shampoo.
- It is recommended that patients with burns receive 15-20 minutes of cooling in the immediate aftermath of the burn. This is inclusive of any time bystanders have provided effective cooling measures. Cooling of burns immediately following injury is a critical intervention to reduce the risk of skin graft requirements, long-term scarring, chronic pain, and sensory disturbances. Cooling is also an important analgesic strategy in these patients. Burns should be cooled with cool (not cold) running water wherever possible, which may involve remaining on scene for over 20 minutes in patients without immediate life-threatening burns or injury, to access a source of cool running water. In patients requiring immediate conveyance, the use of cool saline may be sufficient to help limit the damage caused by the burn. Paramedics and EMRs/FRs should continue to be diligent in monitoring for signs of hypothermia whilst cooling burns patients and avoid whole-body cooling if possible. Consider utilizing ambulance heater if required.
- If applying burns dressings, the 'shiny side' faces down/towards the patient.
- Burned patients lose fluids rapidly. In the immediate aftermath of a burn, patients should receive up to 2 liters of fluid to maintain a systolic blood pressure > 120 mmHg.
- For partial thickness or deeper burns, estimate the body surface area involved using the Lund and Browder chart.

Additional Treatment Information

- Burns are often associated with other types of trauma. Fluid therapy to manage shock due to blood loss must strike a balance between the patient's fluid requirements resulting from the burn and the need to prohibit further bleeding from the traumatic injury.
- 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. Provide high-flow supplemental oxygen and monitor SpCO where available. See [J02: Carbon Monoxide](#) for additional treatment information.
- Hydrogen cyanide is a colourless gas with a faint, bitter, almond-like odor. Sodium cyanide and potassium cyanide are both white solids with similar odours 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. See [J03: Cyanide](#) for additional treatment information.
- Critical Care Paramedics should follow Trauma Services BC's Provincial Burn CPG ([available from the Trauma Services BC web site](#)).

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 burn trauma should be conveyed to the closest appropriate trauma receiving hospital as per local trauma destination guidelines or clinical pathway.

General Information

- Trauma Services BC defines a 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 < 10 or > 50
 - > 5% TBSA full thickness, any age
 - Burns to face, hands, feet, genitalia, or joints
 - Electrical burns
 - Chemical burns
 - Inhalation injury
 - Any burns associated with major trauma
- The American Burn Association classifies burns as minor, moderate, and major based upon burn depth and size. The traditional classification of burn depth as first, second, third, or fourth degree is being replaced by a system reflecting the future treatment requirements in the continuum of care, although 'fourth degree' is still 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
 - 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
 - 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
 - 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
 - Fourth degree: burns extending through the skin to underlying tissues of the fascia or muscle

Interventions

First Responder

- Maintain awareness of airway patency
 - → [B01: Airway Management](#)
- Remove burned clothes and decontaminate patient as required
 - → [J01: Approach to Toxic Exposures](#)
 - → [PR05: Patient Decontamination](#)
- Cool burned areas for 15-20 minutes using cool running water wherever possible; this may require remaining on-scene for a prolonged period of time
 - 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
- Provide supplemental oxygen for patients with potential airway burns or inhalation injuries
 - → [A07: Oxygen Administration](#)

Emergency Medical Responder – All FR interventions, plus:

- Estimate total surface area using [Burn Estimation Charts](#)
- Initiate conveyance; consider intercept with additional resources
- Consider utilization of ambulance heater during conveyance if significant body surface area cooling required

- If no inhalation injury, consider [nitrous oxide](#) to effect

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

- Obtain vascular access
 - [→ D03: Vascular Access](#)
- If hypotensive:
 - Consider other causes of shock
 - [→ D01: Shock](#)
 - Fluid bolus 500 mL up to maximum of 2 L
- In cases of prolonged conveyance:
 - [Ongoing fluid maintenance calculation](#)
 - (Patient weight in kg) x (total burned surface area in %) x 1.5 ml = (volume to be administered over 8 hours)
- Analgesia as required:
 - [→ E08: Pain Management](#)
 - Intranasal [KetAMINE](#)

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

- Provide analgesia as required:
 - [FentaNYL](#)
 - [KetAMINE](#)
- Consider induction and anesthesia maintenance strategy if airway management is predicted; ketamine is the preferred induction agent; phenylephrine must be available for peri-intubation hypotension; post-induction analgesia is likely to be required
 - [→ PR18: Anesthesia Induction](#)
- Consider early surgical airway (FONA) if deterioration predicted
 - [→ PR22: Surgical Airways](#)

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

- Hemodynamic support in interfacility transfers
 - Fluid 3ml x kg x %TBSA
 - 50% given in the first 8 hours
 - 50% percent given in the next 16 hours.
 - Change to balanced fluids (Plasmalyte/Ringers Lactate)
 - Goal is urine output 30-50 ml/hr
 - If urine output ≤ 30 ml/hr increase rate by %20.
 - If urine output ≥ 50 ml/hr decrease rate by %20.
 - If urine output < 15 ml/hr for 2 consecutive hours or requiring 2 x the fluid rate for 2 consecutive hours consider Albumin 5% at 1/3 fluid rate while the remainder 2/3 will be Ringers or Plasmalyte.
 - [Call ETP prior to treatment of Albumin](#)
 - At 12 hours post-injury calculate the 24 hour fluid
 - If 24 fluid rate exceeds 6ml x kg x %TBSA then initiate [Albumin 5%](#) at 1/3 fluid rate while the remainder 2/3 will be Ringers. Titrate the fluid to urine output.
 - Assess for abdominal compartment syndrome with a [bladder pressure](#).
 - [NORepinephrine](#) to maintain MAP > 65 mmHg
 - Hemoglobin ≥ 70 g/L
 - [Call ETP prior to treatment of blood administration](#)
 - [→ PR30: Out-of-Hospital Blood Administration](#)
 - Consider [calcium](#) or cortisol for catecholamine resistant shock or adrenal insufficiency.
 - [Call ETP prior to treatment of calcium or adrenal insufficiency](#)
- Respiratory support
 - Neuromuscular blockade as required for induction and to facilitate mechanical ventilation; [rocuronium](#) is the

preferred agent

- Warning: succinylcholine is contraindicated in burns > 24 hours old
- Follow restrictive lung disease ventilation strategies.
- Consider [escharotomy](#) for inability to ventilate secondary to circumferential or near-circumferential burn.
- [Call ETP prior to escharotomy treatment](#)
- Pain control
 - [HYDROMorphone](#)
- Suspect cyanide toxicity and provide [hydroxycobalamin](#) if two of the following are present:
 - SBP < 90 mmHg
 - Lactate > 9 mmol/L
 - Decreased level of consciousness
 - Measured cyanide > 39
- Apply [Trauma BC Provincial Burn Guidelines](#) for interfacility conveyances in consultation with transport advisor

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. 2020. [\[Link\]](#)
2. Alberta Health Services. AHS Medical Control Protocols: Algorithm #5 - Burns. 2020. [\[Link\]](#)
3. BC Emergency Medicine Network. Major Burns Trauma. [\[Link\]](#)
4. Vancouver General Hospital. Burn CPGs. [\[Link\]](#)

