Thunder Bay Regional Health Sciences Centre

Policies, Procedures, Standard Operating Practices No. TR-02

Title: Trauma Burn Guidelines	☐ **Policy** ☐ **Procedure** ☒ **SOP**
Category: Unit/Department Specific **Sub-category:** Emergency/Trauma Services	**Distribution:**
Endorsed: VP, Patient Experience and Chief Nursing Executive & RVP, Regional Cancer Care **Signature:**	**Approval Date:** Nov. 2018 **Reviewed/Revised Date:** April 2024 **Next Review Date:** Nov. 2021

CROSS REFERENCES: *Child Abuse and Neglect – Duty to Report (PAT-5-174); CCSO Burn Consultation Guidelines*

1.0 PURPOSE

To deliver optimal patient care to adult and paediatric burn injured patients within the Northwest Regional Trauma Network (NWRTN) by assisting staff and physicians with the care of a patient who as sustained a significant burn injury.

2.0 POLICY STATEMENT

Burns from heat, radiation, chemical or electrical contact can damage the skin and tissues resulting in blisters, pain, and swelling. Burns can lead to infection and can cause scarring if not treated promptly and properly. Ensuring patients receiving timely intervention and access to appropriate care is crucial in providing optimal care to this patient population.

3.0 PROCEDURE

3.1 Complete Primary Assessment (Airway, Breathing, Circulation, Disability, Environment)
Assessment and initial treatment of severe burns is performed simultaneously with trauma resuscitation. Initial management focuses on stabilizing the airway, breathing, and circulation (the ABC's). The primary evaluation includes assessing for evidence of respiratory distress and smoke inhalation injury, evaluating cardiovascular status, looking for other injuries, and determining the depth and extent of burns.

3.1.1 Airway: Patients with upper airway burns should be intubated early, before airway anatomy becomes distorted by edema. Soot in the mouth, facial burns, and body burns may be more useful predictors of inhalation injury than symptoms of stridor, hoarseness, drooling, and dysphagia

3.1.2 Breathing: Decreased level of consciousness, inhaled smoke or toxins (such as carbon monoxide or cyanide), or associated injuries can interfere with ventilation and/or oxygenation. Patients with circumferential burns to the chest or abdomen may develop respiratory compromise as the result of decreased chest wall compliance.

3.1.3 Circulation: Children with signs of compromised circulation at initial presentation (such as unexplained tachycardia, poor peripheral perfusion, or hypotension) should be carefully evaluated for associated injuries. Children with compromised circulation who are being examined several hours after the burn injury may be experiencing burn shock, with or without associated injuries.

4.0 Airway Management

It is critical to maintain the airway and provide supplemental oxygen in patients with major burns. Among patients who manifest signs of smoke inhalation, a sizable percentage develop complete airway obstruction and there is no clinical means to determine which patients will do so. Fluid resuscitation can exacerbate laryngeal swelling, increasing the difficulty of tracheal intubation. Therefore, intubation should not be delayed if severe inhalation injury or respiratory distress is present or anticipated. Intubation prior to transport is prudent for many patients who require transfer to a burn center.

4.1 Common signs of significant smoke inhalation injury and the potential need for intubation include:

- Persistent cough, stridor, or wheezing

- Hoarseness
- Deep facial or circumferential neck burns
- Nares with inflammation or singed hair
- Carbonaceous sputum or burnt matter in the mouth or nose
- Blistering or edema of the oropharynx
- Depressed mental status, including evidence of drug or alcohol use
- Respiratory distress
- Hypoxia or hypercapnia
- Elevated carbon monoxide and/or cyanide levels

4.2 Diagnostic Tests:

- ABG (may be misleadingly normal initially)
- Chest x-ray
- Serial peak expiratory flow rates
- End tidal CO_2
- Serum lactate concentration should also be obtained if cyanide poisoning is a concern
- Carboxyhemoglobin level be obtained in **ALL** patients with moderate or severe burns, standard pulse oximetry is **NOT** reliable with significant carbon monoxide toxicity

4.3 Should mechanical ventilation be necessary, institution of low tidal volume ventilation to minimize airway pressures reduces the incidence of ventilator-associated lung injury and improves outcome.

5.0 Immediate Burn Care

5.1 Preventing further injury by removing clothing that is hot, burned, or exposed to chemicals:

5.1.1 Assess and manage pain
5.1.2 Remove jewelry, and non-adherent debris
5.1.3 If initial cooling of burn not performed pre-hospital, burn wounds may be covered with wet gauze or towels, which can decrease pain and may be kept on the wound for as long as 30 minutes
5.1.4 Cooling can minimize the zone of injury. Cool running water or cool water compresses x 20 minutes as soon as possible after the injury.
5.1.5 Elevate extremity to the level of the heart (not above) to promote circulation and assist in reduction of edema
5.1.6 Administer tetanus prophylaxis as indicated
5.1.7 If maltreatment is suspected, further investigation and notification of social or child protective services is warranted (see *PAT-5-174: Child Abuse and Neglect – Duty to Report*)
5.1.8 Consider wound care specialist assessment.
5.1.9 Consider a referral to Child Life Specialist for support of painful procedures/burn care with children.

6.0 Collect Burn History

6.1 Date and time of injury.
6.2 Mechanism of burn; was smoke inhalation involved.
6.3 Burn Mechanism**:**

6.3.1 Heat: the depth of the thermal injury is related to contact temperature, duration of contact of the external heat source, and the thickness of the skin. Because the thermal conductivity of skin is low, most thermal burns involve the epidermis and part of the dermis. The most common thermal burns are associated with flames, hot liquids, hot solid objects, and steam.
6.3.2 Electrical discharge: the magnitude of the injury depends on the pathway of the current, the resistance to the current flow through the tissues, and the strength and duration of the current flow. Assess for entry and exit wounds.
6.3.3 Friction: Injury from friction can occur due to a combination of mechanical disruption of tissues as well as heat generated by friction.

6.3.4 Chemicals: Injury causes a caustic reactions depending on the duration of exposure, the nature of the agent will determine injury severity. Contact with acid causes coagulation necrosis of the tissue, while alkaline burns generate liquefaction necrosis. Systemic absorption of some chemicals is life-threatening, and local damage can include the full thickness of skin and underlying tissues.

6.3.5 Radiation: Radio frequency energy or ionizing radiation can cause damage to skin and tissues. The most common type of radiation burn is the sunburn, therapeutic radiation therapy burns and burns from excessive radiation from diagnostic procedures. The clinical results of ionizing radiation depend on the dose, time of exposure, and type of particle that determines the depth of exposure. Depending on the photon energy, radiation can cause very deep internal burns. Up to date Nov 2020

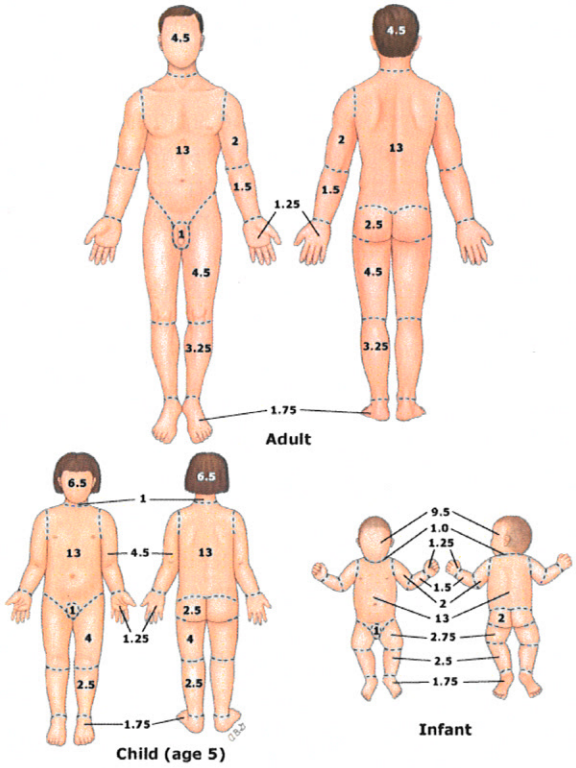
6.4 First aid provided at initial burn.

6.5 Past medical history, allergies and medications, last oral intake and last tetanus Immunization date.

7.0 Burn Assessment

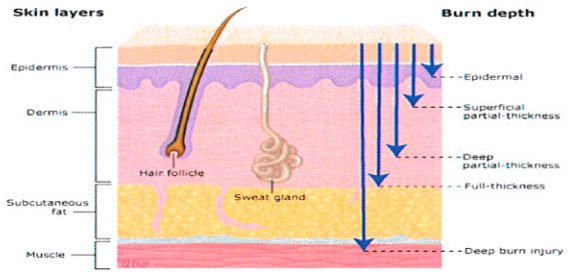
7.1 Extent of Burn:(Total Body Surface Area (TBSA) affected, in a percentage)

7.1.1 *Lund and Browder Chart* is based on age and burned area (most accurate).



7.1.2 Palmer Method: is used to measure small or scattered burns. A 1% burn is considered to be the size of the patient's hand (including fingers).An accurate percentage of TBSA is essential to calculating fluid resuscitation. Inaccuracy can cause under or over resuscitation of the patient with burns.

7.2 **Burn** Depth**:** The depth of the burn is reflective of the layers of skin and tissue affected. In assessing depth remember that the dermis is the vascular layer, so superficial burns, which affect the epidermis, will not bleed.



7.2.1 Superficial burn**:** Involves only the epidermis, the burn site is red, painful, dry, and with no blisters. Epidermis usually peels away in 3-5 days.

7.2.2 Partial thickness burn**:**

7.2.2.1 Superficial partial thickness: Involves the epidermis and part of the dermis layer of skin. These burns characteristically form blisters within 24 hours between the epidermis and dermis. They are painful, red, and weeping and blanch with pressure.

7.2.2.2 Deep partial thickness**:** These burns extend into the deeper dermis and are characteristically different from superficial partial-thickness burns. Deep burns damage hair follicles and glandular tissue. They are painful to pressure only, almost always blister (easily unroofed), are wet or waxy dry, and have variable mottled colorization from patchy cheesy white to red. They do not blanch with pressure, they will heal in two to nine weeks. These burns invariably cause hypertrophic scarring. Differentiation from full-thickness burns is often difficult.

7.2.3 Full thickness burn**:** Involves the epidermis and dermis and may go into the subcutaneous tissue. The burn site may appear waxy white, to leathery grey or charred and charred. The skin is dry and inelastic and does not blanch with pressure.

7.2.4 Fourth-degree burns: Are deep and potentially life-threatening injuries that extend through the skin into underlying soft tissue and can involve muscle and/or bone.

7.3 Reassessment of burn wound depth: Wound depth may evolve from superficial to deep; hence, early reassessment over the ensuing 72 hours is important. Assessment should continue over 7 to 14 days, as needed. Deep burn wounds will require a different treatment.

7.4 Burn severity**:** Minor or mild burns are those that can be treated in a physician's office or in an emergency department as an outpatient.

7.4.1 Moderate burn injury: Moderate burns would be those that require admission to a hospital but not to a burn center. These include superficial burns or deeper burns of limited extent.

7.4.2 Severe burn injury: Severe burn injury can be defined as burns that should be referred to, and treated at, a designated burn centre.

7.5 After initial assessment of burn area is completed, begin fluid resuscitation. Definitive assessment of depth may change over the course of the first 24 to 48 hours of the wound.

8.0 Initial Fluid Resuscitation

8.1 Fluid Resuscitation

8.1.1 Except for superficial burns, fluid resuscitation is recommended for all burns greater than 15% TBSA.

8.1.2 Two large bore intravenous (IV's) or central venous line (CVL) access for major burns should be obtained. Lines can be placed through burned skin if necessary to avoid delays in resuscitation.

8.1.3 Ringers lactate is the preferred resuscitation solution as it contains physiologic concentrations of major electrolytes, and lactate may reduce the incidence of hyperchloremic acidosis that can occur with administration of large volumes of isotonic saline.

8.1.3.1 **Formula:** The typical burn patient requires 2 to 4 mL Ringer's lactate multiplied by patients weight in kg multiplied by burn size in % TBSA during the first 24 hours. Generally 50% of the estimated total volume of fluid is given within the first 8 hours with the remainder during the next 16 hours.

8.1.3.2 IV fluids are given to meet baseline fluid needs and maintain urine output (0.5 mL/kg per hour). Any change to the infusion rate is made as gradually as possible.

8.1.3.2 Patients with inhalation injury require greater resuscitation volumes than those without.

8.2 Burn shock during the initial 24 to 48 hours following major burns is characterized by myocardial depression and increased capillary permeability resulting in large fluid shifts and depletion of intravascular volume. Rapid, aggressive fluid resuscitation to reconstitute intravascular volume and thereby maintain end-organ perfusion is crucial. Delays in fluid resuscitation and inadequate resuscitation are associated with increased mortality

8.3 Over-resuscitation can be problematic and has been associated with multiple morbidities, including acute respiratory distress syndrome, pneumonia, multi-organ failure, and abdominal, extremity, and orbital compartment syndromes. This reinforces the importance of calculating fluid resuscitation needs carefully and of continually adjusting resuscitation efforts according to the physiologic response.

8.4 Adults: Clinical signs of volume status, such as heart rate, blood pressure, pulse pressure, distal pulses, capillary refill, and color and turgor of uninjured skin are monitored every hour for the first 24 hours. Inadequate fluid resuscitation is the most common cause of diminished distal pulses in the newly burned patient

8.5 Body temperature below 35°C (95°F) should be avoided. Warmed IV fluids can be used to maintain core body temperature.

9.0 Paediatric Fluid Resuscitation

9.1 Estimating fluid requirements: Formulas for estimating fluid requirements for children for the first 24 hours following a burn injury include:

9.1.1 Modified Parkland – 4 mL/kg per percent total burn surface area (TBSA, counting moderate (partial thickness) and severe (full thickness) burn area only) **PLUS** normal 24 hour maintenance fluid requirements. Add maintenance fluid with glucose for children <5 years of age.

9.1.2 Galveston – 5000 mL/m² per percent TBSA. Add 2000 mL/m² per day for maintenance requirements.

9.2 Monitoring fluid status: Urine output should be maintained at 1 to 2 mL/kg per hour for patients less than 30 kg and 0.5 to 1 mL/kg per hour for those greater than or equal 30 kg. For outputs that exceed this rate, urine should be tested for glucose. Hyperglycemia (as the result of increased catecholamine levels) can cause an osmotic diuresis that should not be misinterpreted as a reflection of adequate volume status.

9.3 During the early phase of burn resuscitation and before the onset of a hyper metabolic response, heart rate is a better monitor of circulatory status in children than is blood pressure. Tachycardia may indicate hypovolemia, but pain can elevate heart rate in euvolemic patients

9.4 Metabolic acidosis can be a marker for inadequate fluid resuscitation, but also occurs with carbon monoxide or cyanide exposure.

10.0 Burn Center Referral Criteria*

10.1 Criteria:

10.1.1 Partial-thickness burns greater than 10% of TBSA

10.1.2 Burns that involve the face, hands, feet, genitalia, perineum, or major joints

10.1.3 Third-degree burns in any age group

10.1.4 Electrical burns, including lightning injury

10.1.5 Chemical burns

10.1.6 Inhalation injury

10.1.7 Circumferential burns
10.1.8 Burn injury in patients with preexisting medical disorders that could complicate management, prolong recovery, or affect mortality
10.1.9 Any patient with burns and concomitant trauma (such as fractures) in which the burn injury poses the greatest risk for morbidity or mortality. In such cases, if the trauma poses the greater immediate risk, the patient may be stabilized initially in a trauma center before being transferred to a burn unit. Physician judgment will be necessary in such situations and should be in concert with the regional medical control plan and triage protocols.
10.1.10 Burns in paediatric patients who are in hospitals without qualified personnel or equipment for the care of these patients
10.1.11 Burn injury in patients who will require special social, emotional, or rehabilitative intervention

10.2 Burn injuries that should be referred to a burn center include any of the criteria listed.
10.3 Patients rapidly transferred to a burn center can be wrapped in a clean dry sheet and do not require any additional dressing.
10.4 If the patient doesn't meet the transfer criteria or is questionable, consult plastic surgery per PS-23.
10.5 Transfer Process:
10.5.1 Transfer of any patient must be coordinated with the burn-centre physician via Criticall.
10.5.2 **Procedure**: CritiCall (1-800-668-4357) will provide assistance for patient referrals or medical advice from Sunnybrook Burn Centre (for all adult patients) or The Hospital for Sick Children (for all paediatric patients). CritiCall can be accessed at the request of the most responsible physician (MRP). In addition, the Teleburn Program (through CritiCall supports urgent / emergent burn care suggestions and ongoing follow up) is available.

- Provide your location, site and video system number to the consultant at the time of the initial phone consult.
- Complete and fax a "Billing Information for Teleburn Consultants" form at the conclusion of the consult. https://dropbox.otn.ca/files/teleburn_consultants_billing_form.pdf

10.5.3 All pertinent information regarding test, vital signs, fluid administration, and urinary output should be recorded on the burn / trauma flow sheet and sent with the patient. Any other information deemed important by the referring or receiving physician is also sent with the patient.
10.5.4 Every effort will be made to adequately stabilize patient prior to transfer. Physician attendance will not be necessary during transfer unless it is anticipated the patient will require procedure in transit which only a physician can perform.

11.0 Burn Skin Care:

11.1 There is growing support for washing the wound using only mild soap and water.
11.2 Ruptured blisters should be debrided. Potential reasons to rupture intact blisters include:
11.2.1 Large and expanding blisters may exert pressure onto the underlying wound surface.
11.2.2 Large blisters can impair range of motion or movement (e.g., hand, fingers, foot, and toe).
11.2.3 Intact blisters can hinder the accurate assessment of burn depth.
11.2.4 The risk of infection is increased in intact blisters.
11.2.5 Components of blister fluid are harmful to wound healing.

11.3 All partial and full-thickness burns should have dressings. Preferably a dressing that can stay in place longer, decreasing pain and discomfort. Silver dressings have been shown to provide antimicrobial coverage and less frequent dressing changes.
11.4 Special considerations:
11.4.1 Face: Superficial partial-thickness burns to the face are best managed by daily gentle washes, followed by the application of a topical cytoprotective or moisturizing agent(i.e. Vaseline)
11.4.2 Ears: Burns to the ear are managed conservatively with shaving the hair around the ear, daily cleansing, and application of a topical ointment
11.4.3 Ocular: Ocular burns should be treated with non-steroid-containing topical antimicrobial ointments to the eye and eyelid if burned. Cool saline compresses can be applied to the eyelids, and burned eyelashes and eschar may need to be removed. An eye patch may be needed in the case of a thermal injury or lid retraction from a splash injury.

11.4.4 Hands and feet: treat conservatively with daily cleansing, followed by gauze-based, non-adherent, or antimicrobial dressings. High risk for strictures.
11.4.5 Perineum: daily cleansing and antimicrobial dressings. Catheter drainage systems are generally not required for most superficial burns; however, pain on voiding due to peri-urethral involvement or the necessity for monitoring the adequacy of resuscitation or urinary output might require catheter placement. High risk for contamination or infection
11.4.6 Consider a referral to Child Life Specialist for support of painful procedures/burn care in children.

12.0 RELATED PRACTICES AND/OR LEGISLATIONS

12.1 Critical Care Services Ontario (CCSO) & Criticall Burn Centre Consultation Guidelines

13.0 REFERENCES

13.1 American Burn Association. (2022). Retrieved from www.ameriburn.org.
13.2 Ontario Telemedicine Network. (2015). *Teleburn*. Retrieved from https://support.otn.ca/en/teleburn
13.3 Emergency Nurses Association. (2023). Trauma nursing core course (9th Ed.) Des Plaines, IL, ENA
13.4 Gauglitz, G.G., & Williams, F.N. (2018). Overview of the management of the severely burned patient. *Up-to-date.* Wolters Kluwer.

Appendix A

BURN CARE PATHWAY:

Arrives to ED
- Primary assessment (ABCDE), Triage
- Sedation/pain management
- Fluid resuscitation Ringers Lactate if > 20% TBSA (2-4ml x kg x %TBSA burned) ½ first 8 hours, ½ next 16 hours)

Burn History
- Date/Time of injury
- Mechanism/smoke inhalation
  First aid provided
- Past medical history
- Allergies/medications
- Last meal
- Tetanus date

Burn Assessment
- Blisters +/-
- TBSA burned = %
  See Lund Browder chart
- Depth/Color
- Blanchable +/-

Burn Depth
Partial thickness:
- uniform, pink, blanchable

Deep partial thickness:
- hemorrhagic, patchy, white
- sluggish cap refill

Full thickness:
- brown, black, no refill,

Does patient meet any of the following criteria:
- Children: partial thickness burns >10%, full thickness any size
- Adults: partial thickness burns > 20%(>10% for over 50years), full thickness > 5%
- Chemical, electrical, lightening, high pressure steam
- Face, hands, genitals, perineum, feet
- Flexural joints (neck, axilla, elbow, knee)
- Circumferential deep burns
- Inhalation injury
- Septic burns

→ **Consult Plastics/ Burn Center/Critical for possible transfer** Specialized Burn Unit Sunnybrook or Sick Kids

NO

Does patient require admission?
- pain management
- full thickness in adults
- concerns of infection
- suspect abuse
- complex medical condition

YES ADMIT

1. Consult Plastic Surgeon for MRP or Pediatrician with plastics consulting. If Plastics unavailable, consult chief of surgery or designate
2. Consult CNS Wound care
3. Apply Acticoat flex 3(pediatric) Q 3 days OR if not tolerated, Adaptic with Bacitracin Q daily
4. Pain Management
5. Burn reassess in 48-72 hours

NO

IN EMERGENCY ROOM
1. Consult Plastic Surgeon for review if appropriate by ED MD, fax referral to plastics office, patient to confirm F/U apt with SJCG or PEDS outpatient
2. Consult Chief of Surgery or designate if Plastics not available
3. Deroof blisters > 1 cm, wash burns with soap/ water.
4. Dress with Acticoat flex 3 moistened with Intrasite gel, cover with sterile water moistened gauze, abdominal pads, Hypofix, cling, netting to secure. Change Q 3 days
   a. **If Acticoat is not tolerated (ongoing pain/burning)**, Adaptic with Bacitracin/Mupirocin, abd pads, cling, netting to secure. Change daily
   - Do not wrap limbs circumferentially, wrap digits individually, and allow for mobility of affected limb
6. Facial burns: No dressings, wash with soap and water, apply thin layer of Vaseline, patient to repeat TID
7. Arrange Burn reassessment/dressing change in 48 -72 hours from initial burn as follows:
   a. Plastic surgeon on call
   b. Paediatric outpatient (children)
   c. SJCG wound clinic (adults), specify on referral "Burn"
   d. Referral to outpatient Occupational therapy at TBRHSC if joint involvement
8. Provide analgesia for at least 72 hours, instruct patient to take analgesia prior to follow up appointment