STS Care of Thermal Burns
≥ 20% Total Body Surface Area

Initial Assessment

Remove burned clothing, rings, watches, and jewelry
Cervical spine precautions (if history of blast injury or other significant trauma)

Estimate total body surface area (TBSA) with partial and full thickness burns using the Shriners burn diagram (see accompanying page)
Check temperature and begin continuous temperature monitoring if indicated (see burn FAQ sheet)

≥ 20% TBSA

Airway

Initiate **100% FiO_2 by non-rebreathing face mask** with noninvasive $EtCO_2$ monitor in place for all burns related to fire (can omit for scald and non-fire-related thermal burns)
Manage airway if indicated (see box to right)

Fluids

Establish **IV access** (2 large bore IVs for burns ≥ 20% TBSA)
Initiate **normal saline or Ringer's lactate infusion** according to fluid administration recommendations (see box to right)
Do not bolus (avoid "fluid creep")
Insert **Foley catheter** for urine output monitoring (goal 1 mL/kg/hr)

Pain

Pain control with IV morphine 0.1 mg/kg/dose (max 10 mg/dose)
or IV fentanyl 1-2 mcg/kg/dose (max 200 mcg/dose)
Avoid IM administration due to erratic absorption

Transfer

Call Shriners at 513-872-6201 and ask to speak with the charge nurse
Key information to convey:
Mechanism of burn including whether it occurred in a closed space
TBSA with partial/full thickness burns
Summary of interventions (fluid rate, Foley, airway interventions, pain management, temperature)

Temp Regulation

Dress the burns with dry, sterile gauze or cover the patient with a dry sheet if the burns are extensive
Keep the patient warm (blankets, turn up ambient room temperature, warmed IV fluids, head covering, Bair Hugger™)

Pitfalls to Avoid

- Overestimation of TBSA
- Over/under resuscitation with IV fluids
- Endotracheal intubation when not indicated
- Inadequate temp monitoring and hypothermia

Indications for emergent airway management in a burn patient

- Obtundation with absent airway reflexes (no cough/no gag)
- Hoarse voice or cry, stridor, drooling, difficulty speaking, respiratory distress, obvious swelling of the oropharynx
- Extensive (> 40%) TBSA burns

In the absence of the above findings, emergent intubation may not be indicated. Flash facial burns, singed nasal/facial hair, and carbonaceous material (soot) in the naso/oropharynx are not absolute indications for emergent intubation as long as the patient is breathing comfortably.

Fluid administration recommendations

Use normal saline or Ringer's lactate

5 years or less: 125 mL/hr
6-13 years: 250 mL/hr
14 years or older: 500 mL/hr

Labs/Studies to Consider

- I Stat (Shriners requests this if intubated)
- Renal profile and CBC
- Noninvasive carbon monoxide measurement
- Venous co-oximetry (ie carboxyhemoglobin level)
- Lactic Acid (Stat)
- Cyanide level
- Urine or blood hCG (if post-menarchal)
- CXR and Type and Screen (if history of blast injury or other significant trauma)

Burn Management Frequently Asked Questions (FAQ)

Initial Assessment

How do I assess for PULSES in a circumferentially burned extremity?

Doppler examination can be used to determine whether there is a circulation deficit in a circumferentially burned extremity.[1] Capillary refill time, warmth/coolness of the distal extremity, and palpation of pulses may be of limited utility in assessing the adequacy of circulation in this situation.

What should I expect a burn patient's MENTAL STATUS to be like?

Typically, a burn patient is alert and oriented and may be in a significant amount of pain. If the patient is not alert, consider associated trauma/injury, carbon monoxide poisoning, cyanide poisoning, hypoxia, and hypoglycemia.[1, 2]

What is the most accurate way to estimate TBSA in burns that are SCATTERED or IRREGULARLY SHAPED?

The palmar surface of the patient's hand including the fingers represents approximately 1% of the patient's total body surface area. Assessment of the size of the palmar surface of the patient's hand and approximating it to the burn areas can aid in estimating the TBSA when burns are scattered or irregularly-shaped.[1]

Do burn patients need a C-COLLAR?

If the burn injury is a result of an explosion, blast, motor vehicle crash, or mechanism that puts the patient at risk for spinal cord injury, then immobilization of the cervical spine with a collar is warranted.

How do I assess for INHALATION injury?

There are 3 distinguishable types of airway inhalation injury: 1) carbon monoxide poisoning; 2) inhalation (thermal) injury above the glottis; and 3) inhalation (chemical and irritant) injury below the glottis. Carboxyhemoglobin levels of 5-10% can be found in smokers. Levels of 15-40% cause central

nervous system dysfunction. 40-60% carboxyhemoglobin causes obtundation and loss of consciousness. Blood gas analysis is normal in carbon monoxide poisoning because the amount of oxygen dissolved in the plasma (PaO_2) is unaffected. Oxygen saturation is also usually normal because a standard pulse oximeter cannot differentiate between carboxyhemoglobin and regular oxygenated hemoglobin. Thermal burns to the respiratory tract are limited to the upper airway above the glottis (nasopharynx, oropharynx, and larynx) because the respiratory tract's heat exchange capability is very efficient so absorption of heat and damage occurs above the vocal cords. Supraglottic edema may be delayed until fluid resuscitation is underway. Generalized edema developing in the upper airway related to the size of burns can occur without direct thermal injury to the upper airway. Inhalation injury below the glottis is almost always chemical in nature. The severity of inhalation injury and the extent of damage are clinically unpredictable based on history and initial exam. Chest x-ray is often normal at the time of initial presentation. Onset of symptoms is also unpredictable. 24 hours of observation is recommended if inhalation injury is suspected. Both inadequate volume of fluid resuscitation and excess fluid resuscitation are damaging to pulmonary function post burn.[1-3]

What is considered a "CONFINED/CLOSED SPACE?"

A confined/closed space is an area where smoke and heat cannot readily escape thereby increasing the risk of an inhalation injury.

Airway Management

How do I know if I need to INTUBATE?

Stridor, hoarseness of voice or cry, drooling, difficulty speaking, respiratory distress, and obvious swelling of the oropharynx are indications for emergent intubation. An obtunded patient or a patient with absent airway reflexes mandates emergent intubation. Extensive total body surface area burns (> 40%) will also require intubation.[1, 2] Flash facial burns, singed nasal/facial hair, and carbonaceous material (soot) in the nasopharynx or oropharynx are not absolute indications for emergent intubation as long as the patient is breathing comfortably and does not display any of the above mentioned signs.

How do I SECURE an ETT?

Adhesive tape sticks poorly to burned skin. The endotracheal tube should be secured with endotracheal tube ties (1/2 inch cotton ties) passed around the head/neck.[2]

Which burn patients require an NG TUBE?

Ileus is common with burns of more than 20% TBSA. Gastric dilatation can ensue.[1] In addition, any patient with an endotracheal tube in place should have an NG tube to decompress the stomach to facilitate ventilation.

Vascular Access

WHERE should I place an IV?

Preferably through unburned skin, but vessels underlying burned skin can be used if necessary.[1] Preparation of the skin or burned tissue overlying the vessel to be cannulated should follow the same protocol as typical IV placement. If peripheral venous access cannot be obtained, a central venous catheter should be placed using unburned areas if possible. Intraosseous lines can serve as temporizing measures until venous access is achieved.

How do I SECURE an IV?

Adhesive tape sticks poorly to burned skin. IV catheters can be secured using a gauze roll or Coban™ Self-Adherent Wrap if available.

Monitoring

How do I SECURE the cardiorespiratory and pulse oximeter MONITORING PROBES to the patient?

Apply over unburned skin if possible. If there are no unburned areas available for application, apply probe and secure with 1-inch gauze.

When is CONTINUOUS RECTAL TEMPERATURE monitoring INDICATED?

Temperature monitoring should be performed hourly in order to prevent hypothermia. In the obtunded or intubated and sedated patient, continuous rectal or esophageal temperature monitoring can be employed for burns ≥ 30% TBSA. Otherwise, noninvasive temperature measurement is adequate.

WHERE is the TEMPERATURE monitoring PROBE located, and how do I hook it up?

The brown thermometer cables are attached to the monitor and the Mon-a-therm™ rectal probe is located in the bedside carts. No calibration is necessary. Monitoring can be performed using transport or in-room monitors.

1. Lubricate the end of the rectal sensor/probe with a small amount of water-soluble lubricant.
2. Insert the rectal sensor/probe two inches into the rectum.
3. Secure the exposed sensor/probe tubing with tape or Tegaderm™ to the buttocks and upper thighs.
4. Insert the Mon-a-therm™ rectal sensor/probe into the thermometer cable.
5. The core body temperature will automatically and continuously display.

What is the UTILITY of TEMPORAL THERMOMETRY in measuring body temperature in burn patients?

Temporal thermometers should be avoided in burn patients. When trialed at Shriners, temporal thermometers were found to be inaccurate.

What are the LIMITATIONS of traditional MONITORING techniques in the burn patient?

In circumferential extremity burns, edema develops in the tissue under the eschar and may gradually impair venous return.[1] This may limit the ability to assess for adequate perfusion by palpation of distal pulses, determination of capillary refill time, and measurement blood pressure. Burn injury also triggers the systemic inflammatory response syndrome which is, in part, characterized by tachycardia.[2] Tachycardia is a common finding in the burn patient and cannot be utilized as a reliable indicator of intravascular volume depletion. Standard pulse oximetry may be falsely reassuring with an oxygen saturation of 100% in the presence of clinically significant carbon monoxide poisoning.

Fluid Management/Resuscitation

WHO needs a FLUID BOLUS?

Routine fluid boluses should be avoided in order to prevent fluid overload (ie “fluid creep”) that will exacerbate generalized edema and contribute to respiratory distress syndrome. If there is a history of acute blood loss secondary to trauma, a fluid bolus to replace intravascular volume would be reasonable as in any trauma patient. In the absence of a history of acute blood loss, initiate resuscitation fluids at the recommended rate (see burn algorithm).

What is “FLUID CREEP?”

“Fluid creep” refers to fluid overload that may result from overestimation of burn size, under appreciation of the limitations of standard hemodynamic monitoring methods in the burn patient, and inadequate reduction of fluid infusion in response to excessive urine output.[3]

What are the GOALS for FLUID RESUSCITATION in a burn patient?

Fluid resuscitation should be aimed at maintaining tissue perfusion and organ function while avoiding the complications of inadequate or excessive fluid therapy. Peripheral vascular resistance markedly increases and cardiac output decreases in the early stages after thermal injury.[1] Tissue blood flow is diminished and redistributed. Cardiac output usually returns to predicted normal levels between 12-18 hours post burn. The edema that forms in injured tissue reaches its maximum in the second 24 hours post burn. Excessive volume of resuscitation fluid exaggerates edema formation leading to compromised local blood supply as well as contributing to worsened respiratory distress syndrome and prolonged time on the ventilator. Inadequate resuscitation can lead to shock and organ failure, most commonly acute renal failure.[1]

Which burn patients REQUIRE a FOLEY CATHETER?

A patient with TBSA burns of 20% or more should have a Foley catheter placed in order to monitor urine output.

What is the best way to know that I am RESUSCITATING EFFECTIVELY?

Urine output is the best guide for ensuring the appropriateness of fluid resuscitation.[1] Insertion of a Foley catheter allows for the calculation of hourly urine output. Goal urine output: adults = 30-50 mL/hr; children < 30 kg = 1 mL/kg/hr.[1-3]

Does the recommended fluid administration rate include MAINTENANCE FLUID REQUIREMENTS?

No. Infants and young children should receive maintenance IV fluid with 5% dextrose in addition to the recommended resuscitation fluid rate.[1]

Is RINGER'S LACTATE or NORMAL SALINE better for a burn patient?

Either fluid can used depending on ease of availability. If a burn patient has metabolic acidosis or is hyperchloremic or hypernatremic, Ringer's lactate would be preferred.

Pain Management

What is the best way to control a burn patient's PAIN?

IV morphine (0.1 mg/kg/dose, max 10 mg/dose) or fentanyl (1-2 mcg/kg/dose, max 200 mcg/dose) is indicated for control of pain associated with moderate to severe burns. Alterations in tissue blood flow resulting from the systemic inflammatory response syndrome associated with the burn make absorption of intramuscular or subcutaneous injections unpredictable.[1] The use of IM injections is therefore not recommended due to this variable absorption and lag time to peak effect. IV administration is the recommended route.

Oral morphine may be administered to those patients who are awake, protecting their airway, and require pain control prior to attainment of IV access. The dose is 0.3 mg/kg/dose (max 20 mg/dose).

Threats/Pitfalls

What are the MOST COMMON THREATS/PITFALLS in the management of burns ≥ 20% TBSA?

Over/under resuscitation with IV fluids, endotracheal intubation when it is not necessarily indicated, lack of adequate temperature monitoring and warming resulting in hypothermia, inadequate measurement of the response to resuscitation with early placement of a Foley catheter and measurement of hourly urine output.[1, 3]

Maintaining the patient's temperature is a priority. The room should be warmed, and the patient should be covered with dry sheets and blankets to prevent hypothermia. Warmed IV fluid (37-40°C) may be used for resuscitation.[1]

Toxicology Considerations

Which burn patients require DECONTAMINATION?

Indications for decontamination of a burn patient are the same as for other patients and include, but are not limited to, exposure to corrosive agents on the clothes or skin and volatile fumes emanating from the patient or the patient's clothing (e.g. gasoline). Clothing should be removed and the patient's skin flushed with copious amounts of lukewarm water.

What is the recommended TREATMENT for CARBON MONOXIDE poisoning?

Humidified 100% oxygen should be administered by nonrebreathing face mask or endotracheal tube until carboxyhemoglobin levels of less than 5% are achieved.[1, 3, 4] The approximate half-life of elimination of carboxyhemoglobin during treatment with high-flow oxygen by tight-fitting mask or endotracheal tube is 74 minutes (range 24-148 minutes). In room air, the approximate half-life is as much as 200 minutes.[5] Existing evidence does not establish whether treatment with hyperbaric oxygen therapy reduces adverse neurologic outcomes in carbon monoxide poisoning.[6] Due to the challenges in transporting a burned patient to a hyperbaric oxygen therapy chamber and providing resuscitative care in the chamber, hyperbaric oxygen therapy is not recommended.[2]

WHO should receive the CYANOKIT?

Cyanide poisoning usually results in sustained loss of consciousness, persistent, severe lactic acidosis, and hypotension. Seizures may also be seen. It is reasonable to consider administration of the Cyanokit to a patient with persistent, severe lactic acidosis and altered mental status of unclear etiology despite adequate oxygenation and ventilation. However, administration of the Cyanokit interferes with laboratory testing performed by colorimetric assay (eg AST, creatinine, magnesium, and bilirubin) and may also interfere with the ability to dialyze a patient due to false detection of a

blood leak from the blood-like appearance of the solution (see Cyanokit package insert for additional details).[7-9] Therefore, the risks and benefits should be weighed carefully before administering the Cyanokit. Urine, sweat, tears, and other secretions become pink or red after Cyanokit administration.[5]

HOW is the CYANOKIT DOSED?

70 mg/kg (maximum dose 5000 mg) IV over 15 minutes[5]

WHERE is the CYANOKIT STORED?

The Cyanokit is stored in the STS Pyxis machine (Trauma 2) and in the Big Room. Additional doses are stored in the inpatient pharmacies at Burnet and Liberty.

Transfer Considerations

How do I know who to TRANSFER TO SHRINERS?

The American Burn Association has identified injuries usually requiring referral to a burn center.[1] See the back of the Shriners burn diagram for a comprehensive list of reasons for referral. You can also call 513-872-6000 and ask to speak with the charge nurse to review the history and findings and decide on the necessity and appropriate timing for referral.

What RESOURCES does SHRINERS have available when the patient arrives to their floor?

There is a surgery resident in house 24 hours/day. Anesthesia and burn surgery attendings are available on an as needed basis dictated by patient condition. This determination is made prior to admission. The Shriners burn surgery attending speaks to the attending at the referring facility prior to transport.

What is the best way to DRESS THE BURNS?

Cover the burn area with a clean, dry sheet. Covering burn wounds prevents air currents from causing pain in partial thickness burns. Ice or wet dressings should not be applied directly to the burn in order to avoid hypothermia and frostbite.[1] Do not apply topical antibiotic ointment if immediate transfer to Shriners is planned.

If I receive a CALL FROM an OUTLYING HOSPITAL regarding a burn patient, does the patient need to come to the CCHMC ED first?

No. The patient can be transferred directly to Shriners for definitive burn wound care. Tell the outlying hospital to call 513-872-6000 and ask to speak with the charge nurse to review the history and findings and decide on the necessity and appropriate timing for referral.

Healing

What can I teach about expected scarring and TIME TO HEALING?

A first-degree burn is limited to the epidermis. Injured cells will peel away within a few days revealing healed skin below with no scarring. Partial-thickness (second degree) burns involve the entire epidermis and variable portions of the dermis. Healing may require 2-3 weeks or even longer. Scarring is minimal if healing occurs within 2-3 weeks. Grafting may be necessary if the wound is open for a longer period of time.[1, 3]

Non-Thermal Burn Considerations

What about ELECTRICAL or CHEMICAL BURNS?

Electrical burns – serious dysrhythmias may occur even after a stable cardiac rhythm has been obtained. Continuous cardiac monitoring may be necessary during the first 24 hours post injury. There may also be occult severe, deep tissue injury.[1]

Chemical burns – copious amounts of water should be used to flush the chemical from the body surface. Powdered chemicals should be brushed from the skin prior to flushing. Chemical eye injuries should be irrigated until instructed otherwise by an ophthalmologist.

References

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