

# BURN

(Last updated 2/5/2019 Rajyabardhan Pattnaik, M.B.B.S, DA; Chaomeng Wu, M.D)

**PRESENTING COMPLAINT:** Blisters, redness over skin, excruciating pain

## FINDINGS

- **A** Check airway, swelling or inhalation injury, immobilize the patient's cervical spine
- **B** ↑ RR
- **C** ↓ BP, ↑ HR or weak pulse (severe burn)
- **D** Variable altered (V,P,U,D)\*
- **E** Remove clothing and check  
Location: face, perineum, hands, feet, circumferential  
Depth: first (erythema), second (+blisters), third degree (dry dark leathery skin)  
Area: Rule of 9's; see algorithm; severe >20%BSA in adults and >15%BSA in children.
- **L<sub>PC</sub>** ↓cRBC, B HB, ↑ HbCO, ↑ K, ↑ Lac, ↑ Glu, ↓ CvO<sub>2</sub>
- **U<sub>PC</sub>** **FAST:** ↓Blood volume, B line(+) (pulmonary edema)

\***V** (verbal), **P** (pain), **U** (unconsciousness), **D** (delirious)

**U<sub>PC</sub>** (point of care ultrasound) **L<sub>PC</sub>** (point of care labs)

## OTHER HISTORY

- Skin or mucosa damage
- **Predisposing Conditions:** Touch with fire, flash, high voltage electrical, chemical or high temperature material, cold exposure (frostbite), radiation.
- Inhalation injury: (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, respiratory distress, hypoxia or hypercapnia, elevated carbon monoxide and/or cyanide levels)
- Myocardial injury: due to electric burn

## DIAGNOSTIC INTERVENTIONS

- **Labs:** Blood count, electrolytes, BUN-creatinine, ABG, lactates, carboxyhemoglobin, C-reactive protein, capillary blood glucose; coagulation profile, liver function tests, amylase.
- **Monitoring:** ECG (particularly if electrical burn, watch for arrhythmia and secondary myocardial ischemia), pulse oximetry (+/- capnography EtCO<sub>2</sub>) monitoring
- **Imaging:**

- CXR: signs of inhalation trauma/ARDS, pneumothorax
- US: check blood supply to the extremities, blood volume, B line, cardiovascular function

## THERAPEUTIC INTERVENTIONS

- **Treatment in order of priority:**
  - **Intubation-mechanical ventilation:** if increased work of breathing, risk of smoke inhalation and rapid airway compromise, or altered mental status:
  - **Fluid resuscitation:** 2 large bore IV accesses (unburned skin, or intraosseous) and fluid resuscitation even if no hypotension or shock: crystalloids (lactate Ringer), adequate volume to maintain urine output  $>0.5$  ml/kg/h; consider modified Brooke formula: IV fluid requirement  $=2-4\text{ml/kg/\% BSA}$ , given one-half the first 8 hours, one-half the following 16 hours; adults burns  $>20\%$  or children burns  $>15\%$  should undergo guided fluid resuscitation based on body size and %BSA.
  - **Bronchodilators:** if bronchospasm
  - **Pain control:** paracetamol and NSAIDs or opioids and ketamine; if needed add benzodiazepine for associated anxiety
  - **Systematic tetanus prophylaxis**
  - **Consider concomitant intoxication:**
    - **CO:** use high flow oxygen
    - **Cyanide** (high lactates, EtCO<sub>2</sub> drop): use hydroxocobalamin
- **Measure urine output:** urinary catheter placement to accurately measure urine output
- **Consult:** Surgery, consider transfer to **burn center**

## MANAGEMENT AFTER STABILIZATION

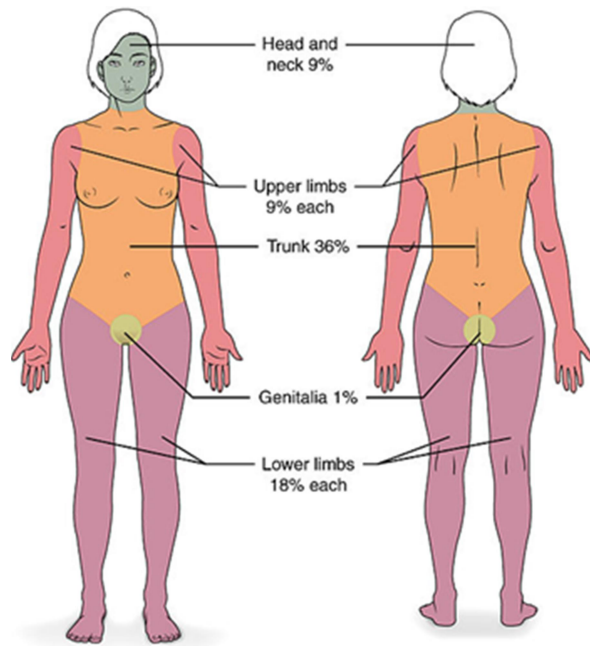
- **Meds: Systemic antimicrobial therapy** if suspected infection
- **Procedures:**
  - **Compartment syndromes (limbs, abdominal, orbital) and eschars:** consider decompressive **escharotomy** if constriction and ischemia
  - **Burn care:** debride bullae and **excise adherent necrotic tissue**; clean with non-alcoholic antiseptic solutions; apply topical antibiotics (silver sulfadiazine); cover with gauze; dressing daily changed; watch for signs of developing infection
  - **Prevent hypothermia:** cover patient with clean wraps (except face)
  - **Abdominal decompression:** nasogastric tube for abdominal decompression

- **Consider:** Laryngobronchoscopy if smoke inhalation; hyperbaric oxygen treatment for severe CO poisoning
- **Nutrition:** Early enriched enteral nutrition, complementary parenteral if needed (total parenteral nutrition increases risk of fungal infection)
- **Prophylaxis:** Stress ulcer and DVT prophylaxis
- **Consult:** Surgery, consider transfer to burn center

## CAUTIONS

- **Rule out** associated deep tissue injury (particularly if electrocution), CO inhalation, cyanide poisoning; Balance fluid status to avoid overload; avoid aggressive transfusion, **lung protective ventilation strategy** (High risk of ARDS development in intubated burned patient); **Do not use succinylcholine** (for ISR) beyond 72 hours after burn (risk of severe hyperkalemia); All **infections** of suspected partial or full-thickness burns warrant aggressive management including admission and parenteral antibiotics. In addition to causing sepsis, burn infections can extend the depth and extent of a burn, converting a superficial partial-thickness burn into a deep partial-thickness or full-thickness burn

## ALGORITHM



(Source: OpenStax College, Anatomy & Physiology p197; available at <http://cnx.org/content/col11496/1.6/>, last accessed 01/20/2014)

## REFERRAL

- Patients with severe burns are typically referred to a burn center. Remember that burned body surface area measurement differs in younger children from teenagers and adults with all measurement systems e.g. Lund and Browder, Rule of 9s.

## REFERENCES&ACKNOWLEDGMENT

Acknowledgement: *Benjamin Bonneton, MD; Pablo Moreno Franco, MD; Joseph C. Farmer, MD*

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