Burns: Critical Care Management

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Airway
- Upper Airway
- Lower Airway
- CO Poisoning

Airway
- Upper Airway
  - direct thermal injury >>> UA edema / obstruction
  - SSX:
    - suspected in any facial burns
    - neck burns
- Rx:
  - 100% humidified O²
  - racemic epinephrine inhalers
  - steroids ???
  - bronchoscopy???

Airway / Breathing
- Lower Airway / Inhalation Injury
- Inhalation of products of incomplete combustion and toxic fumes
  - chemical tracheobronchitis, pulm edema, pneumonia
  - HX: 4
    - closed space burns
    - combustion / explosion with burns to head and torso
    - unconscious / impaired mentation at the scene

Airway / Breathing
- PE:
  - facial burns / singeing of the eyebrows & nasal vibrissae
  - oropharyngeal edema / carbon deposits
  - carbonaceous sputum !!!!!!
- RX:
  - 100% O²
  - ABG
  - carboxyhemoglobin level ( >10%)
  - bronchoscopy

Airway / Breathing
- CO Poisoning
  - HX: closed space / combustion
  - SSX:
    - CO level 20% >>> no symptoms
    - 20-30% >>> HA / nausea
    - 30-40% >>> confusion
    - 40-60% >>> coma
    - >60% >>> death
  - PE: ???
    - cherry red skin is rare
Airway / Breathing

- CO Poisoning
  - mechanism:
    - affinity of CO for HbG (240x O²)
    - displaces O² from Hgb
    - shifts the oxyhemoglobin dissociation curve to the left
  - ½ life
    - RA >>> 250min, 4hrs
    - 100% O² >>> 60min
    - PEEP >>> 45min
    - O² hyperbaric chamber >>> 25min

Circulation / Fluid Management

- Who needs circulatory volume support?
  - 5%, 10%, 30%, 40%, 50%??
- IV access -- Large Bore 16-gauge
  - where: UE vs. LE
  - where: unburned skin vs. burned skin
- What type of fluid?
- How much?
  - degree & extent of the BURN (BSA)
  - weight of patient
  - age; child vs. adult

Circulation / Fluid Management

- Parkland formula:
  - 4cc / kg / %BSA burn of 2nd and 3rd degree
  - 70kg pts c 50% BSA burn
  - 4cc x 70 x 50 =14,000 cc / 24 hrs
- Rate of administration in 24 hrs
  - ½ during the first 8hrs
  - ½ during the next 16 hrs
- 2nd 24hrs
  - D5W and colloid (FFP / albumin / PC)
  - 0.5ml / kg / %BSA of colloid + 2L D5W
- F/U
  - UO
  - CVP / pulmonary catheter

First Degree Burn: Epidermal

- Sunburn-Like
- Epidermis only
- Dry
- Erythema
- Pain
- No blisters
- Not calculated in burn extent

Second Degree Burn: Partial Thickness Burn

- Second Degree
- Through the epidermis into the dermis
- Superficial = dry tender bullae
- Deep = moist, red tender bullae
**Third Degree Burn:**

Full Thickness Burn

- Through epidermis & dermis
- Dry
- Brownish or white
- Leathery
- Does not blanch with pressure
- Painless & Insensate

**Estimating Surface Area with Rule of 9’s**

- **Child**
  - head: 18%
  - torso back: 18%
  - torso front: 18%
  - leg left: 14%
  - leg right: 14%
  - arm left: 9%
  - arm right: 9%

- **Adult**
  - torso front: 18%
  - torso back: 18%
  - leg left: 18%
  - leg right: 18%
  - head: 9%
  - arm left: 9%
  - arm right: 9%
  - genitalia: 1%
  - size of patients palm: 1%

**Local Treatment**

- Evaluate degree / extent of the wound
- Deep second or third degree wound

**KEY:**
- ABC, resuscitation
- early excision & grafting !!!!!
  - 2-4 days post admission and post stabilization

**Contractures:**
Local Treatment: Topical Antimicrobial Agents

- **Silvadene**
  - poor eschar penetration
  - ineffective against pseudomonas & enterobacter
  - sulfa allergy
  - reversible leucopenia

- **Sulfamylon**
  - excellent eschar penetration >>> painful
  - good for ear, nose burns
  - sulfa allergy
  - worsens acidosis (carbonic anhydrase inhibitor)

- **Silver Nitrate and Nitrofurantoin**

Circumferential Burns

- **Eschars formation**
  - impede venous return
  - develop compartment syndrome in extremities or chest wall
  - low tidal volumes
  - high peak pressures
  - progressive neurologic signs (deep tissue pain, paresthesia)
  - cyanosis and impaired capillary refilling

Treatment??

Escharotomy

- Biaxial incision in the extremities
- Uniaxial incision in fingers
- 2-3 incision on dorsum of the hand
- Bilateral midaxillary incisions in the chest joined by bilateral midclavicular incisions
- Use cautery
- No need for local anesthesia

Treatment: Chemical Burns

- Remove the chemical
- Chemical liquid:
  - rinse with water (20-30min)
- Chemical powders (dry)
  - brushed from the wound
  - avoid direct contact
  - rinse with copious amount of water
- **Alkali burns more serious than acid burns**
  - penetrate more deeply
  - require more irrigation with water

Electrical Burns

- More serious than they appear on the surface
- Skin has low resistance
- **Muscles / nerves / bones / vessels have higher resistance**
  - severe damage
- Different rate of heat loss from superficial to deep tissue planes
  - relatively normal overlying skin coexisting with deep muscle necrosis
Electrical Burns
- Acidosis
- Hyperkalemia
- Arrhythmias
- Rhabdomyolysis
  - myoglobinuria
  - Acute Renal Failure
- Fractures from sudden flexion
- Nerve injury

Electrical Burns: Management
- A B C’s
- EKG
- Labs: ABG, electrolytes, urine myoglobin
- Indwelling urethral catheter
  - urine dark
- IVF
  - UO >100cc / hr in a 70kg man
- Mannitol
- Sodium bicarbonate gtt to alkalinize the urine
- Fasciotomy to LE compartments
- Prompt debridement / amputation of necrotic muscle
- X-rays for fractures

Transfer Criteria
- Criteria for transfer to burn center
- Age under 10 years or over 50 years
  - second or third degree burn involving 10% BSA
- All Other Ages
  - second or third degree burn involving 20% BSA
  - third degree burn involving 5% BSA

Transfer Criteria
- Any burns of high risk areas
  - face
  - eyes
  - ears
  - hands
  - feet
  - genitals
- Electrical Burns
- Inhalation injury

Complications of Burns
- Infections
  - give ABX only for proven infection, not prophylactic
  - strict aseptic technique
  - topical therapy (Silvadene, Sulfamylon)
  - Bx / Excision of infected area
  - most common infection: wound, pneumonia
  - most common bacteria
    - early: strep & staph
    - late: gram neg rods (pseudomonas)

Complications of Burns
- Curling Ulcer
  - stress ulcer
- GI problems
  - acalculous cholecystitis
  - duodenal obstruction from SMA syndrome
  - ischemic colitis
- Marjolin Ulcer