Burns: Critical Care Management
Michel B. Aboutanos MD, MPH
Division of Trauma/Critical Care
Department of Surgery
VCU School of Medicine

Airway
- Upper Airway
- Lower Airway
- CO Poisoning

Airway
- Upper Airway
  - direct thermal injury >>> UA edema / obstruction
  - SSX:
    • suspected in any facial burns
    • stridor / oropharyngeal edema
    • 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 HGB (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

Third Degree Burn: (Subdermal)

- Third Degree - leathery various colors

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 patient’s 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 leukopenia
- **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 filling
- **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