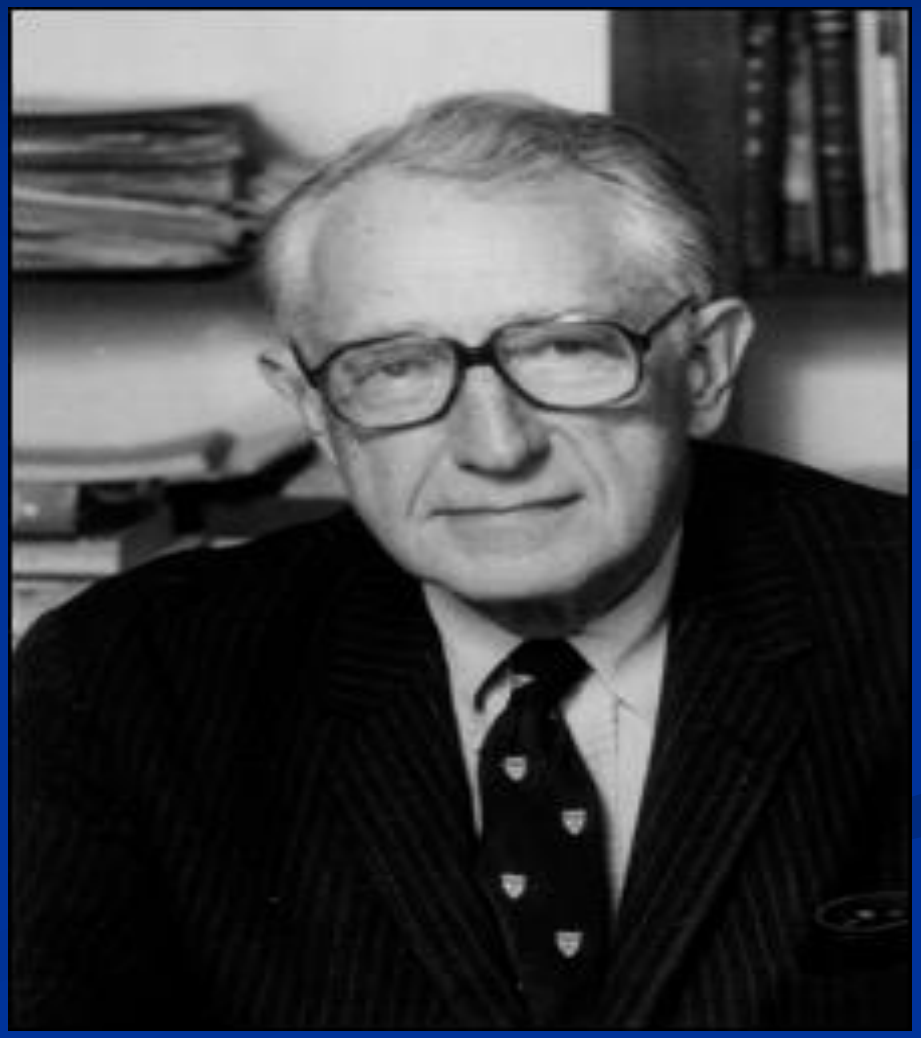
Burns: A Basic Approach and Understanding

Kelli Huesman, MPAS, PA-C

Miami Valley Hospital Regional Burn Unit

Pioneers

- In 1946 Drs Francis Moore and Oliver Cope
- Postulated that space between cell was the major reservoir of plasma loss and etiology of swelling in the burn and unburned tissues.
- Quantified amount the of fluid for adequate resuscitation.



Epidemiology

- Two million burns per year in the US
- 100,00 admissions
- 5,000 deaths
- 250,000-1.5 million estimated cost of injury
- Scald and flame injuries most common over all.
- Flame more common in adults
- Scald more common in children

Burn Wound Depth Variations

- First Degree
- Second Degree- Partial Thickness
- Third Degree- Full Thickness
- Fourth Degree

Burn Injury Depth-First Degree

- Epidermis only
- Erythematous
- No Blisters
- Painful
- Epidermis sloughs off in 3-4 days
- No Operation

Burn Injury Depth-Second Degree

- Epidermis and part of dermis
- Blisters
- Pink and Moist if blisters burst
- Blanches
- Painful
- Heals itself usually

Burn Injury Depth-Third Degree

- Epidermis and dermis completely destroyed
- Charred, leathery and firm
- White and dry with no blanching
- Painless

Burn Injury Depth-Fourth Degree

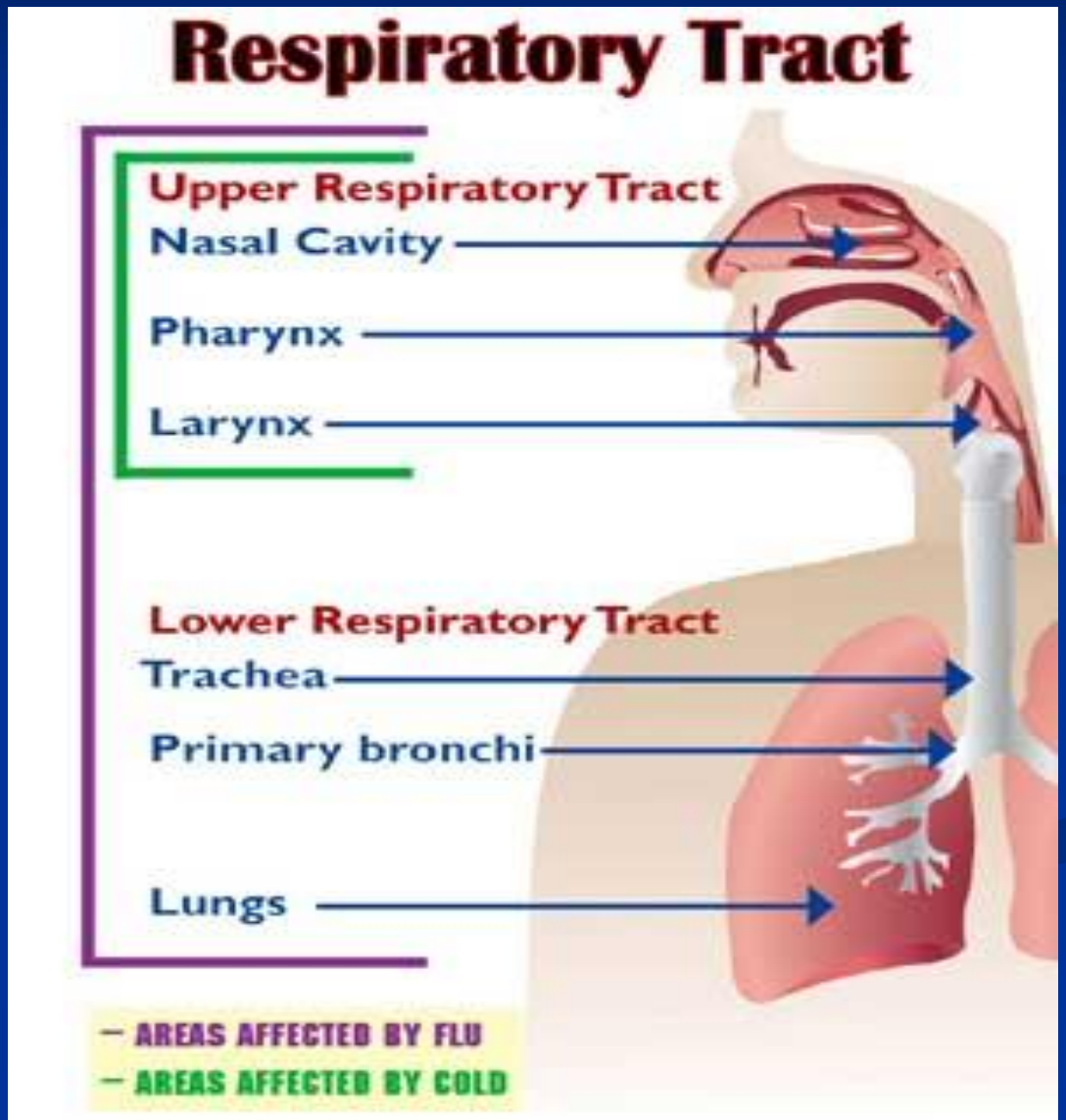
- Epidermis Dermis Fat Muscle Tendon Bone
- Electrical and thermal injury coupled with entrapment

Referral Criteria

- >10% Second Degree
- Third Degree
- Face, hands, feet, genitalia, perineum and major joints
- Electrical injury (including lightning)
- Chemical burns
- Polytrauma Burns that pose greater risk than burns
- Inhalation injury
- Comorbidities preexisting that complicate treatment
- Nonqualified personnel to care for children

Inhalation Injury Types

- Supraglottic
- Infraglottic
- Carbon Monoxide



Inhalation Injury HPI

- Burned in enclosed space
- Unconscious
- Noxious chemicals
- Soot within mouth
- Carbonaceous sputum
- Oropharynx- erythema, edema or soot
- Hoarseness progression
- Stridor
- Tachypnea
- Agitation

Flash Burns to Face

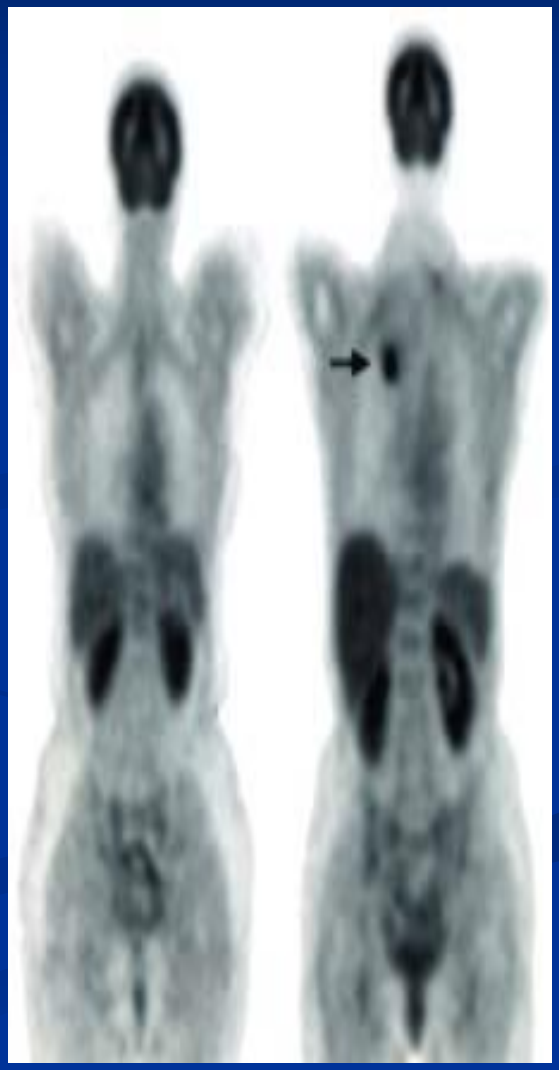
- Non-enclosed space
- Exposure time short
- Carbon deposit around mouth only
- Gas grill, bonfire, fuel on fire histories
- Singed hairs

Signs and Symptoms of Carbon Monoxide Toxicity

- CO % -Symptoms
- 5-10 -Headache and Confusion
- 11-20 -Headache severe Visual Changes
- 21-30 -Disorientation and Nausea
- 31-40 -Irritability, Dizziness and Emesis
- 41-50 -Tachypnea, Tachycardia
- >50 -Coma, Seizure, Death

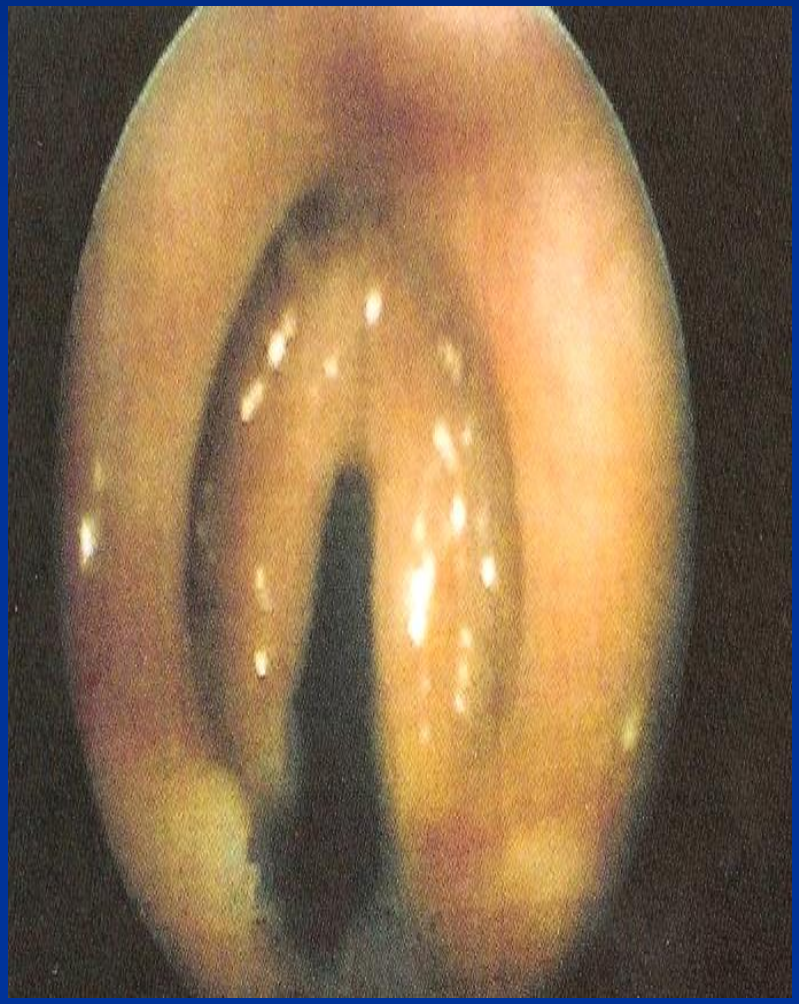
Definitive Diagnosis

- Clinical
- Chest X-ray
- ABG/
- Peripheral Sats
- Fiber optic bronchoscopy

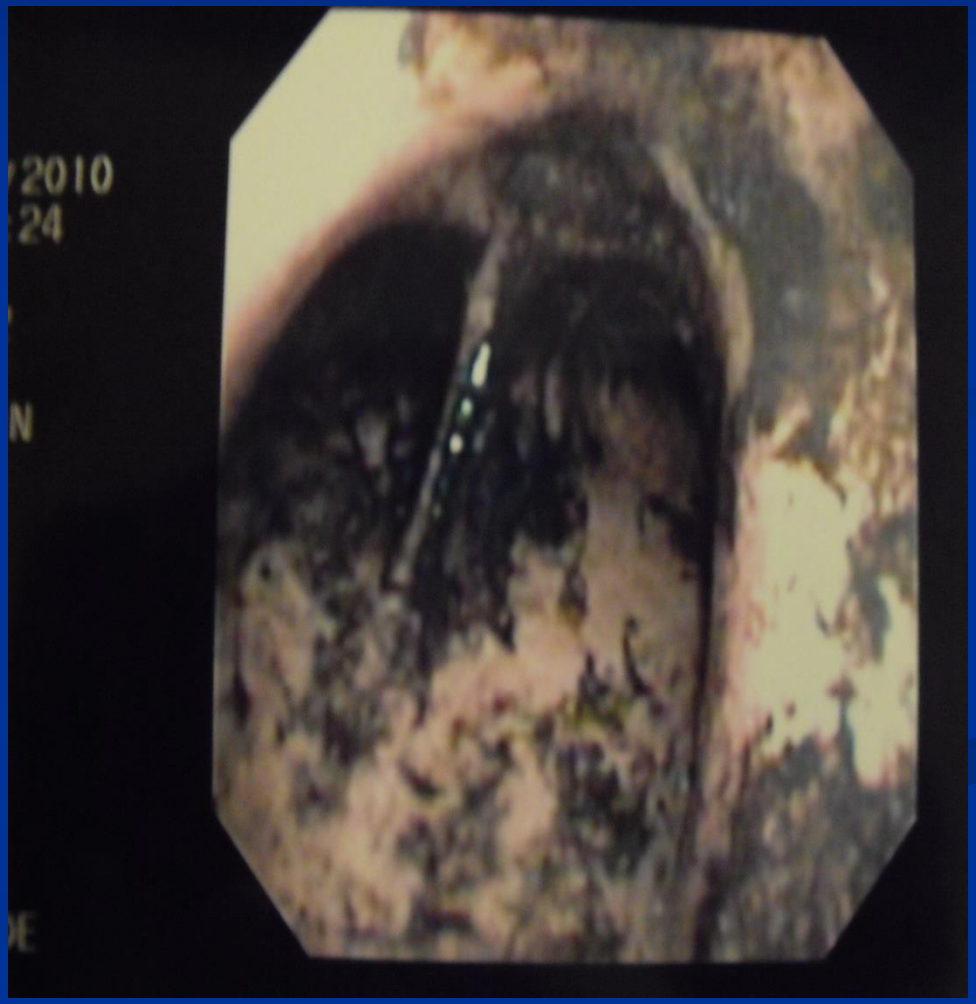


Inhalation Injury Gross Pathology

Supraglottic view

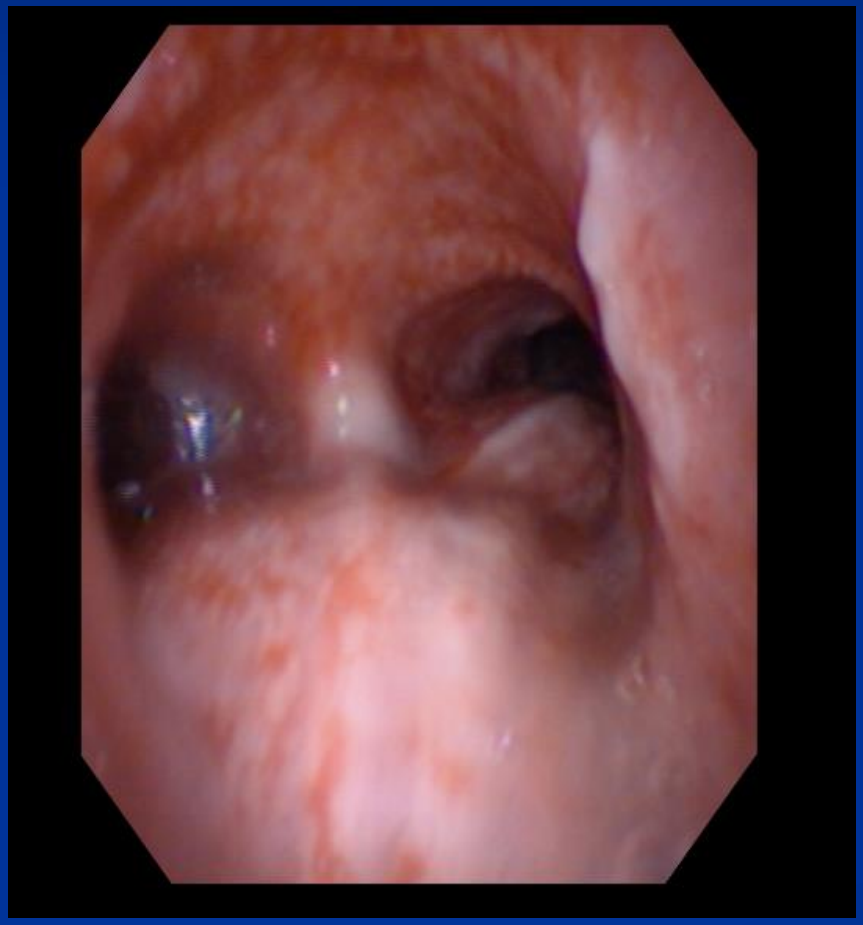


Infraglottic view



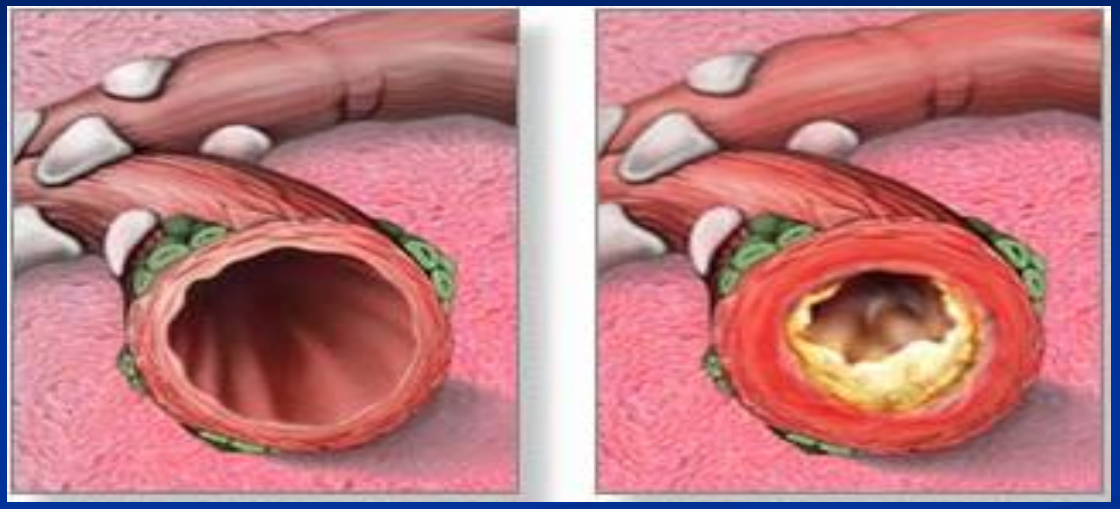
Inhalation Injury Gross Pathology

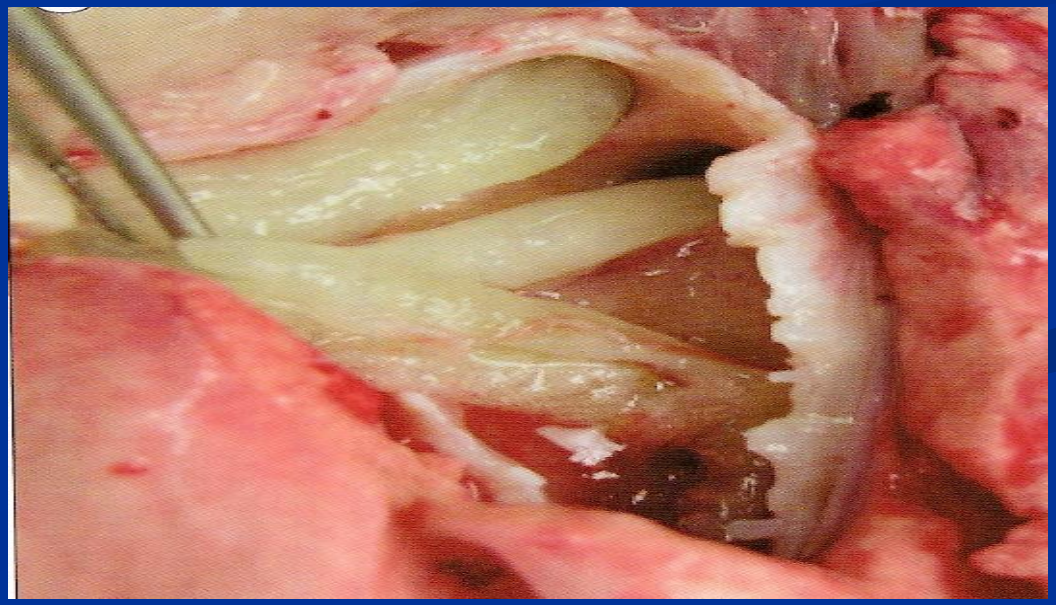
Infraglottic views



Inhalation Injury Pathophysiology

- Local and systemic inflammatory response
- Vascular Permeability
- Mediator cascade initiated-locally
- Fluid influx hypersecretion
- Cilia impairment
- Cast formation-immune cells fibrin and mediators





Inhalation Injury Pathophysiology

- Cast formation- neutrophils, fibrin, mucus and necrotic sloughed epithelium
- Airway plugging
- Compliance and FRC decreased
- Atelectasis and alveolar collapse beyond obstruction

Inhalation Injury Treatment Objectives

- 100% Oxygen supplementation for CO and CN
- CN- sodium thiosulphate
- Intubate early rather than late (esp. long transport times)
- Bronchial Hygiene- Keep secretions cleared (bronchoscopy prn)
- Barotrauma and Acute Lung Injury avoidance

  (lung stretch reduction, low tidal volume and pressure limitation ventilation and HFPV)
- Inhalation injury protocols (immediate implementation)
- Transport to nearest Burn Center

Inhalation Injury Protocol

RESPIRATORY CARE INHALED MEDICATIONS-INTUBATED (MVH Burn Center Admission)

albuterol/ipratropium (DUONEB) must be ordered with Acetylcysteine
albuterol MDI must be ordered with nebulized heparin

- ☐ Smoke Inhalation Protocol
  Routine, ONGOING, First occurrence now Until Specified
- ☐ albuterol/ipratropium (DUONEB) with IPV every 4 hours alternating with Albuterol MDI; THEN
- ☐ Acetylcysteine 20% 3 ml instilled down ET tube; give for 7 days
  3 mL, Inhalation, EVERY 4 HOURS (RT) for 7 days, following albuterol 2.5mg & ipratroprium 0.5 mg therapy
- ☐ Albuterol MDI 3 puff every four hours alternating with albuterol/ipratroprium(DUONEB) THEN:
  3 Puff, Inhalation, EVERY 4 HOURS (RT)
- ☐ Nebulized Heparin 5,000 units with 3cc normal saline every 4 hrs x 7 days
  5000 Units, Inhalation, EVERY 4 HOURS (RT) for 7 days, following Albuterol MDI
- ☐ Albuterol 2.5 mg PRN for wheezing
  0.5 mL, Inhalation, AS NEEDED, Wheezing

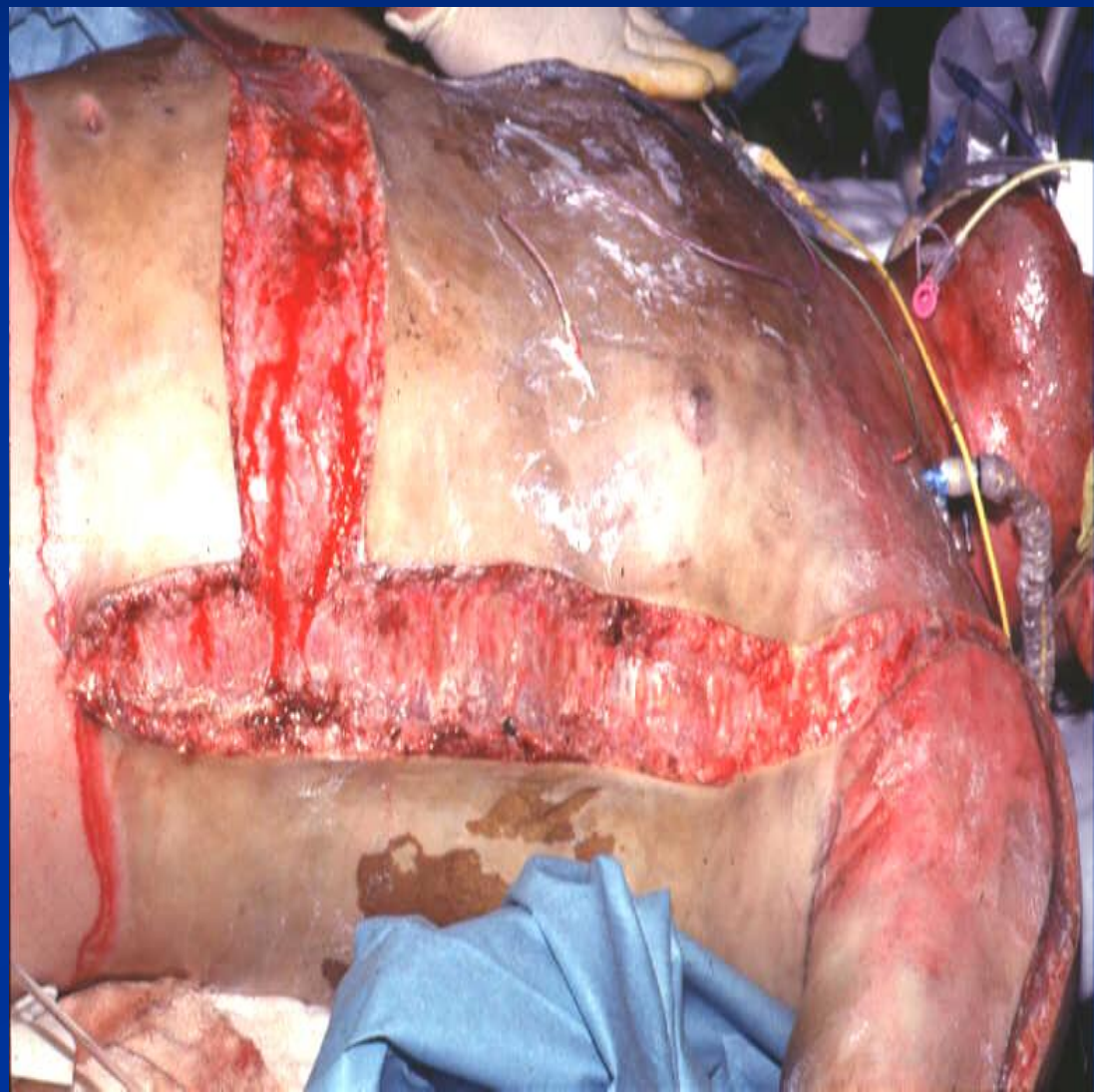
RESPIRATORY CARE INHALED MEDICATIONS-NON-INTUBATED (MVH Burn Center Admission)

albuterol/ipratropium must be ordered with nebulized acetylcysteine
albuterol nebs must be ordered with nebulized heparin

- ☐ Smoke Inhalation Protocol
  Routine, ONGOING, First occurrence now Until Specified
- ☐ albuterol/ipratropium (DUONEB) with Acapella every 4 hours alternating with Albuterol HHN; THEN
- ☐ Nebulized Acetylcysteine 20% every 4 hours following albuterol/ipratropium for 7 days
  3 mL, Inhalation, EVERY 4 HOURS (RT) for 7 days, following albuterol 2.5mg & ipratroprium 0.5 mg therapy
- ☐ albuterol (PROVENTIL/VENTOLIN) 2.5mg/0.5ml via HHN alternating with albuterol/ipratropium THEN:
  0.5 mL, Inhalation, EVERY 4 HOURS (RT), Shortness of Breath
- ☐ Nebulized Heparin 5,000 units with 3cc normal saline every 4 hrs x 7 days
  5000 Units, Inhalation, EVERY 4 HOURS (RT) for 7 days, following Albuterol per HHN
- ☐ Albuterol 2.5 mg PRN for wheezing
  0.5 mL, Inhalation, AS NEEDED, Wheezing

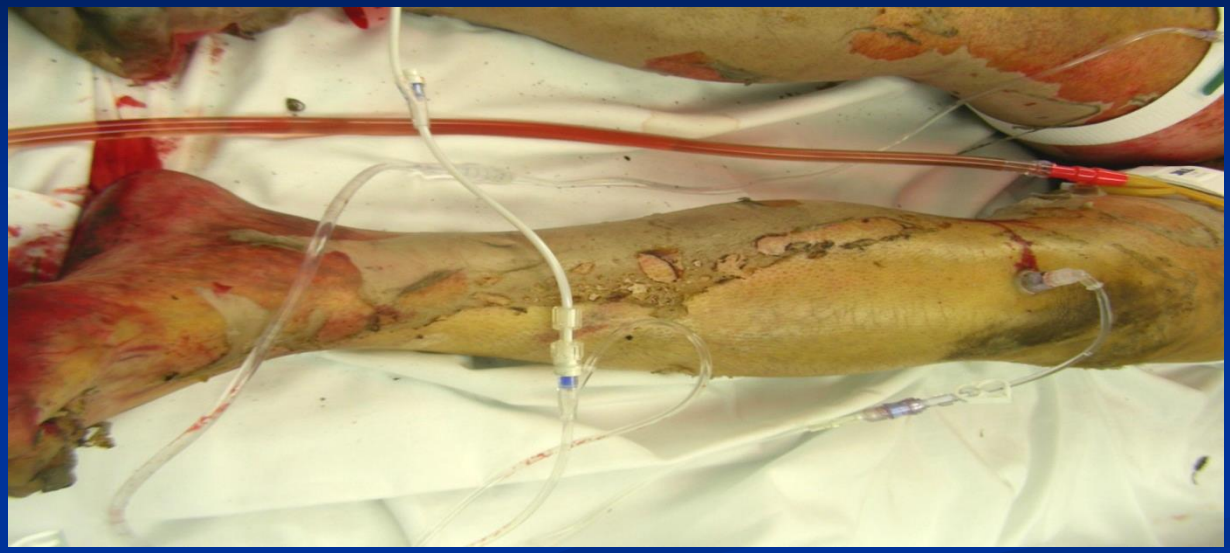
Critical Breathing Assessment

- Circumferential
  chest wall or abdominal burns
- Excursion of CW
  limited or increased intra-abdominal pressure
- Escharotomies
- Genitalia- foreskin reduction



Critical Circulation Assessment

- Circumferential extremity and torso burns
- Compartment Syndrome (6 p's, serial clinical and doppler evals)
- Myoglobinuria
- Escharotomy
- Fasciotomy



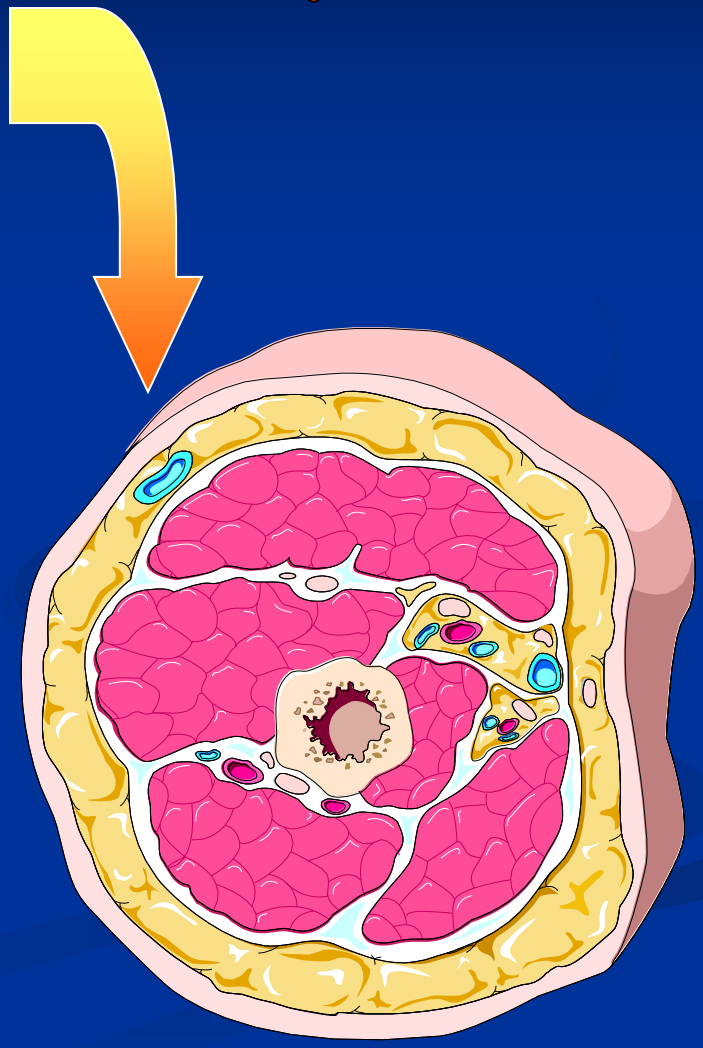
Extremity Compartment Syndrome

Edema within (beneath)

deep investing muscle fascia

Results from

- High voltage electrical injury
- Massive IVF infusion
- Crush injuries
- Delayed escharotomy



Critical Electrical Injury Assessment

Entrance

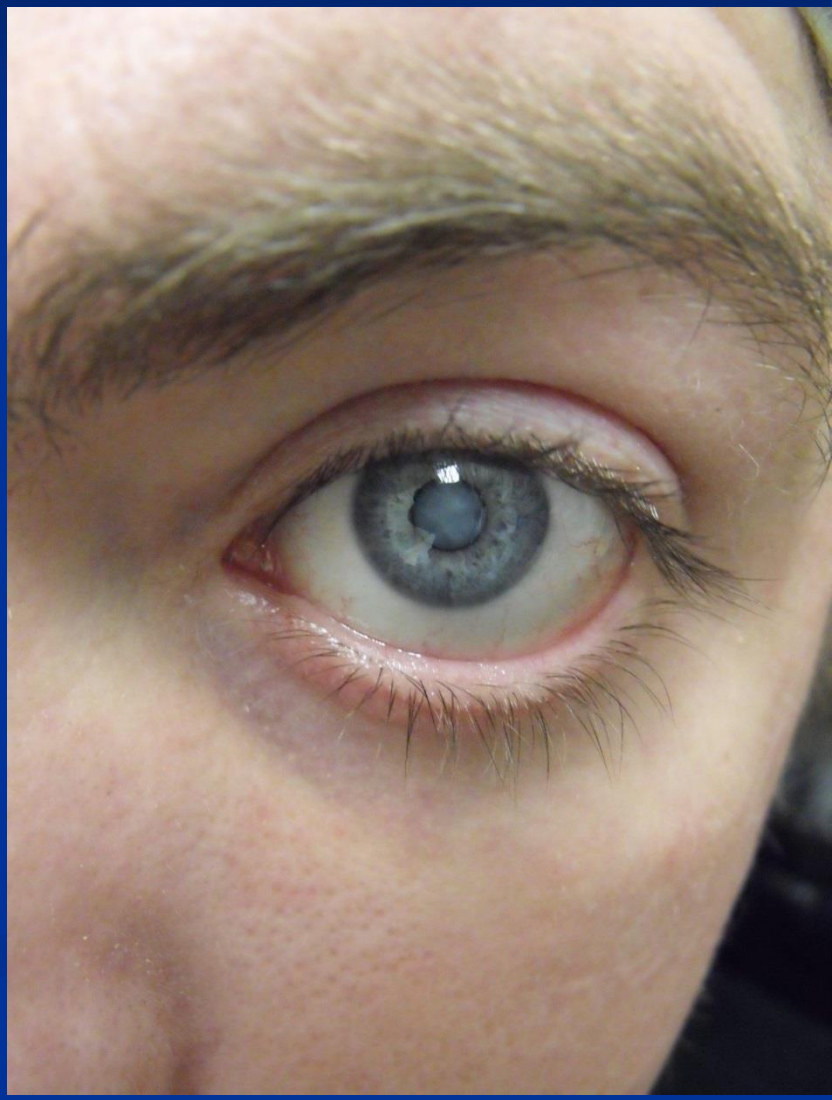
Exit

Critical Assessments

Critical Assessment

- Epidermis, dermis, fat, muscle, tendon and bone
- Electrical and thermal injury coupled with entrapment.

Post Electrical Injury Cataract

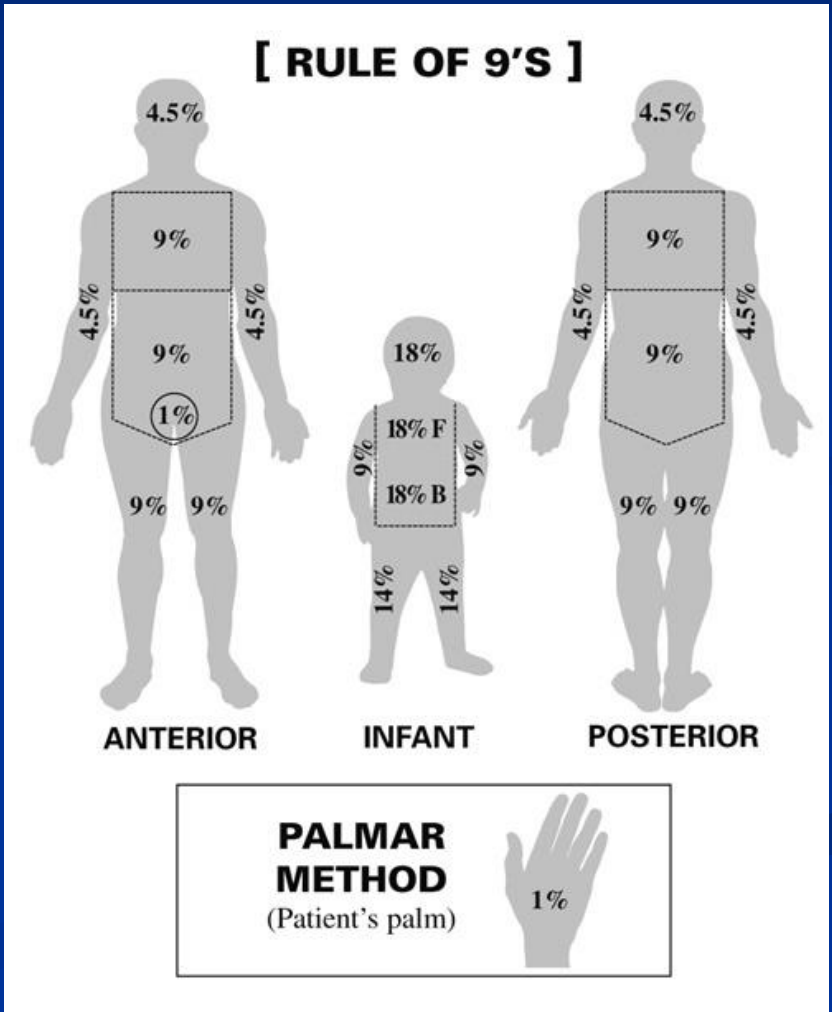


Critical Assessment In Chemical Burns

- Chemical Burns
- First line treatment
- Acid burns
- Alkali burns
- Hydrofluoric acid burns

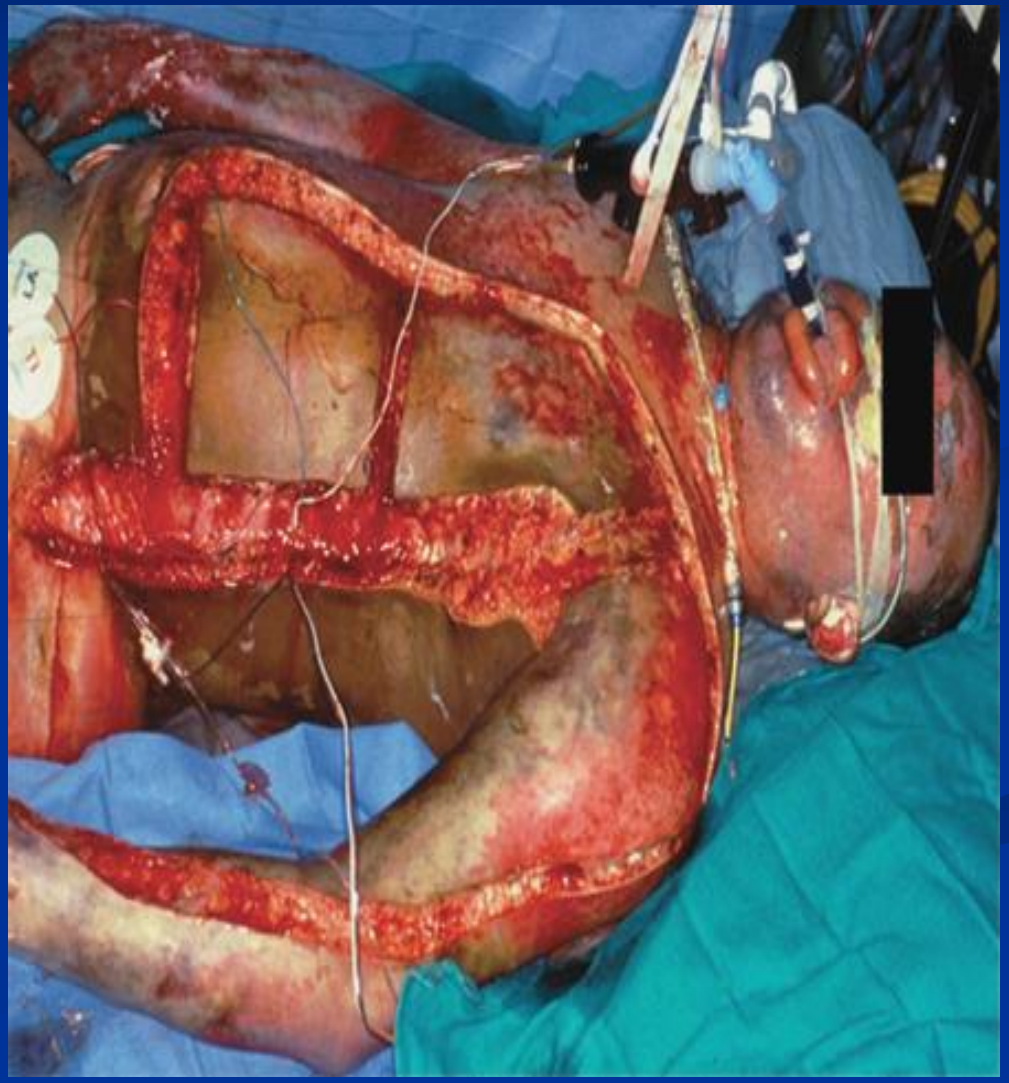
Parkland Formula

- Adult-
- 4cc x kg x % TBSA
- ½ over 1st 8 hours
- ½ over 2nd 16 hours
- Child-
- 3-4cc x kg x %TBSA
- D5LR – at maintenance must be given to children



Burn Edema Pathophysiology

- Biphasic- Immediate and Gradual
- Permeability accentuated
- Plasma and protein extravasation and sequestration in burn and nonburn tissue
- Capillary filtration exceeds lymphatic drainage of tissue
- Repeat Boluses are not recommended



Special Population Considerations

- Age > 65 < 1
- Cardiopulmonary reserve decreased
- Renal reserves
- Volume excess sensitive

Burn Wound Treatment

- Cooling the burn
- Pain control
- Local burn wound care
- Blisters
- Topical agents
- Dressings
- Elevation

Cooling

- Avoid submerging burns into ice water
- Cool tap water compresses to small burns are ok

Treatment

- First degree- topical antimicrobial ointments (i.e. Neosporin).

Partial Thickness Injury Treatment

- Topical Antimicrobials (i.e. SSD, Silver Nitrate Mepilex Ag, Aquacel Ag, Biobrane, triple antibiotic ointment, Acticoat, Transcyte, etc…) usually heals spontaneously

- Deep Partial Thickness takes longer to heal (>2-3 weeks)

Frostbite

- Re-warming

  at 40-42 degrees Celsius for 15-30 minutes or until rewarming complete
- Treatment

  topical “frostbite in Jan demarcate until June

Partial Thickness Blisters

- When taut leave blister intact.
- If blister is flaccid and weepy, d
  use as biological dressings and
  xeroform bid.
- If blister is ruptured and torn a
  (if superficial), SSD, Aquacel A

Full Thickness Injury Treatment

- Sulfamylon
- Tangential Excision
- Fascial Excision
- Integra
- Allograft
- Xenograft
- Autograft
- CEA

Conclusion

Questions/Comments??

Thank You