ABLS: Airway & Inhalation Injury
Objectives

- Discuss pathophysiology of airway inhalation injury
- List 3 types of inhalation injury
- Describe indications for early airway intervention
- Discuss principles of initial management
- List special considerations for children with inhalation injuries
Inhalation Injury Manifested By

- Pathology and dysfunction of the airway and respiratory system from thermal and chemical injury from products of incomplete combustion (smoke)
- Present in 10-20% of burn patients
- Identified in 60-70% of patients who die in burn centers
Types of Inhalation Injury

- Carbon monoxide poisoning
- Injury above the glottis
- Injury below the glottis
# Carbon Monoxide Poisoning

**Hemoglobin Affinity 200X that of O₂**

<table>
<thead>
<tr>
<th>CO (%)</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-10</td>
<td>Mild Headache and Confusion</td>
</tr>
<tr>
<td>11-20</td>
<td>Sever HA, Flushing, Vision Changes</td>
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<tr>
<td>21-30</td>
<td>Disorientation, Nausea</td>
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<tr>
<td>31-40</td>
<td>Irritability, Dizziness, Vomiting</td>
</tr>
<tr>
<td>41-50</td>
<td>Tachypnea, Tachycardia</td>
</tr>
<tr>
<td>&gt; 50</td>
<td>Coma, Seizures, Death</td>
</tr>
</tbody>
</table>
Carbon Monoxide Poisoning

Examination

- Cherry red skin color
- Agitation, decreased LOC

- Cyanosis & tachypnea unlikely (CO₂ removal unaffected)
- PₐO₂ and SₐO₂ likely to be normal
- Only carboxyhemoglobin level may be abnormal
Injury Above the Glottis

- Heat exchange capacity efficient
- Most heat damage occurs above vocal cords
- Resulting edema severe: may occlude airway
- Early intubation preferable
**Injury Below the Glottis**

- Almost always a chemical injury
- Aldehydes, sulfur oxides & phosgenes adherent to surface of smoke particles cause direct damage to epithelium of large airways

**Bronchoscopic exam:**
- Erythema
- Edema
- Ulceration
- Enlarged vessels
Injury Below the Glottis

Additional physiological changes

- Impaired ciliary activity
- Inflammation
- Hypersecretion
- Edema formation

- Ulceration of airway mucosa
- Increased blood flow
- Bronchospasm
- Impaired immune defenses
Injury Below the Glottis

Caution!

♦ Severity of inhalation injury & extent of damage are clinically unpredictable based on history & initial exam

♦ Chest X-rays commonly normal

♦ Markedly worsens overall prognosis

♦ Inadequate fluid resuscitation may worsen situation
Initial Management

- Humidified 100% O$_2$ by mask

- Endotracheal intubation indicated if
  - Airway obstruction imminent as signaled by progressive hoarseness &/or stridor
  - LOC is such that airway protective reflexes are impaired
Intubation

♦ Most experienced person should perform procedure
♦ By means most familiar to that person

♦ Secure the tube!
  • May be impossible to replace due to edema
  • Secure with umbilical or trach tape tied around the head
♦ Emergency cricothyroidotomy rarely needed
History & Physical

History

- Unconscious?
- Noxious chemicals?
- Enclosed space?
History & Physical

Physical

- Carbonaceous sputum
- Facial burns, singed nasal hairs
- Agitation (hypoxia)
- Tachypnea, intercostal retraction
- Hoarseness
- Rales, rhonchi, diminished breath sounds
- Naso or Oro-pharynx erythema
- Inability to swallow
Carbon Monoxide Poisoning

CO Half-Life

- **4** hrs breathing room air
- **1** hr breathing 100% O\(_2\)

Patients with high carboxyhemoglobin levels should receive 100% O\(_2\) until levels are less than 10%.

Hyperbaric oxygen therapy is rarely indicated.
Injury Above the Glottis

- Concern for upper airway obstruction
- Pharyngeal edema or burns &/or stridor: high likelihood of airway obstruction
- Blood gas monitoring useless
- Rely on physical findings of airway injury & extent of cutaneous burns
Treatment

Injury Below the Glottis

Symptoms of bronchial & bronchiolar injury

Larynx
Trachea
Bronchus
Bronchioles
Alveoli
Capillary Bed
Capillaries
Alveolar Duct
Bronchiole
Carina
Injury Below the Glottis

- May present as acute hypoxia (similar to ARDS)
- Intubate before transfer
  - Clear secretions
  - Relieve dyspnea
  - Ensure ventilation
- Steroid prophylaxis not indicated
- Transfer to burn center
Inhalation Injury in Pediatric Patients

- Airways are relatively small
- Upper airway obstruction occurs rapidly
- Careful tube size selection
- Position properly
- Small, uncuffed tubes dislodge easily
- Secure tube and head position
Treatment

Chest Wall Escharotomy

- Circumferential torso burns
- Restriction of ventilation
Summary

- Suspect inhalation injury in patients sustaining burns involving smoke
- Administer 100% humidified \( O_2 \) by mask
- Endotracheal intubation may be required
- Contact burn center early