

# EM CASE OF THE WEEK

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Burns and fires are the leading cause of death in the home for children and young adults, and the second leading cause of home death for all other ages. One third of all burn victims also have inhalation injury. The presence of inhalation injury has a greater effect on mortality than age or the amount of burned surface area.

## EM CASE OF THE WEEK

EM Case of the Month is a weekly “pop quiz” for ED staff. The goal is to educate all ED personnel by sharing common pearls and pitfalls involving the care of ED patients. We intend on providing better patient care through better education for our nurses and staff.



## Isolated Smoke Inhalation

*A 54-year-old male with PMH of asthma is rescued from a burning building. He was responsive at the scene, had no burn injuries, and was started on high-flow oxygen via facemask. In the ED, his vital signs are T 98.8, HR 110, RR 20, BP 110/70, and O<sub>2</sub> sat 96% on 2L NC. On exam, he had no singed hair, no soot in his nose and mouth, and no burns or ulcerations in his mouth. Pulmonary exam revealed diffuse expiratory wheezing. CBC and CMP were WNL and ABG revealed PaO<sub>2</sub> of 100mmHg, PaCO<sub>2</sub> of 35mmHg, pH of 7.37, oxygen saturation of 89%, and carboxyhemoglobin level of 11%. What is the next step in management of this patient?*

- Treat with hyperbaric oxygen
- Discharge with bronchodilators and antibiotics
- Intubate in anticipation of airway edema
- Observe on O<sub>2</sub> and re-evaluate airway and oxygenation requirement



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## Take Home Points

- Smoke inhalation is the number one cause of death in fire-related injuries and can manifest within hours after initial presentation
- Carbon monoxide poisoning most commonly occurs in the winter due to space heaters
- A patient with smoke inhalation should be re-evaluated periodically
- Let clinical symptoms, test results, lactate levels, and carboxyhemoglobin levels guide management
- Keep in mind that smoke inhalation causes injury to the lungs, so excessive fluids and ventilation could cause further damage

## Smoke Inhalation

**The correct answer is D. The patient does not have burns to the face or neck, is oxygenating well on 2L/min with no signs of respiratory distress, and his carboxyhemoglobin level does not warrant hyperbaric treatment. Bronchodilators could be used since he is wheezing, but should be done while under observation at the hospital.**

### Introduction:

The #1 cause of fire-related deaths is smoke inhalation. Inhalation injury often develops within hours after presentation. Patients could get thermal injury in the upper airway. Chemical irritation can also occur from soot, asphyxiation, and toxicity from carbon monoxide (CO) and other gases such as cyanide (CN).

### Indications and Symptoms of inhalation Injury

- Burns to face, neck, lips and oral mucosa
- Singed hair or eyebrows
- Soot-containing airway secretions

Signs of lower respiratory tract injury:

- Coughing, stridor, hoarseness
- Tachypnea, dyspnea, cyanosis
- Decreased breath sounds
- Wheezing, rales, rhonchi, retractions
- Nausea & vomiting
- Unconsciousness or dizziness

Clinical manifestations of elevated carboxyhemoglobin levels (levels can underestimate CO toxicity if the patient received oxygen prior to test):

- 0-10%: usually asymptomatic
- 10-20%: mild headache, atypical dyspnea
- 20-30%: throbbing headache, impaired concentration
- 30-40%: severe headache, impaired thinking
- 40-50%: confusion, lethargy, syncope
- 50-60%: respiratory failure, seizure
- >70%: coma, death

*For a list of educational lectures, grand rounds, workshops, and didactics please visit*

*<http://www.BrowardER.com>*

*and click on the "Conference" link. All are welcome to attend!*



## Management

### At the Scene

- Rescue the patient to decrease exposure
- Administer high flow 100% oxygen via facemask
- Assess the patient's injuries
- Get EKG, pulse ox, and BP if possible
- Intubate if face or neck is burned. If not, observe since it may be necessary later
- Elevate head to minimize airway and facial edema
- Aerosolized epinephrine or corticosteroids can help reduce upper airway edema, but has not been proven
- Once the patient is stable, try to determine: if he/she was involved in explosion, the fire source, the amount of time exposed to the fire, combustion products, and PMH

### In the Hospital

- Evaluate ABCs and re-evaluate airway and oxygenation status frequently since airway edema can progress over 24-48 hours so intubation may be indicated
- Get IV access, cardiac monitoring, and supplemental oxygen if the patient is hypoxic
- Bronchodilators can be helpful if the patient has bronchospasm
- Early CXR underestimates damage since it is mainly in the airways
- Frequent ABGs, sputum analyses, carboxyhemoglobin level, lactate, CBC, EKG, serial cardiac enzymes, PFT
  - Cyanide level testing can take days
  - Lactate levels out of proportion to carboxyhemoglobin levels can be a good indicator of CN poisoning
  - Lactate >10mmol/L is a sensitive indicator of CN >1mg/mg
- Gold standard for diagnosis: bronchoscopy (can also be therapeutic)

## Treatment

- Indications for hyperbaric oxygen therapy
  - Base excess lower than -2 mmol/L
  - CO >25% (>15% if pregnant)
  - Signs of cerebellar dysfunction
  - Cardiovascular dysfunction
  - Pulmonary edema
  - Extremes of age
- In severe cases, early intubation may be necessary
- Vigorous bronchial toilet: to clear the airway and prevent occlusion since mucociliary action is damaged
- Excessive fluid resuscitation in smoke inhalation injury can increase the likelihood of pulmonary edema, so urine output and hemodynamic parameters should guide resuscitation

## Disposition

- Discharge after 4-6hrs observation if:
  - Low risk for injury
  - Vital signs are normal
  - Physical exam is normal
- Consider hospitalization if:
  - Closed-spaced smoke exposure for longer than 10 minutes
  - Carbonaceous sputum
  - Arterial PO<sub>2</sub> < 60mmHg
  - Metabolic acidosis
  - Carboxyhemoglobin >15%
  - Arteriovenous oxygen difference greater than 100 mmHg on 100% oxygen
  - Bronchospasm
  - Odynophagia
  - Central facial burns
- Careful infection surveillance is indicated due to impaired cough reflex, macrophage dysfunction and increased secretions
  - Prophylactic antibiotics are **NOT** recommended

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### ABOUT THE AUTHOR

This month's case was written by Monica Hajirawala. Monica is a 4<sup>th</sup> year medical student from FIU HWCOC. She did her emergency medicine rotation at BHMC in February 2016. Monica plans on pursuing a career in Pediatrics