ED Report Outline – Ava Moroz

Inhaled Poisons- Carbon Monoxide and Chlorine

Etiology/pathophysiology:

Carbon Monoxide = a colorless, odorless, tasteless gas that **binds to hemoglobin**.

- CO is produced when natural gas (methane or propane) is burned.
- Compared to oxygen, carbon monoxide has a **stronger affinity for hemoglobin.** This limits the ability of Hgb to carry oxygen resulting in **severe hypoxia** within the tissues and lactic acidosis due to cellular anaerobic metabolism.
- Carboxyhemoglobin (carbon dioxide bound to hemoglobin) shifts the oxyhemoglobin dissociation curve to the LEFT, making it difficult for oxygen to be released to the tissues (O2 is bound too tightly).

Chlorine = lung toxicant, moderately water-soluble chemical with a pungent, irritating odor that is found in some household products

- When liquid chlorine is released, it quickly turns to gas and stays close to the ground and spreads rapidly. When combined with water, chlorine produces hydrochloric acid, causing injury to the tissues.
- Chlorine is **not systemically absorbed** but compromises the victim by damaging components of the pulmonary system. Chlorine can cause **upper airway and alveolar irritation.**

On-scene treatment:

**** Call 911/poison control immediately if exposure is suspected!**

Carbon Monoxide:

- If CO is suspected in a household, windows should be opened and the house should be evacuated and evaluated for the source of CO.
- EMS team can apply 100% O2 + assess carbon monoxide level with CO oximeters

Chlorine:

- Get away from area where chlorine was released and breath fresh air (remove individual from environment)
- Get the chlorine off your body right away
    - Undress and shower immediately or as soon as you can
    - Remove contact lenses
- Rapidly assess cardiopulmonary status
- Bronchospasm treated with beta-agonists, such as Albuterol
- Eyes irrigated with water or NS

ED treatment:

Carbon Monoxide:

- Administer 100% oxygen until the patient is symptom-free, usually about 4-5 hours
- Hyperbaric oxygen therapy may be needed if COHb is 25%-30%
- Blood glucose testing, toxicology/BAC, head CT, lumbar puncture (to r/o other causes of altered mental status)

Chlorine:

- Obtain chest x-ray (look for pulmonary edema)
- Laryngoscopy/bronchoscopy to determine assess internal damage from exposure

Supportive Care!

- High flow oxygen and possibly intubation (ETT) with positive pressure ventilation
- Asymptomatic? = do not require prolonged observation
- Suctioning to manage secretions if present
- IV fluids
- Bronchodilators prn (albuterol)

Role of the ED nurse:

Carbon Monoxide:

- Maintain oxygen @ 100% FiO2 via non-rebreather mask.
- Perform fingerstick blood sugar, obtain alcohol and toxicology screen, and prepare pt for head CT scan/lumbar puncture as needed
- Perform frequent neurological exams to monitor progress and ensure cerebral edema is not developing.
- Obtain troponin/cardiac enzymes as ordered to look for cardiac damage.
- Perform EKG as ordered.

Chlorine:

- Apply and maintain high flow O2 to maintain O2 saturation >90% and decrease work of breathing
- Elevate HOB to increase chest expansion and ease the work of breathing
- Continuous pulse oximetry monitoring
- Monitor cardiopulmonary status, changes in baseline (incase of delayed pulmonary edema)
- Bronchodilators prn (albuterol)
- Obtain IV access and administer IV fluids (to prevent circulatory collapse)

Discharge/prevention instructions:

Carbon Monoxide:

- Install carbon monoxide detectors in household (can provide early warning of CO)
- Check sources of indoor combustion to make sure they are correctly installed and vented to the outdoors
- Never leave cars running in an enclosed garage
- Inspect exhaust pipes periodically for leaks

Chlorine:

- Do NOT mix household cleaners
    - Combination of bleach (sodium hypochlorite) with an acid produces chlorine gas
- Keep household products out of reach to children
- Follow specific occupational protection methods to avoid or reduce chlorine exposure (goggles, gloves, masks)

Differentiate carbon monoxide and chlorine:

CARBON MONOXIDE	CHLORINE
▪ Colorless, odorless, tasteless gas ▪ Binds to hemoglobin ▪ Produced from smoke, auto exhaust systems, gas heaters, furnaces, hot water heaters ▪ Systemically absorbed	▪ Yellow-green gas, with a pungent + irritating odor ▪ Can be found in household products ▪ Not systemically absorbed (local level @ mucous membranes and possible airway)

Exposure to each, signs, and symptoms

Carbon Monoxide:

- CO is produced from auto exhaust systems, smoke from fires, gas heaters, furnaces, hot water heaters, wood or charcoal burning stoves, or kerosene heaters
    - Length of exposure contributes to the extent of poisoning
    - Carboxyhemoglobin (COHb) levels > 10% indicate carbon monoxide exposure.
    - Fetal Hgb binds even quicker to carbon monoxide putting a fetus at a greater risk for injury from CO poisoning (consider hyperbaric oxygen therapy for pregnant patients)

S/Sx = appear confused with an altered level of consciousness, hypotensive, and in moderate to severe distress (dyspneic)

- Headache, vertigo, nausea, vomiting, visual disturbances, loss of coordination may occur
- A classic sign of CO poisoning is **cherry-red skin** and mucous membranes.
- Cardiac complications, such as ST depression, may occur due to profound myocardial hypoxia
    - Death is usually the result of dysrhythmias

Chlorine:

- Can be exposed to chlorine if household bleach is mixed with other cleaning agents, high concentration of chlorine in pools, and occupationally if working with chlorine.

S/Sx:

- Blurred vision, eyes tearing, **mucosal membrane irritation** (in nose/throat/lungs/eyes) **coughing, dyspnea, SOB** (rapid/shallow breathing), wheezing, nausea, vomiting, skin pain/redness/blisters

    - Respiratory distress may occur immediately if high concentrations are inhaled, or they may be delayed if low concentrations are inhaled.

Findings on pulse oximetry

- **CO** = ***Pulse oximetry readings may be deceiving,*** and appear normal, because the oximeter cannot distinguish between oxygenated hemoglobin and carboxyhemoglobin.
    - Use CO oximeter
- **Chlorine** = Pulse oximetry findings may show hypoxia r/t edema of upper airway, dyspnea, wheezing.

Treatment – when to use oxygen, concentration

Carbon Monoxide:

- **Treated with high flow 100% O2 concentration – even if a pulse oximetry does not show hypoxia!** (to decrease the half-life of COHb and push CO off of the hemoglobin molecules so O2 can bind again)
    - Half life of COHb is 4-5 hours, can be reduced to about 60 minutes
- Transfer to a facility with hyperbaric oxygen therapy may be needed for severe CO poisoning (25-30% COHb)

Chlorine:

- **Supportive care!** – high flow oxygen if hypoxic, bronchodilators if bronchospasm present, monitor pulse oximetry, possible intubation, IV fluids

Prevention

** included in discharge/prevention section above

References

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