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Carbon Monoxide, Smoke Inhalation, Cyanide Poisoning and Medical Rehab

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Behavioral Objectives:

Upon successful completion of this module, the EMS provider will be able to:

1. Identify physical characteristics of CO
2. Identify sources of CO
3. Identify statistics of CO incidents
4. Identify pathophysiology of CO poisoning
5. Identify CO effects on hemoglobin
6. Identify CO effects on major body systems
7. Identify CO exposures and limits (ppm)
8. Discuss importance of being able to monitor CO levels for patients
9. Identify signs/symptoms of CO poisoning and smoke inhalation
10. Identify the treatment of CO poisoning and smoke inhalation
11. Identify possible long term effects of CO poisoning and smoke inhalation
12. Identify the difference between acute and chronic CO poisoning
13. Identify complications related to smoke inhalation
14. Identify measures to prevent possible exposure to EMS personnel
15. Identify physical characteristics of cyanide
16. Identify common sources of cyanide
17. Identify the pathophysiology of cyanide poisoning
18. Identify body tissues most susceptible to cyanide poisoning
19. Identify signs/symptoms of cyanide poisoning
20. Identify the OSHA permissible levels of cyanide
21. Identify the appropriate use of monitors prior to SCBA removal
22. Discuss treatment of cyanide exposure
23. Identify the NFPA 1584 Standard related to medical rehabilitation
24. Identify definition of rehab
25. Identify the 9 steps of NFPA 1584 rehab
26. Identify symptoms of heat stress
27. Identify symptoms of cold stress
28. Identify preventive measures to reduce the risks of heat/cold stress
29. Identify aspects of the importance of proper nutrition
30. Identify signs and symptoms of dehydration
31. Identify signs and symptoms of over-hydration
32. Identify criteria for implementation of the rehab area
33. Identify components of the rehab area
34. Identify assessment performed in the rehab area
35. Identify treatment in the rehab area
36. Identify the work to rest ratio
37. Identify requirements for returning to work at incident
38. Actively participate in case study discussion
39. Successfully complete the post-quiz with a score of 80% or better
References:

- NFPA 1584
- Firerehab.com
- www.nfpa.org
1. List as many sources of carbon monoxide (CO) that you can think of:

2. What is the peak time of day for the majority of CO calls?

3. What effects does CO have on hemoglobin?

4. How does your department measure levels of carbon monoxide:
   - In the environment –
   - The patient’s level –

5. List at least 3 signs and/or symptoms of CO poisoning:

6. Which of the population is at highest risk of signs and symptoms but at lower levels of carbon monoxide?
7. List at least 3 signs and/or symptoms of cyanide poisoning:

8. You will be at this fire scene for an extended period of time. What are the NFPA 1584 requirements, revised January 2009, of when you should go to rehab?

9. List 2 methods to protect yourself at the scene of a response:
   - To heat stress -
   - To cold stress -

10. What do the guidelines say for when you can leave rehab and return to duty at an active scene?
**Expected Carboxyhemoglobin Levels**

- Non-smokers – 5%
- Smokers – up to 10%
  - 5 – 6% for a 1 pack per day smoker
  - 7 - 9% for a 2-3 pack per day smoker
  - Up to 20% reported for cigar smokers
- Urban commuter – 5%

**CO Poisoning**

- Symptoms are often vague, subtle, and non-specific; can easily be confused with other medical conditions;
  - Flu – nausea, headaches
  - Food poisoning - nausea
  - Cardiac and respiratory conditions – shortness of breath, nausea, dizziness, lightheadedness
- CO enters the body via the respiratory system
- Poisoning by small amounts over longer periods of time or larger amounts over shorter time periods

**Symptoms of CO Poisoning Related to Levels and Exposure Time**

- 50 ppm – no adverse effects with 8 hours of exposure (OSHA limit)
- 200 ppm – mild headache after 2-3 hours
- 400 ppm – serious headache and nausea after 1-2 hours (life-threatening >3 hours)
- 800 ppm – headache, nausea, dizziness after 45 minutes; collapse and unconsciousness after 2 hours; death within 2-3 hours
- 1000 ppm – loss of consciousness after 1 hour

**Levels & Exposure Time Cont’d**


- 1600 ppm – headache, nausea, dizziness after 20 minutes; death within 1 hour
- 3200 ppm – headache, nausea, dizziness after 5-10 minutes; collapse and unconsciousness after 30 minutes; death within 1 hour
- 6400 ppm – headache, dizziness after 1-2 minutes; unconsciousness and danger of death after 10 -15 minutes
- 12,800 ppm – immediate physiological effects; unconsciousness and danger of death after 1-3 minutes

**Signs and Symptoms CO Poisoning**

- Carboxyhemoglobin levels of <15 – 20%
  - Mild severity
    - Headache
    - Nausea and vomiting
    - Dizziness
    - Blurred vision

- Carboxyhemoglobin levels of 21 – 40%
  - Moderate severity
    - Confusion
    - Syncope
    - Chest pain
    - Dyspnea
    - Tachycardia
    - Tachypnea
    - Weakness
**Signs and Symptoms CO Poisoning**

- Carboxyhemoglobin levels of 41 - 59%
  - Severe
    - Dysrhythmias
    - Hypotension
    - Cardiac ischemia
    - Palpitations
    - Respiratory arrest
    - Pulmonary edema
    - Seizures
    - Coma
    - Cardiac arrest

- Carboxyhemoglobin levels of >60%
  - Fatal
    - Death
  - Cherry red skin is not listed as a sign
    - An unreliable finding

**Signs and Symptoms Cyanide Exposure**

Levels measured as the methemoglobin level

- 1-3% - asymptomatic
- 3-15% - slight grayish-blue skin discoloration
- 15-20% - asymptomatic, but cyanotic
- 25-50% - headache, dyspnea, confusion, weakness, chest pain
- 50-70% - altered mental status, delirium

**Early Signs of Low Exposure to Cyanide**

- Rapid breathing
- Dizziness
- Weakness
- Nausea and vomiting
- Eye irritation
- Pink or red skin color
- Increased heart rate
- Perspiration

**Later Signs of Exposure to Moderate-High Concentrations of Cyanide**

- Loss of consciousness
- Respiratory arrest
- Cardiac arrest
- Coma
- Seizures

**Work to Rest Ratio**

- Rehab after
  - A 2nd 30-minute SCBA used
  - A single unit 45-minute SCBA used
  - Or 40 minutes of intense work without SCBA
- Depending on conditions and environment, time frames may need to be adjusted
- Vital signs taken and recorded at least twice and 10 minutes apart
- Repeat vital signs in 10 minutes if levels abnormal