



Clinical Pharmacology & Toxicology Pearl of the Week

Carbon Monoxide (CO) ~ Part 1: Sources and Symptoms

Case

- ✓ A 33 year-old male has a several-month history of fatigue, headache, and memory lapse.
 - ✓ Multiple specialists have performed evaluations, but no diagnosis has been established.
 - ✓ During a period of feeling worse than usual, he called a friend, who arrived at the residence to find him semicomatose and called 911.
 - ✓ The patient was given supplemental oxygen and transported to the emergency department, where he is alert and has nonfocal findings on examination.
 - ✓ His carboxyhemoglobin level is 22%. How should he be treated?
-

Sources of CO

- ✓ Fires
- ✓ Auto exhaust
- ✓ Cigarette smoke
- ✓ Malfunctioning water heaters, gas stoves, furnaces
- ✓ Wood-burning fireplaces, blocked chimneys
- ✓ Propane forklifts
- ✓ Ice resurfacing machines
- ✓ Generators
- ✓ Inappropriate heat sources used indoors (e.g., barbecues)

Pathophysiology

- ✓ Rapidly diffuses across alveolar-capillary membranes
- ✓ Binds to hemoglobin with 200-250X greater affinity than oxygen
- ✓ 10-15% of total body CO taken up by tissue, bound to extravascular proteins
 - Myoglobin
 - Cytochrome oxidase
 - Catalase
 - Peroxidases
- ✓ Left shift oxyhemoglobin dissociation curve → hypoxia
- ✓ Binding to cytochrome oxidase → inhibits ox phos → hypoxia, metabolic acidosis, increased lactate
- ✓ Activation of excitatory amino acids → neuronal cell death
- ✓ Binding to myoglobin → myocardial depression, dysrhythmias
- ✓ Nitric oxide (NO) release → hypotension

Clinical Findings

- ✓ Initial
 - Headache, dizziness, nausea
- ✓ Later (higher levels/longer exposures)
 - Syncope, focal neuro sx suggesting CVA, LOC, confusion, seizures, coma
 - Persistent neurologic sequelae
 - Delayed neurologic sequelae (DNS)
 - 2 days – 5 weeks after initial poisoning
 - Those most at risk of DNS:
 - History of LOC
 - Patients with long exposures (> 24 hours)
 - Age > 36
 - COHb > 25%
 - Neurologic and psychiatric symptoms
 - amnesia
 - psychosis
 - parkinsonism
 - paralysis
 - chorea
 - headaches
 - apraxia
 - incontinence
 - peripheral neuropathy
 - dementia

References

1. Buckley N et al. Hyperbaric oxygen for carbon monoxide poisoning (Review). Cochrane Database of Systematic Reviews 2011, Issue 4. Art. No.: CD002041. DOI: 10.1002/14651858.CD002041.pub3.
2. Annane et al. Hyperbaric oxygen therapy for acute domestic carbon monoxide poisoning: two randomized controlled trials. Intensive Care Med 2011 Mar; 37(3):486-92
3. Weaver et al. Carbon Monoxide Poisoning: Risk Factors for Cognitive Sequelae and the Role of Hyperbaric Oxygen. Am J Resp Crit Care Med 2007; 176:491-7.
4. Weaver et al. Hyperbaric oxygen for acute carbon monoxide poisoning. N Engl J Med 2002; 347:1057-67.
5. Hampson N. Outcomes of Patients Experiencing Cardiac Arrest With Carbon Monoxide Poisoning Treated With Hyperbaric Oxygen. Ann Emerg Med. July 2001; 38:36-41.
6. Scheinkestel et al. Hyperbaric or normobaric oxygen for acute carbon monoxide poisoning: a randomized controlled clinical trial. Med J Aust 1999; 170: 203-210.
7. Thom et al. Delayed Neuropsychologic sequelae after carbon monoxide poisoning: prevention by treatment with hyperbaric oxygen. Ann Emerg Med 1995; 25:474-80.
8. Raphael et al. Trial of Normobaric and Hyperbaric oxygen for acute carbon monoxide intoxication. Lancet 1989; 2:414-9.
9. Thom et al. J Appl Physiol 1990;68(3):997.
10. Choi et al. Arch Neurol. 1983 Jul;40(7):433-5.

The Clinical Pharmacology (CP) physician consultation service is available Mon-Fri, 8am-5pm. The on-call physician is listed in ROCA on the AHS Insite page. CP consultations are also available through Netcare e-referral and Specialist Link. You can also find us in the [Alberta Referral Directory](#) (ARD) by searching "Pharmacology" from the ARD home page. Click [HERE](#) for more details about the service.

The Poison and Drug Information Service (PADIS) is available 24/7 for questions related to poisonings. Please call 1-800-332-1414 (AB and NWT) or 1-866-454-1212 (SK). Information about our outpatient Medical Toxicology Clinic can be found in [Alberta Referral Directory](#) (ARD) by searching "Toxicology" from the ARD home page.

More CPT Pearls of the Week can be found [HERE](#).

Created: October 12, 2021

Reviewed: March 6, 2025