



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?
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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

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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.
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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 Calgary Clinical Pharmacology physician consultation service is available Mon-Fri, 8am-5pm. The on-call physician is listed in ROCA. Click [HERE](#) for more details.



The Poison and Drug Information Service (PADIS) is available 24/7 for questions related to poisonings. Please call 1-800-332-1414, and select option 1.