

# CARBON MONOXIDE POISONING

## *Keeping Our Patients Safe*

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Carbon Monoxide Awareness Month is just behind us, recognized each November as cold weather begins to blanket the United States. That makes this issue of *JLGH* a good place to talk about carbon monoxide (CO), since our winter heating needs bring increased risk of CO poisoning. Let's begin by revisiting our pathophysiology regarding hemoglobin and oxygen transport.

Carbon monoxide (CO) is a product of burning any fossil fuel, and hemoglobin has an affinity for CO that is 200 times greater than its affinity for oxygen; myoglobin binds CO even more readily. Carboxyhemoglobin impairs the ability of the cells to burn oxygen and decreases ATP synthesis; this leads to short-term sequelae such as dyspnea, headache, weakness, and nausea.

Long-term exposure can yield lipid peroxidation, as well as white matter and cardiac changes, increasing the risk for neurologic and cardiac pathology. While our most vulnerable patients – infants, the elderly, and those with chronic illness – are most at risk, any of us can be affected when concentrations are high enough.

As many as 95,000 people per year in the United States are sickened by CO exposure, leading to 50,000 hospitalizations and between 1,000 and 1,500 deaths, according to independent registries.<sup>1</sup> The age-adjusted CO-related deaths per 100,000 people for 2020 (the most recent year data are available) is 47 in the state of Pennsylvania.<sup>2</sup> Undoubtedly, thousands are made sick each year by this odorless gas, and as alluded to above, we are most at risk during the winter months, when we are less likely to ventilate our homes and more likely to use indoor heating sources.

For example, CO poisoning can occur during power outages when people rely on portable generators, which can create up to 100 times the carbon monoxide of an efficient fuel-burning car. Portable generators should be kept at least 25 feet from the house and away from vents, doors, and open windows.

Warming the car in the garage is also common but is not without risk, even when the garage door is open. Leaving garage doors open is insufficient to appropri-

ately ventilate, since CO particles can penetrate dry wall.<sup>2</sup> Large engines or several small engines burning in poorly ventilated areas can quickly create a dangerous situation. Recreation vehicles, public garages, and even the trailers that maintenance workers use to haul service vehicles to and from job sites are setups for chronic higher-than-appropriate exposure. In truth, there is no normal exposure level.

Unfortunately, misdiagnosis of CO poisoning is common, with as many as 30% of cases being attributed to food poisoning. While carboxyhemoglobin can be tested using venous blood, results often take time, and levels vary in smokers versus nonsmokers. Use of multiwave fingertip meters can help, although many clinicians would await confirmation with venous values.

Treatment in the acute stage begins with removing a patient and any others from the exposure. High-dose oxygen, for example by non-rebreather for between four and five hours, will improve acute symptoms. Hyperbaric therapy is recommended for patients who are most vulnerable, including patients who are pregnant or have chronic respiratory conditions.

While there is no access to acute hyperbaric therapy in Lancaster, we have the capacity to transport patients for hyperbaric oxygen if necessary, and there is 24-hour capacity at Penn Medicine's multiplace hyperbaric chamber, which can seat several patients at one time. While this offering is a blessing for many of our patients, thinking back to Carbon Monoxide Awareness Month reminds us of the importance of prevention.

So, what can we as leaders in our community do? We can coach patients about hazards and how to prevent risks. We can remind patients to keep chimneys and vents clean, to get leaks in exhaust systems repaired, and to never use engines indoors. They should carefully monitor heating elements, and we should *all* be mindful about ventilation around any fuel-burning engine.

CO monitors, which became widely available in the 1990s and now cost \$35 to \$60, should be installed on every floor of a dwelling and especially close to where people sleep. Smoke detectors are not the same as CO detectors, and while combination detectors are available, lack of mandates on maintaining CO detectors

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and higher costs of combination detectors are deterrents. Unfortunately, only 14% of U.S. homes currently have functioning monitors.<sup>1</sup>

As public health denizens, we can advocate for more ubiquitous detector use and support agencies that help fund detectors for low-income housing, hotels, and businesses. A white paper is currently being circulated by the National Carbon Monoxide Awareness Association advocating for the lowering of detection limits on commercial detectors. Again, there is no “normal” amount of CO to which we should be exposed, and it remains unclear at this time what long-term exposure may do to the health of our citizens. Detector batteries should be changed frequently, and detectors replaced every 5 to 10 years.

Should detectors be placed in child care facilities? State House Bill 494 and State Senate Bill 129<sup>3</sup> would support such a move. And why not go even further?

Why not consider detectors in vehicles? In parking garages? In sheds and hangars? Product information at the point of sale may also be helpful. Any generator or small engine can create carbon monoxide, and notices to consider detector purchase may help save lives.

Carbon Monoxide Awareness Month restarts the conversation every year about how we can help protect our patients from CO hazards. Won't you join me in extending the conversation to our patients?

#### REFERENCES

1. Carbon Monoxide at a Glance. National Carbon Monoxide Awareness Association. Accessed November 16, 2023. <https://www.ncoaa.us>
2. Carbon Monoxide Poisoning. Centers for Disease Control and Prevention. Updated May 18, 2023. Accessed November 16, 2023. <https://www.cdc.gov/co/default.htm>
3. Regular Session 2021-2022, Senate Bill 129. Pennsylvania General Assembly. Accessed November 16, 2023. <https://www.legis.state.pa.us/cfdocs/billinfo/billinfo.cfm?year=2021&sind=0&body=S&type=B&bn=129>

## JLGH FALL 2023 RECAP

### Q&A for Extended Learning

The Fall issue of The Journal of Lancaster General Hospital offered updates in the treatment of sexually transmitted diseases and clinician burnout, as well as a photo quiz about impetigo. Review the questions and answers below to see how much you remember from the issue. Need a refresher? All issues of JLGH are available online at [JLGH.org](http://JLGH.org).

**Q** How often does the Centers for Disease Control and Prevention (CDC) recommend HIV screening for asymptomatic patients ages 13-64 years?

**A** At least once in their lifetime.

**Q** Clinicians can consider testing women with pelvic inflammatory disease for *M. genitalium*. How can this be ordered at LG Health?

**A** Providers should order an “unidentified lab” and specify “*Mycoplasma genitalium* PCR,” which can be performed on an endocervical, vaginal, urethral, or urine specimen.

**Q** Bullous impetigo should probably be treated with oral antibiotics. What can be added to the bath water to help treat recurrent cases of impetigo? How long after beginning antibiotics should patients be considered contagious?

- A**
1. Less than a capful of bleach in a tub full of water.
  2. 24-48 hours.

**Q** In an article about stress and burnout in health care workers, what strategies were offered for employers to help workers stay engaged in their service to patients?

**A** Health care leaders may implement mitigation strategies including: setting clear and well-defined boundaries; requiring scheduled breaks; finding ways to reduce the workload; and facilitating various destressing techniques, such as deep breathing, mindfulness, and time management.

**Q** In “The X-Waiver and the Culture of Addiction Medicine,” Dr. Jon Lepley notes that what percentage of individuals who could receive medical treatment for opioid use disorder actually do?

- a. 5%   b. 15%   c. 25%   d. 55%**

**A** The answer is:

**b. 15%.** We hope that the elimination of the need for the X-waiver will result in better access to lifesaving treatment.