

Carbon Monoxide Exposure: Dräger PAC 3500 & RAD-57

Supersedes: 12-02-13
Effective: 07-01-19

PURPOSE

Carbon monoxide poisoning is one of the single most common poisoning exposure in the United States. Carbon monoxide, or CO, is an odorless, colorless gas that can cause sudden illness and death. Carbon monoxide is found in combustion fumes, such as those produced by cars and trucks, gasoline engines, camp stoves, lanterns, burning charcoal and wood, gas ranges, heating systems, generators and poorly vented chimneys. Structural fires are another common source of CO exposure for both victims and fire fighters. Carbon monoxide from these sources can build up in enclosed or semi-enclosed spaces. Breathing it can poison people and animals in these spaces. All people and animals are at risk for carbon monoxide poisoning. Certain groups including pregnant women/fetuses, infants, and people with chronic heart disease, anemia, or respiratory problems are more susceptible to its effects.

CO toxicity causes impaired oxygen delivery and utilization at the cellular level. CO affects several different sites within the body but has its most profound impact on the organs with the highest oxygen requirement (e.g., brain, heart). Misdiagnosis commonly occurs because of the vagueness and broad spectrum of complaints. Symptoms often are attributed to a viral illness, frequently “the flu” in winter months. It is important to remember that symptoms may not correlate well with measured HbCO levels.

The following list includes commonly recognized symptoms associated with carbon monoxide poisoning. Any of the following should alert suspicion if related to a potential source of CO and when more than one patient in a group or household presents with similar complaints at the same time:

Malaise, flu-like symptoms	Dyspnea on exertion	Coma
Chest pain, palpitations	Lethargy	Headache, drowsiness
Confusion, fatigue	Depression	Syncope; seizure
Impulsiveness	Distractibility	Dizziness; weakness
Hallucinations	Agitation	Memory / gait disturbance
Nausea, Vomiting, Diarrhea	Visual Disturbance	Abdominal Pain, Incontinence

Carbon monoxide should be a diagnosis of exclusion, within the scope of pre-hospital practice. Common, identifiable causes of the above symptoms should be entertained. For example, hypoglycemia or drug overdose.

Not just a winter phenomenon, carbon monoxide poisoning has been seen in other climates and seasons after natural disasters, when residents use generators or pumps which are not properly ventilated. Any process which burns fuel [gasoline, diesel, kerosene, propane, natural gas, charcoal, wood etc.] in an engine, heater or construction equipment can emit CO.

Additional information that is helpful in assessing carbon monoxide exposure includes presence of detectors as well as environmental readings on the environment available from BFD, Inspectional Services or utilities such as National Grid.

DRÄGER PAC® 3500

The Dräger Pac 3500 single gas monitor is designed for industrial personal monitoring applications and can quickly detect carbon monoxide in the range of 0-500 parts per million (ppm). The device has two alarm settings: Alarm 1: ≥ 35 ppm, and Alarm 2: ≥ 50 ppm. In addition to a vibrating alarm, the Dräger Pac 3500 emits an audible, multi-tone signal and a clear, 360 degree visual alarm via bright flashing LEDs at the top and base of the instrument. When Alarm 1 (≥ 35 ppm) has been activated, the user can hit the “OK” button to silence the audible alarm, but it will continue to vibrate as long as it detects CO of 35 ppm or greater. When Alarm 2 (≥ 50 ppm) has been activated, the audible alarm cannot be silenced until CO levels are below 50 ppm.

When operating in area scene where elevated levels of carbon monoxide are suspected, personnel should direct all those potentially exposed to a ventilated area as quickly as possible and notify the appropriate ancillary agencies.

The Dräger Pac 3500 CO Detector is to be attached to the green oxygen bag so one is present on every response. Whenever the device is noted to be missing, damaged, or has an error/service message (a black “X” on the display), notify a supervisor.

RAD-57 OPERATION

The Rad-57 Handheld Pulse CO-Oximeter with Masimo Rainbow® SET® Technology is a noninvasive, arterial oxygen saturation and pulse rate monitor. The Rad-57 features a multicolored LED display that continuously displays numeric values for SpO₂, Perfusion Index (PI) and pulse rate (PR), a Low Signal IQ Indicator (Low SIQ) indicator, alarm status, alarm silence and battery life.

SpO₂ General Description

Pulse oximetry is a continuous and non-invasive method of measuring the level of arterial oxygen saturation in blood. The measurement is taken by placing a sensor on a patient’s fingertip; avoid using small finger or thumb as it relies on signals bounced off the bone: (thumb is too dense and small finger not dense enough). The sensor connects to the pulse oximetry instrument with a patient cable. The sensor collects signal data from the patient and sends it to the instrument. The instrument displays the calculated data in two ways: as a percent value for arterial oxygen saturation (SpO₂), and as a pulse rate (PR)

SpCO General Description

Pulse CO-Oximetry is a continuous and non-invasive method of measuring the levels of carbon monoxide concentration (SpCO) in arterial blood. It relies on the same basic principles of pulse oximetry (spectrophotometry) to make its SpCO measurement. The measurement is obtained by placing a sensor on a patient. The sensor collects signal data from the patient and sends it to the instrument. The Rad-57 displays the calculated data as percentage value for the SpCO, which reflect blood levels of carbon monoxide bound to hemoglobin.

- As with all biological sensors, dropping the device might lead to damage. The finger probe is not compatible with other devices. The finger probe should be kept with the device at all times. The device should also not be submerged or be exposed to very wet conditions.
- Do not use the Rad-57 or sensor during defibrillation.
- The Rad-57 will display a standard O2 saturation (SpO2) and perfusion index.
- Make sure the probe is seated on the finger, with light sensors going thru the nailbed
- The sensing light for the Rad-57 is sensitive to certain waves of light, shielding probe under clothing, blanket or with your hand may be helpful if you are not getting a reading with the Rad-57.
- To change to the carboxyhemoglobin display, press the button labeled 'SpCO'. The carboxyhemoglobin will be displayed as a number on the upper readout as '%SpCO'. The Rad-57 can be used to spot check patients, as trending is not necessary in most situations.
- All elevated readings above 12% should be reconfirmed on another digit

The SpCO reading is to be use as a screening measure. Definitive carboxyhemoglobin determinations should be performed via blood draw. The level in combination with signs and symptoms will assist the physician in making determinations about treatment options. In the prehospital setting any patient with suspected carbon monoxide poisoning should receive oxygen by a non-rebreather mask, unless otherwise contraindicated.

TREATMENT

Rad-57 readings should not be the sole determining factor in treating carbon monoxide exposure. Like any biological monitor, data should be considered in combination with history of exposure (chronic vs. acute) with attention to signs, symptoms and any special considerations. Treat all possibly exposed patients with high concentration oxygen if there is any doubt.

0-5%	Considered normal in non-smokers. When >3% with symptoms, consider high flow oxygen and evaluate environment for CO sources. Consider measuring others in the same room/office/vehicle as patient
5-10%	Considered normal in smokers, abnormal in non-smokers. If symptoms are present, consider high flow oxygen and inquire if others are ill.
10-15%	Abnormal in any patient. Assess for symptoms, provide high-flow oxygen.
>15%	Significantly abnormal in any patient. Administer high-flow oxygen, assess for symptoms.
>25%	Consider transport to hyperbaric facility.

SPECIAL CONSIDERATIONS

Pregnant Women

Pregnant women maybe at higher risk in carbon monoxide situations. This is because of the increased susceptibility of the fetus to the effects of carbon monoxide. The fetal SpCO% maybe 10-15% higher than the maternal readings. All pregnant women with possible CO exposure should be encouraged to have definitive COHb blood levels and physician evaluation.

Multiple Patient Events

The Rad-57 could be most useful as an early screening tool. It may prove to be helpful in decisions to prioritize patients for transportation and in selecting hospital destinations for a multiple casualty incident.

The Rad-57 does not have to be turned off between multiple patient use. However, if you remove the sensor from one patient, be sure to completely close the sensor clip for a minimum of five seconds before reapplying to a new patient. Closing the sensor clip for at least five seconds signals to the device that the probe is off and the RAD-57 will stop all monitoring activity before beginning a new measurement.

DOCUMENTATION

Patient's SpCO% reading must be documented as part of the Patient Care Report. In the case of a multiple patients, the SpCO% should also be documented on a triage tag. A copy of the patient contact form provided by the supervisor when the RAD-57 is used. SafetyPAD has been customized to allow for documentation of findings in suspected carbon monoxide exposure cases.

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