



H182 Lung Weights in Carbon Monoxide (CO) -Related Fatalities

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Learning Overview: After attending this presentation, attendees will be familiar with the mechanism of death in CO-related fatalities and also recognize the possible effects of CO on the weight of the lungs.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by determining if a relationship exists between the presence of postmortem carboxyhemoglobin and the weight of the lungs at autopsy in CO-related fatalities.

CO is a colorless, odorless gas that is produced from the incomplete combustion of organic fuel.¹ It causes hypoxia by preferentially binding to the hemoglobin molecule in place of oxygen, producing carboxyhemoglobin.¹ Commonly recognized as a “silent killer,” CO is the most common lethal poisoning in the United States.² While suicides constitute the majority of CO-related fatalities, over 2,200 deaths resulted from unintentional CO poisoning from 2010 to 2015 in the United States.^{2,3} Non-smokers generally have carboxyhemoglobin concentrations of less than 3% at baseline, depending upon the setting in which they live (e.g., urban versus rural).¹ However, smokers may have a slightly higher hemoglobin concentration, though usually less than 10%.⁴ Therefore, carboxyhemoglobin can be detected in the blood of decedents who die under a wide variety of circumstances, from the 50-pack-a-year cigarette smoker with chronic obstructive pulmonary disease to the arson victim found dead in his home. Other than the “cherry-red lividity” and the bright red viscera often seen on examination, the autopsy findings in acute CO toxicity are not well characterized.² As it can act as a central nervous system and respiratory depressant, similar to opioids, which are frequently associated with pulmonary edema at autopsy, lung weights in CO-related fatalities were evaluated.

This study retrospectively reviewed cases of CO-related fatalities. A search was completed using an online database of deaths investigated by medical examiners and/or coroners from several counties in Michigan and Indiana from 2008 to 2019. This study restricted the search to include the following terms in any portion (a, b, c or d) of the immediate cause of death on the death certificate: *carbon monoxide, inhalation, exhaust, and combustion*. It was also restricted by type of examination, as this study required cases with a full autopsy in order to review the postmortem lung weights. In addition, cases were excluded if carboxyhemoglobin testing had not been completed.

Twenty-eight cases of CO-related fatalities were identified, not including those due to fire exposure. In a study by Molina and DiMaio, average normal lung weights were determined by evaluating postmortem lungs in sudden, traumatic deaths of adults.^{5,6} On average, normal male right lungs weighed 445g and left lungs weighed 395g, while normal female right lungs weighed 340g and left lungs weighed 299g. Of the 28 CO-related deaths, 22 were male, ranging in age from 20 to 74 years, and 6 were female, ranging in age from 19 to 71 years. The right lung in the deceased males ranged in weight from 450g to 1,120g, while the left lung ranged in weight from 270g to 1,040g. This resulted in an average of 782g for the right lung and 710g for the left in males. The right lung in the deceased females ranged in weight from 350g to 660g, while the left lung ranged in weight from 370g to 640g. This resulted in an average of 536g for the right lung and 493g for the left in females. The average percentage of postmortem carboxyhemoglobin was 56.7 among all male and female CO-related deaths.

Compared to the aforementioned normal lung weights, the right and left lungs in male CO-related fatalities were both 1.8 times heavier and in female CO-related fatalities were both 1.6 times heavier. As this data continues to be evaluated, fire-related fatalities that include a component of CO inhalation will be examined for comparison.

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Carbon Monoxide, Lung, Carboxyhemoglobin