K43 Absence of Elevated Carboxyhemoglobin Following Inhalation of Automobile Exhaust

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After attending this presentation, attendees will become familiar with cases of asphyxia due to inhalation of automobile exhaust without an elevated carboxyhemoglobin concentration.

This presentation will impact the forensic community and/or humanity by providing information on cases of inhalation of automobile exhaust with atypical findings.

The objective of this presentation is to present three cases of suicide by inhalation of automobile exhaust that did not result in elevated carboxyhemoglobin levels.

Carbon monoxide is a colorless and odorless gas that is produced as a result of incomplete combustion of organic materials. It is a common component of automobile exhaust. Other components of automobile exhaust include nitrogen, carbon dioxide, water vapor, hydrocarbons, and nitrogen oxides. U.S. air pollution control programs that were initiated in the 1970s resulted in engine design changes and emission control devices that were designed to reduce carbon monoxide, volatile organic compounds, and nitrogen oxides, the more harmful components of automobile emissions. Additionally, changes in the formulation of gasoline have contributed to the reduction of these components of automobile exhaust. These changes may alter the typical findings in some cases of automobile exhaust inhalation, as illustrated by three cases received at the OCME in Baltimore, MD.

Cases 1 & 2: A husband and wife (aged 57 and 55 years, respectively) were found deceased in a running 2001 Chevy Tahoe that was parked in the backyard of a residence. A flexible dryer vent hose was attached to the car exhaust and inserted into the right passenger window, with towels placed into the open areas around the hose. The decedents were seated in the rear seat of the vehicle with two deceased Yorkie dogs between them. There were no signs of a struggle and neither victim showed signs of trauma. The position of the bodies was consistent with the victims dying while seated in the vehicle. Two suicide notes were recovered at the scene, one in the vehicle and one inside the residence. Blood was collected from the decedents and sent to the laboratory for analysis.

Case 3: A 52-year-old male was found unresponsive in a running 1983 Ford Ranger. A garden hose extended from the rear exhaust into a rust hole in the passenger floorboard. The hose was attached to the exhaust with tinfoil and medical tape. Two notes describing his intentions were located, one in the house and one on the seat of the truck. The subject had a history of heroin abuse and had discussed his desire to commit suicide with his father approximately six months earlier. He was resuscitated and transported to the hospital where he died one hour later. Blood was collected and submitted to the laboratory for analysis.

Blood specimens were analyzed for carboxyhemoglobin by gas chromatography. Two aliquots were prepared for each specimen. The first aliquot was sealed in a headspace vial. The remaining aliquot was saturated with carbon monoxide using a tonometer and then transferred to a headspace vial. Potassium ferricyanide was added to each sample to separate carbon monoxide from hemoglobin. A sample of the vial headspace was injected onto a 5A molecular sieve column, reduced to methane with a nickel catalyst and detected with a flame ionization detector. Matrix blank and quantitative controls were included in each batch. Percent carbon monoxide saturation was calculated by comparing the response of the unsaturated sample to the saturated sample.

In cases 1 & 2, toxicological analysis indicated a blood carbon monoxide saturation of 3% for the female decedent and 4% for the male decedent. Other toxicological findings from a comprehensive drug screen and volatiles screen were unremarkable. The toxicological analysis did not include a cyanide screen. The medical examiner ruled that the cause of death was asphyxia due to inhalation of car exhaust and the manner of death was suicide in both cases.

In case 3, carbon monoxide saturation was less than 1%. In addition, ethanol and other volatiles were not detected at a cutoff of 0.01 % (w/v) and free morphine was not detected at a cutoff of 25 µg/L. The toxicological analysis did not include a cyanide screen. The medical examiner ruled that the cause of death was asphyxia due to inhalation of car exhaust and the manner of death was suicide.

The cases presented indicate that suspected carbon monoxide poisoning cases may present with atypical findings. In such cases, a comprehensive toxicological screen and scene investigation should be conducted whenever possible to rule out other causes of death.

Automobile Exhaust, Carbon Monoxide, Asphyxia

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