Stomach gas as a useful matrix for detecting ante-mortem gas exposure. A case of asphyxia by helium inhalation

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Abstract: Identification of helium in cases of fatal asphyxia induced by helium is sometimes difficult, due to its low solubility in water and high diffusibility. Lung tissue and intratracheal gas have been reported as suitable matrices for toxicological examination. This report suggests the utility of stomach gas as a matrix for forensic analysis of the presence of helium.

Key Words: helium, headspace gas chromatography, stomach gas.

Identification of asphyxic inert gases such as helium and argon from biological samples is a potentially useful technique in forensic examination [1-6]. Lung tissue was reported as being useful for the identification of asphyxic inert gases [1-6]. We have previously described the utility of intratracheal gas for such examinations [5]. Here we suggest the usefulness of stomach gas as a matrix for forensic analysis.

CASE HISTORY

A male in his thirties (height, 162 cm; weight, 61 kg) was found dead in his house. His head was covered with a plastic bag, and disconnected from a vinyl tube attached to a cylinder of helium gas, which was empty. The plastic bag was tied around the neck by a hair band. Autopsy findings indicated no evidence of external injury. The heart weighed 256 g and contained 110 mL of dark-red blood without coagulation. The left and right lungs weighed 576 and 651 g, respectively, and were congested. The trachea contained moderate amounts of dark-red, frothy fluid. Marked congestion was observed in each organ. A drug screening test using a Triage™ panel (Biosite Diagnostic, San Diego, CA) yielded negative results. No ethanol was detected on routine head space gas chromatography. Postmortem samples were collected for toxicological examination, including femoral blood and lung tissues.

Equipment

Analysis of helium was carried out in accordance with previous reports [5]. In brief, a model GC-14A gas chromatograph (Shimadzu, Kyoto, Japan) with a thermal conductivity detector was used. The column material used was Molecular Sieve 5A (60-80 mesh). Identification of each component was determined by its retention time as compared to gas standards.

Sample collection and preparation

Sample collection and preparation of the intratracheal gas was carried out as previously described [5]. After sampling of intratracheal gas, stomach gas was

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also collected by direct puncture of the stomach wall using a disposable syringe and needle. The collected gas was immediately placed into a 50-ml glass vial, already sealed with a silicone-rubber septum and aluminum cap, according to our previous report [5].

RESULTS AND DISCUSSION

Helium has physical properties of low solubility in water and low density [7]. It has no anesthetic properties [7] and causes oxygen depletion in inspired air, and acts as a simple asphyxic agent in a closed space [8].

Gas chromatograms for intratracheal gas (Fig. 1a) and stomach gas (Fig. 1b) identified peaks equivalent to helium. Helium was also detected from lung tissue (Fig. 1c), but we could not detect it in blood, as the solubility of helium in blood is low [7]. Since detection of helium in the lungs and intratracheal gas confirmed exposure to a high concentration of helium, these results provided valuable information in reaching the forensic diagnosis [5]. From the autopsy findings and the results of toxicological examination, we concluded that the cause of death was asphyxia due to oxygen depletion.

In the present case, helium was also detected in stomach gas. Gas in the stomach originates from unavoidably swallowed air [9]. Since stomach gas undergoes no postmortem exchange with surrounding air, its gas composition reflects the ante-mortem exposure to gas [1, 2], and sampling at the time of autopsy is easy. For these reasons, identification of gas in the stomach offers valuable information for forensic practice. Samples of stomach gas should be collected in cases where asphyxia due to an inert gas or inhalation of a toxic gas is suspected.

References