CASE REPORT

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A Death Involving Asphyxiation from Propane Inhalation

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ABSTRACT: A death involving asphyxiation by propane inhalation is reported. The presence of propane was determined in blood, brain, kidney, liver, and lung by gas chromatography. Autopsy samples were heated in hot water, and headspace samples from various specimens were injected into the gas chromatograph. The identity of propane was established on the basis of the retention times. The brain of the deceased showed the highest level of propane, whereas the kidney exhibited the lowest level.

KEY WORDS: toxicology, asphyxia, propane

Propane gas is used as a fuel. It is commercially available in small cylinders under various trade names, one of them being Benz-o-matic propane fuel. The toxic hazard rating [*1*] of propane is zero for skin contact. On inhalation, propane is slightly toxic [*1*], causing readily reversible changes. In high concentrations, however, it may act as narcotic [*2*]. Death resulting from inhalation of propane is not to be expected unless, of course, the gas is inhaled continuously to the exclusion of oxygen. In this paper, we report a death involving the inhalation of propane.

Case History

A 22-year-old male was found dead as a result of asphyxia. The asphyxiation was apparently self-inflicted and accidental and was caused by the inhalation of propane gas used to get some kind of "high." The deceased inhaled propane by keeping plastic bags (masks) over his face. The face of the deceased was light purple. Among other things found near the body was an uncapped propane gas cylinder (Benz-o-matic propane fuel). The death occurred sometime between 7:15 p.m. and 9:30 p.m.

The deceased was a college graduate and was employed.

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Autopsy Findings

A pinkish frothy material exuded through the nares and oral cavity. An impression mark of a rubber band was seen on the face.

Petechial hemorrhages were observed in the conjunctivae of both eyes, epicardium, and the pleural surfaces.

The lungs and brain showed evidence of severe congestion and edema. The lung parenchyma also revealed areas of hemorrhage.

The other internal organs exhibited no abnormality except for congestion.

Instrumentation

A Hewlett-Packard Model 5700A gas chromatograph equipped with dual flame ionization detectors was used. The instrument was hooked up to a Hewlett-Packard Model 3380A recorder-integrator. Glass columns used were 0.6 m (2 ft) by 4 mm ($^3/_{16}$ in.) internal diameter and were packed with Porapak Q 80-100 mesh and Chromosorb 102, 80-100 mesh. The oven temperature was 160°C; the detector temperature, 250°C. The range was 100, attenuation was 4. The carrier gas was helium at a flow rate of 30 ml/min. The settings on the Hewlett-Packard recorder-integrator were as follows: area reject, 100; attenuation, 4; slope sensitivity, 0.10 mV/min; and chart speed, 1 cm/min.

Experimental Procedure

A 12.5-ml blood sample was placed in a 15-ml centrifuge tube. The tube was stoppered and heated in a hot water beaker for 5 min. A 100-μl headspace sample was withdrawn and injected into the gas chromatograph. Similarly 100-μl headspace samples from centrifuge tubes containing finely macerated brain, kidney, lung, and liver were injected and were also found to contain propane. The retention times of the peaks obtained from autopsy samples matched those of an authentic sample of propane as well as the sample from the cylinder used by the deceased.

Results

Propane gas was found in autopsy brain, liver, lung, blood, and kidney specimens of a young man. The identification of propane in blood was carried out by gas-liquid chromatography using two different column packings (Porapak Q and Chromosorb 102) whereas the rest of the samples were run with only a Porapak Q column. The gas chromatograms are shown in Fig. 1.

As shown in Table 1, the relative concentration of propane was found to be in the following order:

$$\text{brain} > \text{liver} > \text{lung} > \text{blood} > \text{kidney}$$

Retention times of an authentic propane sample and that of the blood sample on Chromosorb 102 were 0.46 and 0.46 min, respectively.

Discussion

For gas chromatographic determination of gases, various column packings have been used in the past. Hartung and co-workers [3] used an acid-washed Chromosorb P column coated with 30% propylene carbonate connected to a silica gel column modified with 7% potassium hydroxide during a separation of components in a C4 fraction. Another column for analyzing C2–C5 hydrocarbon mixture in air consisted of *n*-octane with Porasil C [4].

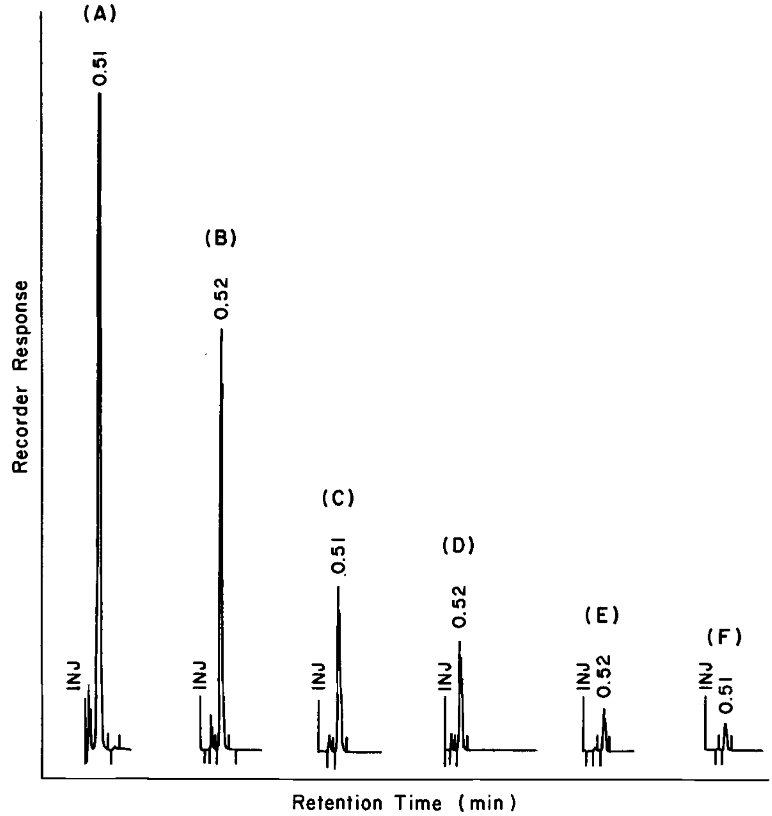

FIG. 1—*Gas chromatogram showing* (A) *authentic propane and propane peaks in* (B) *brain,* (C) *liver,* (D) *lung,* (E) *blood, and* (F) *kidney.*

TABLE 1—*Propane in various autopsy specimens.*

Autopsy Specimen	Headspace Sample, μl	Area Reading for Propane	Retention Time, min	Retention Time of Authentic Propane, min
Brain	100	10 625	0.52	0.52
Liver	100	4 157	0.51	0.52
Lung	100	2 887	0.52	0.52
Blood	100	1 904	0.52	0.52
Kidney	100	985	0.51	0.51

A Porapak Q column was used [*5*] to separate ethylene, propane, isobutane, and *n*-butane. Noles and co-workers [*6*] have also used a Porapak Q column for the separation of gaseous mixtures containing propane. We used Porapak Q and Chromasorb 102 columns because they were available in our laboratory.

It has been recently reported [*7*] that 80% of the total amount of hydrocarbons is absorbed during the first 20 min of inhalation of air containing paraffinic or olefin hydrocarbons and that the rate of absorption increases sharply after that time. Also, the amount of hydrocarbons absorbed in the first 20 min is reported [*7*] to be directly proportional to the number of carbon atoms of the molecule. It would seem logical, therefore, to assume that in the case under consideration, the rate of absorption of propane was not very fast since propane has only three carbon atoms.

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