

A Case of Death After Glue Sniffing

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ABSTRACT

A 25-year-old male, a thinner and/or glue sniffer, was found dead in the bathtub of his house approximately 24 hr after abusing a glue. As the cause of death was unknown, an autopsy of the deceased was performed. The ingredients of the glue in the tissue and organs were analyzed by gas chromatography and gas chromatography-mass spectrometry. Toluene, n-hexane and methylcyclopentane in the mesenteric fat were confirmed by gas chromatography-mass spectrometry, and the toluene concentration analyzed by gas chromatography was 10.9 $\mu\text{g/g}$ in the blood and 50.0 $\mu\text{g/g}$ in the brain. The cause of death was considered to be suffocation or acute cardiac failure under the effect of toluene.

A male thinner and/or glue sniffer, who had been abusing a glue in the bath room of his house, was found dead in the bathtub which was covered with a plastic lid leaving a partial opening. As the cause of death was unknown, an autopsy of the deceased was carried out. The ingredients of the glue in the tissue and organs were analyzed by gas chromatography and gas chromatography-mass spectrometry, and toluene, n-hexane and methylcyclopentane were detected. According to the posture of the deceased in the bathtub, the autopsy findings and the concentration of toluene in the brain, the cause of death was suggested to be suffocation or acute cardiac failure under the effect of toluene.

CASE REPORT

A 25-year-old male, who had been abusing thinner and/or glue since he was a junior high school student, was abusing glue in the bath room of his house at about 9 p.m. on August 17, 1984. Around 7 p.m. on the next day, he was found dead in the bathtub which was covered with a plastic lid leaving a partial opening through which his head could be seen. He lay on his left side with both knees curled up

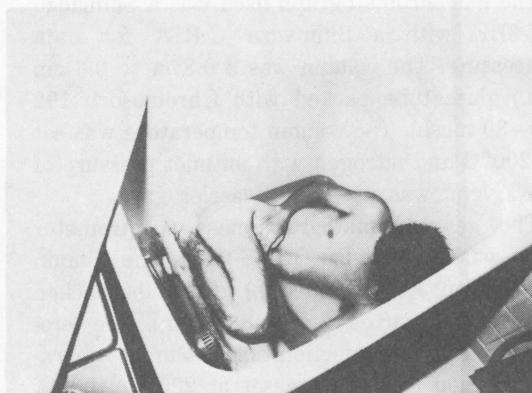


Fig. 1. The posture of the deceased in the bathtub.

towards his chest (Fig. 1). The bathtub was 70 cm in length, 80 cm in width and 90 cm in depth, and contained water which was 6 cm in depth and 30°C. There were two cans containing glue in the bath room. According to the labels of these cans, the glue in one can contained 25-35% of toluene and 20-30% of n-hexane, and the glue in the other can 30-40% of toluene and 20-30% of n-hexane.

It is not known what method he used to sniff the glue.

AUTOPSY FINDINGS

An autopsy was performed at 2:55 p.m. on August 19. The body height was 160.5 cm, and the body weight was 45 kg. No petechial hemorrhages were found in the conjunctivae of either eyelid. The lower part of the abdominal skin was a light greenish-blue color. "Washerwoman" changes of the hands and feet were observed. There were no wounds on the surface of the body. A small amount of dried glue was found on the lateral side of the left thigh. The blood in the heart and large vessels contained no clots. Petechial hemorrhages were found in the capsule of the thymus, the pericardium, the pleurae of the lungs and the mucous membranes of the renal pelvises. Marked congestion was observed in the lungs, spleen, liver and kidneys, and the left and right lungs weighed 545 g and 725 g, respectively.

LABORATORY FINDINGS

The ingredients of the glue in the blood, urine and organs, which were collected at autopsy, were analyzed by gas chromatography⁵⁾ and gas chromatography-mass spectrometry.

The gas chromatograph used was a Shimadzu GC-3BF with a Shimadzu C-R1A for data processing. The column was a 0.8 m × 0.3 cm (i.d.) glass tube packed with Chromosorb 102 (60–80 mesh). The column temperature was set at 200°C and nitrogen with an inlet pressure of 1.5 kg/cm² was used as a carrier gas.

The gas chromatograph-mass spectrometer used was a Shimadzu GCMS-6020. The column was a 1 m × 0.26 cm (i.d.) glass tube packed with Chromosorb 102 (60–80 mesh). The temperatures of the injection port, column, separator and ion source were set at 220°C, 190°C, 270°C and 270°C, respectively. Helium with a flow rate of 20 ml/min was used as a carrier gas. Ionization energy, accelerating voltage and trap current were set at 150 eV, 3.5 kV and 30 μA, respectively.

Toluene, n-hexane and methylcyclopentane in the mesenterial fat were qualitatively analyzed by gas chromatography and gas chromatography-mass spectrometry (Fig. 2–4). The distribution of toluene analyzed by gas chromatography is shown in Table 1.

The carboxyhemoglobin saturation in the blood was 0.82% by our carbon monoxide-total

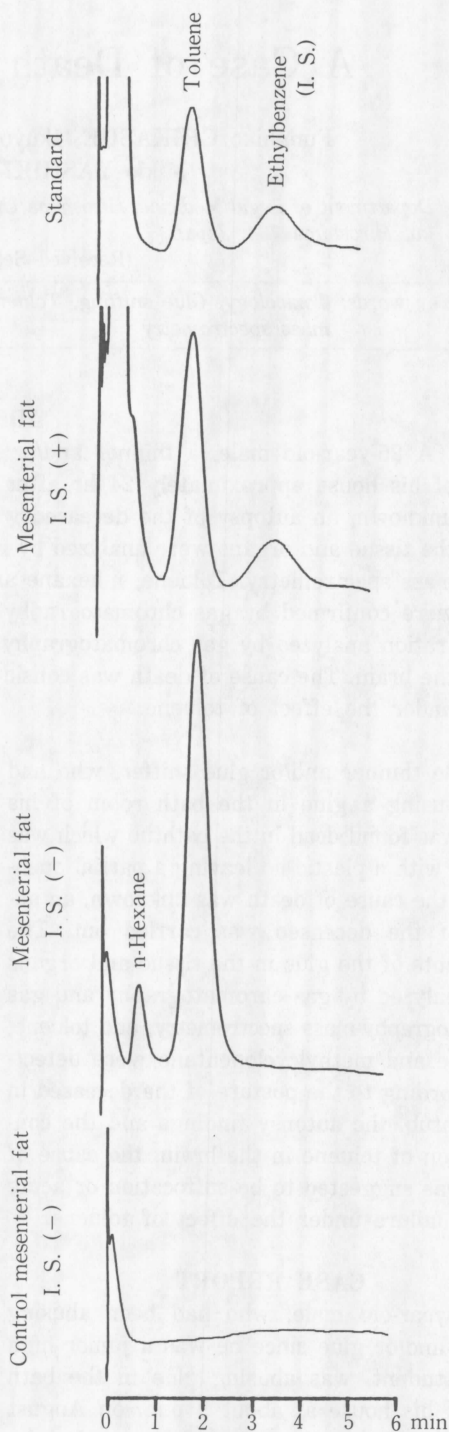


Fig. 2. Gas chromatograms

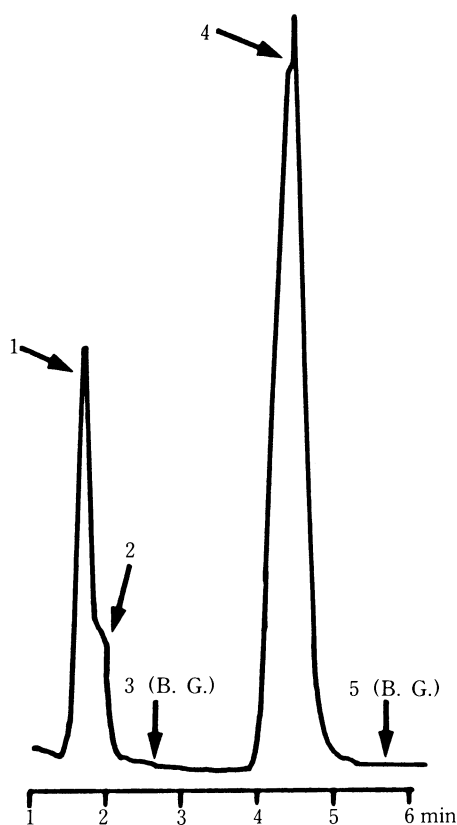


Fig. 3. Total ion current chromatogram. Points (1-5) indicate the points where mass spectra were obtained. B.G.: Back Ground

Table 1. Concentrations of toluene in the materials

Material	Toluene ($\mu\text{g/g}$)
Blood	10.9
Brain	50.0
Liver	44.1
Kidney	25.6
Mesenterial fat	270
Urine	2.44

hemoglobin method⁸.

DISCUSSION

The sniffer was found in the bath room, where there was a gas water heater, the carboxy-hemoglobin saturation in the blood was analyzed. The saturation of 0.82% is in the normal level.

According to Tadokoro¹⁰, there are several causes of death after or during organic solvent sniffing: (1) progressive bulbar paralysis due to

a deep anesthetic state, (2) cardiac failure due to hypersensitivity to isolated catecholamines, (3) suffocation due to obstruction of the air ways and lack of oxygen, and (4) glottis edema and lung edema due to irritation to the mucous membrane or laryngeal spasm due to stimulation of the vagus.

Kojima et al^{6,7} reported that the toluene concentration in the brain of the rats that died from toluene inhalation in the normal atmosphere was not less than 0.75 mg/g, and in the hypoxic atmosphere 0.5 mg/g. In the three fatal cases of organic solvent sniffing reported by Fukui et al², the lowest concentration of toluene in the brain was 312 $\mu\text{g/g}$. It seems that there is no possibility of death due to progressive bulbar paralysis in this case for the toluene concentration in the brain was 50.0 $\mu\text{g/g}$.

Hayden et al³ reviewed the effects of toluene upon the heart. According to Bass¹, sudden sniffing deaths were due to the direct effect of the solvent itself, and toluene and other solvents were related to sudden cardiovascular collapse at a light plane anesthesia level, which is most likely caused by severe cardiac arrhythmia. Taylor and Harris¹¹ reported that the inhalation of toluene fumes in mice slowed the sinoatrial rate, prolonged the P-R interval, and sensitized the heart to asphyxia-induced atrioventricular block, and that the mechanisms of sudden sniffing death in humans might be similar to that of mice. The autopsy findings in this case were not inconsistent with sudden cardiac failure due to the direct effect of toluene upon the heart.

Kashima et al⁴ described that three painters suffering from acute toluene poisoning while painting the inside of a tank fell and drowned in the water in the tank, and that the toluene concentrations in the blood ranged from 16 to 18 $\mu\text{g/ml}$. Okamoto⁹ studied on the relationship between the concentration of toluene in urine and the clinical signs, and classified them into three levels; (1) no signs were observed in cases where the toluene concentrations were less than 1 $\mu\text{g/ml}$, (2) slurring in speech was observed between 1 and 2 $\mu\text{g/ml}$, and (3) incoordination in walking was observed between 2 and 4 $\mu\text{g/ml}$. The toluene concentrations of 10.9 $\mu\text{g/g}$ in the blood and 2.44 $\mu\text{g/g}$ in the urine indicate that the sniffer was in dim consciousness or incoordination. The posture in the bathtub suggested

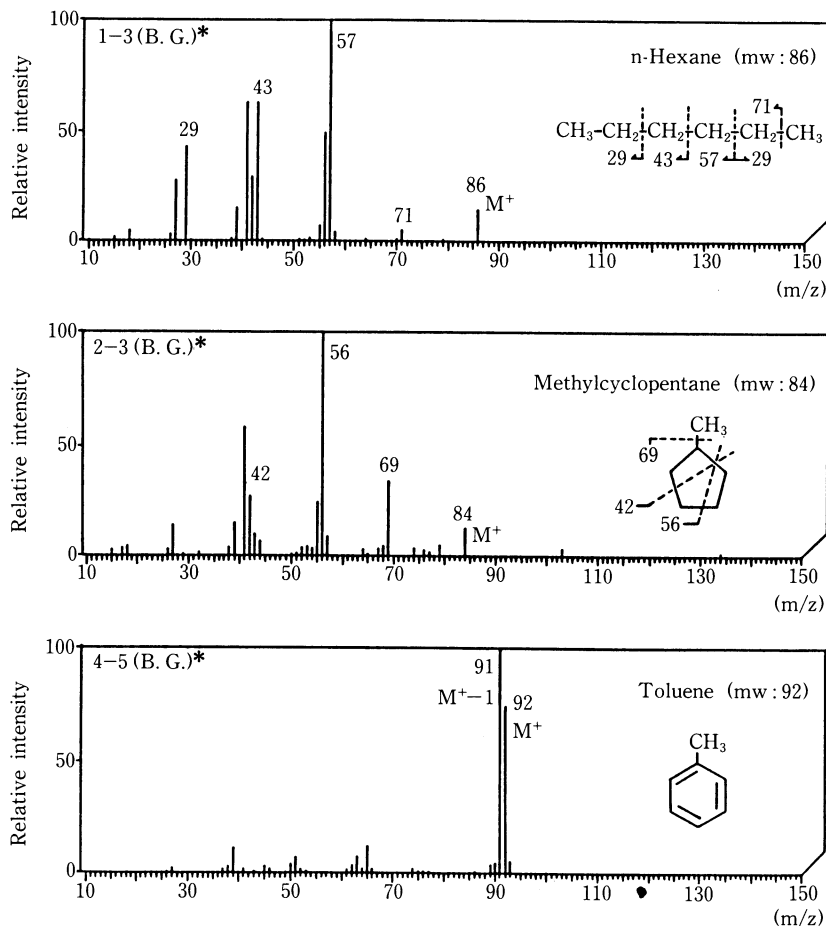


Fig. 4. Electron impact mass spectra. *: Points (1-5) indicate the same as those in Fig. 3.

the possibility of death from suffocation due to the oppression of the air way or sinking of the lingual radix into the pharynx. It seems that there is no possibility of death due to lack of oxygen, for the lid which covered the bathtub left a partial opening.

Glottis edema was not observed, and it is unknown whether a laryngeal spasm occurred or not.

It seems that the cause of death was suffocation or acute cardiac failure under the effect of toluene.

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