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# Toxicological Examination of Stomach Contents –Utility in Clarifying the Situation at Time of Death–

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**Abstract**

**Case Report**: We present an autopsy case of carbon monoxide (CO) poisoning with co-ingestion of brotizolam. A gas chromatography mass spectrometry system was used for toxicological analysis. Brotizolam was detected in stomach contents, but not in other samples such as blood or urine. Saturations of carboxyhemoglobin (CO-Hb) in left and right heart blood were 84.5% and 68.8%, respectively. **Conclusion**: We speculate that brotizolam was ingested immediately before CO inhalation, but the victim died from CO poisoning before brotizolam absorption. We may miss co-ingestion of brotizolam, if toxicological examination is performed for blood and urine alone. This case indicated the importance of drug analysis of stomach contents.

**Key words**: carbon monoxide; brotizolam; toxicological examination, stomach contents

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## INTRODUCTION

Brotizolam is a triazolothienodiazepine derivative in wide use as a prescribed hypnotic agent (1). Co-ingestion of drug or poison such as ethanol, benzodiazepines and antidepressants has commonly been observed in cases of intentional carbon monoxide (CO) poisoning (2). Here we report a case of intentional CO poisoning with co-ingestion of brotizolam, and discuss the importance of drug analysis for stomach contents.

## CASE REPORT

A male in his fifties (height, 171 cm; weight, 92.5 kg) was found dead in the bathroom of his house. The door of the bathroom was sealed up from the inside, and a charcoal brazier containing charcoal residue was also found within the room. Medico-legal autopsy revealed bruising of the back of the right hand, but this injury was not considered contributory to the cause of death. Hypostasis of the body showed cherry-red coloration. The heart weighed 447 g, containing approximately 60 mL of blood without coagulum. The left and right lungs weighed 589 g and 892 g, respectively, with severe congestion and cherry-red coloration. The slightly edematous brain weighed 1483 g. No findings suggestive of natural disease were observed. Stomach contents comprised approximately 80 mL of red-brownish liquid, containing small amounts of food residue. Samples of femoral venous blood, urine and stomach contents were collected for toxicological examinations.

Toxicological analysis using a 6890N gas chromatograph (GC) combined with a 5973 MS mass spectrometer (Agilent Technologies, Santa Clara, CA) was performed using a slight modification of a previously described method (3). Quantitation of ethanol was performed using headspace gas chromatography (4,5). Saturation of carboxyhemoglobin (CO-Hb) in blood was measured using a spectrophotometric method (6).

## RESULTS AND DISCUSSION

In the present case, gas chromatography mass spectrometry (GC/MS) analysis identified brotizolam from stomach contents, but not in blood sample. Acetaminophen was detected from

**Table 1.** Concentrations of acetaminophen and brotizolam in each sample (μg/mL)

| Specimen | Blood | Urine | Stomach contents | Therapeutic range * | Toxic range* | Lethal range * |
|---|---|---|---|---|---|---|
| acetaminophen | 10.0 | 123.4 | 42.7 | 5-25 | 100-150 | 200-300 |
| brotizolam | B.D.L | B.D.L | 6.34 | 0.001-0.02 | 0.02 | 0.01-0.03 |

* Therapeutic, toxic and lethal ranges are cited from the reference (7).
B.D.L: below the detection limit

blood, urine and stomach contents. Table 1 shows the quantitation of drugs in each sample. No ethanol was detected. CO-Hb saturations in left and right heart blood were 84.5% and 68.8%, respectively. This difference in concentrations between left and right heart blood may indicate that death occurred very shortly after CO exposure (8).

Co-ingestion of drugs is occasionally observed in cases of intentional CO poisoning (9). The total amounts of brotizolam and acetaminophen remaining in the stomach contents (80 mL) in the present case were approximately 0.5 mg and 3.4 mg, respectively. Using known toxicokinetic parameters for acetaminophen, such as the distribution volume (0.8–1.0 L/kg) (1), the body weight and femoral blood levels of the victim, the estimated acetaminophen dose was 743-928 mg. Acetaminophen is widely used as an analgesic and antipyretic. The daily dose is usually 350–1000 mg every 4–6 h (1). As the acetaminophen concentration in femoral venous blood was within a therapeutic range and the estimated dose was not suggestive of overdosing, acetaminophen may have contribution little to his death.

Based on the autopsy findings and results of toxicological examinations, we concluded that the cause of death was CO poisoning. We speculated that CO-Hb reached lethal levels almost immediately after brotizolam ingestion. The results of drug analysis in the stomach contents were useful to clarify the situation at the time of death (10). The present case indicates the importance of drug analysis of stomach contents.

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