

# CASE REPORT

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## An Accidental Death Related to Cocaine, Cocaethylene, and Caffeine

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**ABSTRACT:** Cocaethylene is often found in body fluids after concurrent use of alcohol and cocaine. Current research is showing that cocaethylene is more toxic than cocaine. The case presented here involves a death that is due to cocaine, cocaethylene, and caffeine.

The cocaethylene concentrations found were 0.16 mg/L (blood) and 1.85 mg/L (gastric). Caffeine concentrations were 16.40 mg/L (blood) and 15.40 mg/L (gastric). Cocaine was found only in the gastric sample at a level of 0.45 mg/L. The blood alcohol of the subject was 10 mg/dL.

From the case investigation it was determined that the death was accidental but related to the ingestion of cocaine and caffeine tablets. With the combination of alcohol and cocaine use rising, it is becoming evident that the routine screening of medical examiner cases for cocaethylene should be performed.

**KEYWORDS:** pathology and biology, cocaethylene, cocaine, alcohol, caffeine

Cocaine is a highly abused controlled substance, and its use with alcohol can produce a toxic metabolite, cocaethylene [1,5]. Current research shows that cocaethylene may be more important in determining lethality than the parent drug cocaine [2]. Over the counter medications containing caffeine are widely used for the stimulant effect they produce. Combining cocaine, alcohol and caffeine can have a deadly effect as shown in the case described.

### Case History

A 34-year-old woman complained to her husband that she was experiencing a rapid heart rate. This condition lasted about an hour and then she became nauseous, vomited and then collapsed and stopped breathing. Cardiorespiratory life support measures for 45 min failed to revive her.

An interview with the husband disclosed that the subject had a long history of cocaine

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and alcohol use. They had been drinking and snorting cocaine that night. Approximately 2 h later, the decedent ingested some Vivarin® caffeine tablets (amount unknown) and then ingested more 18 h later. About 15 min after the last ingestion of Vivarin® the subject complained of rapid heart rate.

### Autopsy Findings

An autopsy was conducted eight hours after death on this 140 pound, normally developed woman. No evidence of intravenous drug use injuries were found. The liver was moderately fatty and the myocardium contained foci of interstitial fibrosis and myocyte cytoplasmic contraction-band necrosis, consistent with chronic alcohol and cocaine use, respectively. Approximately 150 mL of brown fluid was in the stomach. The urinary bladder was empty.

### Laboratory Procedures

#### *Instrumentation*

Original identification of caffeine, cocaine, and cocaethylene was with a Hewlett-Packard 5890 gas chromatograph with dual nitrogen-phosphorus detectors. The gas chromatograph was linked to two 3393A Hewlett-Packard integrators. The columns used were J&W Scientific DB-1 and DB-1701 cut to 20 meters. Helium was the carrier gas. The injector and detector temperatures were 260°C. The oven temperature was set at 130°C and held for 1 min, then increased 15°C/min to a final temperature of 260°C.

Confirmation and quantitation of caffeine, cocaine and cocaethylene was with a Hewlett-Packard 5890 series II gas chromatograph interfaced with a 5971A series mass selective detector. The column used was an HP-1, 12 meters in length. Helium (1.6 mL/min) was the carrier gas. The injector temperature was 250°C and the source temperature was 280°C. The oven temperature was set at 130°C and held for 1 min, then increased by 20°C/min to a final temperature of 260°C.

#### *Extraction*

Three drops of ammonium chloride buffer (pH = 8.5) were added to 2 mL of blood and 2 mL of gastric sample. Internal standard (codeine) was added at a concentration of 500 ng/mL as well as 8 mL of 1-chlorobutane. The tubes were rotated for 10 min and then centrifuged. The organic layer was removed and evaporated using air. The residue was reconstituted in 100 µL of methanol and 2 µL were injected into the gas chromatograph. Quantitation, using a selected ion monitoring program, was based on the peak area ratios of caffeine, cocaine and cocaethylene to I. S. in comparison to known blood standards. One target ion and two qualifying ions were used for quantitation. The mass ion variance allowance was 10%. The LOD was 0.05 mg/L and the LOQ was 0.10 mg/L. Quantitation curves for cocaine, cocaethylene and caffeine were linear through 2.50 mg/L. Correlation coefficients for cocaine and cocaethylene were 0.991 and for caffeine it was 0.998.

### Results and Discussion

The following results were obtained for the case:

Specimen	Cocaine [mg/L]	Cocaethylene [mg/L]	Caffeine [mg/L]
blood	none detected	0.16	16.40
gastric	0.45	1.85	15.40

These toxicology results, coupled with the history of rapid pulse and sudden fatal collapse, implicate toxicity from cocaethylene and caffeine as the probable cause of death. The blood caffeine concentration level is far below reported lethal levels but consistent with ingestion of over 500 mg. Caffeine taken in excess can cause cardiac stimulation and arrhythmias [3].

Cocaethylene is postulated to be formed in the liver in the presence of cocaine and alcohol [1]. In cocaine associated deaths in which alcohol and cocaine were used together, more than half have detectable cocaethylene. Deaths with high blood cocaine levels correlate with central nervous syndrome seizures and hyperthermia. Deaths with lower levels implicate cardiotoxicity [4]. The relatively low cocaethylene blood level in this case, together with the clinical presentation of the witnessed collapse and autopsy findings, suggest cardiotoxicity with a lethal arrhythmia as the mechanism of death. The high amount of caffeine in the blood may have contributed to the heart disturbance.

Finding a high level of cocaethylene in the stomach contents, especially a level higher than the concentration of cocaine, is surprising considering the hypothesis that cocaethylene is formed in the liver. The authors know of no reports of cocaethylene measurements in gastric contents, but have noticed its presence in other forensic autopsy cases.

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