# CASE REPORT

*M. B. McGee,*[1] *M.D.*

# Caffeine Poisoning in a 19-Year-Old Female

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**ABSTRACT:** A case report is given of a fatality resulting from caffeine intoxication associated with ingestion of an over-the-counter appetite suppressant. Caffeine is one of the drugs most readily available to the general public. Present in many beverages and over-the-counter compounds, caffeine has a relatively low toxicity. Fatalities from caffeine intoxication are rare, with seven cases previously reported in the English language literature.

**KEY WORDS:** pathology and biology, caffeine, poisons

Caffeine is one of the drugs most commonly used by the American public today. Present in many beverages, it also serves as an active ingredient in many over-the-counter compounds purchased primarily for their stimulant, diuretic, or appetite-suppressant effect. Despite caffeine's relatively low toxicity, indiscriminate use of these compounds can result in overdosage and possibly a fatal outcome.

## Case Report

A 19-year-old female became ill with abdominal cramps following an afternoon of bicycle riding. She retired early that evening, but family members stated that she was awake and complaining of abdominal cramping in the early morning hours. At 3:00 a.m. the father was awakened and found the subject, doubled over at the waist, lying on the floor of her bedroom. She was in a semicomatose state with shallow, irregular breathing. Mouth-to-mouth resuscitation was begun, and with the arrival of paramedical personnel, the subject was found to be in coarse ventricular fibrillation. Appropriate treatment including "cardioversion" was administered and the victim was immediately transported to the hospital. On arrival at the emergency room at 6:01 a.m. the subject was unable to maintain a normal cardiac rhythm. Despite continued resuscitation she died at 6:16 a.m. without regaining consciousness and before any laboratory or diagnostic procedures could be begun.

Family members related that the deceased had been in good health until the time of her death, a fact confirmed by a routine clinic visit made six weeks before her death.

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[1]Forensic medicine Fellow and deputy medical examiner, Hennepin County Medical Center, Minneapolis, Minn.

Past medical history was unremarkable with the exception of a drop in body weight from 80 to 45 kg (180 to 100 lbs) over the preceding year as a result of self-imposed dietary restrictions and the frequent use of varied, over-the-counter dietary aids and reducing plans.

An autopsy ordered by the Hennepin County medical examiner showed evidence of agonal aspiration of gastric contents but failed to demonstrate an anatomic cause of death. Examination of stomach and duodenal contents disclosed remnants of partially dissolved gelatin capsules. These capsules contained minute white beads that could be found throughout the stomach. Aliquots of heart blood and stomach contents were initially screened by thin-layer chromatography and revealed a high concentration of caffeine. No acidic, basic, or other neutral drugs were present. Subsequent analysis of the individual white beads from the gastric contents showed a high concentration of caffeine. Blood obtained from the heart at the time of autopsy had a caffeine level of 18.1 mg/100 ml. The gastric contents contained an estimated 18.0 g of caffeine. No other specimens were analyzed for caffeine's presence.

Investigation of the scene revealed three separate vitamin supplement compounds, none containing caffeine. No over-the-counter dietary compounds were present.

## Toxicology

Quantitation of caffeine in the blood followed the Type B procedure as outlined in *Methodology for Analytical Toxicology* [*1*] with chloroform substituted for benzene in the extraction procedure. The extract was then returned to an acid-aqueous phase with 5*N* hydrochloric acid, and the absorption measured 273 nm on a Beckman DB-G spectrophotometer. Whole blood standards of caffeine at 10 mg/100 ml and 20 mg/100 ml were similarly prepared, extracted, and measured. For confirmation of identification, extracts of the subject's specimen were submitted without internal standards to gas-liquid chromatography using a Shimadzu 4B gas chromatograph with a flame ionization detector. Columns 1.8 m (6 ft) long packed with 3.0% SE on Chromosorb W were used at an oven temperature of 180°C. Retention time for the standards and the subject specimen was 4.5 min.

## Discussion

Caffeine (1,3,7-trimethylxanthine) is a naturally occurring alkaloid found in many plants distributed worldwide. It was discovered early in history, and its presence in society today is due largely to the aqueous extracts of these plants as coffee, tea, cocoa, and other substances. A powerful stimulant of the central nervous system, caffeine also stimulates cardiac muscle, relaxes smooth muscle, increases gastric secretions, and produces diuresis [*2*].

Fatalities resulting from caffeine poisoning are rare, with only seven previously reported cases [*3–9*] (Table 1). A possible explanation for this low frequency is the gastric irritation and vomiting that develop before absorption of toxic amounts can occur [*3*]. Normally caffeine is rapidly and completely absorbed from the gastrointestinal tract with distribution in various tissues in approximate proportion to their water content [*10*]. Transformation of caffeine is nearly complete with an average half-life of 3½ h [*10*]. A fatal dose is estimated at 10 g [*2*].

Caffeine toxicity can present as a spectrum of clinical symptoms. Most of these originate in the central nervous and circulatory systems and can follow ingestion of 1 g or more of caffeine. Initially, insomnia, breathlessness, and excitement progressing to mild delirium may be seen [*2*]. Sensory disturbances, diuresis, tachycardia, extrasystoles, and elevated respirations as well as vomiting induced by potent gastric irritation can be present

TABLE 1—*Fatalities resulting from caffeine ingestion.*

| Author | Subject | Source | Estimated Dose, g/Route of Administration | Level in Blood, mg/100 ml | Reference |
|---|---|---|---|---|---|
| Jokela and Varliainen | 35-year-old-female | caffeine solution | 3.2/intravenous | ... | *6* |
| Farago | 15-month-old male | caffeine in sodium benzoate solution | 18.0/oral | 71.0 antemortem<br>104.0 postmortem | *7* |
| Borkowski | 61-year-old male | caffeine in sodium benzoate solution | 18.0/oral | ... | *8* |
| Grusz-Hardy | 45-year-old female | ... | 50.0/oral | 7.9 | *9* |
| Alstott et al | 27-year-old female | caffeine alkaloid | 6.5-12.0/oral | ... | *5* |
| DiMaio and Garriott | 5-year-old female | Tri-aqua tablets | 3.0/oral | 15.85 | *3* |
| Turner and Cravey | 34-year-old female | caffeine tablets | unknown/oral | 10.6 | *4* |
| McGee | 19-year-old female | over-the-counter diet pills | 18.0/oral | 18.1 | ... |

[2,3]. Convulsions result from the central stimulating effect with death caused by respiratory failure [2]. Hyperglycemia and ketonuria associated with caffeine toxicity have been reported [11]. These latter findings may be attributed to a stress reaction or the xanthine's ability to mimic the metabolic effects of the cathecholamines including lipolysis, glycogenolysis, and gluconeogenesis [2,11].

Over-the-counter obesity control products were represented by phenylpropanolamine, benzocaine, and methylcellulose [12]. Phenylpropanolamine, a sympathomimetic agent chemically and pharmacologically related to ephedrine and amphetamine, may represent the primary pharmacologic agent in over-the-counter appetite suppressants [12]. Caffeine is added in various amounts to many of the appetite suppressants, possibly for its diuretic effect. Those products containing both caffeine and phenylpropanolamine should be considered in postmortem examinations because of their possible additive effect on cardiac stimulation [12].

Despite the low incidence of caffeine toxicity, the ready availability of caffeine-containing compounds to the general public raises serious questions regarding their possible risk.

## Summary

A case of fatal caffeine intoxication is presented with comments on the clinical presentation and toxicologic findings. A listing of the fatalities resulting from caffeine poisoning previously reported in the English language literature is also included.

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Address requests for reprints or additional information to
M. B. McGee, M.D.
Hennepin County Medical Center
Minneapolis, Minn. 55415