H112 Toxicological, Histological, and Immunohistochemical Analysis in a Case of Malignant Arrhythmia Due to Acute Pure Caffeine Intoxication

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Learning Overview: The goal of this presentation is to discuss a very rare case of suicide due to acute pure caffeine intoxication. Since caffeine acute intoxication pathological findings are non-specific, toxicological, histological, and immunohistochemical analysis are essential to prove the role of pure caffeine as cause of death.

Impact on the Forensic Science Community: Deaths by caffeine consumption are rarely described and are mainly related to caffeine-based medication abuse. Due to its high interindividual variability, toxic doses are extremely difficult to define. This presentation will impact the forensic science community by presenting a case that is unusual due to acute intoxication by pure caffeine consumed for suicidal purposes.

Caffeine is a naturally occurring purine-based alkaloid, mostly consumed as a psychostimulant. It can be found in different natural substances, even if its recent use has been related mainly to caffeine-based medications and energy drinks. Its effects are dose-dependent, generally causing undesirable effects with doses higher than 500mg. Only a few cases of death due to acute caffeine intoxication have been described, the majority of which have been attributable to massive consumption of caffeine-based medications, with blood concentration of 15–20ug/ml. In such cases, the cause of death is often identified as ventricular fibrillation due to catecholaminergic stimulation.

Since autopsy findings are non-specific for caffeine, toxicological analysis and the determination of caffeine concentration in the blood are essential. This work presents the case of a 39-year-old Caucasian female found dead at home. At the crime scene, a white powder was found on the victim's lips. The same powder was identified on the kitchen table, as well as in many plastic glasses in the sink, close to other empty glasses. A handwritten letter was found, confirming the suicidal intentions of the women. Samples of white powder were taken for toxicological analysis. During the autopsy, no pathology was found in the major organs, except for the lower esophagus and stomach, which were distended and their consistency was increased. The upper digestive tract contained a solid pinkish-white substance in the shape of the gastric and esophageal cavities (weight of 664g). Samples of that substance, along with blood, vitreous humor, urine, and bile samples, and major parenchymal organs were taken for toxicological analysis. Histological analysis on the brain, heart, liver, kidneys, and stomach were also performed. This revealed myocardial contraction band necrosis, suggesting fatal arrhythmia as the mechanism of death. Toxicological analysis was extremely meaningful, as it proved the presence of pure caffeine inside the gastric and esophageal cavities. Caffeine concentration in the blood was 47μg/ml, and very high levels of catecholamines and their metabolites were detected in the urine samples. The white powder sampled at the crime scene was confirmed to be pure caffeine. Immunohistochemical analysis of the myocardium demonstrated the β1-adrenoceptor involvement.

Deaths by caffeine consumption are rarely described and mainly relate to caffeine-based medication abuse. Due to its high variability among individuals, toxic doses are extremely difficult to define. Our case is unique due to an acute intoxication by pure caffeine consumed for suicidal purposes. Toxicological analyses associated with the histological signs of myocardial injury confirmed the cause of death was due to fatal arrhythmia due to pure caffeine intoxication.

Caffeine, Arrhythmia, Acute Intoxication

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