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The Tissue Distribution of Fluoride in a Fatal Case of Self-poisoning

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The purpose of this paper is to report a case of fluoride poisoning along with a discussion of poisoning characteristics, analytical procedures, and a review of previous reports of fatal intoxications with analytical data. A case of suicidal ingestion of 40 mL of a rust removal agent containing hydrofluoric acid and ammonium fluoride by a 33-year-old white male is presented. He had an organic personality disorder with residual schizophrenia and previous suicide attempts with therapeutic drugs and cleaning products. At admission he presented with a Glasgow coma score of 3; third degree atrioventricular block and asystole. Resuscitation efforts were performed during which the patient suffered two episodes of ventricular fibrillation followed by asystole. In spite of advanced resuscitation efforts and the administration of calcium chloride, he died 2.5 hours after the ingestion. Analytical data in the hospital showed calcium levels of 3.1 mg/dL and metabolic acidosis. Internal findings were: erosive gastritis, brain edema, as well as pulmonary and hepatic congestion. Quantitation of fluoride was performed using an ion-selective electrode for the anion. Disposition of fluoride in the different tissues was: peripheral blood, 19.4 mg/L; urine, 670 mg/L; vitreous humor, 2.5 mg/L; liver, 40.0 mg/kg; kidney, 60.0 mg/kg; lung, 17.5 mg/kg; brain, 2.5 mg/kg; spleen, 30.0 mg/kg; bone, 0.5 mg/kg; and gastric content 1120 mg/L (67 mg total). Validation of the analytical method was performed using different spiked tissues, in a range of concentrations from 2.4 to 475 mg/L or mg/kg, and submitting them to dilution (1:25) to avoid the matrix effect and to bring these concentrations to the range of the aqueous calibration curve (0.19-19 mg/L). Limits of detection and quantitation were 0.02 and 0.1 mg/L, respectively. The linearity of the method, for all studies tissues, was excellent, with r² values of 0.999. Accuracy and precision were within 10.5% and 5.7%, respectively. Fluoride analyses using the ion selective electrode are simple, sensitive, and rapid. This is the first case we are aware of that provides a complete tissue distribution study of fluoride after a human poisoning, including a validated analytical method. Based on the autopsy findings, patient history, toxicology results, and previously reported data the forensic pathologists ruled that the cause of death was due to a fluoride poisoning, and the manner of death was listed as suicide.

Keywords: Fluoride, Self-poisoning, Tissue Distribution, Postmortem