K3 Metabolism and Estimation of Intake of Intravenous Nicotine Injection

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Learning Overview: The goal of this presentation is for attendees to better understand the distribution of nicotine in the body and the pathophysiology of acute nicotine poisoning.

Impact on the Forensic Science Community: Estimating the details of nicotine intake based on its distribution of nicotine and its metabolite, cotinine, in the body could be expected to be helpful for not only forensics, but also treatment for acute nicotine poisoning.

A rare case of death involving nicotine poisoning through an intravenous injection was experienced; the metabolism of nicotine in the body was analyzed and the intake was estimated based on the results.

Case History: A young Asian female was found by her husband in cardiorespiratory arrest in a hotel room. She was brought to the hospital, but was subsequently declared dead. About 36 hours later, a forensic autopsy was performed to identify the cause of death. A syringe, liquid nicotine, and hydrogen peroxide water were found in her hotel room.

Autopsy Findings: The subject was an adult female (height: 153cm; weight: 45.3kg). She had dark reddish-purple hypostasis and her face was moderately congested. The palpebral conjunctivae were congested, with few petechiae. Injection marks running along the course of the blood vessel with subcutaneous hemorrhage were seen on the left elbow fossa, left forearm, and right upper arm. Both left and right heart blood contained dark red blood with liquidity. The brain (1,285g) was edematous and swollen, and the lungs (left: 380g; right: 385g) were moderately congested with parenchymal hemorrhage. The other organs were also congested.

Results and Discussion: The present case was considered acute poisoning. Toxicologic examination clarified the presence of nicotine, which reached the lethal level in blood. Further examination was performed in other body fluids and organs, and a high level of nicotine was detected in the tissue around the injection mark on the right upper arm. Cotinine, the metabolite of nicotine, was quantified, but a low level was indicated, except for in the tissue around the injection mark on the right upper arm. Hydrogen peroxide was also quantified, and the results were within the normal range of a healthy person. For these reasons, it was concluded that the cause of death was acute nicotine poisoning by intravenous injection. Nicotine absorbed into the body migrates to the liver to be metabolized and discharged from the kidneys. Based on the half-life of nicotine and cotinine, it appears possible to estimate the amount and the time passed since intake, but this is extremely difficult because of individual genetic and racial differences in the metabolization of nicotine. Therefore, much more data must be collected from individual samples and analyzed in terms of the efficiency of nicotine metabolism. The quantification of nicotine and cotinine in cases involving nicotine poisoning could be useful to estimate the amount, route, and time of intake.

Nicotine, Injection, Toxicology

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