Distribution of 11-Nor-9-Carboxy-Δ^9-tetrahydrocannabinol in Traffic Fatality Cases

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Abstract

11-Nor-9-carboxy-Δ^9-tetrahydrocannabinol (THC-COOH) distributions in postmortem specimens are rarely reported. Fifty New Jersey State Medical Examiner's cases in which automobile accident deaths suspected of involving marijuana intake were studied for the distributions of THC-COOH in postmortem urine, blood, vitreous humor, and bile specimens. Cases were selected based on immunoassay (TDx) urine test results. If the preliminary urine test indicated the presence of THC-COOH (apparent THC-COOH concentration ≥ 20 ng/mL), urine, heart blood, vitreous humor, and bile specimens from the case were analyzed for THC-COOH concentrations by gas chromatography–mass spectrometry. The mean, standard deviation, and range of THC-COOH in heart blood, urine, and bile found in these 50 cases were 0.081, 0.082, and 0.016–0.33 µg/mL; 0.314, 0.415, and 0.044–2.33 µg/mL; and 12.9, 11.4, and 1.03–43.7 µg/mL, respectively. THC-COOH was absent (detection limit, 1 ng/mL) or at low concentration (< 10 ng/mL) in vitreous humor specimens. The mean, standard deviation, and range of the bile-to-blood and urine-to-blood ratios were 242, 196, and 17.2–888 and 4.70, 4.05, and 1.14–19.2, respectively. The highest concentrations of THC-COOH were found in bile and the lowest in vitreous humor. These findings are consistent with the high hydrophobicity nature of THC-COOH and further suggest that bile is the specimen of choice for detecting low level of THC-COOH in postmortem cases.

Introduction

With a long history of pharmacological studies on tetrahydrocannabinol and a recent emphasis in workplace drug testing, 11-nor-9-carboxy-Δ^9-tetrahydrocannabinol (THC-COOH) depositions in blood and urine have been widely studied and data are readily available. On the other hand, data concerning the distributions of THC-COOH in postmortem specimens are rarely reported. Perhaps, this is because death caused by cannabis overdose has, to the authors' knowledge, not been reported, while general interest in understanding the involvement of drugs (other than ethanol) in traffic fatalities is a relatively new development.

The effects of drugs on human performance and behavior is now an area of great interest to members of the forensic toxicology community. For example, the Joint Society of Forensic Toxicologists, Inc. and American Academy of Forensic Sciences Drugs and Driving Committee has recently published monographs addressing the pharmacodynamic effects of the following drugs: benzodiazepines, cannabis, carisoprodol, cocaine, γ-hydroxybutyrate, ketamine, methamphetamine, 3,4-methylenedioxymethamphetamine, phencyclidine, and opioids (1,2).

Our interest in this area is mainly in understanding the distributions of drugs in postmortem specimens. For example, we have reported the distributions of opiates in vitreous humor (3). Because marijuana, after ethanol, is the most frequently identified drug in studies of drivers involved in unsafe driving practices (4), we have decided to study the distribution of THC-COOH in the following postmortem specimens collected from automobile fatalities suspected of involving marijuana intake: urine, bile, heart blood, and vitreous humor. Specimens selected for this study came from 50 New Jersey Medical Examiner's automobile fatality cases, in which preliminary test (TDx) of urine specimens showed the presence of THC-COOH (apparent THC-COOH concentration ≥ 20 ng/mL). To the best of our knowledge, this study reports the largest database concerning the distributions of THC-COOH in postmortem specimens.

Materials and Methods

Specimens, reagents, and chemicals

Postmortem urine, heart blood, vitreous humor, and bile specimens from 50 New Jersey's Office of State Medical Examiner (Newark, NJ) cases were used in this study. All specimens were collected within the past six months and were kept in refrigeration prior to their analyses. In cases suspected to in-

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