



K32 Altered Pharmacokinetics of Delta 9-tetrahydrocannabinol

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The goal of this presentation is to provide forensic toxicologists and pathologists additional factors to consider in interpreting drug levels following traumatic injuries.

This presentation will impact the forensic community and/or humanity by helping in the understanding of the relationship between delta-9-tetrahydrocannabinol (THC) and driving impairment; understand pharmacokinetics of THC; and understand some factors that could affect THC metabolism.

Marijuana is the common name for a crude drug made from the plant *Cannabis sativa*. It is commonly used for its euphoric effects. The main mind-altering (psychoactive) ingredient in marijuana is delta-9-tetrahydrocannabinol (THC). Some immediate physical effects of marijuana include a faster heartbeat and pulse rate, bloodshot eyes, and a dry mouth and throat. Smoking marijuana results in rapid absorption and is measurable in plasma within seconds after inhalation. Peak THC plasma concentrations occur prior to the end of smoking, and vary depending on the potency of marijuana and the manner in which the drug is smoked. In general, peak THC serum levels typically exceed 100 ng/mL and then fall rapidly: within 2 hours plasma THC concentrations are at or below 5 ng/mL. As a result, detection times in the blood are typically only a few hours after past use. THC has a large volume of distributions and is highly protein bound. THC is eliminated from plasma in a multiphasic manner. Metabolism of THC occurs via the hepatic Cytochrome P450 enzyme system. The major metabolite is 11-nor-delta-9-tetrahydrocannabinol-9-carboxylic acid (THC-COOH).

Marijuana has been shown to impair performance on driving simulator tasks and on open and closed driving courses for up to approximately four hours. Decreased car handling performance, increased reaction times, impaired time, and distance estimation, inability to maintain headway, lateral travel, subjective sleepiness, motor incoordination, and impaired sustained vigilance have all been reported. In 2004 in British Columbia, Canada approximately 25% of drivers involved in fatal accidents had evidence of marijuana use as determined by blood and urine detection of THC or THC-COOH.

A 16y old male driver presented in the emergency department with multiple blunt force injuries sustained during a single vehicle crash. Plasma samples that were collected in the ED for analysis had been determined to have concentrations of THC of 460 nmol/L (0.14mg/L), and a THC-COOH of 110 nmol/L (0.038 mg/L). The individual stated that he smoked marijuana prior to the incident, but that it was a couple hours prior to the sample collection. Based on the THC and THC-COOH concentrations using previously published algorithms, it is predicted that marijuana was smoked less than one hour prior to the sample collection. This contradicts the individual's claims.

Many physiological factors lead to altered pharmacokinetics parameters of commonly prescribed medications, including shock, altered blood flow, and altered perfusion of vital organs. The case demonstrated altered THC pharmacokinetics potentially due to traumatic injuries sustained by the individual.

Driving Impairment, Delta-9-tetrahydrocannabinol (THC), Pharmacokinetics