Application of Models for the Prediction of Time of Marijuana Exposure from Blood of Drivers Arrested for DUI

ANN MARIE GORDON, RODNEY GULLBERG and BARRY K. LOGAN

Washington State Toxicology Laboratory, Seattle, WA

Forensic toxicologists are often asked to interpret THC and carboxy-THC levels detected in the blood of subjects arrested for driving under the influence of drugs (DUID). Marijuana has been shown to impair driving performance for up to 3 hours post Ingestion. Providing a reliable estimate for the time of use would help in the interpretation of such cases. In 1992, Huestis et al (J. Anal. Toxicol. 16:283:290 1992) presented two mathematical models for the prediction of time of marijuana exposure from plasma concentrations of THC and carboxy-THC based on data from participants in clinical studies. Model I utilized plasma THC concentrations and model II utilized the THC:carboxy-THC ratios in plasma.

In this study, these models were applied to blood THC and carboxy-THC concentrations in DUI arrestees. Unlike the controlled clinical data, there are additional limitations to arrestee data. Blood, not plasma is the sample collected in DUI arrests; plasma:blood correlations are approximately 2:1. Second, when dealing with DUI arrestees, verification of the time of last THC use and duration of use is not possible. Many of the arrested drivers admitted repeated use of marijuana over an extended periods of time.

Since both THC and carboxy-THC accumulate in chronic or repeat users, the variability of predicted time from the models would increase. Ninety one positive THC cases with reliable information as to the time of last smoking were selected. THC levels averaged 5.2 ng/mL (median 4 ng/mL, range 1-21) and carboxy-THC levels 57.6 ng/mL (median 40 ng/mL, range 9-248). Model I calculations, based on the THC concentration alone, showed little correlation between the predicted and actual time of use. Model II, based on THC:carboxy-THC ratio, proved more reliable for predicting the actual time of smoking. Time of use from smoking to the blood draw ranged from 50 to 233 minutes and the time between the driving and blood draw was limited by the time required to stop and arrest the subject, evaluate the impairment and obtain the blood draw. Ninety four percent of the time the predicted time fell within the 95% confidence intervals predicted by the model

The data presented here supports the usefulness of Model II in predicting the time of marijuana use, but some caution must be used due to the limitations to this data. First, cases were pre-selected for short intervals between the time of smoking and the time of the stop. Second, the manner in which cases were selected may have excluded chronic smokers as these subjects might be less likely to answer questions regarding time of use. However, even in light of these limitations, it appears that the time of use predicted by Model II may be useful and when considered in the context of the overall case, including the observed driving of the subject, the observed impairment of the subject during the physical exams and subject's statements when rendering an opinion as to the impairment of a subject arrested for DUID involving marijuana.

Corresponding author: ann.gordon@wsp.wa.gov