K75 EtG/EtS in Ethanol Negative Urine Specimens From Sexual Assault Victims

Kristin W. Kahl, MS, University of Miami Toxicology Laboratory, Miami, FL 33136; Lisa J. Reidy, PhD, University of Miami Forensic Toxicology Laboratory, Miami, FL 33136*

Learning Overview: After attending this presentation, attendees will understand the significance of urine Ethyl Glucuronide/Ethyl Sulfate (EtG/EtS) testing in sexual assault cases.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by providing data demonstrating the usefulness of EtG/EtS urine quantitation from victims of sexual assault where alcohol is indicated but ethanol is not detected.

EtG and EtS are minor metabolites of ethanol that have traditionally been used as biomarkers of ethanol use in abstinence programs due to their longer half-lives relative to ethanol. The longer half-lives of these metabolites may also be useful for crimes where reporting and sample collection times may vary, such as Drug-Facilitated Crimes (DFC). The classification of a DFC includes Drug-Facilitated Sexual Assaults (DFSA). According to literature, ethanol is the most frequent drug detected in DFSA victims; however, due to the variation in reporting and sample collection times, some victims may not have blood or urine collected until hours or days after the alleged incident. Delays in sample collection can result in specimens being negative for ethanol, even if the victim was intoxicated at the time of the incident. This study investigates whether EtG and EtS are useful markers of ethanol use in DFSA cases where urine specimens are negative for ethanol.

Urine specimens utilized in this study were from suspected DFSA victims submitted to the University of Miami Toxicology Laboratory (UMTL) from June 2018 to July 2019. Specimens were first analyzed for ethanol using Headspace/Gas Chromatography/Flame Ionization Detector/Mass Spectrometry (HS/GC/FID-HS/GC/MS/FID) with a Limit Of Detection (LOD) of 0.01g/100mL. If ethanol was not detected in a urine specimen and alcohol was indicated from case histories, the specimens were analyzed for EtG and EtS by Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS). The quantitative EtG/EtS method was validated according to the Scientific Working Group for Forensic Toxicology (SWGTOX) validation guidelines.

The quantitation range for EtG was 200–10,000ng/mL (LOD 100ng/mL) and 50–2,500ng/mL for EtS (LOD of 25ng/mL) with a 1/x linear model. No significant matrix effects or carryover were observed. A dilution study was also performed during validation and case specimens were diluted, when necessary. Due to EtG being produced without the ingestion of ethanol, EtG is only reported if EtS is also present in the urine specimen. Case information and history were taken from sexual assault cases forms. The quantitative results, ratio of EtG:EtS, and case information were reviewed for each case.

Between June 2018 and July 2019, 167 urine DFC cases were submitted to the UMTL, of which 70 specimens were tested for EtG/EtS. Neither EtG nor EtS was detected in 12 of the specimens. Sixty-four cases directly stated, or indicated, that alcohol may have been involved in the incident, but no ethanol was detected. Of the cases in which alcohol was indicated, EtG and/or EtS was reported in 57 (89%) of the cases. The concentration of EtG ranged from 212ng/mL–467,650ng/mL and 60–117,650ng/mL for EtS. In seven cases, both EtG and EtS or only EtS were detected but were less than the lower limit of quantitation. The ratio of EtG:EtS ranged from 0.84–12.96 (mean: 3.85, median: 2.67). The range of time elapsed from the time of the incident to sample collection was 7–137h. Seven specimens were collected within 0–12h, 24 specimens were collected within 13–24 h, 16 specimens were collected within 24–48 h, and 23 specimens had unknown collection times or were collected more than 48 hours after the alleged incident.

Although testing for EtG/EtS in DFSA cases is not considered routine, the results presented show a high level of consistency between self-reported alcohol use and the detection of EtG/EtS in urine specimens when ethanol is not detected. The results also show that although sample collection times after the alleged incident can vary, EtG/EtS are still able to be detected for multiple days after ethanol ingestion, thereby corroborating the victim's statement of alcohol use.

Sexual Assault, Ethyl Glucuronide, Ethyl Sulfate