K62 Forensic Toxicology Findings in 150 Alleged Cases of Drug-Facilitated Sexual Assault (DFSA) in San Francisco

Nikolas P. Lemos, PhD, Eric A. Ingle, BA, Cecilia O. Medina, BS, Glenda M. Easterling, BS, Pavlos Karamanidis, BS, Chinyere M. Williams, BS, Jonas E. Knight, BS, Jonas E. Knight, BS, and Justin A. Volk, OCME, Forensic Lab Division, Hall of Justice, N Ter, 850 Bryant St, San Francisco, CA 94103*

After attending this presentation, attendees will understand the wide variety of drugs commonly encountered in DFSA cases and value the usefulness of toxicology testing in such cases.

This presentation will impact the forensic science community by providing valuable information on drug incidence in victims of DFSA and will offer blood reference concentrations of drugs commonly detected in such cases.

Between July 1, 2010, and June 30, 2011, the Laboratory Division of the San Francisco OCME performed toxicologic evaluations in 150 cases of suspected Drug Facilitated Sexual Assault (DFSA). The age of the subjects ranged from 12 to 57 years (mean: 30). The 150 cases were comprised of 129 females, 18 males, and three transgender females. Healthcare providers attending to DFSA victims are trained to collect urine specimens in these types of cases and only collect blood specimens if the alleged crime took place within hours of their examination. Specimens are typically evaluated for ethanol and related volatiles using Gas Chromatography equipped with Flame Ionization Detection (GC/FID), then screened by Enzyme-Linked Immunosorbent Assay (ELISA) for amphetamines, benzodiazepines, cannabinoids, cocaine, methadone, phencyclidine (PCP), ketamine, and opiates/opioids and by Gas Chromatography/Mass Spectrometry (GC/MS) for over 100 other drugs and metabolites including, but not limited to, diphenhydramine, carisoprodol, meprobamate, and γ-hydroxybutyrate (GHB).

Of the 150 cases, 101 had urine only, 17 had blood only, one had plasma only, and 31 had both blood and urine specimens. The 101 cases with only urine pertained to 93 females, five males and three transgender females. Of them, 33 cases had no drugs detected, but 28 were positive for ethanol with a mean ethanol concentration of 0.22% (w/v) and a range of 0.04 to 0.44 % (w/v). It is noteworthy that ethanol is only quantified in urine if the Division is provided with a forensic urine specimen (i.e., a urine specimen obtained about 20 min after the voiding of the urinary bladder; a collection protocol believed to produce urine that is a recent kidney filtrate and which better approximates blood ethanol concentrations). Besides ethanol, the most frequently reported substances in these urine specimens were cocaine/benzoylecgonine (15/18 cases), THC-COOH (14 cases), levamisole (11 cases), diphenhydramine (10 cases), and methamphetamine/amphetamine (8/8 cases). Many other psychoactive compounds were also detected as listed in Table 1.

Table 1: Drugs in Urine-Only Cases

Compound	Frequency
Benzoylecgonine	18
Cocaine	15
THC-COOH	14
Levamisole	11
Diphenhydramine	10
Methamphetamine	8
Amphetamine	8
Cocaethylene	5
Methadone	4
Oxycodone	3
Morphine	2
Codeine	2
MDMA	2
MDA	2
Citalopram	2
Pseudoephedrine	2
Dextromethorphan	2
Sertraline	2
7-Aminoclonazepam	2
Alprazolam	1
Diazepam	1
Nordiazepam	1
Lorazepam	1
6-Monoacetylmorphine	1
Diacetylmorphine	1
Hydrocodone	1
Hydromorphone	1
Bupropion	1
Promethazine	1
Venlafaxine	1
Trazodone	1
Mirtazepine	1
Phencyclidine	1
THC	1
Carbamazepine	1

 ** Presenting Author*

The 18 cases which had blood products (17 whole blood specimens and one plasma specimen) pertained to 10 females and 8 males. These alleged victims' age averaged 27 years (range: 12 – 41 years). The plasma case was found to be negative. Ethanol was reported in five cases with a mean concentration of 0.11% (w/v) and a range from 0.01 – 0.15% (w/v). Methamphetamine was the most commonly encountered substance in these blood cases as it was found in four cases with a mean concentration of 0.35mg/L (range: 0.16 – 0.66mg/L). Amphetamine was detected in two blood specimens (0.01 and 0.04mg/L) as was THC-COOH (6 and 86ng/mL). Finally, THC was found in one of these blood specimens at a concentration of 8ng/mL.

The 31 cases that had both blood and urine specimens associated with them pertained to 26 females and five males whose average age was 29 years (range: 17 – 57 years). Of these 31 cases, seven had no drugs detected in either blood or urine. Ten blood specimens were positive for ethanol at a mean concentration of 0.11% (w/v) with a range of 0.02 – 0.37% (w/v). THC and THC-COOH were the most commonly encountered substances in these blood specimens found in six and four cases, respectively. THC mean concentration was 2ng/mL with a range of 1 – 4ng/mL while THC-COOH mean concentration was 20ng/mL with a range of 6 – 59 ng/mL. Other psychoactive compounds were also detected in these blood specimens as presented in Table 2. Of the corresponding 31 urine specimens, nine were positive for ethanol at a mean concentration of 0.17% (w/v) with a range of 0.02 – 0.38% (w/v). Methamphetamine, amphetamine, diphenhydramine, THC-COOH, and cocaine were among the most frequently detected drugs in this set of urine specimens (Table 2).

Table 2: Drugs in Cases with both Blood and Urine Specimens

Compound	Frequency in Blood	Frequency in Urine
Benzoylecgonine	3	4
Methamphetamine	3	6
Amphetamine	2	6
Cocaethylene	2	4
Methadone	2	3
Diphenhydramine	2	5
Cocaine	1	4
Citalopram	1	0
Chlordiazepoxide	1	0
Nordiazepam	1	0
Oxycodone	1	3
Trazodone	1	1
Venlafaxine	1	1
Levamisole	0	3
THC-COOH	0	4
Paroxetine	0	1
Hydroxyzine	0	1
Dextromethorphan	0	1

This study demonstrates the variety of substances that are commonly encountered in alleged DFSA victims' toxicology specimens. Ethanol, cocaine, methamphetamine, cannabis, and diphenhydramine are among the most frequently encountered drugs in DFSA case investigations. Interestingly, 44% of the cases reported early enough for a blood collection to take place pertained to male victims, suggesting males are more likely to report early on to the authorities that they may be victims of DFSA but females often delay the reporting, thus rendering blood collection useless. This study will improve the ability of forensic toxicologists and law enforcement personnel to better participate in the investigation of such crimes in their own jurisdictions.

DFSA, Toxicology, San Francisco

 ** Presenting Author*