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# Medical and Toxicological Aspects of Drug Facilitated Sexual Assault

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## Abstract

There has been an increasing number of reports in the press of cases of drug-facilitated sexual assault (DFSA). Although the press has emphasized the role of flunitrazepam (Rohypnol<sup>™</sup>), the so-called "date rape drug," gamma-hydroxybutyrate (GHB), alcohol remains the most commonly used drug to facilitate rape. Collection of forensic evidence to prove DFSA can be problematic due to the delayed presentation of the victims and endogenous levels of GHB in the urine. Hair segmentation analysis is a new technique that allows identification of exogenous drugs up to one month after ingestion. Implementation of preventative measures such as not drinking from open containers, avoiding alcohol intoxication in public settings, and monitoring for signs of unexpected intoxication among friends should decrease the occurrence of DFSA.

**MeSH Words:** Drug-Facilitated Sexual Assault; Date Rape; Drugs; Gama-Hydroxybutyrate; Flunitrazepam; hair

## Introduction

Drug-facilitated sexual assault (DFSA), often mistakenly called "date rape," is the surreptitious administration of a drug, usually in a beverage, for the purpose of facilitating nonconsensual sexual intercourse [1]. The typical scenario involves a 15–35 year old woman who attends a social event at which alcohol is served, such as a party, pub, or bar. She awakens hours later in a strange environment with physical evidence of sexual intercourse but without signs of violence. She has complete amnesia for the event and may remember only minimal identifying facts regarding the perpetrator. Presentation for medical care is often delayed hours or even days

after event until the victim realizes that she had engaged in nonconsensual intercourse and that the confusion and amnesia suggest that she was drugged. DFSA has also been reported to happen to men.

At least 20 drugs have been reported to perpetrate DFSA [2] (see table ). Characteristics common to most of these drugs include rapid onset of action and anterograde amnesia. It is important to note that while under the influence of drugs inducing anterograde amnesia, victims may be able to perform typical daily activities and may not outwardly exhibit abnormal behavior [3]. Victims may give the appearance of compliance with the demands placed on them

by the perpetrator but have little or no recollection of the actual events.

#### Drugs Used to Facilitate Sexual Assault [2]

Alcohol
Alprazolam
1,4 Butanediol
$\gamma$ - Butyrolactone
Cannabis
Chloral hydrate
Clonazepam
Diazepam
Flunitrazepam
$\gamma$ - Hydroxybutyrate
Ketamine
Meprobramate
Midazolam

#### Prevalence

Three studies have examined the prevalence of drugs in cases of alleged DFSA. In one study [4], rape treatment centers throughout the US were invited to submit urine samples of victims of alleged DFSA. Of 2003 samples analyzed, nearly two-thirds were found to contain either alcohol or drugs; 63% ethanol, 30% marijuana but less than three percent contained gamma-hydroxybutyrate (GHB) or flunitrazepam, the two drugs most highly associated with DFSA.

A second study [5] also used a convenience sample of urine specimens from law DFSA enforcement agencies, departments of emergency medicine, and rape crisis centers across the US. Over a 26 month period, 79 samples were collected; 39% were negative for any drugs, 38% tested positive for ethanol, 18% positive for cannabinoids, 8% were positive for cocaine and benzodiazepines, and 4% for GHB. Smaller percentages tested positive for amphetamines, opiates, propoxyphene and barbiturates. Of note, 35% of the samples tested positive for multiple drugs.

A final study [6] also found a prevalence rate of 61% in 2026 samples for any drug or alcohol, with 67% of those positive being positive for alcohol and 30% for cannabis.

It is important to note a number of significant limitations in these studies. First, the study population is not a representative sample of all

victims of DFSA. A systematic sampling procedure was not employed and it is not clear how the participating centers selected the samples for submission [1]. These results are not clearly generalizable to other geographic locations. Secondly, these studies date from 1999 [5], 2000 [4], and 2001 [6], and it is possible that there have been changes in the preferred drug(s) of use for DFSA. Finally, as will be discussed later in this paper, identification of these drugs in urine, particularly GHB, is problematic. However, these prevalence studies do highlight the fact that the most commonly used drug in DFSA is alcohol, and given that in one study [5] one third of the samples were positive for multiple drugs, suggest that DFSA probably also occurs in the context of voluntary drug and alcohol ingestion as well.

The drug which has most commonly been associated with DFSA is Flunitrazepam [1,7], a sedative-hypnotic benzodiazepine. It is manufactured by Hoffman-LaRoche Company under the trade name Rohypnol™. It is prescribed in Europe and South America for treatment of anxiety and insomnia; it is illegal in DFSA in the US. It is packaged as 1 and 2 mg, olive-green oblong tablets. Odorless and tasteless when dissolved in drinks, legally manufactured tablets when added to drinks cause them to turn a turquoise/green color. When ingested, onset of action begins within 30 minutes, peak effect is at 2 hours and duration of action up to 8 hours [8]. Clinical effects include rapid loss of inhibition and decreased level of consciousness in addition to the typical anxiolytic and amnesic effects of benzodiazepines.

The other drug most commonly associated with DFSA is GHB. GHB initially gained popularity as a dietary supplement and a club drug. It binds to GABA<sub>B</sub> as well as specific GHB receptors within the mesocorticolimbic dopaminergic pathways, altering levels of a number of CNS compounds including dopamine and acetylcholine; an extensive review of its neuropharmacologic features has been recently published [9]. Although its only legal use is for

the treatment of narcolepsy, instructions on its illicit preparation are easily obtained on the

internet [10]. Colorless and odorless in beverages, it has a salty taste. Onset of action is rapid with peak effects 20 to 45 minutes after

ingestion [11]. GHB induces short-term anterograde amnesia, increased libido, suggestibility and passivity. Adverse, dose-related effects include seizures, respiratory depression and hypoxia, respiratory arrest, and coma. These adverse effects are potentiated by alcohol or other CNS depressants. Management of acute intoxications is beyond the scope of this paper but had been extensively reviewed [9,12,13]. Unlike flunitrazepam, a number of deaths have been reported in cases of DFSA in which GHB was used.

Both 1,4 butanediol (1,4-BD) and gammabutyrolactone (GBL) are GHB precursors which are metabolized to GHB. GBL has more rapid absorption than GHB resulting in higher serum concentrations, and longer duration of action due to its greater lipid solubility, the lipid tissues acting as reservoirs [14]. GBL can be easily and legally obtained as a cleaning solvent [15]. 1,4-BD is competitively metabolized by alcohol dehydrogenase to GHB. Since alcohol dehydrogenase has a greater affinity for alcohol than 1,4-BD, metabolism of 1,4-BD is delayed when they are co-ingested, resulting prolonged clinical effects and increased toxicity [13]. 1,4-BD is legally available in many countries as a health supplement.

### Screening

The most commonly collected body fluid for forensic toxicological evidence in alleged cases of DFSA is urine. Blood is rarely collected except in post-mortem cases. Oral fluid has been used for detection of workplace and driving drug use [16] but has not been used for DFSA. There are a number of technical difficulties in performing forensic analysis in order to prove the presence of drugs in a rape incident. Due to the amnesia associated with the drugs, victims often present for medical evaluation hours or days after the actual event, resulting in delayed specimen collection. In addition, levels of detection in urine vary depending on the type of analysis performed such that small amounts of drug may be missed by routine analysis,

especially if the specimen is collected several days after the event. Benzodiazepines and most other drugs which have been implicated in

DFSA are detectable in urine for up to 3 days by routine screening techniques. GHB represents a special problem in that it is a natural metabolite of the CNS neurotransmitter GABA.

Endogenous levels of GHB are naturally present in blood and urine. Although baseline endogenous levels of GHB in urine have been established [17-19], these are derived from small study populations that are not clearly representative of the sex and age of the typical victims of DFSA and have not been universally accepted as norms. The window of detection of GHB in urine is not more than 12 hours [5,11]. Ethanol is easily detected in urine.

### Drug-facilitated sexual assault

Sample collection should be performed at the first instance that the victim presents for medical evaluation, even if several days have elapsed. The Clinical Pharmacology and Toxicology Laboratory at Sheba Medical Center routinely performs screening for benzodiazepines in urine. Screening for GHB and ketamine is performed only if specifically requested. Benzodiazepines can be detected up to 3 days after the incident but specimens should preferentially be obtained within 12 hours. The clinician must provide specific details regarding the clinical toxicologic symptoms of the event. Currently the courts do accept detection of drugs in urine by this laboratory in alleged cases of DFSA as admissible evidence [Dr. Asher Gofer, personal communication]. If a sample of the ingested liquid or its container can be obtained, this can be submitted to the police toxicologic laboratory in Jerusalem for drug identification. All patients should undergo initial medical evaluation and stabilization in the ED and then referred to the appropriate rape evaluation center for continued treatment. Specimens can be obtained in the ED or at the rape center as long as no delay in collection will occur.

A relatively new forensic technique which has interesting applications for DFSA is the hair segmentation technique [20-25]. This technique allows for detection of drugs weeks after the alleged incident, compensating for the delay in presentation of the victim and for endogenous

levels of GHB. A hair sample consisting of about 100 hairs is collected from the vertex 3-4 weeks after the episode. The sample is decontaminated, segmented, and then drug

concentration measured in each segment. For GHB, 3mm segments are prepared to determine basal concentrations such that a peak level in one segment would represent exogenous drug ingestion. For other drugs, 2 cm segments are

prepared. A single positive segment is suggestive of a single exposure whereas multiple positive segments are suggestive of repeated drug use. The presence of a single positive segment does not prove that an episode of DFSA occurred, only that a specific drug was ingested; it cannot prove or disprove whether or not the drug ingestion was voluntary. Multiple positive segments suggest a routine pattern of drug use by the victim but do not exclude the possibility that the present alleged episode was not voluntary. Currently, the hair segmentation technique is not performed in Israel.

Prosecution of these cases is challenging. As noted earlier, many cases of DFSA occur in settings of recreational use of drugs and alcohol. Indeed, the rape victim may have volitionally ingested the drugs and/or alcohol but may not have given consent to the sexual assault. In many cases the victim is unable to describe the assailant due to the amnesic effects of the drugs. The presence of semen does not prove that the intercourse was nonconsensual. However, in the setting of a victim who is not known to use recreational drugs and/or alcohol or who exhibited an unusual episode of intoxication, detection of single episode of drug use may support the claim of DFSA [1].

### Prevention

Prevention is a key element in avoiding DFSA [2]. Young women should be cautioned to:

- Be aware of high risk social situations
- Control alcohol consumption and avoid intoxication
- Not drink from previously opened containers
- Not drink if the container has not been constantly under observation
- Go with friends; if anyone acts intoxicated, immediately remove them from the environment

### Conclusion

DFSA represents a challenging combination of medical and forensic toxicology. Clinicians

should have a high level of suspicion in the rape victim with a delayed DFSA presentation to medical care, especially if anterograde amnesia for the events is present. Prevention is possible and clinicians should prospectively educate patients at risk.

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