

SPECIAL COMMUNICATION

Marc LeBeau,¹ M.S.; Wilmo Andollo,² B.S.; W. Lee Hearn,² Ph.D.; Randall Baselt,³ Ph.D.; Edward Cone,⁴ Ph.D.; Bryan Finkle,⁵ Ph.D.; Diane Fraser,⁶ M.S.; Amanda Jenkins,⁷ Ph.D.; Joel Mayer,⁸ Ph.D.; Adam Negrusz,⁹ Ph.D.; Alphonse Poklis,¹⁰ Ph.D.; H. Chip Walls,¹¹ B.S.; Lionel Raymon,¹¹ Pharm.D., Ph.D.; Michael Robertson,¹² Ph.D.; and Joseph Saady,¹³ Ph.D.

Recommendations for Toxicological Investigations of Drug-Facilitated Sexual Assaults

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ABSTRACT: The recent increase in reports of drug-facilitated sexual assaults has caused alarm in the general public and prompted forensic toxicologists from across North America to address the toxicological issues surrounding this matter. The authors have developed recommendations and guidelines to inform law enforcement, medical, and scientific personnel of the requirements for performing successful toxicological examinations in cases of drug-facilitated rape.

KEYWORDS: forensic science, drug-facilitated, sexual assault, drug rape, date rape, forensic toxicology

For years, criminals have used sedatives such as chloral hydrate to incapacitate victims; usually to facilitate the theft of property. Today, this idea of slipping someone a “Mickey” has changed in both the choice of drugs used and the purpose for which they are used. The drugs utilized today may be more difficult to detect, possess amnesic properties, and impair an individual rapidly. Since these drugs are often odorless, tasteless, and colorless, their surreptitious administration into food or beverages is relatively simple (1).

A review of *Microgram* from 1992–1998 reveals a substantial

increase in federal and state seizures of these “knock-out” drugs. We have also seen a notable increase in the number of women reporting loss of memory during parties or a night out; sometimes waking up later in strange places, inappropriately dressed with no recollection of the events that occurred the evening before. In addition, “rave” parties have gained in popularity and with them “new” designer drugs. Some of the drugs used at “raves” possess the potential to sedate and may lead to the sexual assault of an unwary victim (2).

To address the problem, the authors met during the 1998 American Academy of Forensic Sciences Meeting in San Francisco, California, to discuss the issues surrounding the toxicological investigations of drug-facilitated rape. The goal of the group was to develop guidelines for use by law enforcement and medical professionals in the collection and submission of biological specimens from victims of suspected “date rape” assaults. Furthermore, a number of recommendations were developed to assist the field of forensic toxicology in these investigations.

Commonly Encountered Drugs in Cases of Drug-Facilitated Rape

Unlike popular belief, the number and variety of drugs used for the purposes of sexual assault are vast (3,4). Table 1 lists common symptoms reported by victims of drug-facilitated rape. Table 2 lists drugs that have been detected in victims or suspected to have been used in these cases (3,4). While these drugs consist mainly of central nervous system (CNS) depressants, others, that do not impair consciousness or memory, function by lowering the user’s inhibitions. One of the most difficult aspects of toxicological investigations is the extensive varieties and vast chemical differences of drugs used in cases of drug-facilitated rape.

Although rapists may disable their victims by spiking their drink, it is important that other scenarios for the victim’s sedation be addressed. First is the recreational use of one or more drugs by the victim. The result is that the victim may lose consciousness, the ability to make rational decisions, and after the assault, may have no recollection of the events. Second is the victim’s lack of knowledge of the effects of mixing prescription or over-the-counter medications with alcoholic beverages or recreational drugs. This

¹ Chemistry Unit, FBI Laboratory, Federal Bureau of Investigation, Washington, D.C. 20535.

² Dade County Medical Examiner Dept., Miami, Florida 33136.

³ Chemical Toxicology Institute, Foster City, California 94404.

⁴ National Institute of Drug Abuse, Baltimore, Maryland 21224.

⁵ Cameron, Montana 59720.

⁶ Food and Drug Administration, Cincinnati, Ohio 45202.

⁷ Cuyahoga County Coroner’s Office, Cleveland, Ohio 44106.

⁸ University of Toronto, Toronto, Ontario and The Centre of Forensic Sciences, Toronto, Ontario M7A 2G8.

⁹ University of Illinois at Chicago, Chicago, Illinois 60612.

¹⁰ Medical College of Virginia, Richmond, Virginia 23298.

¹¹ University of Miami, Miami, Florida 33177.

¹² National Medical Services, Willow Grove, Pennsylvania 19090.

¹³ Virginia Division of Forensic Science, Richmond, Virginia 23219.

TABLE 1—*Reported symptoms by victims of drug-facilitated rape.*

Confusion	Lack of Muscle Control
Decreased Heart Beat	Loss of Consciousness
Dizziness	Nausea
Drowsiness	Reduced Blood Pressure
Impaired Judgement	Reduced Inhibition
Impaired Memory	

TABLE 2—*Drugs detected in victims or suspected in drug-facilitated rapes.*

Ethanol	Barbiturates
Benzodiazepines:	Cocaine
Alprazolam	Marijuana
Clonazepam	Opiates
Chlordiazepoxide	Muscle Relaxants:
Diazepam	Carisoprodol
Flunitrazepam	Cyclobenzaprine
Fluazepam	Meprobamate
Lorazepam	Antihistamines:
Triazolam	Diphenhydramine
GHB	Chloral Hydrate
Ketamine	
Scopolamine	
Amphetamines:	
Methamphetamine	
MDMA	

may also lead to similar symptoms as listed in Table 1 and set the scene for a sexual assault.

One drug which is frequently involved in these crimes is ethanol (3,4). When ethanol is used alone or in combination with other drugs, it increases the risk of sexual assault. One study found that 55% of female victims of "acquaintance rape" had used ethanol immediately before the assault (5). Ethanol can cause all phases of CNS depression, from paradoxical disinhibition with increased sociability, to sedation, amnesia, and unconsciousness at higher doses. When used in combination with other CNS depressants, the effects of ethanol are exacerbated (6). Furthermore, the relative lack of taste of grain alcohol may allow it to be administered to an unsuspecting victim without their knowledge.

In addition to ethanol, benzodiazepines are also frequently implicated drugs in drug-facilitated sexual assaults. While flunitrazepam (Rohypnol®) has received much of the media's attention, it is important to realize that any benzodiazepine may be used in an attempt to incapacitate a victim. Benzodiazepines are the most widely and frequently prescribed sedative and hypnotic drugs throughout the world and are therefore readily available. When mixed with ethanol, the sedative effect of benzodiazepines is enhanced (7,8). An important side effect of several of these drugs is that of anterograde amnesia (6); the drug may prevent the assault victim from remembering the assault, even if she/he was conscious throughout the ordeal. The common analytical problem with many of the benzodiazepines referenced in Table 2 is their ability to give rise to multiple metabolites and conjugates that cross-react poorly with the common immunoassay techniques. In addition, they are present in blood and urine at very low concentrations (9–11). These characteristics make the drugs desirable to many perpetrators and the drugs undoubtedly often go undetected by toxicologists.

Gamma-hydroxybutyrate (GHB), also a CNS depressant, is another drug that has been detected in victims of drug-facilitated rapes (1,3,4). It can easily be synthesized from common ingredients

with recipes readily available on the Internet and in the underground literature. Additionally, it is available as a street drug and is common in the "rave" community. Analytical difficulties surrounding GHB include the fact that it has a very short half-life, is difficult to interpret analytically, and requires a targeted analysis for detection (3,4,12).

While ethanol, benzodiazepines, and GHB comprise the majority of the drugs used to facilitate sex crimes, other less-popular drugs are also being used. These include ketamine, barbiturates, chloral hydrate, ethchlorvynol, and antihistamines such as diphenhydramine (4).

Specimen Selection

While each case has its own history and peculiarities that may warrant the use of one specimen over another, urine is usually the specimen of choice for a toxicological investigation of drug-facilitated rape. Compared to blood, urine samples allow for a longer window of detection of drugs and metabolites commonly used in these crimes. These specimens should be collected and refrigerated as quickly as possible. The sooner a urine specimen is obtained after the alleged event, the greater the chance of detecting drugs that are quickly eliminated from the body. A urine specimen may be of little value if it is not obtained within 4 days of the suspected drugging of the victim. While it is realized that many of the drugs listed in Table 2 may have been eliminated from the urine in less than 96 h, a few may remain at trace levels, warranting the collection and analysis of the specimen. It is imperative that medical facilities that are responsible for initiating the collection of sexual assault evidence have complete evidence collection kits, including urine collection containers.

Blood specimens are also important, particularly when the alleged crime has occurred within 24 h of collection. The blood should be collected in a container with preservatives, such as a grey-top tube containing sodium fluoride and potassium oxalate, and be stored in a refrigerated condition. It is recommended that drugs identified in urine specimens be specifically targeted for in blood drug screens. A blood concentration of a drug, along with pharmacokinetic information, may assist in corroborating or disproving a victim's version of events.

Analytical Suggestions

While it is not the authors' intent to publish specific requirements for analytical tests to be used in these investigations, we suggest that the following recommendations be considered.

First, while there are mixed opinions in the scientific community about the necessity of hydrolyzing urine prior to an analysis for benzodiazepines, the authors recommend an enzymatic hydrolysis instead of acid hydrolysis to lower the detection limit of the benzodiazepine confirmatory assays. This recommendation is based on the fact that many benzodiazepines and metabolites yield the same benzophenones upon acid hydrolysis, thus the specificity of the assay may be questioned (13–15).

Second, when using an immunoassay screening technique, one must be aware of how well these drugs, particularly the benzodiazepines, cross-react with the antibody. Many immunoassay antibodies do not cross-react well with the metabolites of some benzodiazepines that are commonly used to facilitate rape (10,11,16–18). Relying on such methodology to determine if an individual was drugged may lead to an inaccurate conclusion due to false negative results. It is suggested that analytical methodologies,

such as immunoassays, be thoroughly validated to show the true limits of detection for common benzodiazepines and their respective metabolites.

Next, forensic toxicology laboratories should develop or adopt sensitive assays capable of screening and confirming the non-benzodiazepine drugs used to commit drug-facilitated rapes. Targeted compound analysis generally achieves the sensitivity required for some of these drugs.

Finally, due to the criminal nature of these cases, it is strongly recommended that mass spectral confirmation of results be performed. The authors have had success using gas chromatography-mass spectrometry (GC-MS), as well as liquid chromatography-mass spectrometry (LC-MS), to achieve detection limits below 10 $\mu\text{g/L}$ for most of the commonly encountered drugs used in these types of cases.

Research

To date, there has been marginal research in the area of drug-facilitated rape. The authors believe that immediate attention must be given to research areas that will increase our understanding of these cases, aid interpretation of results, and provide improved analytical capabilities.

An area of research of great interest is the use of hair specimens to detect drugs used to commit sexual assaults. An unfortunate frustration surrounding cases of drug-facilitated rape is that victims frequently do not report the crime for days to weeks after the alleged event. While there have been numerous studies on the identification of drugs (including benzodiazepines (19–21)) in hair, most studies have focused on chronic drug use instead of a single dose as typically seen in drug-facilitated rape cases. Hair may prove to be a valuable specimen in situations where, as a result of a delay in reporting the crime, natural processes have eliminated the drug from typical biological specimens such as blood and urine.

Another specimen to be investigated is sweat. A sweat patch could be placed on a victim during the rape examination and removed 3 to 7 days later. Any drug excreted in the sweat is adsorbed onto the patch. Once removed, the patch is extracted and analyzed for targeted compounds. While research into the detection of drugs in sweat has been performed (22), published reports do not address whether the single doses used in drug-facilitated rape cases are detectable in this specimen.

Research may also be beneficial to determine the prevalence of the amnesiac effect of the “date rape” drugs, alone and in combination with alcohol. This research may result in improved understanding of the lapse of time between the sexual assault and the time the crime is reported, as well as gaps in the victim’s account of events.

Conclusions

There have been alarming reports of drug-facilitated rape. Victims, medical professionals, and law enforcement officers are relying on the forensic toxicologist to conduct the best possible testing of the available specimens.

This paper has set forth a number of recommendations that, if followed, will provide for a cohesive approach to addressing these cases. For the medical and law enforcement fields, it is suggested that a 100-mL urine specimen be obtained as quickly as possible, at least within 4 days of the alleged event. In addition, a 30-mL blood specimen should be collected and preserved when it can be obtained within 24 h of ingestion of the drug.

Forensic toxicology laboratories should develop and validate analytical procedures that can detect and identify the common date rape drugs at low concentrations. For the benzodiazepine class, immunoassay screening techniques should be thoroughly evaluated for their usefulness of detecting low levels of these drugs. Some laboratories have combined a GC/MS assay with an immunoassay as the screening technique.

Research is encouraged in the use of non-routine specimens, such as hair and sweat. Use of such specimens may be beneficial in the investigation of these crimes when there is a delay in reporting. Additionally, research into the amnesiac effect of these drugs with and without the presence of ethanol would be helpful to better understand the confusion experienced by the victims.

While it is not the intent of the authors to dictate how best to handle the toxicological investigation of drug-facilitated rapes, we strongly believe that these recommendations are sound and should be considered by the field. It is realized that with time some recommendations may require modification, and we intend to continue our effort to address this important issue.

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Additional information and reprint requests:

Marc LeBeau
Chemistry Unit
FBI Laboratory
Federal Bureau of Investigation
Washington, DC 20535