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TOXICOLOGY

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Prospective study of 101 patients with suspected drink spiking

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Abstract

Objective: To evaluate cases of suspected drink spiking presenting to the ED by the prospective collection of standardized relevant historical, clinical and laboratory data.

Methods: A prospective observational study of 101 patients presenting to metropolitan hospital ED with suspected drink spiking within the previous 12 h. Clinical history, including details surrounding the alleged drink spiking incident, and examination. Blood ethanol concentration measurement, together with the analysis of urine and blood samples for illicit and sedative drugs.

Results: Of the 97 alleged drink spiking cases included, there were only 9 plausible cases. We did not identify a single case where a sedative drug was likely to have been illegally placed in a drink in a pub or nightclub. Illicit drugs were detected in 28% of the study group. Ethanol was commonly detected, with the mean number of standard drinks consumed being 7.7 ± 3.9 SD, and the median blood ethanol concentration at the time of presentation was 0.096% (96 mg/dL). At follow-up there were no major sequelae and no police prosecutions. Thirty five per cent of patients still believed that they had been a victim of drink spiking irrespective of the results.

Conclusion: Our study did not reflect the current public perception of drink spiking. Drink spiking with sedative or illicit drugs appears to be rare. If drink spiking does occur, ethanol appears to be the most common agent used. Of greater concern was the frequency of illicit drug use and excessive ethanol consumption within the study population, making it difficult to determine whether a person had truly had a drink spiked.

Key words: *Drink spiking, toxicology, alcohol, drug facilitated sexual assault.*

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Introduction

'Drink spiking' refers to drugs or ethanol being added to a drink (alcoholic or non-alcoholic) without the consent of the person consuming it.[1] It is purportedly done for purposes, such as sexual assault, rape, assault and robbery.

The public perception of drink spiking is that sedative drugs are placed (usually by men) into the drinks of others (usually women). In recent years, there appears to have been an increase in the number of cases being reported within the media, although the anecdotal reports outnumber formal complaints to the police by an estimated factor of 10.[1] A recent national report estimated that as many as 3000–4000 suspected incidents of drink spiking occurred in Australia between 1 July 2002 and 30 June 2003;[1] however, the authors acknowledge that these estimates should be taken as a rough guide only.

Despite an increasing number of reports and the media attention to the issue, little supportive forensic evidence remains, potentially as a result of late presentation of victims, reluctance to seek police involvement and the short half-lives of the drug agents implicated.[2–5] For those presenting to ED in Australasia, there is generally no routine collection of clinical or laboratory data, thus the true extent of drink spiking is unknown. Currently, there appears to be no clear consensus regarding the management of these cases.

The present study aimed to obtain a clearer understanding of the nature of alleged drink spiking presentations to ED by performing detailed historical, clinical and laboratory assessment on presumed victims.

Methods

Study design and setting

This was a prospective observational study of patients presenting with suspected 'drink spiking'. The study was carried out in the ED of Sir Charles Gairdner Hospital (SCGH) and Joondalup Health Campus (JHC) in Perth, Western Australia (WA). Both departments serve a metropolitan area and have a combined annual census of approximately 75 000 adult patients. Other metropolitan hospitals were invited to redirect patients if they met the inclusion criteria. The Human Research Ethics Committees at SCGH and JHC approved the study protocol.

Staff education

ED staff were briefed about the study. They were alerted to the time-critical nature of specimen collection and procedures for maintaining a forensic 'chain-of-evidence'. Staff were also reminded that particular patients might require additional assistance from sexual assault services and police.

Patient selection and treatment protocol

As a key stakeholder, the WA Police Service conducted a concurrent drink spiking awareness and prevention campaign. Members of the public were encouraged to attend either the SCGH or JHC ED if they or their friends believed that they had been a victim of drink spiking. The police provided assurance to the public that detection of voluntary illicit drug taking as part of the drug screen would remain confidential to the study project and not involve prosecution.

Patients aged 16 years and over who either self-presented or were brought to the ED by police, paramedics, friends or relatives believing that they or the patient had had their drink spiked were recruited. For inclusion, all cases had to be within 12 h of the alleged drink spiking event or still exhibit signs or symptoms of intoxication at the time of presentation. Clinical staff also enrolled cases with altered conscious state or behaviour where they had reasonable suspicion that drink spiking might be implicated. Retrospective consent was obtained from these patients; however, if they chose not to continue to participate in the study, biological samples collected earlier were destroyed.

Blood and urine samples were sealed with tamper-proof security tape and placed in a dedicated locked refrigerator. In all cases the 'chain of evidence' was preserved through required signatories for sample handover to the toxicology laboratory.

Data collection

A preformatted data collection tool was used in all cases. Information collected included patient demographic data and details about the incident (place, company kept, when and what symptoms developed). A detailed history of drugs and alcohol ingested (time of first drink, number of drinks) before the incident was sought. A member of the SCGH ED-based clinical toxicology service confirmed the history by direct patient interview either during their emergency presentation or within three working days by telephone. This

information was correlated with findings following a full physical examination and laboratory results.

The number of standard drinks consumed was calculated from the reported numbers and types of drinks consumed (e.g. full-strength beer, wine, spirits etc.), assuming that one standard drink contains 10 g of ethanol.[6] If a person was unable to accurately describe the volume of an alcohol drink consumed, then it was assumed that the volume was one standard drink.

Laboratory screening

Blood ethanol concentration was measured by gas chromatography.

Qualitative urine drug screening was performed using the CEDIA assay (Microgenics, Fremont, CA, USA) and Hitachi 917 automatic immunoassay analyser (Hitachi 917, Hitachi, Tokyo, Japan). Classes of medications and illicit drugs screened included benzodiazepines, opiates, cocaine, cannabis, sympathomimetic-type amines and ethanol. Gas chromatography-mass spectrometry analysis, performed on a Hewlett-Packard (Hewlett Packard, Palo Alto, CA, USA) 5890 gas chromatograph interfaced with a Hewlett-Packard 5971 mass-selective detector, specifically identified: gammahydroxybutyrate (GHB), ketamine, 7-amino flunitrazepam, 7-amino clonazepam, 7-amino nitrazepam, nordiazepam, oxazepam and temazepam, codeine, morphine and tetrahydrocannabinol carboxylic acid. Individual sympathomimetic-type amines specifically identified were amphetamine, methylenedioxymethylamphetamine and methamphetamine.

Concentrations of GHB above endogenous levels (10 mg/L) were considered indicative of GHB ingestion.[7] The 'limit of quantitation' for the method performed was determined to be: ketamine (100 μg/L), benzodiazepines (20 μg/L), codeine (50 μg/L), morphine (50 μg/L), tetrahydrocannabinol (2 μg/L), amphetamine (50 μg/L) and methamphetamine (50 μg/L).

Drink spiking case definition

We defined a patient to be a 'plausible drink spiking case' if the following criteria were met: (i) patient believed that they had had their drink spiked; (ii) patient denied ingesting any agent detected by laboratory screening; (iii) patient signs and symptoms during the drink spiking incident were consistent with agents detected by laboratory screening.

Patient follow-up

Patients were contacted by the Clinical Toxicology Service once laboratory results became available. The patients' condition and views about the results were recorded and they were invited to obtain police involvement if applicable.

Sample size and data analysis

All data were entered into Microsoft Access and Excel programs. Statistical analysis was performed using SPSS V.12 software (SPSS, Chicago, IL, USA).

Results

Presentation profile

One hundred and one patients were enrolled over a 19 month period. Four patients were subsequently excluded from analysis, three because of late presentation to the ED (>12 h from onset of symptoms and not showing signs of intoxication) and one patient admitted to taking an intentional oral hyosine overdose. All had blood and urine samples collected. Of the remaining 97 cases, 88% were female (median age 23 years, interquartile range [IQR] 19–28) with 59% less than 25 years of age. Only 25% of patients presented between Monday and Thursday. Of those presenting, the majority (72%) reported onset of symptoms of drink spiking in pubs or nightclubs. Most patients self-presented (53%) or arrived by ambulance (39%), and just 8% were brought to the ED by police. Presentation to the ED was between 22.00–04.00 hours for 69% of the study group. The median time from onset of symptoms to presentation was 2.5 h (IQR 0.3–20.2 h) and sample collection 4.5 h (IQR 2.5–7.8 h).

Plausible drink spiking cases

We identified nine cases we believed were plausible drink spiking incidents. Of these, four patients denied ingesting the drugs that were detected in urine (Table 1). Amphetamines were detected in three patients. One was a 20-year-old man who thought that his friends placed a tablet in his drink as a prank, and another was a 19-year-old woman who developed signs and symptoms after leaving a nightclub. She was subsequently lost to follow-up. The third case was a 23-year-old sex worker who had voluntarily ingested

Table 1. Plausible drink spiking cases involving drugs

Age (years)	BAC	Symptoms at presentation	Drugs detected	Patient comments	Clinical toxicologist comments
23F	0	Sudden collapse and coma after drink requiring intubation and ICU admission	• Gammahydroxybutyrate • Opiates • Benzodiazepines • Amphetamine & metamphetamine	• Voluntary consumption of ecstacy tablet • A sex worker at client's home • Client is known drug dealer	• Required morphine and midazolam in ICU • Gammahydroxybutyrate urine level 1232 mg/L • Refer to Box 1
20M	0	Acting strangely, paranoid. Dilated pupils	• Cannabinoids • Amphetamine & metamphetamine	• Voluntary consumption of marijuana • 'Friends may have given me a drug'	• Similar symptoms when previously ingested amphetamines • Likely 'pranking' with amphetamines
30F	0	Became drowsy and dizzy 30 min after soft drink ingestion. Had a headache consistent with usual migraine	• Opiates • Benzodiazepines	• Could 'see lots of dots' • Denies ingestion of any detected substances	• Incident took place in shopping centre at 10.00 hours • History of pseudo-seizures, anxiety and migraines • Had access to temazepam • Opiate consistent with codeine
19F	0	Hyperventilating, feels anxious, tachycardic and hypertensive	• Opiates • Amphetamines	• Lost to follow-up	• Administered panadeine forte in ED before sample collection • Unable to exclude intentional ingestion

BAC, blood ethanol concentration on sample collected in the ED (mg/dL).

ecstacy (methylenedioxymethylamphetamine) but had high levels of GHB detected 17.5 h after the onset of symptoms (Box 1). The fourth case was a 30-year-old woman with a past history of migraines, anxiety and pseudoseizures, who developed symptoms (~1000 h) 30 min after drinking from an unattended drink resting on her infant's pram in a shopping centre. Benzodiazepines and opiates (consistent with codeine ingestion) were detected.

The remaining five cases had an alcohol consumption history inconsistent with the detected high blood ethanol levels (median 174 mg/dL) (Table 2).

Alcohol

Only 7% (7/97) of patients denied having consumed alcohol, with a further three patients not being able to recall if alcohol had been consumed; two of these returned a negative blood ethanol reading. Of the 87 who reported drinking alcohol, 76% had consumed more than four standard drinks, with the mean number of standard drinks consumed being 7.7 ± 3.9 SD (range 1–21). On presentation, 13 of the 87 patients recorded zero blood ethanol concentrations. Of the 74 with measurable blood ethanol levels on presentation, the estimated median blood ethanol concentration at the time of presentation (BAC) was 0.096% (96 mg/dL).

Illicit drugs detected

Illicit drugs were detected in 28% (27/97) of patients, with 85% of these having two or more drugs (including ethanol) detected. Amphetamines and cannabis (tetrahydrocannabinol) were the most common substances found. In 10 patients, amphetamines were detected in the urine, even though the patients denied ingesting amphetamines. None had symptoms consistent with acute amphetamine intoxication, and the median blood ethanol level at time of presentation was 98 mg/dL. With the exception of the plausible drink spiking case (case three in Table 1), all opiates and benzodiazepines detected in urine had been prescribed to the patients.

Disposition and follow-up

The majority (87%) of patients were discharged from the ED. Other than the case admitted to ICU (Box 1), all

Box 1. Plausible drink spiking case using gammahydroxybutyrate (GHB)

A 23-year-old woman was transferred from another metropolitan hospital to the ICU at SCGH ventilated for coma and seizures of uncertain aetiology. She was enrolled in the study 17.5 h after the onset of symptoms once the history of drinking in a bar with unknown men became available. GHB was detected in her urine. When later contacted to feedback laboratory results and confirm the reported history, the patient changed her account of the event.

The patient was a 23-year-old sex worker who had left home at ~14.00 hours to travel to a private residence of a man who was a known drug dealer to provide services. She had two vodka and orange drinks and finished her work at ~16.15 hours. The man offered to pay her to stay for another 3 h, and she contacted a friend to say she would be staying. He served her another drink that tasted odd. Approximately 15 min later she felt weak, unable to stand and collapsed. She was dragged into another room where there were two other men, and had no further memory of events until she awoke in the ICU at SCGH.

Her friend told her that the male client contacted her ~17.00 hours to say that the patient had collapsed, and was vomiting and fitting on the floor. The friend collected the patient and took her to hospital.

The patient had reported to the police that her mobile phone and money had been stolen; however she did not wish to lay charges against the man involved, as she was fearful of the repercussions.

other patients were admitted to the ED observation ward overnight. Eleven per cent were referred to the Sexual Assault Referral Centre. The WA Police Service was involved in one in four of our patients; however, only 8% reported that they were still pursuing police proceedings at follow-up. At the time of manuscript preparation, no police prosecutions had taken place. No significant sequelae were reported by any patient at follow-up, and nearly all reported that they were completely symptom-free by 24 h; however, 35% still believed that they had been the victim of a drink spiking incident irrespective of the results.

Discussion

Much of the research on drink spiking to date has concentrated on laboratory analysis of urine and/or blood samples for the detection of drugs in patients who allege either drink spiking or sexual assault.[7–10] Usually, no correlation is taken with the patients' symptoms or their drug taking history. To our knowledge, this is the first prospective Australian study where clinical, historical (including drug and alcohol ingestion) and laboratory data have been collated on patients who believe that they have had their drinks spiked.

Our findings do not support the public perception that sedative drugs are being used to spike people's drinks. We did not identify a single case where a sedative drug had been placed in a drink in a pub or nightclub setting. No cases of ketamine or flunitrazepam ingestion were detected. The only case where GHB was used as a drink spiking agent was in a situation not commonly associated with drink spiking (refer to Box 1). A detailed history enabled this case to be identified. In the other three plausible cases involving a drug agent, a detailed history did leave some doubt in the authors' minds as to whether these patients had their drinks spiked as alleged. For example, in one plausible case involving benzodiazepine and opiates that took place at a shopping centre, the patient's medical record revealed that she had access to these drugs. She had a known history of migraines, which might have been the cause of her symptoms.

We identified five plausible drink spiking cases whose high blood ethanol levels (median 174 mg/dL) were inconsistent with their drink history. This supports previous findings that ethanol might be an agent being used in drink spiking.[11–13] In a Welsh 1 year study of patients allegedly having their drink spiked presenting to an ED, 34/75 patients enrolled had blood ethanol concentrations measured, with 65% of those patients having a blood ethanol concentration >160 mg/dL.[12] Relying on these patients' recall of alcohol consumption, with high blood ethanol levels, makes it difficult to determine whether their drinks were truly spiked. For example, one case in our study was a woman who awoke naked in a motel room. She had recollection of only consuming one standard drink at a bar during a job interview. Collateral history from the bar owner confirmed that this woman had consumed at least 10 'shooters' within a short period of time, before leaving the bar. Although initially appearing to be a plausible drink spiking case, collateral history excluded her. From our study it appears that drink spiking does

Table 2. Plausible drink spiking cases involving alcohol

Age	BAC	Patient comments	Clinical toxicologist comments
17F	106	• Went to a party the night before • On arrival remembered having only one glass of vodka at 19.00 hours • No memory of the rest of the night	• Brought in to ED 12 h after onset of symptoms by concerned mother who had found her to be 'intoxicated' • After further questioning on follow-up, the patient recalled also having one glass of beer and two glasses of Jack Daniel's
18F	196	• Claimed felt unwell after one drink (vodka shooter) at 21.00 hours in a nightclub less than 2 km from SCGH	• Arrived 0.5 h after onset of drink spiking symptoms • Initially told triage staff that she was not a victim of drink spiking • Changed story with mother's arrival
19F	174	• Went to a local pub at 20.00 hours less than 2 km from SCGH • Had 1 glass of bourbon/coke and 1.5 glasses of champagne • Then felt dizzy, disorientated and nauseated	• Brought to ED 3 h by police after onset of symptoms • Bought own drinks at bar • No recollection of what happened after drinking 1.5 glasses of champagne
20F	41	• Sex worker at a brothel 4 km from SCGH • Served three glasses of wine by brothel staff from 20.00 hours • Suddenly felt as if she had '10 glasses of wine'	• Arrived 8 h after onset of drink spiking symptoms • Brought in by ambulance from brothel • Urine positive for methylenedioxymethylamphetamine, metamphetamine and amphetamine. Pt denied amphetamine use for 2 years. No signs or symptoms consistent of amphetamine intoxication
20F	219	• University student at a ball 4 km from SCGH • Claims to have drank soft drink only from 20.00 hours • Drowsy, vomiting, double vision at 22.30 hours	• Brought to ED by concerned mother 3.5 h after onset of symptoms

BAC, blood ethanol concentration on sample collected in the ED (mg/dL).

occur but is rare, and if it occurs ethanol is the likely agent used.

Of greater concern was the high level of self-reported alcohol ingestion and blood ethanol concentrations, as previously reported in two UK studies.[12,13] Although many patients were surprised at their blood ethanol levels, most were unconcerned at their high levels of alcohol consumption.

The present study also found a significant use of illicit drugs, mainly amphetamines and cannabis. In those where an illicit drug was detected, 85% had an additional agent (including ethanol) detected. This has been the finding in other studies.[8–10,13] Scott-Ham and Burton found in their series of 1014 cases of drug-facilitated sexual assault that cannabis was detected in 26% of cases, cocaine 11% and amphetamines 7%.[10] The finding of 10 patients whose symptoms were inconsistent with amphetamine intoxication (despite amphetamine detection in their urine) demonstrates the difficulty in interpreting laboratory studies, and performing studies, such as ours, that are reliant on patients giving accurate histories, especially when it involves the use of illicit drugs.

The present study demonstrates the difficulty in investigating alleged drink spiking incidents. Emergency departments do not routinely collect blood and urine specimens for drug levels as they usually have no impact on patient management. Furthermore, they do not routinely collect forensic specimens, as was required in the present study. As a result of the sophisticated laboratory testing required, there was a significant cost involved. As drink spiking is a crime, it would be better dealt with by the police service (as happens for drunk driving); however, only one in four of our patients had involvement of the WA Police Service.

We would recommend that any patient presenting alleging that they have had their drinks spiked should have their symptoms treated on their merits.

Any biological specimens that need to be collected for forensic purposes should be collected and processed by the police services.

The present study has several limitations. A concurrent awareness campaign by the police and universities might have led to an increase in reporting, especially in younger people. Our inclusion criteria might have limited cases enrolled, or staff might have enrolled patients who were purely intoxicated and not a victim of drink spiking. We did not record patients who declined to participate in the study. We relied on patients for a history of alcohol and drug consumption and the time of onset of symptoms, which might have been unreliable with the level of alcohol and drugs being detected. The absolute blood ethanol concentration is difficult to interpret because of inter-individual variability in tolerance to ethanol. The low prevalence of sexual assault means that the present study might be too small to be used to comment on the use of illicit substances in drug-facilitated sexual assault. Further, we made assumptions that any drink consumed was a 'standard' drink.

Conclusion

In our study of 97 alleged drink-spiked victims presenting to two metropolitan ED, we found only 9 cases of plausible drink spiking, 5 of which involved alcohol. There were no cases identified where sedative drugs were placed in drinks in pubs or nightclubs. In our study population, drink spiking did occur but was rare. If drink spiking does occur, ethanol is more likely to be used as the drink spiking agent. We identified five patients with high blood ethanol levels inconsistent with their ingestion history, suggesting the possibility that ethanol might be used as a drink spiking agent. Of greater concern was the amount of illicit drug use and alcohol consumed, with the high blood ethanol concentrations in our study population.

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Competing interests

None declared.

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