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Toxicological results in a fatal and two non-fatal cases of scopolamine-facilitated robberies

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ABSTRACT

The use of scopolamine as an incapacitating drug, in sexual crimes and robberies, has been known for many decades. However, blood concentrations and doses of scopolamine in those cases are largely unknown. Here we present the toxicological results of one fatal and two non-fatal cases in a series of scopolamine-facilitated robberies. In the fatal case, the concentration of scopolamine in heart blood was 0.30 mg/L, about 3000 times higher than the average therapeutic level of 0.0001 mg/L (for one dermal patch). In femoral blood, the concentration of scopolamine was much lower (0.0048 mg/L), but still 50 times higher than therapeutic levels. The scopolamine concentration in the stomach was very high (20 mg/kg) as compared to the heart blood and femoral blood, which explains the very high concentration in heart blood by postmortem leakage from the stomach. In the non-fatal case, the scopolamine concentration in serum, obtained 23 h after the incident, was 0.00035 mg/L. The estimated concentration of scopolamine at the time of the incident is 0.0035 mg/L. In the other non-fatal case, scopolamine was detected in urine and in hair.

1. Introduction

Scopolamine, also known as hyoscine, is an anticholinergic drug that is used worldwide for treating motion sickness. The most popular generic form is a dermal patch, which contains 1.5 mg of scopolamine. The scopolamine is delivered through the skin at a rate of about 1 mg per 3 days; this leads to a low steady-state plasma concentration of 0.00005–0.00010 mg/L [1]. Scopolamine is also used by a limited number of illicit drug users, generally for its hallucinogenic properties, but also for its presumed aphrodisiac properties [2; 3; 4; internet reports of users]. Vallersnes et al. [5] described an epidemic of scopolamine poisonings among illicit drug users by ingestion of "fake" Rohypnol tablets containing scopolamine. Main clinical features were mydriasis, (visual) hallucinations, plucking behavior, agitation and coma.

The use of scopolamine as an incapacitating drug, in sexual crimes and robberies, has been known for many decades. Extracts of Brugmansia and Datura plants have been reported to be widely used for that purpose in South-America [6]. Anterograde amnesia, hallucinations and submissive behavior are prominent symptoms in victims of scopolamine-facilitated crimes [7]. In contrast to its possibly widespread use in drug-facilitated crimes, blood concentrations and doses of scopolamine in those cases are largely unknown.

Recently, LeGarff et al. [8] described a fatal case of a fatal Datura poisoning during a robbery. The victim's death was attributed to disordered heart rhythm due to severe anticholinergic syndrome. Blood concentrations of scopolamine, atropine and hyoscyamine could unfortunately not be measured as the corpse was embalmed.

In this article, we present one fatal and two non-fatal cases of scopolamine-facilitated robberies.

In the fatal case and in one non-fatal case, blood concentrations were measured.

2. Description of the cases

2.1. Case 1

A 53-year old man was found dead at home, lying in his bed in prone position. There were no signs of a crime and natural death was concluded. In the next days, cash withdrawals from the deceased's bank account took place by the use of his debit card. Several other cases of possible drug-facilitated robbery, involving the same suspect, were brought to the attention of the police. This led to a forensic autopsy of victim 1, about 3 days after the discovery of the body, which was probably 4–5 days after his death.

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Investigations by the police showed that the suspect dated other men, intoxicated and robbed them. Analysis of the suspect's computer showed that he had searched the internet for scopolamine.

2.2. Case 2

Victim 2 met the suspect in a cafe. They had dinner in a restaurant and then went to the victim's home to drink whiskey. After drinking the whiskey, the victim only remembers that he was scaring off non-existent visitors. Later, he interpreted this as hallucinations. He also noticed that several of his belongings were stolen. He went to a hospital for a urine analysis on his own account (approximately 12 h after the incident). This analysis indicated the presence of opiates in his urine, which proved to him that he had been intoxicated and that he had to contact the police. A hair sample was taken by the police, 79 days (2.6 month) after the incident.

2.3. Case 3

Victim 3 got into contact with the suspect via a gay dating site. On the day of the crime, the suspect came to the victim's home to prepare dinner, of which some components tasted bitter. During the after-dinner massage, the victim lost consciousness and remained unconscious for 15 h. After waking up, he noticed that several goods had been stolen. As he suffered of nausea and amnesia, he went to the hospital on his own account, where a serum and a urine sample were taken, 22 h after the massage. As the toxicological analysis in the hospital gave negative results, he went to the police.

3. Materials and methods

Postmortem investigations (autopsy, toxicological, histological and immunohistochemical examinations) were performed according to medicolegal standards, using protocolized and audited procedures. The toxicological analysis was performed as described previously [9], and consisted of an alcohol analysis with GC–FID, using two columns with different polarities, a GHB analysis with GC–MS after BSTFA-derivatization, a targeted analysis of 57 compounds with LC–MS/MS, and a general unknown screening that consisted of HPLC–DAD analysis and GC–MS analysis after BSTFA-derivatization. The concentrations of scopolamine and citalopram were determined by targeted LC–MS/MS analysis, using the same instrumentation and a similar method as described previously [9]. Hair analysis was performed on four successive 1-cm hair segments by Laboratoire ChemTox, France, using LC–MS/MS.

4. Results and discussion

4.1. Case 1

Histopathological examinations showed moderate postmortem changes, in agreement with a post-mortem delay of several days. There were no signs of a pathological disorder that could explain death. Edema was present in the brain and lungs and there was urine retention. In the small airways, stomach content was found. This may have been a possible cause of death, by induction of asphyxia. However, literature shows that stomach content may also reach small airways by manipulation of the body after death [10]. The prone position in bed is also likely to have caused asphyxia (positional asphyxia). There were no signs of violence, except for a hemorrhage under the lip. Wound dating showed that this lesion was acquired 3–5 h before death; it may have been caused by accident, e.g. bumping.

The systematic toxicological analysis showed the presence of scopolamine and citalopram in heart blood. The concentrations of scopolamine and citalopram were then measured in both heart blood and femoral blood, in order to study possible postmortem redistribution. There were no indications for the recent use of alcohol or GHB. The concentrations of scopolamine and citalopram were determined by targeted LC–MS/MS analysis and are shown in Table 1. Limits of quantitation were 0.0005 mg/L for scopolamine and 0.001 mg/L for citalopram.

The concentration of scopolamine in the heart blood (0.30 mg/L) was about 3000 times higher than the average therapeutic level of 0.0001 mg/L (dermal patch). In femoral blood, the concentration of scopolamine (0.0048 mg/L) was considerably lower than in heart blood, but still 50 times higher than therapeutic levels. Reference values for scopolamine in cases of intoxication are scarce. Balíková [11] reported an average serum concentration of scopolamine of 0.0130 mg/L (maximum: 0.0500 mg/L) in 12 patients who were hospitalized after drinking herbal tea that contained 78 mg of scopolamine (and/including other alkaloids) during a meditation session. Clinical features observed were: impaired perception, hallucinations, aggression, agitation, amnesia, mydriasis, dry skin, tachycardia, hyperthermia, hypotension, collapse, coma and respiratory depression. Anticholinergic symptoms have been described by others at lower concentrations (0.0005–0.0018 mg/L) [5,12] and included mydriasis, visual hallucinations, plucking behavior, agitation, altered mental status, tachycardia, facial flushing, dilated pupils, dry skin and coma. Individual sensitivity may play a role in the toxicity of anticholinergic drugs; it is known that elderly people are more sensitive to anticholinergic drugs [13]. The concentration of scopolamine in femoral blood in this case is therefore a concentration that probably will have caused some of the side-effects mentioned above.

Table 1
Toxicological findings in the three cases. No other compounds were detected.

Case number	Δt (time lapse to sampling)	Material	Result
1	Unknown (fatal)	Heart blood	Scopolamine 0.30 mg/L; citalopram 0.47 mg/L
		Femoral blood	Scopolamine 0.0048 mg/L; citalopram 0.66 mg/L
		Stomach contents	Scopolamine 20 mg/kg
2	12 h	Urine	Ethanol 0.8 g/L; scopolamine, amphetamine, morphine, codeine, paracetamol and paracetamol-metabolites detected
	79 days (2,6 month)	Hair	Scopolamine in three 1 cm-segments, 0.2–0.8 ng/mg
3	23 h	Serum	Scopolamine 0.00035 mg/L
		Urine	Scopolamine, possible scopolamine-metabolites detected
	Corrected for $t^1/_2$	Serum	Scopolamine 0.0035 mg/L