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Collective poisoning with hallucinogenous herbal tea

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Abstract

An incident wherein more than 30 people were poisoned with a herbal infusion during a meditation session is described. The clinical features observed were hallucinations, agression, agitation, amnesia, mydriasis, dry skin, tachycardia, hyperthermia, hypotension, collapse, coma and respiratory depression. All patients recovered, although mechanical ventilation was required in some instances. A portion of the herbal infusion was found to contain atropine (hyoscyamine), scopolamine (hyoscine), harmine, and other alkaloids. The estimated ingested doses (free bases) were atropine 4 mg, harmine 27 mg, and scopolamine 78 mg. The mean concentrations in 21 serum samples obtained approximately 6 h after ingestion of the infusion were atropine 5 ng/ml, harmine 8 ng/ml, and scopolamine 13 ng/ml.

Keywords: Poisoning with hallucinogens; Atropine; Scopolamine; Harmine; Toxicology

1. Introduction

In Prague, June 2001, more than thirty people aged 20–50 years were participating in a meditation session named 'releasing autohypnosis of forest medicine men'. The session was advertised as 'an exercise in lucid thinking supported with Amazonian psychoactive agents'. Between 11.00 and 12.00 h the participants ingested 100–200 ml herbal tea prepared allegedly from South American plant(s) with the name 'Ikitos' or 'Toe'. A participant described the course of the event thus: 'after the first meditation, during the first break, I ingested that drink. Its taste was disgusting. I fainted in the break after a second hour of meditation and came to my senses again in hospital'. The clinical features noted on presentation at hospital were: impaired perception, hallucinations, aggression, agitation, amnesia, mydriasis, tachycardia, hyperthermia, dry skin, hypotension, collapse, coma and respiratory depression. All patients recovered with supportive treatment, which included mechanical ventilation in severe cases.

A sample of the herbal infusion was brought to our laboratory by police between 15.00 and 16.00 h. Later, samples (blood, urine, and/or gastric lavage fluid) from 28 patients were also sent to our laboratory from five hospitals in Prague. Sampling was performed between 17.00 and 18.00 h in most cases (one case at 15.30), i.e. on average 6 h post-exposure. Urine was screened for amphetamines including methylenedioxymethamphetamine (MDMA, Ecstasy) and cannabinoids by EMIT–DAU method with negative results.

The intention of this paper is not to present a fully validated new method but it is presented as an interesting case report of unusual poisoning incident.

2. Materials and methods

2.1. Materials

Atropine sulphate (M_W 694.8), harmine hydrochloride (M_W 248.7), scopolamine hydrobromide (M_W 438.3), internal standard strychnine nitrate (M_W 397.4) were from Merck. Separate stock reference standard solutions were prepared in methanol (2 mg/10 ml, expressed as salts); methanolic working solutions were prepared by dilution. Diethyl ether (Penta), ethyl acetate (Multisolvent, Scharlau), dichloromethane (J.T. Baker), isopropanol (Lachema), and methanol (Penta) were analytical reagent grade. Ammonium hydroxide (23%) was from Penta. Tris(hydroxymethyl)aminomethane (Tris) was from Fluka. Potassium acetate (0.1 M, pH 4) was prepared from glacial acetic acid and potassium hydroxide (both Penta). Bond Elut Certify columns (1211–3050) were from Varian. Bovine serum was from Institute of Physiology, Academy of Sciences, Prague.

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2.2. Qualitative analysis

2.2.1. Extraction

Herbal infusion (0.5 ml), gastric lavage fluid (1 ml) or urine (2 ml) was mixed with 2 M Tris buffer, pH 9 (0.5 ml) and extracted (10 min) with diethyl ether (5 ml). After centrifugation (4000 rpm, 3 min), 4 ml of the ether extract were evaporated to dryness under compressed air and re-dissolved in 200 μl ethyl acetate, 1 μl of which was analyzed by GC–MS with splitless injection.

2.2.2. GC–MS

The instrument was a GC–MSD (HP 5890-5973) used in standard electron impact scan mode. The analysis was performed using a HP-5MS 30 m × 0.25 mm i.d. fused silica capillary column (0.25 μm film). The oven was programmed from 65 to 280 °C. Acquisition of mass spectra was in the range 35–550 *m/z*. The Wiley 275 mass spectral database was used to aid peak assignment.

2.3. Quantitative analysis of serum samples

2.3.1. Extraction

Serum was extracted using Bond Elut Certify columns [1]. Serum (1 ml) was mixed with Tris buffer (1 ml) and the internal standard (100 ng strychnine nitrate in 5 μl methanol). Samples so prepared were applied to columns conditioned by washing sequentially with methanol (2 ml) and distilled water (2 ml). After sample application, the column was washed with distilled water (2 ml) and potassium acetate, (0.1 M, pH 4.0) (1 ml). The analytes were eluted with dichloromethane:isopropanol:ammonium hydroxide (8:2:0.2 by volume), (3 ml), prepared daily. Eluates were evaporated to dryness as above and re-dissolved in 100 μl ethyl acetate, 1 μl of which was analysed by GC–MS. Calibration (internal standard method) was based on analyses of bovine serum spiked with each analyte to concentrations of 0, 5, 25 and 100 ng/ml (expressed as salts) in duplicates.

2.3.2. GC–MS analysis

Analytical conditions were as described above except that spectra acquisition was performed in SIM mode:

Analyte	Start time (min)	*m/z*	Dwell time (m sec)
Atropine	10.00	124, 140, 289	35
Harmine	12.42	212, 197, 169, 106	25
Scopolamine	12.80	94, 108, 138, 154,303	25
Strychnine	20.00	334, 319, 120	35

The limits of quantitation in serum were (free bases, ng/ml) atropine: 2, harmine: 4, and scopolamine: 3 (signal-to-noise ratio >5). Correlation coefficients of linear regression of analyte concentration against peak area ratio (analyte to the internal standard) were atropine: 0.998, harmine: 0.950; and scopolamine: 0.945.

3. Results

Atropine (D,L-hyoscyamine), harmine and scopolamine (hyoscine) were detected in the herbal infusion (Fig. 1). Other alkaloids (derived from β-carboline or tropane) were also present, but their identity could not be confirmed unambiguously. Anhydroatropine and anhydroscopolamine were also detected and may have originated by dehydration during gas chromatography. The concentrations (free bases) of atropine, harmine, and scopolamine in the infusion were found to be 27, 179, and 515 mg/l, respectively, giving an estimated dose (assuming the average volume ingested was 150 ml), of atropine (4 mg), harmine (27 mg) and scopolamine (78 mg) plus other unspecified alkaloids.

These same three compounds were detected in all samples of urine and gastric lavage analysed except that harmine was not detected in all the urines.

In the serum samples ($n = 21$) atropine was detected in all cases (mean 5 ng/ml, maximum 13 ng/ml), scopolamine was detected in 12 serum samples (mean 13 ng/ml, maximum 50 ng/ml) and harmine in eight samples (mean 8 ng/ml, maximum 25).

4. Discussion

Tropane alkaloids occur in plants such as *Datura, Atropa, Mandragora* and *Hyoscyamus* species that grow in Central and South Europe and in other parts of the world. Indole alkaloids such as harmine occur mainly in plants from Africa, Middle East and South America, e.g. *Peganum harmala* and *Banisteriopsis caapi* [2–4]. Harmine together with harmaline can be found in the South American hallucinogenic drink known as 'Ayahuasca' [2,5]. Pharmacological and toxicological data about harmine and harmaline in humans are scant [4]. As for atropine and scopolamine, it is known that toxic doses vary greatly between individuals. Children are very susceptible, <10 mg of either substance may be fatal [5–7]. The combined dose of the various alkaloids, which have synergistic actions, in the drink ingested during the meditation session, was potentially fatal.

It has been reported [5,6] that a significant portion of a dose of atropine (50%) is excreted unchanged in urine and our findings seem to be in agreement with this observation. Harmine is thought to be metabolized extensively [8] and indeed we did not detect it in most of the urine samples analyzed. Similarly scopolamine is not excreted unchanged in urine to any great extent, again in agreement with our findings. The mean concentrations of atropine, harmine, and scopolamine (5, 25, and 13 ng/ml, respectively) in serum sampled approximately 6 h post-ingestion, are in agreement with toxic concentrations of these compounds reported elsewhere

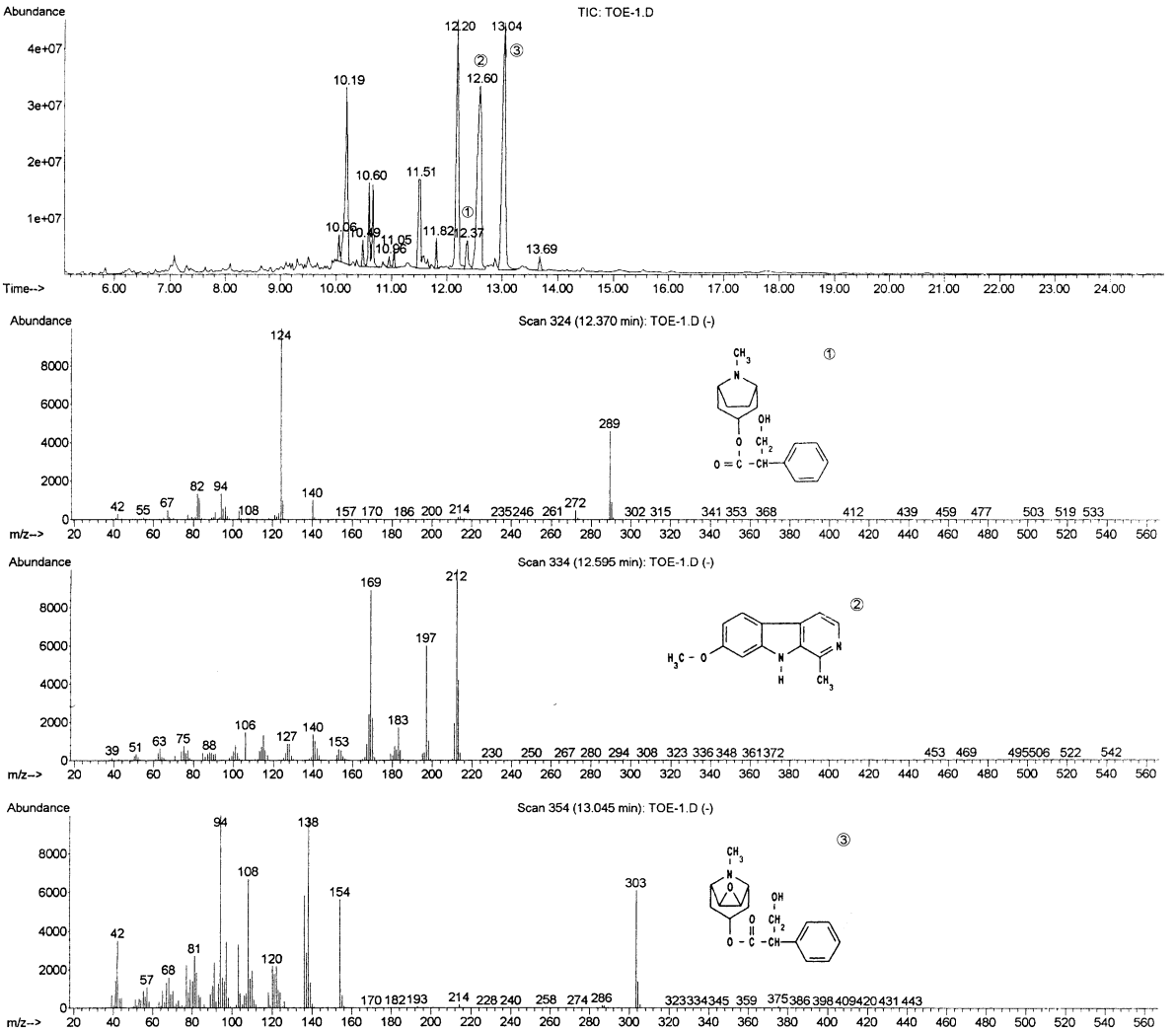

Fig. 1. GC–MS analysis of a solvent extract of the herbal infusion: (1) atropine; (2) harmine; (3) scopolamine.

[5,6] except that to our knowledge no previous human data on harmine is available.

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