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Case report

Forensic features of a fatal *Datura* poisoning case during a robbery

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ABSTRACT

Datura poisonings have been previously described but remain rare in forensic practice. Here, we present a homicide case involving *Datura* poisoning, which occurred during a robbery. Toxicological results were obtained by second autopsy performed after one previous autopsy and full body embalmment. A 35-year-old man presented with severe stomach and digestive pain, became unconscious and ultimately died during a trip in Asia. A first autopsy conducted in Asia revealed no trauma, intoxication or pathology. The corpse was embalmed with methanol/formalin. A second autopsy was performed in France, and toxicology samples were collected. Scopolamine, atropine, and hyoscyamine were found in the vitreous humor, in addition to methanol. Police investigators questioned the local travel guide, who admitted to having added *Datura* to a drink to stun and rob his victim. The victim's death was attributed to disordered heart rhythm due to severe anticholinergic syndrome following fatal *Datura* intoxication. This is a recent case of a rare homicide involving *Datura* that highlights general information on *Datura* and discusses forensic interpretation after a previous autopsy and body embalmment.

1. Introduction

Datura is a poisonous plant belonging to the *Solanaceae* family, which includes nine species, such as *Datura stramonium* (known also as "jimson weed" or "devil's weed"), *Datura inoxia*, and *Datura ferox* [1]. *Datura* species grow worldwide and are used as medicinal plants for the treatment of asthma or pain or as an aphrodisiac [2,3]. The toxicity of *Datura* has been well described for years [4,5] in relation to its uses for poisoning [6], recreation, and predation in robbery or rape attempts [7]. Its main toxic compounds are tropane alkaloids, including atropine, hyoscyamine (the levo-isomer of atropine) and scopolamine. These alkaloids are present in all parts of the plant. Variations in the concentrations of these three alkaloids may be observed among *Datura* species [8], but they are present in all of the species [9].

Atropine and scopolamine are muscarinic antagonists that cause anticholinergic syndrome, which is characterized by ocular effects (mydriasis and paralysis of accommodation), dryness of the mucosal lining (which affects the mouth, sinuses, etc.), mental disorders (excitation, agitation, confusion, delirium, hallucinations, etc.), neurological effects (colonic spasms and seizures), hyperventilation, hyperthermia, sinus tachycardia, and disordered heart rhythm [1,7,10].

Death is uncommon in cases of *Datura* intoxication, and in most cases [6,7], complete recovery occurs after one or two days [11] with symptomatic treatment (supportive care and gastrointestinal decontamination). An acetylcholinesterase inhibitor, physostigmine, is a specific antidote to *Datura* intoxication [11]. Death from intoxication occurs due to respiratory depression, disordered heart rhythm or respiratory inhalation in the case of seizures [11].

Many parts of the *Datura* plant can be used, including the seeds (in domestic dyes), leaves (in tea, for fumigation, in craft wine, and in skin balm), and flowers (in herbal infusions) [5,6].

The literature contains descriptions of accidental *Datura* intoxication, including cases caused by eating a hamburger [6], drinking homemade "moon flower" wine, which resulted in scopolamine poisoning [12], drinking Indian tonic water [13], drinking tainted comfrey tea [14] and eating honey [15], and many cases of fatal poisoning have occurred in children who were attracted by the capsules and seeds [2]. *Datura* is also known as a recreational drug due to its hallucinogenic and psychoactive effects [2,4]. It can be used in several ways, such as ingestion through drinking [10], smoking [16] or chewing the seeds [17]. *Datura* consumption may result in chronic mental disorders, and such cases have been reported after acute or chronic intoxication [18].

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Datura intoxication may also be involved in criminal activity, such as sexual assault or robbery. Sáiz et al. have described multiple uses of the scopolamine compound in *Datura*, such as the blowing of *Datura* powder into victims' faces during sexual assaults to block their free will [7]. Uribe et al. have reported several cases of scopolamine and hyoscyamine use in robberies and rapes in Colombia [19]. To the best of our knowledge, no previous case of homicide has been described.

Datura is difficult to identify in a forensic context because tropane alkaloids are difficult to detect by gas chromatography–mass spectrometry (GC–MS) and liquid chromatography–diode array [1]. Liquid chromatography–tandem mass spectrometry (LC–MS/MS) is cited as the most effective technique for identifying these alkaloids.[1]. Moreover, the main toxicology studies analyzing tropane alkaloids have been in clinical, therapeutic or pharmacological fields [20–24]. Concentrations of tropane alkaloids in biological fluids after *Datura* consumption are rarely reported [6,25,26] and are even less frequently reported in forensic samples, such as viscera [6] or hair [27]. Tropane alkaloids have been detected in urine and blood in a few cases [25,26,28], and the rarity of these cases is likely due to the short half-lives of these compounds. Atropine has been reported to have a plasmatic half-life of approximately 4–6 h [29]. Scopolamine is rapidly eliminated during the first 24 h after intoxication [19], and its half-life has been reported to be approximately 1.5 h [30].

Recent studies have reported positive results for atropine and scopolamine in the hair of living people after chronic *Datura* use, as determined by ultraperformance liquid chromatography–tandem mass spectrometry analysis (UPLC–MS/MS) [1,27,31,32]. These reports have introduced a new range of toxicology methods for *Datura* investigation.

Few studies have described tropane alkaloid detection after the death of the *Datura* consumer (summarized in Table 2), and only Steenkamp et al. have shown positive qualitative results for viscera (gastric content, liver, and kidneys) [6].

2. Case report

2.1. Context

A 35-year-old man had been traveling for six months around the world. During the last part of his trip to Java, Indonesia, in Southeast Asia, he decided to visit a volcano by car with a tour guide and a driver. While traveling in the car, he suffered from severe stomach and digestive pain and rapidly became unconscious. His guide disappeared with his belongings while the driver took him to the nearest hospital. Resuscitation was not attempted, and he died before medical intervention. The medical diagnosis of the patient at the time of death was heart attack.

The first autopsy was performed in Indonesia, and no evidence of trauma or pathology was detected. The cause and the manner of death were undetermined. The information provided by the local authorities did not reveal whether toxicology samples were collected during this autopsy. Prior to repatriation of the body to France, the cadaver was embalmed and treated with formalin and methanol products. Then, a second autopsy was requested by the judiciary in France and performed.

2.2. External examination and autopsy

External examination was performed on the embalmed body, which revealed the presence of autopsy sutures and some superficial and non-fatal wounds, i.e., a right parietal bruise and several bruises on the internal parts of the right and left arms. The autopsy showed that all of the organs had been previously cut into multiple pieces and then placed into the thoracic cavity. They were all fixed with formalin/methanol products. Despite the embalmment and due to the length of time between the death and second autopsy, the viscera were in an advanced stage of putrefaction.

At autopsy, toxicology samples were obtained (hair, liver, brain, psoas muscle, and vitreous humor). The samples were placed into glass vials, except for the hair, which was kept at room temperature, and the vitreous humor was placed into a glass vial that contained sodium fluoride. A 3 mL volume of vitreous humor and approximately 15 mg of each visceral sample were collected.

2.3. Toxicology findings

The samples obtained during autopsy were transported immediately after their extraction from the corpse to the toxicology laboratory. The samples (except for the hair, which was kept at room temperature) were refrigerated at 4–6 °C. Toxicological analyses were performed at two days after autopsy.

Analyses of the hair and vitreous humor were performed. The brain, psoas muscle and liver samples were putrefied, and toxicological analyses were performed as for the hair and vitreous humor, without alkaloid or other produce detection.

For the vitreous humor sample, ethanol quantification was performed by gas chromatography coupled with headspace mass spectrometry (GC–MS) in an alkaline solution of 0.1 mL methylclonazepam (used as an internal standard). The detection of heroin, cocaine, amphetamines and other drugs was performed by

Table 1
Toxicology analysis of the vitreous humor.

Sample	Test for	Qualitative result	Quantitative result
Opioids, cannabinoid amphetamine derivate; cocaine derivates	Ethanol	Negative	
	Methanol	Positive	**10** g/L
	Morphine	Negative	
	Codeine	Negative	
	6-Mono-AcetylMorphine (6MAM)	Negative	
	Methadone	Negative	
	2-Ethylidine-1,5-Dimethyl-3,3DiPhenylpyrrolidine (EDDP)	Negative	
	Δ9-tetra-hydro-cannabinol (Δ9THC)	Negative	
	Cocaine	Negative	
	Amphetamine	Negative	
	Ephedrine	Negative	
	Metamphetamines (MDA, MDMA, MDEA ...)	Negative	
	Mephedrone	Negative	
Benzodiazepines	Diazepam (Nordiazepam etc.)	Negative	
Tropane alkaloid	Atropine + Hyosciamine	Positive	**1** ng/mL
	Scopolamine	Positive	**5** ng/mL