The Analysis and Distribution of Mescaline in Postmortem Tissues

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Abstract

Mescaline (3,4,5-trimethoxyphenethylamine) is a hallucinogenic alkaloid found in the peyote cactus. This report documents mescaline distribution in a death caused by multiple gunshot wounds. Mescaline was extracted with a butyl chloride liquid-liquid method and identified by mass spectrometry. Quantitative analysis was performed by gas chromatography using a nitrogen-phosphorus detector. Concentrations of the drug were 2.95 mg/L, 2.36 mg/L, 8.2 mg/kg, and 2.2 mg/kg in blood, vitreous, liver, and brain, respectively.

Introduction

Mescaline is a naturally occurring hallucinogenic alkaloid found in the peyote cactus. Peyote cactus (Lophophora williamsii) is found in Mexico and the southwestern United States (1). Although the use of mescaline is illegal in the United States, it is legally used in religious rituals of the Native American Church, usually in the form of a tea brewed from the cactus or by ingestion of the “button” top of the cactus (2). Although chemically unrelated to lysergic acid diethyl amide (LSD) (Figure 1), the hallucinogenic effects of mescaline are similar to that of LSD, although they are longer lasting.

Typical hallucinogenic doses range from 200 to 500 mg of the hydrochloric or sulfate salt with blood concentrations of 3.8 mg/L at 2 h and 1.5 mg/L at 7 h after ingestion (3). Reynolds et al. (4) reported the death of an individual due to massive traumatic injuries while under the influence of mescaline. Drug concentrations in the blood, liver, and urine were reported at 9.7 mg/L, 70.8 mg/kg, and 1163 mg/L, respectively. Nolte and Zumwalt (5) reported a case of mescaline intoxication resulting in death. An antemortem blood sample contained 0.48 mg/L of mescaline and a urine sample 61 mg/L of mescaline.

This report describes the mescaline concentrations in a traumatic death case.

Case History

The victim was a 53-year-old American Indian male who was purportedly using Peyote in a religious ceremony with others. During the course of the ceremony, the victim was shot multiple times by another participant.

Materials and Methods

Reagents
Methamphetamine and Mescaline were purchased from Radian (now Cerilliant, Austin, TX). All other reagents were analytical reagent grade purchased from Fisher Scientific (St. Louis, MO) and VWR (St. Louis, MO).

Analytical procedure
To 1.0 mL whole blood, 1.0 mL vitreous humor, or 1.0–2.0 g tissue homogenate (1:4), internal standard (methamphetamine)
was added and the pH adjusted by the addition of 0.5 mL concentrated NH₄OH. The sample was extracted with 10.0 mL n-butyl chloride. The organic layer was then transferred to a clean culture tube and back-extracted into 3 mL 1N H₂SO₄. The pH was adjusted again with 0.5 mL concentrated NH₄OH and the sample was extracted into 2.5 mL of n-butyl chloride. The organic layer was then evaporated to dryness under N₂ with the addition of methanolic HCl at 40°C. The sample was reconstituted with 100 μL methanol for injection into the gas chromatograph (GC).

Qualitative analysis was performed by SIM gas chromatography-mass spectrometry (GC-MS) using an HP-1 12.0-m x 0.2-mm column. The primary ion used for a positive identification was 182 with secondary ions 167 and 181.

Quantitative analysis was performed by GC using a nitrogen-phosphorus detector. An HP 5890 GC was used with an HP-1 12.0-m x 0.2-mm column. The operating parameters consisted of a column temperature programmed from 100 to 300°C at 10°C/min. The injection volume was 2 μL done by a splitless injection with a 1.0-min purge. A representative chromatograph is presented in Figure 2. The ratio of mescaline peak area to methamphetamine peak area was compared to a calibration curve bracketing the concentration of the specimen. The curves were prepared from spiked whole blood controls and deionized water that were extracted at the same time as the specimens evaluated by that curve.

Results and Discussion

The mass spectrum of mescaline is presented in Figure 3. The concentrations of mescaline are presented in Table I. An immunoassay test performed on the urine was negative for other drugs of abuse and the blood was negative for alcohol.

A review of the literature reveals a paucity of data relating to the distribution of mescaline. Charalampous et al. (6) report a mean Cₚmax of 3.8 mg/L blood concentration from subjects given 500 mg of labeled mescaline hydrochloride. Mokrasch and Stevenson (7) report a mean Cₚmax of 14.8 mg/L blood concentration after being given a 5-mg/kg dose of mescaline sulfate intravenously. These controlled studies offer much information on drug/metabolite concentrations. Reynolds and Jindrich (4) report a traumatic death associated with mescaline use with a blood concentration of 9.7 mg/L. The present case documents blood and tissue concentrations significantly lower than these; however, no data are available as to the amount ingested, the time interval between consumption and death in the case, or the hallucinogenic effects, if any.

References


Table I. Distribution of Mescaline

<table>
<thead>
<tr>
<th>Tissue</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Femoral Blood</td>
<td>2.95 mg/L</td>
</tr>
<tr>
<td>Vitreous</td>
<td>2.36 mg/L</td>
</tr>
<tr>
<td>Liver</td>
<td>8.2 mg/kg</td>
</tr>
<tr>
<td>Brain</td>
<td>2.2 mg/kg</td>
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</tbody>
</table>

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