CASE REPORT
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Intravenous Mushroom Poisoning

Steven C Curry, MD*
Mark C Rose, MD†
Phoenix, Arizona

From the Central Arizona Regional Poison Management Center, Department of Medical Toxicology, St Luke's Medical Center;* and the Departments of Medicine and Medical Education, Good Samaritan Medical Center, Phoenix, Arizona.†

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Address for reprints: Steven C Curry, MD, Department of Medical Toxicology, St Luke's Medical Center, 1800 East Van Buren, Phoenix, Arizona 85006.

Mushrooms of the genus Psilocybe frequently are ingested by recreational drug users for their hallucinogenic effects. We present the case of a 30-year-old man who allegedly received an intravenous injection of an extract of Psilocybe mushrooms. His clinical course was characterized in part by vomiting, severe myalgias, hyperpyrexia, hypoxemia, and mild methemoglobinemia, and it was similar to two previously reported cases. The patient improved rapidly with supportive care. [Curry SC, Rose MC: Intravenous mushroom poisoning. Ann Emerg Med September 1985;14:900-902.]

INTRODUCTION

Mushrooms of the genus *Psilocybe* are a common source of recreational drug abuse. At least two hallucinogenic indoles, psilocybin and psilocin, have been isolated from this genus.[1] Oral ingestions can produce a clinical syndrome characterized by hallucinations, laughter, vertigo, ataxia, mydriasis, paresthesias, nausea, vomiting, weakness, and sleep.[1,2] The effects of the mushroom are short-lived and usually require no specific treatment,[3] although children may develop seizures and fever.[2]

Our patient allegedly was injected intravenously (IV) with an extract of a *Psilocybe* mushroom. His clinical presentation was remarkably similar to those in the only other report in the medical literature.[4] It was characterized in part by hyperpyrexia, hypoxemia, mild methemoglobinemia, vomiting, and severe myalgias.

CASE REPORT

A 30-year-old man was brought to the Central Arizona Regional Poison Management Center at St Luke's Medical Center after paramedical personnel were summoned to his home. The patient had abused *Psilocybe* mushrooms extensively in the past, but had never taken them parenterally.

Two to four hours prior to admission, while at a party, the patient received an IV injection of what he stated was an extract of "fresh" *Psilocybe* mushrooms. The mushrooms were heated and squeezed, and the "juices" were drawn into a syringe. It is not known whether the extract was filtered with cotton prior to injection. The exact volume administered also was unknown.

Within ten minutes after injection, the patient developed chills, rigors, dyspnea, headache, and severe myalgias involving all muscle groups, particularly the flanks and thighs. He barely was able to drive to his home, where he developed persistent vomiting. The patient's symptoms were so severe that his wife summoned paramedical personnel.

A medical history and review of systems was unremarkable except for a 30-pack-year smoking history and the past abuse of methamphetamine.

Initial physical examination revealed an acutely ill man. He had central and peripheral cyanosis, was crying in pain, and was vomiting repeatedly. Vital signs were as follows: blood pressure, 117/58 mm Hg; pulse, 125; respirations, 28; and temperature, 40.1 C orally.

The patient's chest was clear to auscultation with full, equal breath sounds. Auscultation of the heart was normal. The abdomen was flat and diffusely tender to mild palpation. The patient was tender to palpation over all major muscle groups, especially the flanks and thighs. Examination of the extremities was unremarkable except for the cyanosis and the tattoo of a mushroom on his left arm. Neurological and funduscopic examinations were

normal. There was no evidence of hallucinations.

Arterial blood gases obtained while the patient breathed room air were as follows: PO_2, 70 mm Hg; PCO_2, 29 mm Hg; pH, 7.48; and methemoglobin, 5.1% (0.68 gm/dL). A posteroanterior chest radiograph and ECG were normal.

A complete blood cell count, SMA12, creatine phosphokinase (CPK) isoenzymes, serum amylase, and electrolytes revealed the following: WBC, 7,200/mm^3 with 60 segs, 34 bands, and six lymphocytes; hemoglobin, 13.3 g/dL; mean corpuscular volume, 95 fL; potassium, 3.2 mEq/L; glucose, 183 mg/dL; phosphorus, 0.6 mg/dL; SGOT, 55 U/L (normal, < 40); and SGPT, 61 U/L (normal, < 38). A protime and partial thromboplastin time were normal, as was the platelet count. A urinalysis was normal except for many hyaline casts per low-power field and a few granular casts per low-power field. Urine for myoglobin was negative. Blood and urine were sent for culture and later were reported negative.

A blood drug screen performed by GC-mass spectrometry, which can detect more than 450 commonly used and abused drugs and/or their metabolites, including sympathomimetics, was negative. The indoles psilocin and psilocybin are not detectable by this method. A urine drug screen using thin-layer chromatography revealed only phenylpropanolamine, which was not present in the patient's blood. No effort was made to determine the presence of indoles such as psilocin and psilocybin in the urine.

Initial treatment included oxygen, IV fluids (2L normal saline/1 hr; D_5 0.45% NaCl with 40 mEq KCl/L at 200 mL/hr), and analgesia (IV morphine sulfate 4 mg every five minutes up to 16 mg every two hours), but no antipyretics. Within one hour the patient's temperature dropped to 38 C, and within 16 hours he was afebrile. Nausea, vomiting, and myalgias resolved over 24 hours. Arterial blood gases drawn two and one-half hours after admission while on oxygen 5 L/min per nasal cannula showed the following: PO_2, 115 mm Hg; PCO_2, 30 mm Hg; pH, 7.47; and methemoglobin, 0.6% (0.08 g/dL). Arterial blood gases drawn while breathing room air 24 hours after admission showed the following: PO_2, 85 mm Hg; PCO_2, 40 mm Hg; and pH, 7.39.

Repeat chemistries 24 hours after admission were as follows: glucose, 118 mg/dL; SGOT, 36 U/L; phosphorus, 1.7 mg/dL; total bilirubin, 1.3 mg/dL; and SGPT, 63 U/L. CPK remained normal. The patient was asymptomatic, and a repeat physical examination was normal, without evidence of liver tenderness or enlargement, 36 hours after admission. The patient left against medical advice and was lost to follow-up.

DISCUSSION

Sivyer and Dorrington reported two patients who had received IV injections of *Psilocybe* mushrooms.[4] These patients developed nausea, vomiting, diarrhea, rigors, arthralgias, myalgias, loin pain, headache, and skin eruptions. Laboratory results included elevated renal and liver function studies, which were normal after seven days in one patient. Both patients had a leukocytosis and a left shift the day after injection. It was not clear how much dehydration may have contributed to the elevated creatinine and BUN in the two patients.

Our patient presented with a very similar clinical picture, including myalgias, rigors, vomiting, flank pain, headache, and a left shift. In addition, our patient suffered from hypoxemia, mild methemoglobinemia, and hyperpyrexia. Sivyer and Dorrington noted that their two patients had been injecting themselves with mushroom extracts for several days before presenting for medical treatment. Whether their patients had been symptomatic since their first injections is not stated, although one would suspect that they would not have continued to inject themselves for several days if they were severely symptomatic the entire time. Our patient became very ill after the first and only injection of the mushroom extract. Possible, but unknown, differences between our case and the two cases reported previously that could account for differences in onset of symptoms include the species of mushroom involved, the concentration and volume of the extract administered, and the age of the mushrooms.

Although *Psilocybe* mushrooms are not known as hepatotoxins, there is one report of elevated SGOT, lactic dehydrogenase, and alkaline phosphatase levels after oral ingestion of *Psilocybe cyanescens* by a 17-year-old boy.[5] Sivyer[4] noted a transient rise in liver function studies in at least one of his patients. Our patient exhibited only a mild elevation in SGPT without any other evidence to suggest true hepatotoxicity. Of course we do not know that the SGPT was not elevated prior to the injection of the mushroom extract.

The methemoglobinemia that developed in our patient was not severe enough to require treatment with methylene blue. A methemoglobin concentration of 0.68 g/dL alone would not even have produced cyanosis. A total of 1.5 g/dL methemoglobin or 5 g/dL unoxygenated hemoglobin is required to produce a noticeable cyanosis.[6] The combination of mild to moderate hypoxemia with the mild methemoglobinemia, however, probably accounted for the observed cyanosis.

The etiologies of acquired methemoglobinemia are diverse and include multiple pharmaceutical agents, nitrites, and many industrial chemicals.[6] There was no history of exposure to any of these agents in our patient. We could find no reports of methemoglobinemia after ingestion of *Psilocybe* mushrooms or after the administration of psilocybin or psilocin to experimental subjects. The chemical constituents of a simple extract of mushrooms would be expected to be rather complex and, perhaps, could include compounds that are capable of oxidizing hemoglobin to the metform, although this is entirely conjectural.

Certainly the IV injection of foreign material may have adverse effects on the lungs after entering the pulmonary circulation, possibly explaining the transient hypoxemia in our patient. Pulmonary microemboli have been documented after injections of street drugs containing starch and talc.[7] The crude mushroom extract that our patient allegedly injected also may have contained small particles capable of causing vessel occlusion.

The source of our patient's increased temperature is not known. Hyperpyrexia has been reported after ingestion of *Psilocybe* mushrooms in children.[2] In IV drug abusers, a fever frequently represents an infectious process such as endocarditis, hepatitis, bacteremia, or soft-tissue infections. Blood and urine cultures in our patient were negative, and no other source of infection was apparent.

An acute febrile reaction of unknown etiology after the IV injection of heroin has been termed "cotton fever"[8-10] and may pertain to our case. The cause of "cotton fever" is not known. Suggested etiologies include pyrogens in the cotton used to filter substances before injection, transient bacteremia, multiple pulmonary microemboli, or other mechanisms.[9] Certainly the mushroom extract with which our patient was injected most likely contained fungi, may have contained other pyrogens, and may have been contaminated with bacteria.

The assumption that our patient was injected with an extract of *Psilocybe* mushrooms is based on the history he provided. Unfortunately none of the administered mushroom extract or the mushrooms themselves were available for analysis. The signs and symptoms of our patient, however, were similar to those previously reported by Sivyer and Dorrington.[4] In addition our patient was familiar with *Psilocybe* mushrooms because he had raised them for personal use for three years. We therefore believe that the extract that the patient received was prepared from mushrooms of the genus *Psilocybe*.

SUMMARY

Our patient presented acutely ill with hypoxemia, cyanosis, mild methemoglobinemia, hyperthermia, vomiting, and severe myalgias. No infectious etiology was found, and the patient recovered with supportive care. Unlike the two previously reported cases,[4] no meaningful evidence of liver or renal toxicity was noted. If this form of abuse continues, more clinical information should be gathered to better define the illness that can be produced by the IV injection of *Psilocybe* mushroom extracts. In treating such patients, at this time it seems most important to rule out an infectious process and to administer supportive care.

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