



Kidney Research and Clinical Practice

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Case Report

Severe but reversible acute kidney injury resulting from *Amanita punctata* poisoning



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ABSTRACT

Article history:

Received 9 December 2014
 Received in revised form
 30 March 2015
 Accepted 27 May 2015
 Available online 29 July 2015

Keywords:

Acute kidney injury
Amanita punctata
 Mushroom poisoning

Mushroom-related poisoning can cause acute kidney injury. Here we report a case of acute kidney injury after ingestion of *Amanita punctata*, which is considered an edible mushroom. Gastrointestinal symptoms occurred within 24 hours from the mushroom intake and were followed by an asymptomatic period, acute kidney injury, and elevation of liver and pancreatic enzymes. Kidney function recovered with supportive care. Nephrotoxic mushroom poisoning should be considered as a cause of acute kidney injury.

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Introduction

About 1,900 species of mushrooms grow in Korea. Among them, 243 (13%) species are poisonous. Mushroom poisoning occurs every year. Forty-eight cases of mushroom poisoning reported from 2006 to 2013 resulted in 17 fatalities [1]. According to previous reports, *Amanita virosa*, *Amanita verna*, and *Amanita subjunquillea* are leading causes of mushroom poisoning in Korea [2]. The causal toxin is defined as “amatoxin,” and poisoning by these mushrooms shows typical clinical features which give clues to suspect amatoxin poisoning. It causes early gastrointestinal symptoms followed by fulminant liver and renal failure. There are mushroom intoxication-related renal failures other than amatoxin poisoning. *Amanita smithiana* and *Amanita proxima* are reported to be nephrotoxic. The causal toxin is different from the amatoxin, and a delayed onset of acute reversible renal failure is a typical clinical feature. In addition, *Cortinarius* spp.

intoxication (orellanine-containing mushrooms) is well known to cause severe irreversible renal failure.

Amanita vaginata var *punctata* (*A. punctata*) belongs to genus *Amanita* section *Vaginatae* as a variety of *A. vaginata*. It is considered edible mushroom [3–6]. There were rare previous reports on kidney toxicity of *A. punctata*. Here, we report our experience of acute kidney injury resulting from *A. punctata* ingestion which recovered by supportive care.

Case report

A 73-year-old woman collected mushrooms in the suburbs of Pyeong-taek city in the southern Gyeonggi province in August 2014. She ingested about 100 g of boiled mushrooms. She complained about anorexia, nausea, and mild dizziness the same day. The symptoms had disappeared the following day, and she did not seek medical help. Six days after ingestion of the mushrooms, she experienced nausea and one episode of mild vomiting. Symptoms persisted, and 4 days later, she visited a hospital near her residence and was transferred to our emergency room.

At presentation, the patient complained about nausea but insisted that her oral intake had not lessened appreciably. Her medical history included hypertension, dyslipidemia, and

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<http://dx.doi.org/10.1016/j.krccp.2015.05.007>

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diabetes mellitus. She took regular medicine including sitagliptin 100 mg, amlodipine 5 mg, olmesartan 20 mg, *Ginkgo biloba* extract 40 mg, and atorvastatin 20 mg. Her renal function was normal in February 2014 at an examination at a private clinic. Serum blood urea nitrogen (BUN) and creatinine (Cr) levels were 23 mg/dL and 0.8 mg/dL, respectively, at that time.

Physical examination showed no remarkable findings except for somewhat dried tongue and lip. Blood pressure was 130/70 mmHg, pulse rate was 88 beats/min, and body temperature was 37.3°C. On laboratory investigation, white blood cell count, hemoglobin, hematocrit, and platelet were 8,800/mm³, 10.5 g/dL, 29.9%, and 178,000/mm³, respectively. Renal function was severely deteriorated (BUN 83.6 mg/dL and Cr 11.53 mg/dL), and the estimated glomerular filtration rate was 3.23 mL/min/1.73 m². Liver enzymes were mildly elevated (aspartate aminotransferase 24 U/L and alanine aminotransferase 43 U/L). The total bilirubin level was normal (0.9 mg/dL), and prothrombin time was not prolonged (12.2 seconds). Amylase and lipase levels were 177 U/L and 393 U/L, respectively. An electrolyte panel revealed sodium, potassium, chloride, total CO₂, calcium, and phosphate levels of 119 mmol/L, 5.2 mmol/L, 82 mmol/L, 18 mmol/L, 8.0 mg/dL, and 5.9 mg/dL, respectively. Urinalysis revealed a specific gravity of 1.008, with no detectable proteinuria. Urine microscopy demonstrated some muddy brown casts. On the renal ultrasonogram, both kidneys were normal in size and cortical thickness (Fig. 1).

The patient provided leftovers of the mushroom she had ingested. The sample was confirmed as *A. punctata* by the National Institute of Horticultural and Herbal Science (Iseo-myeon, Wanju, Korea; Fig. 2).

Supportive treatment was started. Urine output was sufficient at 1,500 cc/d and 4,570 cc/d on Days 1 and 2 of admission, respectively. On Day 3, BUN and Cr levels had decreased (61.6 mg/dL and 8.13 mg/dL, respectively), and urine output was maintained. Renal biopsy was not performed because of the sustained improvement. On Day 9, BUN and Cr levels were further decreased (23.8 mg/dL and 1.93 mg/dL, respectively), and the patient was discharged without any symptoms. She has been followed up regularly in a renal clinic. At the 1-month follow-up, BUN and Cr levels were 12.2 mg/dL and 1.12 mg/dL, respectively.



Figure 2. Photographs of *Amanita punctata*.

Discussion

Rapid diagnosis of mushroom intoxication is difficult. Detection of mushroom toxin is not routinely available in clinical settings, and patients often visit clinics after the toxin has declined in concentration. Even in laboratories equipped for the analysis, the task can be time consuming, which delays the initial management. Compounding the challenge, information about toxic substances in mushrooms is lacking until today. Thorough history taking, deducing the causal

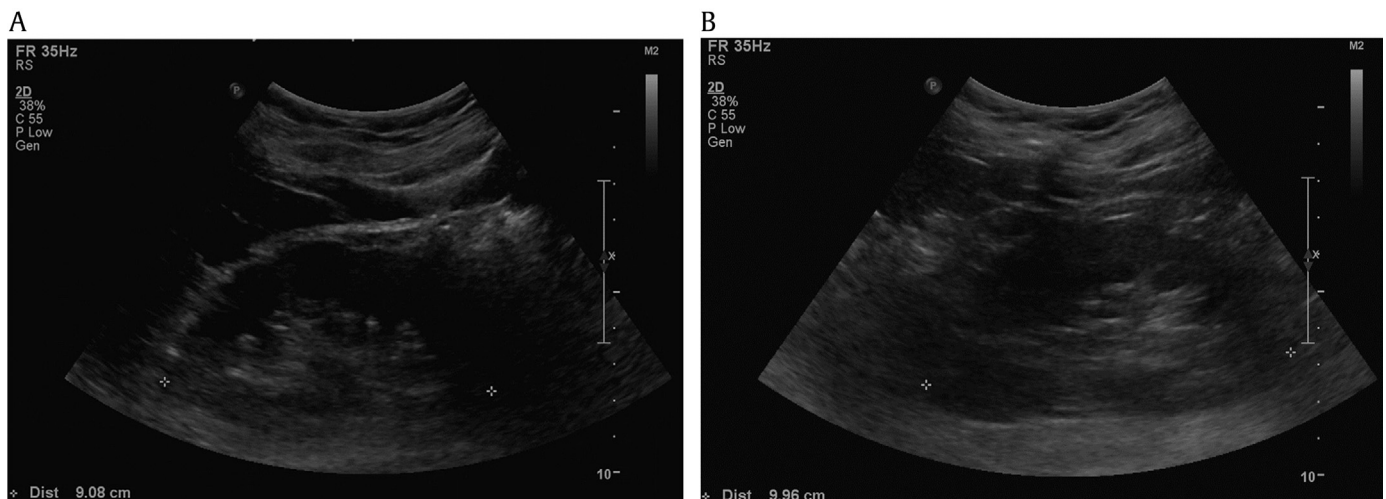


Figure 1. Renal ultrasonogram. Both right (A) and left (B) kidneys are normal in size and cortical thickness.

mushroom, and monitoring clinical progress are crucial for the initial diagnosis.

Amanita punctata is considered an edible mushroom [3–6]. The pileus is dark gray or grayish brown and 6–8 cm in diameter. It is oval when young and becomes bell shaped with a round mound and then flat with growth. The stipe is white or light gray and covered with dark gray powder. It measures ~10–13 cm in length and ~10–15 mm in width. The mushroom grows in the temperate deciduous forest regions of Korea, Japan, Europe, and North America and is collectable between the summer and the autumn [4].

The present patient displayed early gastrointestinal symptoms within 24 hours after ingestion of *A. punctata*, followed by severe acute kidney injury with relatively mild hepatitis and pancreatitis. These clinical findings are similar to cases of poisoning due to the *A. smithiana* toxin. *A. smithiana* is a nephrotoxic mushroom distributed primarily in North America. Its toxic substance is named as *A. smithiana* toxin. *In vivo*, *A. smithiana* poisoning demonstrates gastrointestinal symptoms during the first 2–12 hours (median 6 hours) after mushroom ingestion, which is followed by delayed kidney injury 2–6 days later [3,7]. With supportive therapy including hemodialysis, renal prognosis is good that in all previous cases, renal recovery was 100%. Liver enzymes can be elevated, but mild. *Amanita smithiana* toxin can be detectable by thin-layer chromatography in laboratory settings, although this analysis is not entirely specific for the toxin [8]. *Amanita boudieri*, *Amanita echinocephala*, and *Amanita gracilior* express *A. smithiana* toxin detected using thin-layer chromatography.

Amanita nephrotoxic syndrome refers to mushroom poisoning characterized by early onset of gastrointestinal symptoms, mild hepatitis, and severe but reversible acute kidney injury with acute interstitial nephritis [3]. *Amanita proxima* and *Amanita pseudoporphyria* intoxication demonstrate similar clinical manifestations, even in the absence of *A. smithiana* toxin and amatoxin. Previously, *A. smithiana* toxin has not been detected in *A. vaginata*.

Most previous reports of mushroom poisoning in Korea were about amatoxin poisoning, a well-known mushroom intoxication syndrome worldwide. Mortality approaches 40%, and multiple organ failure including kidney failure can occur. Amatoxin is a heat-stable toxin and resistant to enzymatic hydrolyzation which means the toxicity was not changed during cooking of the mushroom. When the mushroom is ingested, the toxin is absorbed through the gastrointestinal mucosa and passes through enterohepatic circulation and renal reabsorption. Amatoxin inhibits DNA-dependent RNA polymerase-B by blocking messenger RNA synthesis, and thereby it causes extensive tissue damage especially to the intestinal mucosa, hepatocytes, and renal tubular cells. There are several subtypes of amatoxin; alpha amanitin is the most potent. It can be detected using radioimmunoassay, high-performance liquid chromatography, and enzyme-linked immunosorbent assay [9].

Amatoxin poisoning demonstrates a typical clinical progress, which is useful for diagnosis [10]. Within 24 hours of ingestion, gastrointestinal symptoms including nausea, vomiting, abdominal pain, or watery diarrhea occur. An asymptomatic period follows and precedes a second phase where renal and hepatic functions start to deteriorate. Premature discharge can occur when symptoms have appeared to resolve. In the third phase, ~3–5 days after ingestion, liver and kidney

failures progress to shock, multiorgan failure, and death. Mushroom poisoning in Korea most frequently results from ingestion of *A. virosa*, *A. verna*, and *A. subjunquillea*, which present typical findings of amatoxin poisoning [2]. Similar clinical features in *Amanita virgineoides* intoxication suggest the presence of amatoxin [11].

In this case, the occurrence of gastrointestinal symptoms within 24 hours from ingestion followed by an asymptomatic period, acute kidney injury, and elevation of liver and pancreatic enzymes is compatible with amatoxin poisoning. However, kidney injury was more severe compared with liver function, which is different from typical amatoxin poisoning where fulminant hepatic failure predominates kidney failure and pancreatitis. Lack of data on liver and kidney function of the previous 10 days before admission makes it impossible to exclude the possibility of amatoxin poisoning. Urinary detection was not possible because amatoxin is typically not detectable in urine >4 days after mushroom consumption. Analysis of any leftovers of *A. punctata* for amatoxin would be helpful.

Another well-known mushroom poisoning resulting in severe renal failure is orellanus syndrome due to *Cortinarius orellanus* intoxication. This syndrome demonstrates delayed onset of renal failure without gastrointestinal symptoms. Prognosis is poor, with a recovery rate of 40% [12]. Our case showed different clinical manifestations with good prognosis; orellanus syndrome has not been reported in mushrooms of genus *Amanita*.

Here we report a first case of *A. punctata* poisoning causing acute reversible kidney injury in Korea. Clinical features were similar to those of *Amanita* nephrotoxic syndrome. Nephrotoxic mushroom poisoning should be considered as a cause of acute kidney injury. Further accumulation of knowledge on poisonous mushrooms and the development of tools for rapid detection are necessary for the management of nephrotoxic mushroom poisoning.

Conflicts of interest

The authors have no conflicts of interest.

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