—Case Reports—

Successful Rescue of a Patient with Acute Aconitine Poisoning Complicated by Polycystic Renal Hemorrhage

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Introduction: Aconitine is a highly toxic diterpenoid alkaloid, produced by plants of the *Aconitum* genus, that is still used in Chinese herbal medicines. Aconitine poisoning remains common in China and other parts of Asia.

Case Report: A 48-year-old man received a diagnosis of aconitine poisoning after ingesting herbal medicinal wine made with *caowu*, which is made from *Aconitum kusnezoffii* roots, and was admitted to our hospital's emergency department. Electrocardiography and thoracoabdominal computed tomography showed cardiovascular toxicity from aconitine poisoning along with polycystic renal hemorrhaging. Because the arrhythmia was not controlled with lidocaine, blood purification with a reduced dosage of heparin was performed to treat the arrhythmia and to avoid increasing the bleeding of the polycystic renal hemorrhage. The patient recovered from aconitine poisoning and polycystic kidney hemorrhage.

Conclusions: This case significantly advances our understanding of hemoperfusion with reduced heparin for the treatment of ventricular arrhythmia caused by aconitine poisoning.

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Key words: aconitine poisoning, polycystic kidney hemorrhage, blood purification

Introduction

Aconitine is a highly toxic diterpenoid alkaloid produced by plants of the *Aconitum* genus which is still used in Chinese herbal medicines[1]. The Chinese herbal substances known as *chuanwu* and *caowu*, which consist of roots of *Aconitum carmichaelii* and *Aconitum kusnezoffii*, respectively[2], are commonly used to relieve pain caused by various diseases[3]. Because of faulty processing, overdosing, and drinking herbal medicinal wine made with alkaline aconitine herbs, aconitine poisoning remains common in China and other parts of Asia[4]. Various toxic symptoms, such as paresthesia, anesthesia, and weakness, are observed within a few minutes of aconitine ingestion and are followed by gastrointestinal symptoms, such as nausea, vomiting, diarrhea, and cardiac problems, the most common of which is ventricular arrhythmia[5]. Although aconitine toxicity has been recognized for many years, information about treating the toxic effects remains poor[6]. We describe a case of acute aconitine poisoning in which complication by polycystic renal hemorrhage made management of its cardiovascular and other symptoms more challenging.

Case Report

A 48-year-old man ingested 30 mL of herbal medicinal wine to relieve low back pain. A few minutes later, he felt paresthesia, chest distress, and dyspnea. The mouth, tongue, all 4 limbs, and the entire body then become numb, and the patient experienced dizziness, nausea, frequent vomiting, and restlessness. He consulted a local hospital and, after undergoing electrocardiography (ECG), was given a diagnosis of premature ventricular bigeminy. He was admitted to the hospital at 3:17 pm 3 hours after ingesting the wine. He was then immediately transferred to our hospital without receiving further treatment.

When admitted to our hospital, the patient was conscious. Physical examination revealed equal respiratory

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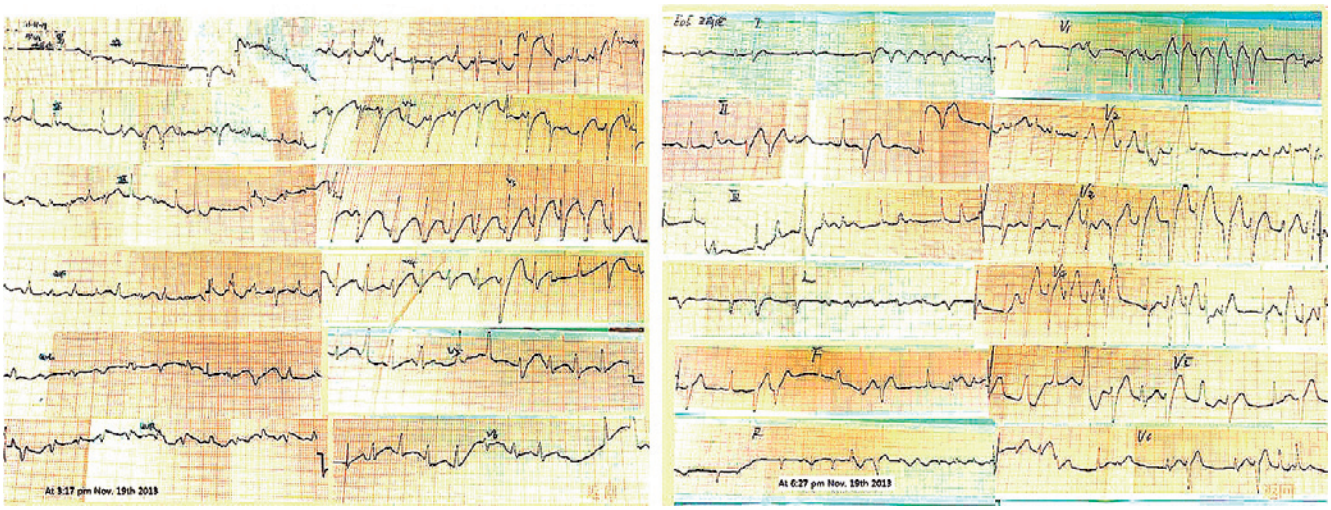

Fig. 1 Electrocardiography results immediately after admission

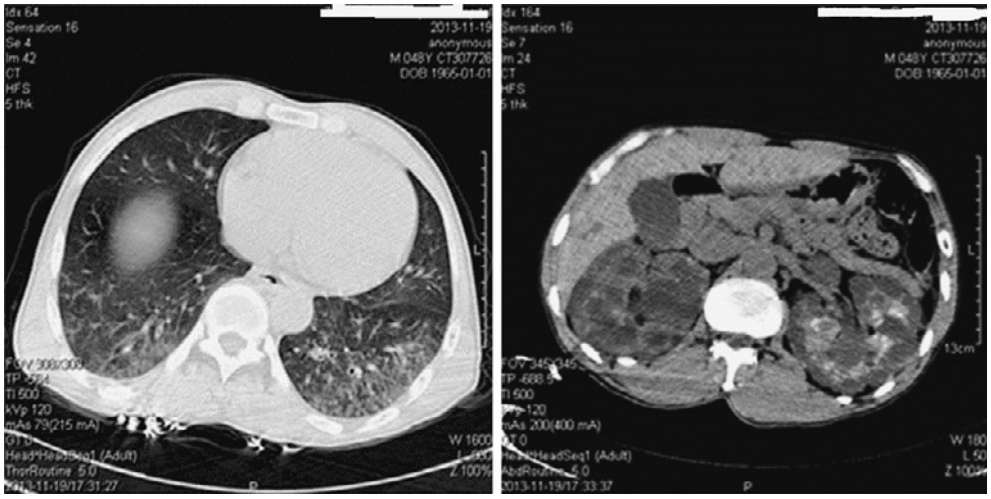

Fig. 2 Thoracoabdominal computed tomography scan

sounds in both hemithoraces, crude respiration, slightly moist rales in the bottoms of both lungs, a temperature of 36.2℃, a heart rate of 152 beats per minute, a respiratory rate of 22 per minute, a blood pressure of 90/67 mm Hg, and SpO_2 of 97% (oxygen uptake of 3 L/minute). The patient exhibited arrhythmia with frequent premature beats but no pathological murmurs. Percussion pain was experienced in both kidneys, and the patient had a limb muscle strength of grade IV. The patient confirmed that the herbal medicinal wine had been made with *caowu*. A medical interview revealed a family history of polycystic kidney disease.

After admission ECG showed sinus beats, frequent premature ventricular beats, paroxysmal atrial tachycardia, frequent polymorphic ventricular tachycardia, paroxysmal ventricular tachycardia, T-wave changes, and a prolonged Q-Tc interval (**Fig. 1**). A thoracoabdominal computed tomographic (CT) scan showed a mottled low attenuation mass in both lungs with an ambiguous margin. Renal changes indicated the presence of a polycystic kidney cyst with hemorrhage (**Fig. 2**). Acute aconitine poisoning complicated by polycystic renal hemorrhage was diagnosed. A liquid chromatography tandem-mass spectrometry method was developed to analyze aconitine in blood and urine samples, which were obtained immediately after the patient was admitted. The aconitine concentrations in the blood and urine samples were 5.3 ng/mL and 139 ng/mL, respectively. Other blood biochemistry results included a creatinine level of 118 μmol/L, a carbamide level of 8.54 mmol/L, a potassium level of 3.2 mmol/L, and an actic acid level of 3.1 mmol/L. The blood gas analysis results were pH 7.42; PaO_2, 125 mm Hg; $PaCO_2$, 24 mm Hg; Antibody (AB), 15 mmol/L; and Base excess (BE) −8 mmol/L.

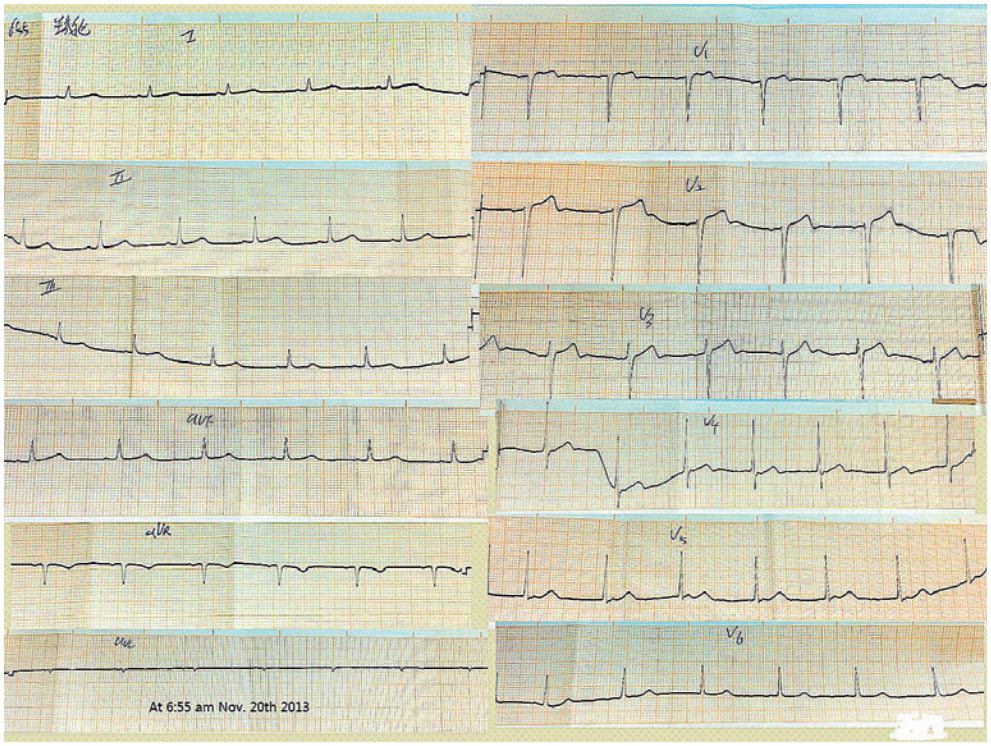

Fig. 3 Electrocardiography results the day after treatment

Treatment and Prognosis

Because of the rhythm instability, 50 g of acticarbon in 100 mL of water was administered orally instead of through a gastric lavage tube. Intravenous hydration was performed twice to treat the hypotension and frequent vomiting (2,250 mL of fluid containing 3.5 g of potassium chloride and 2.5 g of magnesium sulfate was infused with a urinary production of 400 mL within 6 hours after admission). Atropine (1 mg) was injected intravenously 7 times with an interval of 10 to 90 minutes. Intravenous injection of lidocaine (100 mL) was performed, repeated 15 minutes later, and was then followed by continuous intravenous infusion of lidocaine at a rate of 1.7 mg/minute using a micropump to treat the severe arrhythmia symptoms, such as frequent polymorphic ventricular premature beats and nonsustained ventricular tachycardia. The administration of lidocaine was stopped at 8:50 pm the same day because of a poor prognosis.

Hemoperfusion was started at 9:00 pm and continued for the following 3.5 hours with 2 perfusion devices. The first perfusion device contained no heparin, and the second device contained half of the normal dose of heparin. After hemoperfusion the blood pressure decreased to 80/50 mm Hg, and the patient's consciousness became dim. The consciousness level of the patient recovered after the injection of methylepinephrine to maintain the blood pressure at 120/70 mm Hg. The arrhythmia improved at 11:00 pm, although ECG still indicated a premature ventricular bigeminy (88 beats per minute).

At 6:00 am the next day, the results of ECG were normal (**Fig. 3**). At 11:15 am hemoperfusion was repeated once for 2 hours (a single perfusion device without heparin). Administration of methylepinephrine was stopped at 1:00 pm, when the patient sustained a stable blood pressure, warm extremities, and normal urine production. An abdominal CT scan performed on the third day showed polycystic kidney disease with hemorrhage. However, the amount of bleeding did not increase, and blood biochemistry tests indicated normal serum and urine creatinine levels. The patient was discharged from the hospital 1 week later.

Discussion

The clinical symptoms and laboratory tests of the present patient indicated a typical case of acute aconitine intoxication. The impairments of cardiovascular function and renal function, such as fatal ventricular arrhythmias and hypotension complicated with polycystic renal hemorrhage, were the main challenges of treatment.

Gastrointestinal absorption is the main route for aconitine poisoning. The symptoms of poisoning will appear 10 minutes to 3 hours after aconitine is orally ingested[7]. If treatment for the toxicity is delayed, the risk of mortality will increase. Aconitine is harmful to nerves and the

heart through the following poisoning mechanisms. First, aconitine continuously combines with and activates the voltage-sensitive sodium channels in cell membranes of the myocardium, nerves, and skeletal muscles to promote the inactivation of the fast response cells of the heart to cause arrhythmia[8,9]. Second, aconitine excites the vagus nerve to cause bradycardia and atrioventricular block and induces delayed arrhythmia and early arrhythmia after depolarization[10]. Third, aconitine excites the ventromedial nucleus of the hypothalamus to cause hypotension and bradycardia. The main clinical manifestations of aconitine poisoning include the impairment of the nervous, cardiovascular, and digestive systems. The symptoms include paresthesia or anesthesia of the face, mouth, and 4 limbs; hypotension, chest pain, palpitations, bradycardia, sinus tachycardia, and ventricular ectopic beats; and nausea, vomiting, abdominal pain, and diarrhea. The symptoms of our patient were consistent with those of aconitine poisoning.

In cases of aconitine poisoning the main causes of death are refractory ventricular arrhythmia and cardiac arrest[11]. Currently, the main treatment to rescue the lives of patients with aconitine poisoning is supportive therapy, which includes timely monitoring of organ function and blood pressure; ECG monitoring; emetics and gastric lavage; infusion and diuresis; using atropine to prevent excitation of the vagus nerve, lidocaine to treat ventricular arrhythmia, and dopamine to maintain the blood pressure; respiratory support; and blood purification[12]. In the present case, acticarbon was given orally at the beginning of treatment to eliminate the toxicity in the stomach. However, because of the severe arrhythmia, acticarbon treatment was not repeated. For the rescue of this patient from acute aconitine poisoning, we learned that the control of ventricular arrhythmia and shock were critical. To treat the frequent ventricular premature beats and ventricular tachycardia, treatment with hypokalemia, magnesium ion supplements, and lidocaine injections are important. Electrical cardioversion treatment should be applied when necessary. However, in the present case, atropine and lidocaine were ineffective for treating rapid ventricular arrhythmia. This result indicates that in treating rapid ventricular arrhythmia caused by aconitine poisoning we have limited experience.

Therefore, to explore effective treatments for the arrhythmia caused by aconitine poisoning, additional studies are required[13]. Pu et al. have reported that for treating ventricular tachycardia a high dose of lidocaine (200 to 300 mg for the first treatment and then continued intravenously with a maximum dosage of 1,400 mg per hour) has a faster effect than a normal dosage but has no severe side effects[14]. Yeih et al. have reported a case of polymorphic ventricular tachycardia that was treated successfully with amiodarone after lidocaine treatment failed[13]. Evidence from clinical practice has suggested that for treating ventricular tachycardia the appropriate first-line medications may be amiodarone and flecainide[7]. In the treatment of refractory ventricular arrhythmia, cardiogenic shock, and pulmonary edema, the performance of cardiopulmonary bypass during the early stage to maintain systemic hemoperfusion and tissue oxygenation is helpful for rescuing patients[15].

For clearing aconitine from the blood and promoting recovery from intoxication and cardiac function, blood purification plays a key role. Lin et al. have proposed that blood purification might play an important role in the treatment of ventricular arrhythmia that is insensitive to antiarrhythmic drugs[7]. This possibility is supported by the present case, in which the patient rapidly recovered from ventricular arrhythmia and other clinical symptoms after hemoperfusion. In this case, low back pain caused by polycystic kidney disease and complicated by hemorrhage was the reason that the patient ingested the herbal medicinal wine made from *caowu* and became intoxicated. The polycystic kidney disease complicated by hemorrhage not only worsened kidney function but also caused additional problems for heparin usage during blood purification. Blood coagulation is a common complication during hemoperfusion and can seriously affect the rescue effort. Therefore, systemic heparinization is usually administered during hemoperfusion. However, heparin may induce or increase bleeding. To avoid an increase in bleeding, except for rinsing the perfusion devices with heparin saline, the dosage of systemic heparinization in this case was reduced, and 2 perfusion devices were used for the first perfusion to avoid blood coagulation. The results demonstrated that the decreased dosage of systemic heparin did not worsen the renal cyst hemorrhage and did not affect the treatment. Currently, few studies of heparin-free hemoperfusion have been reported. A study by Cao et al. suggests that heparin-free hemoperfusion is helpful for avoiding bleeding or worsening the bleeding in patients with acute intoxication who are bleeding or have a bleeding tendency[16]. However, more studies are needed regarding the successful performance of heparin-free hemoperfusion.

Conclusion

The successful rescue of this patient significantly improves our understanding of hemoperfusion with reduced heparin in the treatment of ventricular arrhythmia caused by aconitine poisoning and complicated by polycystic renal hemorrhage.

Conflict of Interest: There is no conflict of interest for this manuscript.

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