

A Case of Severe Puffer Fish Poisoning: The Best Time to Establish Artificial Airway

Siqi Zhu (✉ 13510331323@163.com)

Peking University Shenzhen Hospital <https://orcid.org/0000-0003-0267-3500>

Ying Yang

Peking University Shenzhen Hospital

Zhao Fan

Peking University Shenzhen Hospital

Qidi Zhou

Peking University Shenzhen Hospital

Xiaoran Fan

Peking University Shenzhen Hospital

Case Report

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Abstract

Background Puffer fish poisoning is one of the main causes of death from food poisoning in China. Currently, there is still no effective treatment method. The establishment of artificial airway and early implementation of mechanical ventilation are crucial to the prognosis of patients, but the optimal time is still not clear.

Case Presentation A 62-year-old male patient complained of 'numbness around the mouth for 3 hours after eating puffer fish' was admitted to the emergency department, he was performed gastric lavage in time, but did not be performed protective endotracheal intubation. His condition worsen rapidly and respiratory and cardiac arrest was quickly occurred. He received aggressive treatment in the ICU, but still did not regain spontaneous breathing.

Conclusion The establishment of artificial airway and early implementation of mechanical ventilation are crucial for the prognosis of patients, and we provide possible principles for performing endotracheal intubation.

Background

Puffer fish is a valuable food among asian cultures and is safe for regular use in some countries (such as Japan) [1], but tetrodotoxin (TTX) in it may still cause human poisoning if not properly cooked [1–3]. TTX has posed a threat to human health in asian countries and has spread to the Pacific and Mediterranean regions due to global sea temperature rise [2, 3]. In China, puffer fish poisoning is also one of the main causes of death from food poisoning [4]. TTX is one of the most powerful neurotoxins known to cause death in patients due to respiratory or heart failure [2, 3, 5]. Mechanical ventilation is a key measurement for the treatment of severe puffer fish poisoning [2, 5]. However, when to establish artificial airway is still unclear. This paper intends to explore the best time to establish artificial airway through reviewing a case of severe puffer fish poisoning.

Case Presentation

- The 62-year-old male patient was admitted to the emergency department at 21:25 on December 23, 2019, complained of 'numbness around the mouth for 3 hours after eating puffer fish'. The patient ate pufferfish (a piece of fish and liver, a bowl of fish soup) at around 19:00 on that day. After about half an hour, he developed numbness around his mouth and gradually developed numbness in his tongue and limbs. He had no dyspnea, speech disorder, swallowing difficulty, body movement disorder, dizziness and headache. He had eaten puffer fish for many times in the past few years without any uncomfortable symptoms. He had a history of gout, and the treatment was unknown. He

denied the history of hypertension, diabetes, coronary heart disease and other diseases, and denied the history of food and drug allergy. Vitals: body temperature: 36.3°C, pulse rate: 128 beats/min, respiratory rate: 20 beats/min, blood pressure: 148/78 mmHg, pulse oxygen saturation: 99%. He was sane, fluent speech, and his bilateral nasolabial sulci was symmetrical. He was clear to auscultation of both lungs, and no rhonchus or moist rhonchus. His heart rhythm was normal, and no pathologic murmurs. His abdomen was soft, and no tenderness or rebounding pain. No edema was found in both lower limbs. The attending doctor immediately gave him gastric lavage treatment and a monitoring was made. The patient felt uncomfortable during gastric lavage. The gastric lavage tube was removed at 21:40, and the patient complained of numbness of the tongue and was vague in his speech. During this period, monitoring showed that the patient's heart rate was between 118–130 beats/min, respiratory rate was between 20–30 beats/min, blood pressure was between 140/80–189/110 mmHg, and pulse oxygen saturation was between 98%–99%. At 22:30, gastric lavage treatment was made again, but he was sudden loss of consciousness with blausucht at 22:44, and his artery pulse disappeared. The attending doctor checked the mouth of the patient and no vomit were found. Cardiopulmonary resuscitation (CPR) was immediately started, and he was admitted to intensive care unit (ICU) for further treatment. After resuscitation, emergency bedside echocardiography showed no abnormal ventricular segmental motion and no pericardial effusion. No lung exudation, pneumothorax and other lesions were found on emergency chest radiographs. Emergency laboratory tests showed that white blood cell (WBC), red blood cell (RBC) and platelet counts were in the normal range. Liver and kidney function and electrolyte were basically normal. Both the hypersensitive troponin T (hs-cTnT) and troponin I (TnI) were in the normal range. During his stay in ICU, he was given comprehensive treatment such as blood perfusion, catharsis, neurotrophic therapy, brain cell protection therapy, anti-oxidation, correct acidosis, fluid replenishment, electrolyte correction, and anti-infection. The patient was still in coma and failed to recover from spontaneous breathing. He was transferred to another hospital for hyperbaric oxygen treatment on December 31, 2019.

Disscussion

- A poison isolated from the ovaries of puffer fish by Dr. Yoshizumi Tahara in 1894 was named TTX in 1909 [2, 6]. TTX is mainly found in the liver and ovaries of puffer fish. It binds to the sodium channels of human excitable tissues (muscles and nerves), inhibits the influx of sodium ions, affects the generation of action potentials and impulse conduction, and causes paralysis of nerves and muscles [2, 3, 5–8]. The severity of symptoms caused by TTX is related to dose and individual differences [2, 3, 8]. Symptoms usually appear within 30 minutes to 6 hours after eating [2, 5, 7], TTX is excreted from urine within 8 hours [5, 7], and symptoms recover within 24 hours [2]. However, people who intakes large numbers of puffer fish can become ill within 30 minutes [5, 8]. Fukuda ranks fugu poisoning at four grades based on symptoms: Grade 1 is neuromuscular symptoms (perioral paresthesia, headache, sweating, pupil constriction) and mild gastrointestinal symptoms (nausea, vomiting, excessive salivation, hematemesis, diarrhea, abdominal pain); Grade 2 is paresthesia

extending to the trunk and limbs, early motor paralysis and lack of coordination;Grade 3 is neuromuscular symptoms worsen, dysarthria, dysphagia, sleepiness, ataxia, floating feeling, cranial nerve palsy, muscle tremor, etc.), heart/lung symptoms (low blood pressure, or hypertension, vasomotor dysfunction, cardiac arrhythmias, cyanosis, pale, difficulty breathing, etc.), skin symptoms (bruises, exfoliative dermatitis, blisters), hypotension and aphasia;Grade 4 is delirium, respiratory paralysis, severe hypotension, and arrhythmia [2, 5, 7, 8].Generally, grade 3 and grade 4 are considered as severe puffer fish poisoning [5, 7].

- Currently, there is no specific treatment for puffer fish poisoning. For patients with severe puffer fish poisoning, timely establishment of artificial airway and implementation of mechanical ventilation is the key to treatment [2, 5, 7, 8].It is important to note that although there is conscious and spontaneous breathing, the severe globefish fish poisoning patients do not appear to breathe myoparalysis at first, but may have the decrease of the tidal volume and minute ventilation and insufficient ventilation because of strength decline[5].So, taking protective endotracheal intubation, or establishmentment of artificial airway, and early implementation of mechanical ventilation is very important.In general, the indications for protective endotracheal intubation are as follows: 1.Coma patients, especially those at risk of inhalation;2. Patients with obvious changes in autonomic respiratory rate and rhythm;3.Patients with cerebral hernia may cause respiratory and cardiac arrest;4.Patients with serious condition and will deteriorates rapidly, which may lead to respiratory and cardiac arrest;5. Patients who requiring prolonged mechanical ventilation due to severe hypoxemia or hypercapnia or other reasons;6. Patients with large-scale trauma of the whole body, especially those who with severe brain injury [9, 10].However, protective endotracheal intubation is associated with pneumonia, length of ICU stay, death and cost [11]. In addition, for patients with mild poisoning, due to their spontaneous breathing, muscle relaxants are needed to establish artificial airway, which may aggravate the risk of respiratory muscle paralysis and cause medical disputes.Therefore, it is extremely important to know the best time to establish an artificial airway.
- In this case, the patient was diagnosed as grade 1–2 puffer fish poisoning according to the symptoms at the time of admission. We performed gastric lavage in time, but did not perform protective endotracheal intubation. However, the patient's condition progressed rapidly and respiratory and cardiac arrest quickly occurred.The patient had no underlying heart disease, the cardiac marker troponin was normal after resuscitation, and no segmental ventricular wall motion abnormalities were found on echocardiography. We believed that acute myocardial infarction could be excluded, and pericardial effusion and cardiac tamponade could be excluded on echocardiography.After receiving the diagnosis, the patient found high blood pressure, but no chest pain, abdominal pain, etc.Echocardiography did not indicate aortic widening, blood pressure was stable during the ICU hospitalization, and there was no evidence of aortic dissection.During gastric lavage, the patient had cardiac and respiratory arrest. However, we checked that there was no vomit or secretions in the oral cavity, so there was little possibility of suffocation.The patient had no history of pulmonary basic diseases, and no pulmonary exudative lesions and pneumothorax were found on chest radiographs, acute respiratory distress syndrome and pneumothorax could be rull out.The patient had good normal activities, and echocardiography showed no signs of right ventricle

enlargement or pulmonary hypertension, so the possibility of pulmonary embolism was also low. After the patient arrived at the hospital, his symptoms worsened, from numbness around the mouth to the tongue and slurred words, and finally cardiac and respiratory arrest occurred. Based on the above analysis, we believed that his cardiac and respiratory arrest was caused by acute pufferfish poisoning. The patient had a poor prognosis. We reflected on the treatment process of the case and believed that the establishment of artificial airway as early as possible might be helpful to the prognosis of the patient. Therefore, we believe that the timing of the establishment of artificial airway in puffer fish poisoning patients should be determined according to the severity of the disease, the speed of disease progression, the risk of deterioration, and the basic condition of the patients. Specific indications are as follows: 1. Patients with grade 3 or above of Futian poisoning should establish an artificial airway immediately; 2. Symptoms of poisoning occur in a short time, especially in patients with symptoms within 30 minutes after eating. 3. For grade-1 patients who progress rapidly to grade-2 during treatment or still progress after active treatment for 6–8 hours, an artificial airway should be established immediately; 4. Patients who eat the liver or ovaries of puffer fish, eat large amounts of fish, or drink alcohol at the same time should establish artificial airway immediately, no matter what grade they are at at the time of treatment; 5. Artificial airway should be established before gastric lavage in patients with previous basic diseases such as cerebrovascular disease and risk of aspiration; 6. Artificial airway should be established immediately in elderly patients or patients with liver and kidney dysfunction, which may lead to toxin metabolism disorder or delayed excretion. In addition to the above, all patients should assume that an artificial airway needs to be established urgently, and prepare the personnel and materials for the establishment of the artificial airway in advance.

Conclusion

- In conclusion, puffer fish poisoning is one of the main causes of death caused by food poisoning in China. Currently, there is still no specific treatment method. The establishment of artificial airway and early implementation of mechanical ventilation are crucial for the prognosis of patients, and we provide possible principles for performing endotracheal intubation.

Abbreviations

TTX

tetrodotoxin

CPR

cardiopulmonary resuscitation

ICU

intensive care unit

WBC

white blood cell

RBC
red blood cell

hs-cTnT
hypersensitive troponin T
TnI
troponin I

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Written informed consent for publication of the clinical details was obtained from the patient.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on request.

Competing interests

The authors declare that they have no competing interests.

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Authors' information

Emergency Department Peking University Shenzhen Hospital, 1120 Lianhua Road, Futian District
Shenzhen, 518036, Guangdong, China

Siqi Zhu, Ying Yang, Zhao Fan, Qidi Zhou & Xiaoran Fan.

Corresponding author

Correspondence to Siqi Zhu

Authors' contributions

SQZ had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis; SQZ, YY participated in the treatment of this patient and were involved

in the development of the conclusions. SQZ,XRF collected all datas; SQZ wrote the first draft with assistance from YY and ZF ,and SQZ edited the final draft. QDZ made critical revision of the article for important intellectual content. All authors agreed with the results and conclusions of this article. All authors read and approved the final manuscript.

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