A Case Report of Puffer Fish Poisoning from United Arab Emirates

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Received: 1 June 2021

Accepted: 2 March 2022

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DOI 10.5001/omj.2023.23

ABSTRACT:

Lagocephalus sceleratus, better known as the puffer fish, or fugu, is considered a decadent delicacy in Asia, although it is a well-known source of deadly food poisoning. Puffer fish contain a potent neurotoxin, called tetrodotoxin (TTX). This toxin usually causes a group of symptoms which include weakness, light-headedness, paresthesia of the face and extremities, nausea, and loss of reflexes. In severe toxicity, death occurs due to respiratory failure and cardiovascular collapse. TTX poisoning is common along the coasts of Asian countries. Here, we report a case of a 19-year-old man who presented with signs and symptoms suggestive of puffer fish poisoning. Laboratory investigations and imaging were normal, but dietary history was the key to diagnosis. Early recognition of this condition and proper supportive management is essential for survival.

Keywords: Puffer Fish, Poisoning, Tetrodotoxin, United Arab Emirates

INTRODUCTION:

Puffer fish poisoning is a well-known type of fish poisoning, its lethality is credited to tetrodotoxin (TTX). TTX poisonings have been reported in Japan, Taiwan, Hong Kong, Cambodia, Bangladesh, and the United States. Fugu or puffer fish dishes are usually prepared by licensed puffer fish cooks only in Japan. Despite this, two hundred twenty-three Japanese patients have suffered TTX poisoning, and thirteen of these patients died from 2002 to 2006. Fifty-three patients in Singapore were diagnosed with TTX poisoning, and 8 of these patients died from 2001 to 2006. In 2008, three outbreaks

happened in Bangladesh, affecting one hundred forty-one people, seventeen of whom died from respiratory arrest. Ten incidents of puffer fish poisoning were reported in Hong Kong which involved twenty-three persons with one fatality from 1993 to 2006 [1]. Exact mortality rates are difficult to determine due to the disease's rarity. The main mechanism by which TTX affects the body is through sodium (Na+) channel blockage at heart myocytes, skeletal muscles, the central and peripheral nervous system which results in a variety of clinical features from mild symptoms reaching to respiratory arrest and death. Medical history is the cornerstone of making diagnosis especially in the absence of TTX level. Diagnosis can be confirmed through TTX estimation by blood or urine. Treatment of puffer fish poisoning consists of supportive care. Management is based on continuous support till the toxin excreted through urine. Few medications trials were advocated but without satisfactory results.

In literature, no previous reports of such cases were found in the United Arab Emirates, so we report a case of severe poisoning, and suggest observations for such a presentation in the Middle east. Studies that support and oppose the use of anticholinesterase inhibitors in TTX poisoning are limited, but we believe that it enhanced our patient’s recovery.

CASE REPORT:

A previously well 19-year-old man with no significant past medical history brought by national ambulance because of difficulty in breathing for thirty minutes. He woke up with repeated vomiting, followed by difficulty in breathing for which national ambulance was contacted. Paramedic arrived at his home and assessed his condition, he was awake, alert and oriented, the airway was patent, breathing initially was adequate, and there were no signs of bleeding. During assessment, his level of consciousness rapidly deteriorated, and became unresponsive. He became pulseless while shifting him

to the ambulance and Cardiopulmonary resuscitation was commenced as per Advanced Cardiovascular Life Support (ACLS) protocol. Return of spontaneous circulation was achieved after two cycles of CPR and was intubated. He arrived at the emergency room after fifteen minutes.

On arrival, his vital signs were within normal range, maintaining oxygen saturation above 98% on mechanical ventilation. Central nervous system examination showed bilaterally dilated pupils measuring 6mm, reactive and round, his Glasgow Coma Scale (GCS) was 3/15. Respiratory, cardiovascular and abdominal examination was non-significant. Random blood sugar was 8.7mmol/L, and urine ketones was negative. Electrocardiogram reported normal, with no arrhythmias. Full blood count and electrolytes were within normal limits. Urgent CT brain without contrast was ordered and the report was unremarkable. Toxicology screen was unremarkable. Arterial Blood Gas (ABG) showed respiratory acidosis, with the following readings: pH: 7.32, pO2: 99.8 mmHg, pCO2: 55 mmHg, HCO3: 23.5 mmol/L.

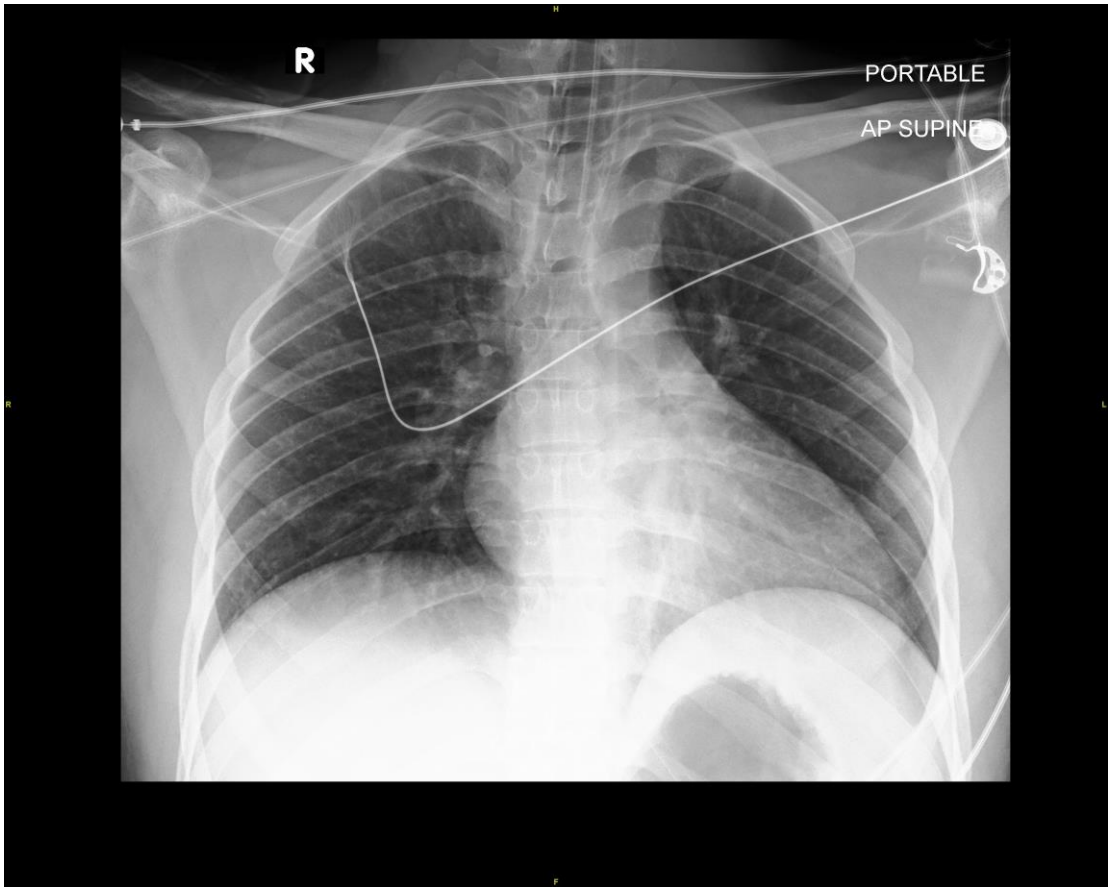

Figure 1: Chest X-Ray Portable shows unremarkable study.

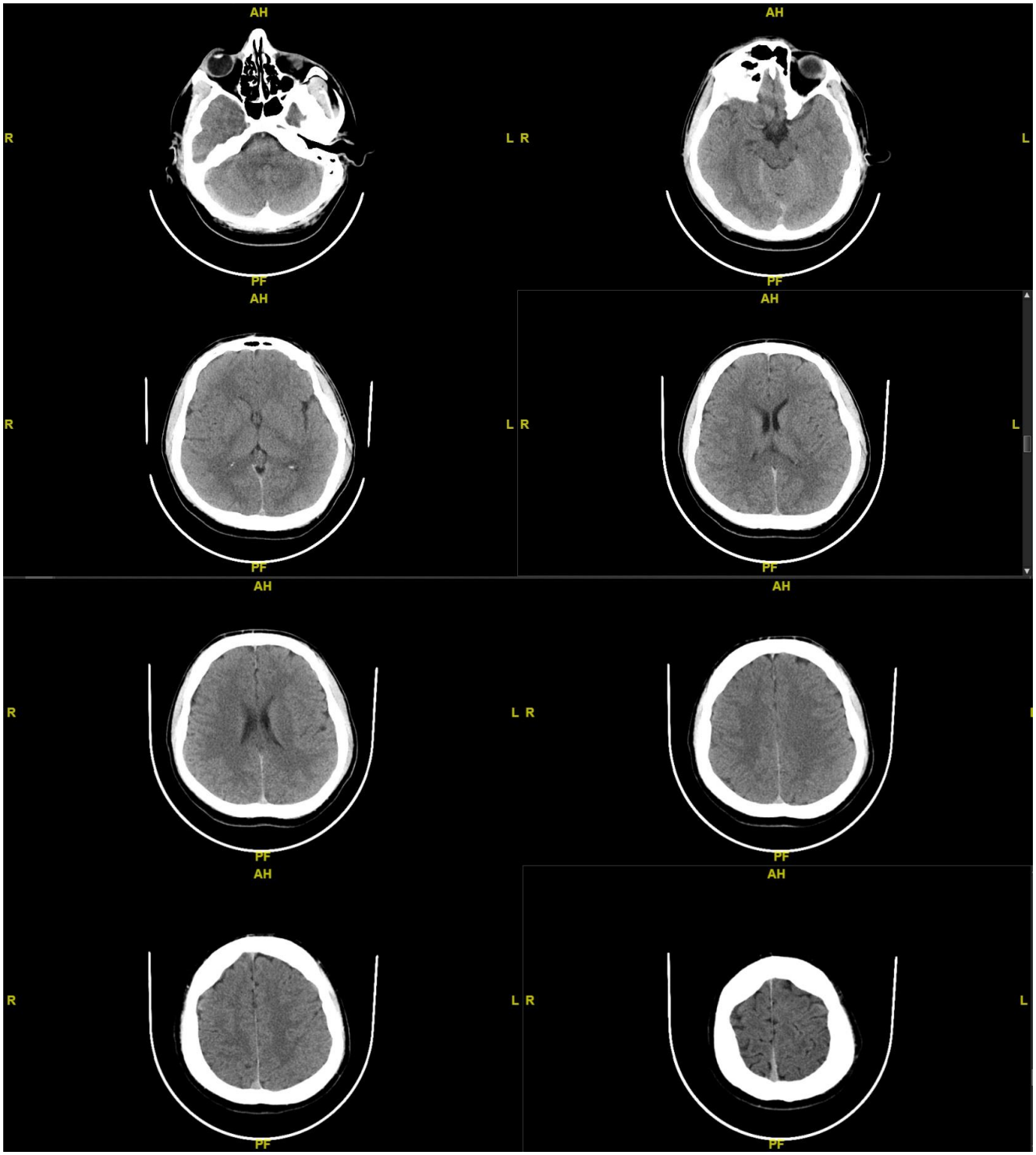

Figure 2: CT Head or Brain without contrast shows normal brain scan with no CT evidence of vascular insult or space occupying lesions.

After taking history from the family, we concluded that the patient ingested grilled puffer fish for his dinner twenty minutes before sleeping, which was confirmed by a photo of the fish. Gastric lavage was done and activated charcoal was given. Then shifted to the ICU for close monitoring. After the review of related articles, an anticholinesterase inhibitor was considered.

He started responding after two doses of intravenous neostigmine 2.5mg, regained consciousness after six hours and was extubated. Next day, he remained conscious, alert and oriented, maintaining oxygen saturation on room air, and vital signs were within normal range. CNS examination showed rounded, regular and reactive pupils, with a GCS of 15/15. His ABG normalized, with the following readings: pH: 7.46, pO2: 103 mmHg, pCO2: 35 mmHg, HCO3: 24.5 mmol/L.

During hospitalization, after transferring him to the medical ward, he experienced unsteady gait, but improved gradually. He was discharged home after three days. Later, following discharge, he visited the Emergency department for mild headache and dizziness, for which MRI was done and it was reported as a normal study, he was diagnosed with tenson headache and analgesics were prescribed. Follow up one month later in the outpatient clinic, he was completely fine and free of symptoms.

DISCUSSION:

Tetrodotoxin (TTX) is one of the deadliest natural toxins, mainly concentrated in the liver, ovaries and other body parts, such as the intestine. It was found that washing, cooking, or other food preparation doesn't destroy the toxin. This neurotoxin acts on peripheral, motor, sensory, and autonomic nerves. It has a direct central effect on the chemoreceptor trigger zone causing nausea and vomiting, on the respiratory centre leading to depression of respiration, and may cause a drop in blood pressure by relaxing vascular smooth muscle and blocking peripheral autonomic nerves [2]. TTX blocks Na+ conductance by binding extracellularly at the receptor site of Na+ channels. Therefore, Na+ influx is prevented, action potentials hold off, and nerve excitability is suppressed. However, this is not the case in puffer fish themselves, it does not manifest TTX toxicity because they lack TTX-binding sites in the Na+ channels [3].

Clinical features include headache, diaphoresis, body numbness, dysarthria, dysphagia, nausea, vomiting, abdominal pain, generalized malaise, weakness, and lack of coordination. In severe cases, hypotension, cardiac arrhythmias, muscle paralysis, and cranial nerve dysfunction may develop. Death results from respiratory failure and cardiovascular collapse [4]. The duration and severity of symptoms is determined by the quantity of TTX consumed, and usually the onset is thirty minutes to 6 hours after ingestion [1].

Table 1: In 1941, Fukuda and Tani provided a clinical grading system for TTX poisoning [5].

Grade 1	Perioral numbness and paraesthesia, with or without gastrointestinal symptoms (mainly nausea, vomiting, abdominal pain, diarrhoea).	5–45 minutes
Grade 2	Lingual numbness, numbness of face, and other areas (distal). Early motor paralysis and in-coordination. Slurred speech. Normal reflexes.	10–60 minutes
Grade 3	Generalized flaccid paralysis, respiratory failure, aphonia, and fixed or dilated pupils. Patient is conscious.	15 minutes–several hours
Grade 4	Impaired conscious state, respiratory paralysis, severe hypotension, and cardiac arrhythmia.	15 minutes–24 hours

Diagnosis is usually made through history taking, clinical findings and toxidrome. Dietary history is the key for diagnosis. In the absence of a positive history of puffer fish consumption or the detection of TTX in leftover food, determination of TTX in the patient's urine and/or plasma by mass spectrometry (MS) methods is essential to confirm the diagnosis. Earlier studies have revealed that TTX only remains in the plasma component of the blood for a matter of hours (less than 24 hour), but can be found in urine even on day four after ingestion [6].

As of now, there isn’t any particular curative set of medications for TTX poisoning; the only viable plan of care is to treat the symptoms and give supportive treatment as addressed below. Mainstay of treatment is supportive care especially respiratory support until the TTX is excreted in the urine. Within sixty minutes of ingestion of the toxin, giving activated charcoal and performing gastric lavage or inducing vomiting can be effective in the management of TTX poisoning [7]. Respiratory support includes endotracheal intubation in cases of difficulties with salivation and respiratory secretions, and when respiration becomes shallow and dyspnoea occurs. Ventilatory insufficiency due to respiratory muscle paralysis is a clear indication for assisted or controlled ventilation which is life-saving. If after a short period, patients with severe TTX poisoning are maintained with adequate respiratory support, in addition to early diagnosis and supportive management, the patients can usually recover completely [7].

Monoclonal antibody against tetrodotoxin (anti-tetrodotoxin) is available, but no studies on efficacy have been published [1]. Evidences found in case reports and series are insufficient and limited for or against the use of anticholinesterases such as edrophonium or neostigmine [8]. In view of the clinical response of three patients in a study by Chew et al., with TTX poisoning treated by anticholinesterase drugs, it is likely that TTX causes a competitive reversible block at the motor end-plate as well as at the motor axon and muscle membrane. This blockage can be reversed by increasing the quantal release of acetylcholine at the neuromuscular junction by anticholinesterase drugs [9]. Study by Ahsan et al. showed that anticholinesterase drugs possibly enhanced muscle paralysis recovery [10]. Considering tetrodotoxin is less stable in an alkaline environment, administration of 2% sodium bicarbonate has been proposed. In addition, cysteine is stated to be effective in particular cases of puffer fish poisoning [4].

In Japan, the fatality rate fell from 80% at the beginning of the last century, with more than 100 deaths per year, to about 6% in the 90's due to the improvement of early life-saving systems in emergency medicine. In other Asian countries, mortality rates between 2–22% were reported [6].

In our case, patient had a grade four TTX toxicity as per Fukuda and Tani grading system, and there was a drastic improvement in the patient's status following the administration of neostigmine. Initially, he suffered from respiratory muscle paralysis that led to cardiac arrest. Return of Spontaneous Circulation (ROSC) was achieved after two cycles of Cardiopulmonary Resuscitation (CPR), for which he required mechanical ventilation and admission to the Intensive Care Unit (ICU). Two doses of neostigmine were administered and resulted in dramatic clinical response. The following morning patient was extubated and became fully conscious and oriented. Although tetrodotoxin may be quantified in serum, whole blood, or urine to confirm the diagnosis, these tests are not available to us locally. Literature was reviewed and elicited two similar articles; a case series and case report. CK et al. reported seven patients presenting with signs of pufferfish poisoning with different grades of severity, most of the patients didn't require ICU admission, and one of the patients had grade three poisoning and required intubation post admission [11]. As for Zhu et al. light was shade on the importance of artificial airway and early implementation of mechanical ventilation, the case was diagnosed with grade one to two puffer fish poisoning at admission, patient had no protective endotracheal intubation initially and arrested following worsening respiratory status [12].

Other causes of respiratory failure and cardiac arrest were ruled out based on the overall clinical picture and positive history of puffer fish ingestion. Because the patient had no previous history of hospitalization or emergency visits for abdominal pain, and no prior history of fatigue and weakness, and had no symptoms at his follow-up visit, acute porphyria and myasthenia gravis was ruled out, respectively.

In conclusion, this research article highlights the equal importance of thorough preparation and active awareness in the regions of countries where poisonous fish is sold to the general population or fishing is common. Food and dietary history are vital, especially in younger patients who present with nonspecific neurological signs and symptoms after a meal. Health practitioners should be aware of the

condition, as to initiate early and appropriate management. Even though there are no sufficient articles supporting the use of anticholinesterase drugs, our patient vastly improved after receiving it.

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