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ORIGINAL ARTICLE/ARTICLE ORIGINAL

Acute paralysis after seafood ingestion

Paralysie aiguë après ingestion de fruits de mer

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Summary The first European case of tetrodotoxin intoxication is reported in a patient who ingested a trumpet shellfish from the Atlantic Ocean in Southern Europe. He suffered general acute paralysis with respiratory failure necessitating ventilation. Early neurophysiologic studies showed complete peripheral nerve inexcitability, with no recordable sensory or motor responses, and normal electroencephalography. Tetrodotoxin was detected in high quantities in the patient's blood and urine through high performance liquid chromatography-mass spectrometry analysis. Seventy-two hours after admission the patient recovered normal strength, reflexes and sensation.

Résumé Le premier cas européen d'intoxication par tétrodotoxine est rapporté chez un patient ayant ingéré un coquillage trompette de l'océan Atlantique, dans le sud de l'Europe. Il a développé une paralysie générale aiguë et une insuffisance des muscles respiratoire justifiant une intubation. Les études neurophysiologiques ont montré une inexcitabilité nerveuse initiale totale, motrice et sensitive, et un électroencéphalogramme normal. La tétrodotoxine du mollusque a été retrouvée en quantités élevées dans le sang et l'urine du patient par une analyse en chromatographie liquide à haute performance couplée à une spectrométrie de masse. L'évolution a été rapidement favorable en 72 heures.

Introduction

Toxins are substances that are synthesized by living organisms, which are harmful to humans. These can be produced by some bacteria, fungi, vertebrates, or marine microorganisms [11], which usually live in symbiosis with reefs in

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tropical and subtropical waters. Some micro-algae synthesize a large group of toxins, known as ''paralytic shellfish poisoning'', which have a chemical structure consisting of a common quinazolinic derivative with different associated ions. The toxin is especially accumulated in the fish skin and gonads and in the mollusk intestine and liver, and its level increases by bioaccumulation throughout the food chain from micro-algae to humans. While toxins do not affect fishes [6], humans can be affected. Tetrodotoxin (TTX) is considered the most lethal toxin originating in the marine environment. Its name comes of the *Tetraodontidae* family, but it was later found in other fishes and mollusks [15].

We present the case of a man who ingested a contaminated trumpet shellfish captured in the southern coast of Europe with large concentrations of TTX.

Case report

The patient was a 49-year-old male, without any previous story or treatments. A few minutes after eating the ventral serving of trumpet shellfish, he started to feel perioral numbness, which then extended towards both arms, followed by abdominal pain, nausea and throwing up. Some minutes later on, he developed palsy. Upon the arrival of the emergency services, he was conscious, with general muscle weakness, absence of brainstem and deep reflexes but normal vital signs. Oro-tracheal intubation and mechanical ventilation were required because of breathing difficulties.

Computed tomography and magnetic resonance imaging were normal, both at supra tentorial and brainstem levels. Heart rhythm was normal at 95 beats per minute. Laboratory results, including liver and renal function, blood examination, coagulation and cerebrospinal fluid were normal.

He was admitted in the intensive care unit (ICU) where the only administrated sedatives were Midazolam® 10 mg and Succinylcholine® 80 mg for intubation. The patient still presented general muscle weakness. After 24 hours, he started to show minimal motor activity, with a completely normal level of consciousness during the following hours. After 6 hours, he started moving his neck muscles, and the oro-tracheal tube was removed after 24 hours. The patient was discharged from the ICU 72 hours after admission, having recovered normal levels of strength, reflexes and sensation.

Neurophysiological examinations

Neurophysiological studies were performed 24 hours, 48 hours, and 4 weeks after ingestion. Results were compared with previously established normative data.

An electroencephalogram was performed after 24 hours, while the patient was intubated, but without any sedatives or muscle relaxants. It was normal, with alpha and beta rhythms and good reactivity.

Electroneurography (ENG) of median, ulnar, peroneal, tibial, and facial nerves with surface and needle intramuscular recording electrodes (Sierra II, Cadwell®) showed profound loss of nerve excitability, without any recordable motor or sensory responses even with supramaximal intensities (100 mA, 1 ms) (Tables 1 and 2). Insertion activity was abolished and no spontaneous or voluntary activity could be detected by needle electromyography (EMG).

After 48 hours, only motor responses could be recorded. These were abnormal with reduced amplitude but a normal morphology of the compound muscle action potentials, prolonged distal latencies, and reduced conduction velocities. No signs of temporal dispersion or conduction block were noted at any stimulation points (Table 2). F-wave latencies were either absent or prolonged (Table 3). Repetitive ulnar-nerve stimulation at 3 and 10 Hz gave rise to normal results. There was no spontaneous activity at needle EMG, and motor unit potentials and recruitment were normal.

After 4 weeks, sensory nerve action potentials were still absent or of low amplitudes with prolonged distal latencies (Table 2). Motor conduction velocities and other conduction parameters had returned to normal (Table 1). Normal F-wave responses were obtained (Table 3).

Biochemical studies

The non-ingested part of the shellfish was frozen and a mollusk bioassay was carried out to determine the biotoxins. The results showed 151 and 25,500 μg of toxin/100 grams in the mollusk's meat and digestive glands, respectively; these values are much higher than the upper limit allowed by Spanish legislation (80 μg/100 grams).

The remaining part of the mollusk and patient's urine and blood samples were both sent to the department of pharmacology laboratory, Santiago University, Spain, in order to be analyzed in the same conditions. High-performance liquid chromatography-mass spectrometry (HPLC-MS) analysis was carried out. The mass spectrometer was operated in enhanced mass spectrum (EMS) mode to confirm the TTX presence, and in enhanced product ion (EPI) mode to quantify the toxin. A sample of the trumpet shell digestive gland was homogenized and extracted according to the official procedure for PSP [14]. The level of TTX in the trumpet shellfish was 24.85 mg/100 grams of digestive gland and in the patient's urine and blood samples 285.38 ng/mL and 24.54 ng/mL, respectively. Therefore, the presence of TTX in the mollusk and the patient's blood and urine was confirmed.

Discussion

All cases of TTX intoxication described so far appeared in the tropical and subtropical regions of Asia and the Pacific [1,4,7,13] or in the USA, in which case these were caused by fish imported from Japan or Taiwan [2]. Our case is the first report of TTX intoxication from fish captured in the European coast. The trumpet shellfish ingested by the patient belonged to the species *Charonia lampas lampa*. It had been captured in the Portuguese coast.

Both the intensity and speed of development of symptoms depend on concentrations of the toxin in the mollusk digestive glands. No antidote is available after toxin ingestion and the specific treatment must be supportive. The ingestion without treatment has a mortality rate that can reach 60%. In our case, the onset and severity of symptoms corresponded to the maximum degree of TTX intoxication. Just before consumption, the shellfish was boiled for 45 minutes, but this failed to reduce toxicity as TTX is heat-stable, nor is it damaged by freezing [12].