CASE REPORT

Lionfish poisoning: a rare clinical case

Avvelenamento da pesce leone: un raro caso clinico

Margherita Moretti * **Jole Serra °**

Abstract: Poisoning by Scorpaenidae, including lionfish, is rare and typically occurs in tropical countries, although cases of injury caused by Scorpaenidae have been reported in the literature, even in non-tropical areas. We present a clinical case that occurred in the emergency room of Beirut Military Hospital and was treated by Italian healthcare teams. The clinical manifestations and clinical-therapeutic management are reported alongside references to existing scientific literature.

Riassunto: L'avvelenamento da Scorpaenidae, tra cui il pesce leone, è un evento raro e tipico dei paesi tropicali sebbene in letteratura siano descritti molteplici casi di lesioni causate da Scorpaenidae anche in aree non tropicali. Si riporta un caso clinico avvenuto nel pronto soccorso dell'Ospedale Militare di Beirut trattato dai team sanitari italiani in cui saranno riportati le manifestazioni cliniche e la gestione clinico terapeutica con riferimento letteratura scientifica esistente.

Key words: Scorpaenidae, fish envenomation, Lion fish, clinical treatment.

Key messages:

- Adequate information for healthcare professionals on the initial management of cases of poisoning by marine species ensures favourable clinical outcomes.
- In cases of Scorpaenidae poisoning, soaking the affected area in hot water deactivates the heat-sensitive components of the toxin, making it a safer and more effective method than other approaches.

Introduction

The Scorpaenidae family is a large group of fish characterised by their ability to cause poisoning through a variety of spines. This family is responsible for the second most frequent case of fish poisoning after skates and rays. They are widespread in tropical, subtropical and temperate regions, and some species have also been found in polar regions. It is not possible to provide an accurate estimate of the number of cases of poisoning, but it is not uncommon.

The Scorpaenidae family consists of three groups, which are distinguished based on the structure of their poisonous organs and toxicity levels. These three groups are:

- Pterois, which are equipped with long, thin spines, small venom glands and a less powerful sting (e.g. lionfish and zebrafish) ***(Fig. 1)***;
- Scorpaena: shorter and thinner spines; larger venom glands; and a more powerful sting (e.g. scorpionfish; Notesthes robusta) ***(Fig. 1)***.
- Synanceia: equipped with strong, powerful spines; highly developed venom glands; and a potentially fatal sting (e.g. stonefish) ***(Fig. 1)***.

Injuries and poisonings have been reported in open water, for example through accidental exposure during fishing or diving activities, and at home, for example through careless handling by aquarium owners. Members of the Scorpaenidae family possess around 18 spines, which are distributed between the dorsal, pelvic and anal regions. Each spine is associated with a pair of venom glands and is wrapped in a fluid integumentary sheath. During poisoning, the sheath descends down the spine,

* Captain, MD, Italian Army - Military Hospital of Rome 'Celio'.
° Captain, MD, 'Tuscany' Carabinieri Legion Health Service.

Corresponding: Email: morettimargherita94@gmail.com

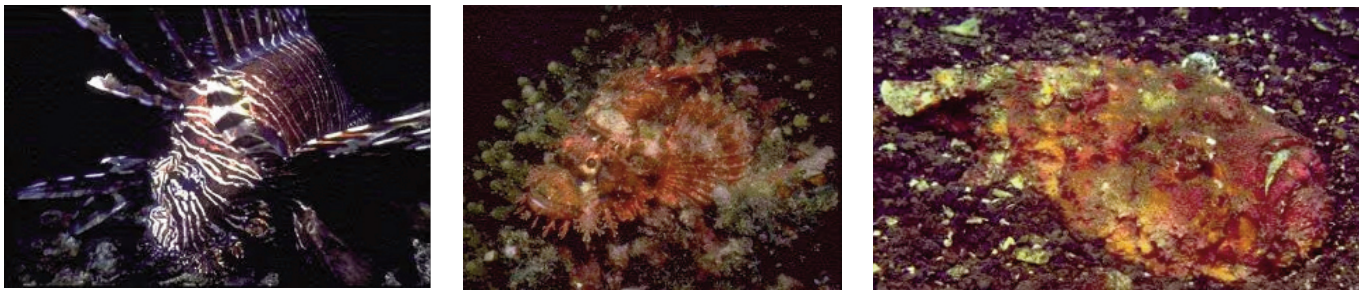

Fig. 1 - Pterois (lionfish), Scorpaena (scorpionfish) and Synanceia (stonefish).

compressing the venom glands located at the base and causing the venom to move towards the anterolateral depressions of the spines, which then penetrate the wound (1). Lionfish venom comprises a thermolabile neurotoxin that causes oedema, plasma extravasation, and cutaneous thrombotic lesions (2). A comparative study of Caribbean lionfish species showed that, in vitro, the venom causes haemolysis, weak cytotoxicity, proteolytic and hyaluronidase activities; in vivo, however, it is neither haemorrhagic nor myotoxic, but causes oedema, plasma extravasation and thrombotic-like skin lesions. Some minor differences have been observed in the venom secretions of adult and juvenile species (3). Excruciating pain and neuromuscular alteration are the immediate consequences of being stung by members of the Synanceia genus. The pain can spread to the whole limb and the local lymph nodes, peaking in intensity after 60–90 minutes and lasting over 12 hours if left untreated. Mild pain may persist for days or weeks. Less severe symptoms, though still very painful, follow poisoning by the genera Scorpaena and Pterois. Typically, poisoning results from one or more stings, each surrounded by a bluish halo of cyanotic tissue. Oedema, erythema and subsequent hyperaemia may also extend to the entire limb. Tissue necrosis is rare in the absence of secondary infection (unlike other cases of fish poisoning). Vesicle formation, especially in the hands, can easily lead to skin tissue flaking, cellulitis and hypoesthesia. Systemic symptoms may include nausea, muscle weakness, dyspnoea and hypotension (4, 5). The severity of the poisoning depends on several factors, including the species responsible, the number of stings and the victim's age and general health.

- Pterois: In a series of 101 cases in the United States, 92% of patients presented with local pain, 60% with oedema, and 13% with systemic symptoms. There were no fatalities. Wounds were categorised according to severity, with 95% being grade I (erythema), 4% being grade II (vesicles), and 1% being grade III (tissue necrosis). Hot water immersion therapy was used to treat pain in 97% of patients; the administration of the antidote was not necessary in any case. One patient required intravenous antibiotic therapy and one hypotensive patient responded well to intravenous fluid therapy. Thirteen per cent of patients experienced minor systemic symptoms.

Based on this and other US reports, most lionfish stings result in uncomplicated wounds that cause intense local pain, but respond well to warm water immersion therapy. Although rare cases of death have been reported in open water, the available data are very general and therefore unreliable.

- Scorpaena: the severity of injuries and systemic symptoms is greater than in cases of Pterois poisoning. The fatality rate of poisoning cases is controversial. One case (Mozambique, 1957) is considered a direct consequence of intravenous venom penetration, or most likely an anaphylactic reaction, due to the absence of identifiable elements at the sting site. Other reports describe death occurring days or months after poisoning, suggesting a possible correlation with secondary complications (e.g. wound infection, tetanus) (1).

Once the domain of fishermen and seafarers, the sea is now a place of discovery for many snorkelling enthusiasts. The Mediterranean Sea is home to a variety of species, some of which are poisonous and potentially dangerous. However, the Mediterranean's biodiversity is constantly increasing thanks to the progressive topicalization of its waters, which is being driven by a global increase in temperatures. This has resulted in species from tropical and subtropical areas settling in our sea, which was previously foreign to them. Encounters with these species can be dangerous, so it is useful to learn to recognise them.

- Echinoderms, for example, are characterised by slow, non-aggressive movements and include sea urchins, starfish and sea cucumbers ***(Fig. 2)***.

Fig. 2 - Echinoderms (from left): sea urchins, starfish and sea cucumbers.

Injuries and cases of poisoning are mainly the result of careless handling or accidental exposure, which is exacerbated by the poor visibility in fast-flowing water. Of the various species of sea urchin, the most venomous are the flower urchin (Toxopneustes pileolus) and the Tripneustes species. These species have specific structures called pedicellariae that are equipped with a triple mandibular apparatus surmounted by venom glands. These glands are capable of penetrating the skin and are difficult to remove due to their distinctly adherent valvular structure. Contact can result in intense pain, paresthesia, hypotension, respiratory distress and muscular paralysis, which can last up to six hours. One case involved a female diver who lost consciousness and drowned following accidental contact with a flower urchin. The most toxic species of sea star is the crown-of-thorns starfish (Acanthaster planci), which has long, sharp spines topped by a covering associated with glandular structures that produce a variety of toxins responsible for local and systemic effects. Poisoning begins with the spines penetrating the skin, which is usually followed by immediate excruciating pain. Divers have often reported difficulty ascending to the surface, as well as disorientation and loss of control, due to the intense pain. Multiple punctures or injuries to joints are associated with pain and impaired mobility for several weeks. Systemic symptoms include prolonged nausea and vomiting, headaches, arthralgia, paresthesia and muscle paralysis. Sea cucumbers are also responsible for food poisoning. They have a surface coating containing toxins (the main one of which is holoturin) and a mass of whitish or pinkish tubules known as the organ of Cuvier. This organ is located within the anal region and is everted by the animal when it is attacked or disturbed. Direct contact with these components, or even fragments released nearby, can induce contact dermatitis and severe ocular inflammation, and, in severe cases, blindness (6).

- Stingrays are cartilaginous fish found on the seabed. They have a flattened body, one or more strong spines on the tail, and ventrolateral sacs containing venom ***(Fig. 3)***. They are not aggressive towards humans, but injuries following contact with these animals are very common, especially when the victim accidentally steps on the fish, triggering a defence mechanism. The tail is thrown at the victim, usually striking the foot or lower leg and causing a deep wound with jagged edges. The animal's punctorial apparatus injects a protein toxin into the wound, causing intense pain immediately. Stingray venom is highly complex chemically and differs between the various species known to date. Neuro-inflammatory mediators such as hyaluronidase, cystatin, calglandulin, neurokinins, calcium and histamines contribute to the excruciating pain associated with stings. Systemic symptoms are rare and include nausea, vomiting, diarrhoea, muscle cramps, abdominal pain and hypotension (8).
- Octopuses are generally harmless and only become aggressive when provoked. Their bites pose little risk to survival, except for the bite of the blue-ringed octopus, which inhabits the waters of the Pacific Ocean ***(Fig. 3)***. The venom secreted by the salivary glands of the blue-ringed octopus contains numerous components, one of which is the highly toxic tetrodotoxin. It blocks voltage-dependent sodium channels, thereby blocking peripheral nerve conduction and causing paralysis and death from respiratory failure. Central nervous system effects include nausea, vomiting, miosis, diabetes insipidus, and depression of cortical activity. However, the prognosis is generally excellent; in cases of severe poisoning, oral and peripheral paresthesia, blurred vision, muscle paralysis and respiratory failure can appear rapidly (7).
- Portuguese Man 'o War: this oceanic species is found in the tropical

Fig. 3 - Ray and octopus.

waters of the Atlantic, Pacific and Indian Oceans, although it has also recently been spotted in the Mediterranean Sea. Thanks to a transparent gas-filled pouch, it partially remains at the surface, beneath which are tentacles that can reach a length of up to 50 metres ***(Fig. 4)***. These tentacles contain more than ten different types of venom capable of quickly paralysing and killing small fish, and they retain their venomous power even when detached from the main body. Stings cause a burning sensation and local contact dermatitis in humans, the effects of which may last for several days. In rare cases, anaphylactic shock, fever, cardiac arrhythmia and respiratory failure may occur.

Purpose

In light of the ongoing topicalization of the seas, this case report outlines innovative perspectives on the clinical treatment of rare but urgent medical conditions.

Fig. 4 - Portuguese Man 'o War.

Materials and methods

As expected in cases of poisoning, the Italian medical staff at the Beirut Military Hospital used a clinical approach involving the management of the wound and, if necessary, the extraction of the foreign body. This was followed by the affected body region being immersed in hot water (about 45 °C) and immediate analgesic treatment.

Clinical case presentation

On 13 July 2023, the Emergency Department at Beirut Military Hospital accepted a male patient who reported being bitten by a lionfish on the back of his left hand. He also complained of severe pain in his left arm, which radiated to the corresponding hemithorax. The patient was in a state of psychomotor agitation, but was alert, oriented and cooperative. There were no skin lacerations except for a

small, slightly raised, reddened and dark punctiform lesion at the puncture site, and the hand and entire arm were oedematous.

The patient was able to accurately report the incident: he recalled being in diving training at the time of the traumatic event and reported being at a depth of 25 metres. While performing the planned ascent manoeuvres, he felt a sting on his left hand, where he was wearing his protective glove. He recognised the lionfish immediately and began to feel a sharp pain.

Monitored vital parameters showed an arterial pressure of 135/95 mmHg, a heart rate of 112 bpm, a respiratory rate of 18 acts/min, and an SpO_2 of 96% in room air. On objective examination, diffuse oedema and erythema of the left upper limb were observed, starting from the left hand. The puncture site was indicated on the back of the hand, where no foreign body was visible; only a slightly raised, reddened, dark punctiform lesion was noted.

Results

Due to the extremely painful clinical manifestations and oedema that started in the left hand and were described as progressive, an intravenous infusion of 200 mg of hydrocortisone and 10 mg of tramadol in 100 ml of 0.9% saline was administered. At the same time, the left hand and as much of the distal part of the arm as possible were placed in a container of warm water at approximately 40 °C. The poison inoculation site was dressed by nursing staff with hydrogen peroxide and Betadine, after ruling out the presence of foreign bodies. After approximately 20 minutes, the oedema had not progressed, vital parameters remained stable (with the exception of blood pressure, which had increased to 150/100 mmHg) and the patient's reported pain had not abated. Therefore, a further intravenous infusion of tramadol (10 mg) in 100 ml of 0.9% saline was administered.

After a further 20 minutes, the patient's reported pain gradually subsided and their vital signs stabilised. The patient was monitored for six hours after admission and administered human tetanus antibody immunoglobulin (250 IU/1 ml) intramuscularly. As the patient reported living a considerable distance from the hospital and being unable to return to Beirut for follow-up visits, he was discharged with home treatment consisting of amoxicillin/clavulanic acid 875/125 mg twice daily for seven days and paracetamol 1000 mg tablets as required, as a precautionary measure.

Approximately ten days after the incident, the diver visited the Beirut Military Hospital Emergency Department to say goodbye to the medical staff. The injury was no longer visible, and the patient reported that he was experiencing complete remission of painful and oedematous symptoms, as well as psychological and physical well-being, about three days after the poisoning.

Discussion

According to the literature, the aim of therapy in cases of Scorpaenidae poisoning is to provide local and systemic analgesia, treat wounds at risk of infection, provide supportive therapy, and treat systemic symptoms if necessary in cases of significant poisoning. Wound treatment involves gently removing the visible spines and sheath to prevent further penetration or rupture and to inactivate the thermolabile components of the venom, which might otherwise cause a severe systemic reaction. Surgical removal of embedded spines is indicated when they are located near joints, nerves or vessels.

Visual inspection for foreign body retention can be supplemented with radiographs for radioluminous foreign bodies or ultrasound for radio-opaque foreign bodies. Surgical debridement, incision and drainage, or fasciotomy, are not indicated unless the wound contains foreign bodies, becomes necrotic or develops compartment syndrome (9). The recommended initial treatment for Scorpaenidae poisoning is immersion in warm water, as with poisonings from echinoderms, rays, and other marine species. According to the literature, immediately immersing the affected extremity in warm water (up to 45 °C) for 30–90 minutes (or until the painful symptoms subside) inactivates the thermolabile components of the venom, making it a safer and more effective treatment than other methods (e.g. cold water, vinegar, papaya compresses or ice) (10). Additional local analgesia may be necessary, taking care not to cause burn injuries to the patient. Oral or intravenous opioids are indicated for pain that is not controlled by hot water immersion. Benzodiazepines are indicated for anxiety, muscle spasms, or for patients with wounds that are difficult to immerse or anaesthetise. All forms of restraint, such as watches and bracelets, must be removed from the affected extremities, which should be kept unloaded to facilitate lymphatic and venous drainage. Painful lymphoedema following stonefish poisoning may require compression treatment with long gloves or elastic stockings (9). Prophylactic antibiotics are generally not indicated, except for people with deep puncture wounds and immunocompromised

individuals. Once infection has been established, timely therapy must be instituted to cover potential marine pathogens. Infections caused by Gram-negative bacteria and mycobacteria require combined antibiotic therapy. The typical Gram-positive infections are those caused by Streptococcus iniae, characterised by impetigo and cellulitis, and those caused by Erysipelothrix rhusiopathiae, which manifest as erysipeloid. These infections can be treated with single antibiotics, particularly penicillins or macrolides (if there is a penicillin allergy), until the results of the culture examination and antibiogram are available. In cases of suspected Mycobacterium marinum infection, confirmation by culture examination is necessary, as is initiation of clarithromycin and ethambutol combination antibiotic therapy (11).

Necrotising marine infections may be monomicrobial, caused by bacteria such as Vibrio vulnificus, Aeromonas hydrophila or Edwardsiella tarda, or polymicrobial. In both cases, if necrotising lesions are present, the infection can progress rapidly to necrotising fasciitis and myonecrosis, particularly in immunocompromised patients, those on steroid therapy, and those with diabetes mellitus, HIV/AIDS, liver or renal failure, or cancer. These patients should initially be treated with broad-spectrum antimicrobials, especially in cases of penetrating trauma, until the outcome of culture examinations from drains or biopsies is known. Subjects with cirrhosis, hepatitis, uremia, haemosiderosis, or other conditions involving iron retention are at a higher risk of invasive Vibrio infections, which are associated with a higher mortality rate. They should be treated empirically with combinations of third-generation cephalosporins (ceftazidime), fluoroquinolones and tetracyclines or aminoglycosides and trimethoprim-sulfamethoxazole (in paediatric cases where tetracyclines and quinolones are contraindicated) (11). Tetanus prophylaxis is recommended for all marine species injuries in patients with an uncertain history of tetanus vaccination (9.1).

Corticosteroid therapy based on hydrocortisone or methylprednisolone may be used to prevent or treat serum sickness, either alone or in combination with a venom antidote. Stonefish antivenom is rarely indicated for lionfish poisoning, unless the symptoms respond to warm water immersion and additional treatment with analgesics and regional anaesthetics.

Stonefish antivenom, currently available in Australia, is produced by Commonwealth Serum Laboratories (CSL). It consists of 2,000 IU per 1.5–3 ml vial and is administered either intramuscularly or intravenously, after dilution and skin testing to assess the risk of an anaphylactic reaction to equine sera (12).

Conclusions

With almost a thousand new 'alien' species, the Mediterranean is the marine region with the highest number of 'invasions' worldwide. The main causes of this are climate change, rising sea temperatures, and human activities such as uncontrolled fishing, pollution, shipping traffic, and ship dumping. New tropical species enter the Mediterranean from two main geographical areas: the Suez Canal, through which organisms from the Red Sea enter, and the Strait of Gibraltar, through which species from the Atlantic coast of Africa enter. To this flow must be added species that are introduced unintentionally through ship bilge water or hull seepage, which is often discharged into the sea without any precautions (12). Given the increasingly frequent presence of Scorpaenidae species in non-tropical waters, particularly in the Mediterranean, it is important for medical and nursing staff to be familiar with poisonous marine species, as well as the current recommended medical and pharmacological treatments. This is particularly useful in military first aid contexts, as well as in isolated areas where specialist personnel and sufficient diagnostic capacity are lacking. Healthcare personnel should have adequate information on how to manage cases of marine species poisoning, particularly regarding initial treatment involving immersion in warm water and the administration of parenteral analgesics. It is also important to remember that, in cases of marine injuries, tetanus prophylaxis is necessary rather than human tetanus immunoglobulin, and that prophylactic antibiotic administration is needed in cases of deeply penetrating, lacerated or necrotic wounds to prevent major bacterial overinfection in situ (9).

Bibliography

1. **Stephen J Vetrano, Jeffery B Lebowitz, Steven Marcus,** Lionfish envenomation, J Emerg Med. 2002 Nov.
2. **Cutis**, Aquatic Antagonists: Lionfish (Pterois volitans). 2018 October.
3. **Aránzazu Sáenz, Natalia Ortiz, Bruno Lomonte, Alexandra Rucavado, Cecilia Díaz,**Comparison of biochemical and cytotoxic activities of extracts obtained from dorsal spines and caudal fin of adult and juvenile non-native Caribbean lionfish (Pterois volitans/miles). 2017 Oct.

4. **DF. Hwang DF, Noguchi** T. Tetrodotoxin poisoning. Adv Food Nutr Res. 2007.

5. **Auerbach PS, McKinney HE, Rees RS, Heggers JP.** Analysis of vesicle fluid following the sting of the lionfish Pterois volitans. Toxicon. 1987.

6. **S. A. Gallagher** Echinoderm Envenomation Department of Emergency Medicine University of Colorado Health Sciences.

7. **J. M. Hirshon** Octopus Envenomation Department of Emergency Medicine University of Maryland School Medicine, 2018 Jun.

8. **J. L. Meade Stingray** Envenomation American College of Emergency Physicians, 1998.

9. **Scott A Gallagher, MD, FACEP; Chief Editor: Joe Alcock, MD, MS,** Lionfish and Stonefish Envenomation Treatment & Management, 2013 Oct.

10. **Atkinson PRT, Boyle A, Hartin D, McAuley D.** Is hot water immersion an effective treatment for marine envenomation? Emerg Med J 2006 Jul.

11. **Diaz JH.** Skin and soft tissue infections following marine injuries and exposures in travellers. J Travel Med. 2014 May-Jun.

12. **C. Nike Bianchi, C. Morri.** 'Global sea warming and «tropicalization» of the Mediterrean Sea: biogeographic and ecological aspects, 2003.

Disclosures:

The Authors declare that they have no relationships relevant to the contents of this paper to disclose.

Manuscript received on 21/12/2023; reviewed on 02/05/2024; accepted on 07/10/2024.