

Aquatic Antagonists: Scorpionfish Envenomation

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PRACTICE POINTS

- As some species of scorpionfish proliferate, providers may see an increase in envenomation cases.
- Physicians should suspect scorpionfish stings based on clinical symptoms and physical examination.
- Scorpionfish toxins are thermolabile, and patients can find symptom relief by immediately immersing the affected area in hot water (42 °C–45 °C) for 30 to 90 minutes.

Scorpionfish are among the most venomous creatures found in American and Caribbean seas. Their envenomation is responsible for considerable morbidity and socioeconomic burden associated with marine animal injuries. Avoiding physical contact with scorpionfish through proper identification prevails as the chief prevention method for stings. This article discusses common features of scorpionfish as well as the clinical presentation and treatment options following exposure to its toxins.

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With the growing popularity of water sports and a proliferation of invasive species, human injuries from marine animal envenomation continue to rise.¹⁻³ Members of the scorpionfish family Scorpaenidae are second only to stingrays as the leading cause of the 40,000 to 50,000 injuries annually from marine life worldwide.⁴ Because scorpionfish represent a growing threat and competition with native species, it has been suggested that they could replace endangered species on restaurant menus.⁵⁻⁸ Scorpionfish have been introduced by humans from tropical to temperate seas and are now common off the coast of California and the eastern coast from New York to Florida, as well as in the Caribbean, the Bahamas, and off the southern coast of Brazil. Victims of scorpionfish stings experience

considerable pain and may require days to weeks to fully recover, highlighting the socioeconomic costs and burden of scorpionfish envenomation.^{9,10} Fishers, divers, swimmers, and aquarium owners are most often affected.

Family

The common term *scorpionfish* refers to both the family Scorpaenidae and the genus *Scorpaena*. Members of this family possess similar dorsal, anal, and pelvic fins, though they vary between genera in their size and the potency of the venom they insulate. Other familiar members include the genus *Pterois* (lionfish) and *Synanceja* (stonefish). *Synanceja* are the most venomous within the group, but scorpionfish stings more commonly arise from *Pterois* and *Scorpaena*.⁸ Because of the rare shapes and vibrant colors of scorpionfish, some traders and aquarium owners will seek and pay high prices for these fish, providing further opportunity for envenomation.^{11,12}

Characteristics

Scorpionfish have with a high variation in color, ranging from lighter grays to intense reds depending on their geographic location and habitat. *Synanceja* are bland in coloration, blending in with rocks and gravel, but the more dramatic-appearing *Scorpaena* exhibit a large cranium and wide range of multicolored patterns (Figure 1).¹³ *Pterois* serve as the most conspicuous member of the group with brightly colored red and white stripes (Figure 2). Scorpionfish commonly grow up to 19 inches long and boast 12 dorsal, 2 pelvic, and 3 anal spines housing 5 to 10 mg of venom.¹⁴ An integumentary sheath encapsulates each spine housing the glandular tissue that produces the potent venom.

Toxin Properties

Unlike *Pterois* and *Synanceja*, *Scorpaena* do not have venom ducts around their glands, complicating the work of marine biologists aiming to extract and study the venomous toxins.

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FIGURE 1. Red scorpionfish (*Scorpaena scrofa*). Photograph courtesy of Sylvain Le Bris (<https://www.inaturalist.org/>). Republished under the Creative Commons Attribution (CC BY-NC 4.0).

Several studies have managed to isolate scorpionfish venom and overcome its unstable heat-labile nature to investigate its biologic properties.^{15–20} Several high-molecular-weight proteins (50–800 kDa) comprise the venom, including hyaluronidase, integrin-inhibiting factors, capillary permeability factor, proteases, and some less-understood cytolytic toxins. These factors provoke the inflammatory, proteolytic, hemorrhagic, cardiovascular, and hemolytic biologic activities at both the local and systemic levels, directing damage to wounded tissues and inducing vascular and tissue permeability to reach cellular processes far and wide. Mediators of inflammation include tumor necrosis factor, IL-6, and monocyte chemoattractant protein 1, followed by neutrophils and other mononuclear cells, initiating the immune response at the wound site. Toxin potency remains for up to 2 days after fish death.¹

Clinical Manifestation

Physicians may be guided by clinical symptoms in identifying scorpionfish stings, as the patient may not know the identity of their marine assailant. Initially, individuals punctured by scorpionfish spikes will experience an acute pain and burning sensation at the puncture site that may be accompanied by systemic symptoms such as nausea, vomiting, diarrhea, tachycardia, hypotension, loss of consciousness, difficulty breathing, and delirium.^{9,21–23} The pain will intensify and radiate distal to the site of envenomation, and the wound may exhibit vesiculation, erythema, bruising, pallor, and notable edema.^{4,24} Pain intensity peaks at 30 to 90 minutes after envenomation, and other systemic symptoms generally last for 24 to 48 hours.²⁵ If patients do not seek prompt treatment, secondary infection may ensue, and the lingering venom in the blister may cause dermal necrosis, paresthesia, and anesthesia. Chronic sequelae may include joint contractures, compartment syndrome, necrotic ulcers, and chronic neuropathy.¹

Management

Treatment of scorpionfish stings primarily is palliative and aimed at symptom reduction. Patients should immediately



FIGURE 2. Lionfish (*Pterois volitans*). Photograph courtesy of 808_Diver (<https://www.inaturalist.org/>). Republished under the Creative Commons Attribution (CC BY-NC 4.0).

treat wounds with hot but not scalding water immersion.^{26,27} Given the thermolabile components of scorpionfish venom, the most effective treatment is to soak the affected limb in water 42 °C to 45 °C for 30 to 90 minutes. Any higher temperature may pose risk for scalding burns. Children should be monitored throughout treatment.²⁸ If hot water immersion does not provide relief, oral analgesics may be considered. Stonefish antivenom is available and may be used for any scorpionfish sting given the shared biologic properties between genera. Providers evaluating stings could use sterile irrigation to clean wounds and search for foreign bodies including spine fragments; probing should be accomplished by instruments rather than a gloved finger. Providers should consider culturing wounds and prescribing antibiotics for suspected secondary infections. A tetanus toxoid history also should be elicited, and patients may have a booster administered, as indicated.²⁹

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