

# CASE REPORT

## Stonefish “Okoze” Envenomation during Food Preparation

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Stonefish is a dangerous and venomous fish commonly found in the shallow waters of the Pacific region. Its envenomation is reported worldwide with increasing frequency. Although envenomation usually occurs in those engaged in marine sports, chefs may suffer envenomation during cutting stonefish, which is eaten either sliced raw, boiled, or deep-fried by Japanese. Since many people cook and eat Japanese food, it is important to know that cutting a stonefish for cooking carries the risk of envenomation. However, most primary and emergency physicians have not encountered cases of envenomation during food preparation. Here we describe a case of envenomation occurring while cooking. The patient was a healthy 33-year-old man working as a chef in a Japanese restaurant. He was presented to an academic emergency department after suddenly developing severe pain in his right fourth finger while cutting a stonefish. The finger was reddish, swollen, and tender. The pain reduced after immersing his hand in hot water, and disappeared within 18 h without any complication. In this report, we describe the history of stonefish envenomation and provide a brief review of the literature related to this form of envenomation. (Keio J Med 59 (1) : 19–22, March 2010)

**Keywords:** stonefish, envenomation

### Introduction

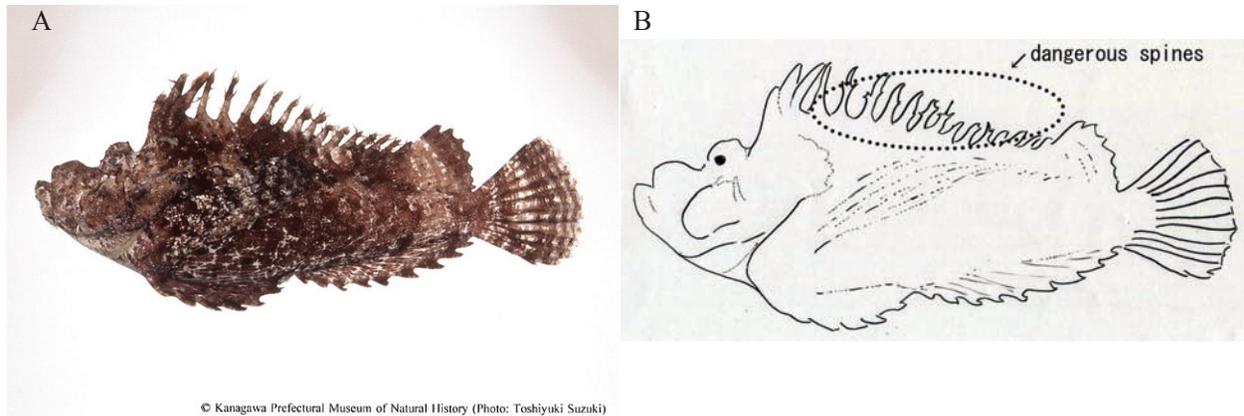
The stonefish “okoze” is considered the most venomous of fish. It lives in the shallow waters of the Pacific region. Each stonefish has 13 dorsal spines, and each spine is connected to a pair of venom glands capable of producing a very potent but heat-labile venom.<sup>1,2</sup> The venom contains a proteinaceous toxin, which initially causes severe pain around the site punctured by the fins. It has also been reported to be myotoxic, neurotoxic, vasopermeable, and cardiotoxic.<sup>3,4</sup> The craggy and warty surface of the fish provides excellent camouflage against the surrounding mud. Swimmers or divers are usually injured by accidentally treading on the fish. Therefore, patients with stonefish envenomation often present to hospitals in locations where beach activities are a common pastime.

In some parts of Asia, such as Japan, stonefish is considered a great delicacy. Cutting this fish is a well-known occupational hazard for seafood handlers. However, most primary and emergency physicians have not en-

countered cases of envenomation occurring while cooking. Here we present a case of envenomation that occurred while cutting the stonefish okoze.

### Case Report

A healthy 33-year-old man working as a chef in a Japanese restaurant was presented to an academic emergency department (ED) by ambulance because of sudden severe pain in the fourth finger of his right hand. The pain started while he was cutting an okoze (**Fig. 1A**). His finger was punctured by the spine of the stonefish (**Fig. 1B**). He described the pain as intense, constant, throbbing, and extending with numbness to the right palm, although he had no cardiopulmonary symptoms such as dyspnea, wheezing, palpitation, faintness, or lightheadedness. His vital signs were stable and normal. Physical examination revealed redness and swelling of the finger with bruising on the fingertip (**Figs. 2 and 3**) and tenderness of the entire finger. There were no other skin or mucosal lesions.



**Fig. 1** (A) Stonefish “Okoze” (Reprinted photo from Kanagawa Prefectural Museum of Natural History). 13 dorsal spines are armed with toxic fish venom. (B) Scheme of stonefish “Okoze.” Spines inside dotted frame have toxic venom.

Other physical and neurological findings showed no abnormalities. He had no history of allergies, and laboratory and imaging tests were not needed.

Based on the symptoms of the present illness and physical examination findings, the patient was diagnosed with stonefish envenomation. However, pricks or residual fins were not detected in the finger. After irrigation and sterilization with alcohol, his right hand was immediately placed in a basin of hot water to relieve the pain. The pain and numbness disappeared within 30 min of hot water immersion. No other symptoms developed during his stay in the ED. Four days later, he reported that the pain and tenderness lasted for only 18 h and disappeared by the next morning, without the need to take a painkiller or an antimicrobial agent.

Written informed consent for publishing the report of this case was obtained from the patient.

### Discussion

In this report, we describe a case of stonefish envenomation that occurred while cutting the stonefish okoze, which is considered an occupational hazard for seafood handlers. Although stonefish envenomations have been reported worldwide with increasing frequency, most reports describe envenomation occurring among individuals engaged in marine sports.<sup>1,5,6</sup> To our knowledge, the case described here is the first report of envenomation occurring while cooking; it is not related to marine activities. Since diagnosis is made based on the history, it is important to know that cutting a stonefish while cooking Japanese food carries a risk of envenomation.

Stonefish belong to the Synanceiidae family, whose members are equipped with a sophisticated defense mechanism. Dorsal spines armed with toxic fish venom prevent attack from their natural foes. They live in tropical and warmer temperature oceans worldwide and can lie perfectly camouflaged under the sand in shallow wa-

ters, and hence, envenomation by these fish usually occurs among individuals who step on their ventral fins during marine activities and water sports.<sup>1</sup> Interestingly, Japanese chefs also suffer stonefish envenomation while cutting okoze, a kind of stonefish. Okoze is considered a delicacy or savory dish in some parts of Asia, including Japan, although it is rarely eaten in other countries.<sup>7</sup> This difference in the cuisine culture relates to the types of stonefish living in the local area. Envenomations during marine sports are mainly caused by *Synanceia verrucosa*, which is inedible, as well as *S. nana* and *S. hornium*. *Inimicus japonicus*, also known as okoze in Japan, lives mainly in Asia, and the Japanese eat it sliced raw, boiled, or deep-fried.

Expert chefs do not usually suffer envenomation because they avoid the ventral fins when handling the fish; however, some chefs in training and those unfamiliar with Japanese food may be injured through contact with okoze. Since many people eat Japanese food and cook many kinds of fish, including venomous fish such as stonefish, scorpionfish, and stingray, cases of envenomations occurring while cooking may increase. To prevent stonefish envenomation, chefs cooking Japanese food need to know which types of stonefish contain venom and where such venom is stored; the chefs must also develop expertise in handling these fish. The standard technique is to insert the second finger into the mouth of the fish to hold it while cutting off the ventral fins. Furthermore, health professionals must know that food handlers are at risk of stonefish envenomation while cutting okoze and must teach proper techniques to chefs unfamiliar with these fish.

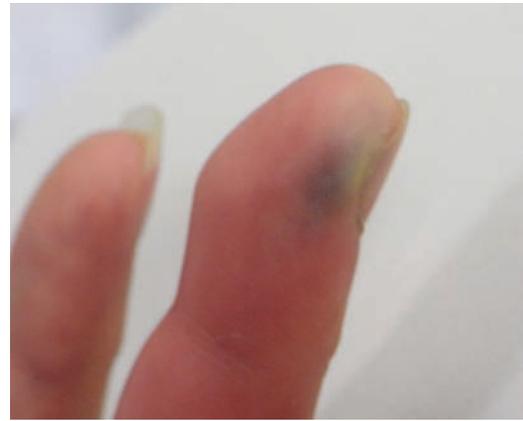
Many case reports and series have shown that stonefish envenomation is usually self-limiting with no significant consequences. Primary care providers must therefore be educated about pain relief, including hot water immersion, administration of oral or parenteral opioid analgesics, and local infusion of lidocaine, which are all



**Fig. 2** The right hand of the patient on arrival. The fourth finger of the right hand had redness and swelling, 30 minutes after injury.

essential for treatment.<sup>6</sup> A study has reported that the foot is the most common site of injury, accounting for 83% of cases. In this study, it has been reported that only 17% of injuries are on the fingers.<sup>8</sup> However, as an occupational hazard for workers in the food industry, the most commonly injured site may be the hand, including the index finger. The stonefish venom verrucotoxin is an unstable protein with a pH of 6.0 and molecular weight of 150,000. Laboratory studies have shown that the venom contains a proteinaceous toxin, which is myotoxic, neurotoxic, vasopermeable, and cardiotoxic.<sup>3,9</sup> One study found that the toxin inhibits K<sub>ATP</sub> current through the muscarinic M<sub>3</sub> receptor-PKC pathway.<sup>9</sup> Another study reported that the toxin modulates Ca<sup>2+</sup> channel activity through the beta-adrenoreceptor-cAMP-PKA pathway.<sup>3</sup> Although the toxicities are not yet fully understood, it is well known that the toxin is denatured by heat, which may result in a loss of toxicity. Thus, it has been recommended that the affected site be immersed in non-scalding hot water (45°C) for 30 to 90 min or until the pain subsides. Studies have concluded that hot water soaks are effective in controlling the pain in 74% of cases.<sup>2,4</sup> In the present case, hot water immersion was performed for 30 min, and the patient's pain subsequently disappeared after 18 h.

In most patients, the pain disappears completely and sensation returns; however, there have been rare reported cases of respiratory weakness, heart failure, convulsions,



**Fig. 3** The fourth finger of the right hand. Bruising was revealed on the fingertip, 30 minutes after injury.

necrotizing fasciitis, and severe tissue necrosis.<sup>1,6,7,10</sup> Some of them have also recommended prophylactic use of antimicrobial agents. Activity and proliferation of some microbes, such as *Vibrio vulnificus*, are positively correlated with surrounding temperature. Thus, a hot water bath used in the absence of concomitant prophylactic antimicrobial agents may raise the subcutaneous temperature of the affected area and consequently facilitate the activity and proliferation of those microbes.<sup>2,7</sup> Therefore, administration of antimicrobial chemotherapy before or during hot water immersion should be considered, although prophylactic antimicrobial chemotherapy has been controversial. In the present case, despite the absence of antimicrobial chemotherapy, there was no bacterial infection on the finger. In all cases, the patient's condition should be carefully and closely monitored, regardless of whether prophylactic antimicrobial chemotherapy is included in the treatment.

In conclusion, stonefish envenomation can occur among chefs in Japanese restaurants as well as individuals engaged in water sports. Since many people cook and eat Japanese food, health professionals should be aware that cutting okoze is a risk factor for stonefish envenomation and should know how to apply pain relief, including hot water immersion therapy.

## References

1. Brenneke F, Hatz C: Stonefish envenomation -- a lucky outcome. *Travel Med Infect Dis* 2006; **4**: 281–285.
2. Atkinson P, Boyle A, Hartin D: Is hot water immersion an effective treatment for marine envenomation? *Emerg Med J* 2006; **23**: 503–508.
3. Yazawa K, Wang J, Hao L: Verrucotoxin, a stonefish venom, modulates calcium channel activity in guinea pig ventricular myocytes. *Br J Pharmacol* 2007; **151**: 1198–1203.
4. Kreger A: Detection of a cytolytic toxin in the venom of the stonefish (*Synancecia trachyris*). *Toxicon* 1991; **29**: 433–433.

5. Lee J, Teoh L, Leo S: Stonefish envenomation of the hand - a local marine hazard: a series of eight cases and a review of the literature. *Ann Acad Med Singapore* 2004; **33**: 515–520.
6. Prentice O, Fernandez WG, Luyber TJ: Stonefish envenomation. *Am J Emerg Med* 2008; **26**: 972.e1–2.
7. Tang W, Fung K, Cheng V: Rapidly progressive necrotising fasciitis following a stonefish sting: a report of two cases. *J Orthop Surg* 2006; **14**: 67–70.
8. Ngo S, Ong S, Ponampalam R: Stonefish envenomation presenting to a Singapore hospital. *Singapore Med J* 2009; **50**: 506–509.
9. Wang J, Yazawa K, Hao L, Onoue Y, Kameyama M: Verrucotoxin inhibits KATP channels in cardiac myocytes through a muscarinic M3 receptor-PKC pathway. *Eur J Pharmacol* 2007; **563**: 172–179.
10. Rishpon A, Cohen Z, Brenner S: Neuroma formation and toe amputation resulting from stonefish envenomation. *Arch Dermatol* 2008; **144**: 1076–1077.