

Marine envenomations

Part 2 – Other marine envenomations

BACKGROUND Australian waters contain a variety of venomous creatures, including jellyfish, stinging fish, blue-ringed octopus, sea snakes, cone snails and stingrays.

OBJECTIVE Part 2 of this article focusses on common marine envenomations other than jellyfish stings.

DISCUSSION Even though mortality from these envenomations is low, there is a high level of morbidity especially with stonefish and other stinging fish envenomations. Some envenomations, however, are serious enough to require antivenom treatment and deaths still occasionally occur.



Figure 1. Blue-ringed octopus
Photo courtesy of Vern Draffin

Blue-ringed octopus (*Haplochaena* spp.)

The blue-ringed octopus is a small, usually inconspicuous, brown coloured octopus that develops brilliant blue ring shaped markings when disturbed (Figure 1). The genus is found throughout Australian coastal waters; the southern blue-ringed octopus (*H. maculosa*) in southern regions, and the greater blue-ringed octopus (*H. lunulate*) in more tropical areas. A third species, the blue-lined octopus (*H. fasciata*) has also been described along the east coast of Australia. This genus has been associated with severe neurotoxic envenomation resulting in respiratory failure and human fatalities.^{1,3} The blue-ringed octopus is found in tidal rock pools and is very attractive, especially to children and tourists who are at risk of envenoma-

tion when they pick it up or step on it. The venom contains tetrodotoxin (also found in puffer fish flesh) that is secreted in the saliva of the octopus. It causes blockade of neuronal sodium channels leading to weakness, numbness or paraesthesia, breathing difficulties and ultimately, respiratory paralysis.

Symptoms and signs of blue-ringed octopus envenomation

- Pain is not a prominent feature of the bite
- Within 10 minutes, symptoms of poisoning begin to develop; initially weakness and numbness about the face or neck, difficulty breathing, nausea and vomiting
- In severe cases, there is rapid progression to flaccid paralysis and apnoea. The patient may be completely paralysed and unable to respond, sometimes with fixed dilated pupils, but the sensorium is often intact, and care should be taken to avoid negative remarks that the alert patient may hear.

First aid and treatment

- Remove victim from the water
- If victim is apnoeic, support breathing with expired air respiration and urgently transfer to hospital
- A pressure immobilisation bandage should be

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Figure 2. Stonefish (*Synanceia* spp.)

applied to the affected limb (as for land snakes)

- Endotracheal intubation and artificial ventilation may be required until the effects of venom wear off (typically this takes 24–48 hours).

There is no antivenom available for blue-ringed octopus envenomation, however, although two fatalities have been reported,⁴ these envenomations are uncommon.

Stinging fish

Stonefish (*Synanceia* spp.)

Stonefish (Figure 2) are found throughout the world, and may be described as the world's most dangerous stinging fish. The two Australian species, *Synanceia trachynis* and *S. verrucosa*, are found commonly throughout tropical Indo-Pacific waters. They are extremely well camouflaged and dig themselves into the surrounding sand or mud, making them almost impossible to see (Figure 3). Thirteen dorsal spines project from venom glands along their back; with venom involuntarily expelled when the spine is pressed. Stonefish venom, unlike other marine venom, is purely for defence. Fatalities have been recorded in the Indo-Pacific region, but not in Australian waters.

Symptoms and signs of stonefish envenomation

- Despite the presence of myotoxic, neurotoxic and cardiotoxic components of the venom in experimental models, human envenomation is characterised by:
 - immediate extremely painful sting with pain extending rapidly up the limb
 - associated rapid local swelling
- The severity of symptoms is related to the spine penetration depth and the number of spines involved



Figure 3. Stonefish camouflaged in sand

- Systemic effects of the venom may include muscle weakness, paralysis and shock.

First aid and treatment

- Bathing or immersing the stung area in hot water may be effective
- Hospitalisation for intravenous narcotic analgesia +/- local anaesthetic (without adrenaline) infiltration or regional block may be required
- Definitive management consists of administration of stonefish antivenom (produced by CSL Ltd, Australia, from the venom of *S. trachynis*), which is usually given intramuscularly
- Indications for antivenom include:
 - severe pain
 - systemic symptoms or signs of envenomation (weakness, paralysis)
 - multiple punctures indicating the discharge of several spines and thus injection of a larger amount of venom. (Recommended antivenom dose is one ampoule for 1–2 spine punctures, two ampoules for 3–4 spine punctures, three ampoules for greater than four spine punctures)
- Tetanus prophylaxis should be undertaken depending on the patient's immunisation status. Severe stings may produce an area of tissue necrosis, particularly if antivenom administration is delayed. This may require surgical debridement or even skin grafting. Consideration should also be given to the presence of broken spines within the wound, which should be X-rayed if in doubt.

Other venomous fish

Australia has numerous stinging fish distributed around its coastline (Figure 4). Many of these fish are found in tropical waters, but others are present in temperate waters.



Figure 4. Lionfish

Symptoms and signs of fish envenomation

- The major clinical feature of fish stings is immediate severe pain which may be prolonged and difficult to manage even with narcotic analgesia
- The pain will usually subside within 24 hours, but swelling may persist for several days.

First aid and treatment

- Immersion of the affected area (almost always a hand or foot) in hot (not scalding) water
- Infiltration of the wound with local anaesthetic (without adrenaline) agents provides dramatic relief in most cases, although occasionally a regional nerve block will be required
- Tetanus prophylaxis should be updated, and the wound examined for signs of infection or retained foreign material in the form of broken spines
- Stonefish antivenom could be of use for scorpion fish type stings, but requires further clinical assessment.

Based on in vitro evidence of the potential for stonefish antivenom to neutralise lionfish (*Pterois volitans*) venom toxicity, an aquarium worker was recently treated with this antivenom – to good clinical effect – for a significant lionfish spike to her thumb.⁵

Bacterial infections

Zoonotic bacterial infections can be a problem. Humans tend to have good natural immunity to marine bacteria, and most fish associated wound infections tend to be self limiting.⁶ Infections are mixed, and comprise mainly of genera vibrio, pseudomonas and aeromonas. Minor wounds can be treated with early and efficient simple cleaning of the wound with an antibacterial solution. If infections are more severe antibiotics of choice include doxycycline, ciprofloxacin or cefotaxime.⁷

Cone shells (*Conus spp.*)

Cone shells are predatory marine snails better referred to as cone snails (Figure 5). They live mainly in shallow tropical and subtropical reef waters of the Indo-Pacific. There are more than 600 varieties that have been identified worldwide; more than 70 seen in tropical and subtropical waters of Australia. All are venomous; with the venom injected by radula teeth resembling small harpoons held in their proboscis (Figure 6). Cone shell venom is diverse and complex in its action. It consists of numerous neurotoxic peptides that act pre- and post-synaptically to give rise to neurological symptoms.

Over recent years the venom of the cone shells has been studied extensively. Pharmaceutical companies are now utilising the selectivity and potency of conus derived peptides in the manufacture of medications for pain, epilepsy and other disorders.⁸

Symptoms and signs of cone shell envenomation

- Stings are usually as a result of cone handling
- Initially there is sharp pain, with the stung area becoming swollen and pale
- Numbness may follow as well as signs of neurological impairment including weakness, lack of coordination, and visual and speech disturbances
- Less common systemic symptoms include nausea and generalised pruritus.

First aid and treatment

- Remove victim from the water
- Pressure immobilisation first aid should be applied and left in place until resuscitation facilities are available, as assisted ventilation may be required to avoid hypoxia
- There is at present no antivenom for cone shell stings
- The wound should be regarded as potentially contaminated and tetanus prophylaxis should be updated if required.

Stingrays

Stingrays are found throughout the world and so named because of the venomous barbs present on the dorsum of their tails (Figure 7). Although they are venomous, the major clinical problem is often



Figure 5. Cone shell



Figure 6. Cone shell harpoon in proboscis



Figure 7. Stingray

related to mechanical trauma from the sting itself, which may produce deep penetrating injuries or severe lacerations, or subsequent infection including tetanus. Fatalities and near fatalities from penetrating chest or abdominal wounds by stingray barbs have been recorded.⁹

Symptoms and signs of stingray envenomation

- Envenomation may result in increasing local pain which may spread to involve the entire limb +/- swelling and a characteristic bluish-white appearance of the wound
- Systemic symptoms are rare, but may include nausea and vomiting, salivation, diarrhoea, sweating, muscle cramps, syncope, cardiac arrhythmias and convulsions.

First aid and treatment

- Remove victim from the water; if any major bleeding, apply local pressure
- Immersing the stung area in hot water (as for stinging fish) may provide temporary relief
- Transfer patient to a medical facility (unless very small injury to limb)
- Analgesia, tetanus prophylaxis X-ray, and surgical exploration and debridement may be necessary
- All penetrating chest and abdominal wounds need to be explored (this should be deemed a medical emergency until proven otherwise)
- Infection of the contaminated wound may develop and involve poorly characterised marine bacteria requiring special culture media. Consideration should be given to antibiotic prophylaxis in contaminated wounds, particularly if there has been a delay between the sting and medical treatment
- No antivenom exists for stingray envenomation.

Sea snakes

In addition to highly venomous land snakes, Australia has the highest biodiversity of sea snakes in the world, hosting 59% of all such species (Figure 8). While predominantly concentrated in warm tropical waters, Australian sea snakes are widely distributed throughout Australia. Fortunately however, bites from these snakes are rare and no fatalities have yet been reported in Australia. Although most bites have been reported from Queensland, a few cases



Figure 8. Sea snake

have also been documented in New South Wales and Western Australia. Generally it is fishermen who are most at risk as they pull in nets and sort fish, but swimmers and waders are also occasionally bitten.

Symptoms and signs of sea snake envenomation

- Signs of severe envenomation include myalgia, vomiting, eye signs (ptosis, weakness of external eye muscles, pupillary dilatation poorly reactive to light), paresis of lower motor neurone type, leucocytosis, and rhabdomyolysis
- There is little local pain at the bite site
- Signs of envenomation develop rapidly (approximately 15–30 minutes postenvenomation).

First aid and treatment

- Attention to basic life support is a priority
- Pressure immobilisation first aid should be used and left in situ until the patient reaches medical care
- If there is clinical evidence of envenomation, sea snake antivenom can be given (based on beaked sea snake [*Enhydrina schistosa*] venom). If this not available tiger snake antivenom may be used
- Supportive measures such as intubation and ventilation for respiratory failure or the treatment of hyperkalaemia may also be required.

It has been postulated that the land based snake venom detection kit (SVDK) may be of use. A recent study looking at the reactivity of sea snake venom to the SVDK showed good reactivity to the tiger venom in three of the four sea snake venoms tested.¹⁰ More research into whether this will be useful in the ‘undifferentiated’ marine envenomation will need to be conducted.

Conclusion

Marine stings are mostly the cause of minor injuries, but offer the potential for lethal sequelae. Most often this involves acutely painful fish stings that respond to analgesia and appropriate wound care in general practice. However, sea snake, stingray and blue-ringed octopus bite stings should be managed in the inpatient setting.

SUMMARY OF IMPORTANT POINTS

- There is a high level of morbidity with stonefish and other stinging fish envenomations.
- Tetanus prophylaxis should be undertaken if required.
- The blue-ringed octopus has been associated with severe neurotoxic envenomation resulting in respiratory failure and fatalities.
- Pressure immobilisation and urgent transfer to hospital is a priority for blue-ringed octopus and cone shell envenomation.
- First aid for fish envenomation includes immersion of the affected area in hot water, local anaesthetic and tetanus update.
- Minor bacterial wounds can be treated with antibacterial solutions.
- Antibiotic prophylaxis should be considered in contaminated stingray envenomation.
- Signs of severe sea snake envenomation include myalgia, vomiting, eye signs, paresis, leucocytosis and rhabdomyolysis.

Conflict of interest: none declared.

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