Venomous fish stings are a common environment hazard worldwide. This study investigated the clinical effects and treatment of venomous fish stings. A prospective observational case series of patients presenting with venomous fish stings was conducted in tropical northern Australia. Twenty-two fish stings were included; subjects were 3 females and 19 males; mean age 35 (range 10-63); 9 by stingrays, 8 by catfish, 1 by a stonefish, 1 by a silver scat (Selenotocota multifasciata), and 3 by unknown fish. All patients had severe pain, but less commonly erythema, 3 cases (14%); swelling, 7 cases (33%); bleeding, 5 cases (24%); numbness, 4 cases (19%); and radiating pain, 3 cases (14%). Mild systemic effects occurred in one stingray injury. Treatment included hot water immersion, which was completely effective in 73% of cases, analgesia, wound exploration and prophylactic antibiotics. Stingray injuries should be explored and debrided with large wounds, while other stings only need appropriate cleaning. The routine use of antibiotics is not recommended.

There remains a number of controversies regarding the first aid and treatment of venomous fish stings. Hot water has been suggested as a first aid measure since early this century with reports of efficacy. This simple therapy remains underused by clinicians. Other treatment issues include debridement of stingray wounds and antibiotic use. An antivenin for stonefish stings exists and appears to be effective in case reports of severe envenomation.

Here is reported a 1 year prospective series of venomous fish stings presenting to a teaching hospital in tropical northern Australia.

METHODS

Cases of venomous fish stings, including stingray envenomation, presenting to Royal Darwin Hospital (RDH) between July 1999 and June 2000 were included in the study. The majority of patients were collected prospectively from referrals to the author at the time of presentation. An emergency triage database was searched retrospectively at the end of the period for additional cases. All presentations coded as “bite/sting/envenomation” were selected and reviewed.

The following information was collected on each subject: demographics; date, time and location of the sting; circumstances of the sting; identity of the fish where possible; local effects (pain, swelling, erythema, bleeding, numbness, presence of a spine); systemic effects, first aid used (time and type); investigations and treatment in the emergency department (hot water, analgesia, antibiotics, debridement).

Stings were classified according to the suspected type of venomous fish causing the sting: stonefish, catfish, stingray, or other venomous fish. This classification was based on identification by the patient, circumstances of the sting and local information.

Additional information to the prospective study was collected by discussions with local fish collectors and staff at the local wildlife park aquarium. These persons were interviewed over the telephone regarding fish that commonly cause stings in the region and stings they had received where the fish was identified at the time.

RESULTS

Twenty-two cases were included: 15 were collected prospectively and 7 were included retrospectively. The average age was 35 (range 10-63); 3 females and 19 males. In all cases of fish stings, the patient was fishing at the time. However, only 2 of 9 patients with stingray injuries were fishing, 4 were walking and it was unknown in 3 cases. Of 18 patients where the time of the sting was documented, 10 presented within 2 hours of the sting. Four presented more than 24 hours after the sting, one patient presenting with purulent discharge and cellulitis at the site of a stingray injury.

Of the 22 stings, 9 stings were determined to be caused by stingrays, 8 by catfish, 1 by a stonefish, 1 by a silver scat, and the remaining 3 by unknown fish (see Table 1). In only 1 of the 9 stingray envenomations was the fish caught, and the person sustained an injury to the hand. The patient described the stingray as smaller than a dinner plate with blue spots. In all 8 cases of catfish stings the fish was caught. Three injuries resulted from fish in throw nets, at...
TABLE 1. Please Provide Title

<table>
<thead>
<tr>
<th>Fish Type</th>
<th>Total (%)</th>
<th>Activity</th>
<th>No.</th>
<th>Injury Site</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stingray</td>
<td>78</td>
<td>Fishing</td>
<td>2</td>
<td>Ankle/leg</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Walking</td>
<td>4</td>
<td>Hand/wrist</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Other</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Catfish</td>
<td>100</td>
<td>All fishing</td>
<td>8</td>
<td>Proximal UL</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Foot</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Thigh</td>
<td>1</td>
</tr>
<tr>
<td>Stonefish</td>
<td>100</td>
<td>All fishing</td>
<td>1</td>
<td>Foot</td>
<td>1</td>
</tr>
<tr>
<td>Silver scat</td>
<td>100</td>
<td>All fishing/ throw net</td>
<td>1</td>
<td>Finger</td>
<td>1</td>
</tr>
<tr>
<td>Other</td>
<td>67</td>
<td>All fishing</td>
<td>3</td>
<td>Finger</td>
<td>3</td>
</tr>
</tbody>
</table>

least one of these was attributable to a silver scat. The stonefish was not seen, but the circumstances and clinical effects were consistent with stonefish envenomation (see Fig 1).

All 22 patients had severe pain at the sting site. Other effects were less common, including erythema in 3 cases (14%), swelling in 7 cases (33%), bleeding in 5 cases (24%), and numbness in 4 cases (19%). This excludes the patient who presented 2 weeks after a stingray injury with cellulitis of the hand. There was radiating pain in 3 cases, one of these to the draining lymph nodes (inguinal). In one case where the sting site was on the volar surface of the wrist (approximately over the ulna nerve) there was pain and numbness that radiated distally to the fourth and fifth fingers. Mild systemic effects occurred in one stingray injury with nausea.

Lacerations occurred in all 9 stingray injuries (see Fig 2), but only small puncture wounds occurred with fish spine injuries. The fish spines broke off in the wound in 3 catfish stings, and were removed by the patient in 2 cases. In the third, the spine remained in the finger and was removed in the ED under a digital nerve block (see Fig 3).

The most common first aid applied was hot water immersion. This was applied before reaching the ED in one case. Hot water immersion was used in 15 of the 22 cases. It was completely effective in 11 cases (73%), partially effective in one, not effective in another and not documented in 2 cases.

Plain radiographs were done in 11 cases. No spines were seen except in the case where the catfish spine remained embedded. Ten patients received no analgesia, 4 oral analgesia, and 8 parenteral analgesia. Local anaesthetic was infiltrated locally in 4 cases to explore and irrigate stingray wounds, and a digital nerve block was used to remove the embedded catfish spine.

The wound was explored in 8 cases, 5 stingray injuries, and 3 with catfish injuries. Sixteen patients were prescribed oral antibiotics. Eleven patient received tetanus prophylaxis, 4 were up to date with tetanus immunization, and in 7 patients there was no record.

Four additional persons, all who worked professionally with fish or collected fish commercially, were interviewed over the telephone to gather information about local species of fish, and their experience of fish stings. All 4 confirmed that most stings in the local region occurred from catfish, scats, stingrays, and rarely stonefish. All 4 had been stung on more than 10 occasions, mainly by catfish and scats. In

FIGURE 1. Significant edema of the right foot after stone fish sting.
FIGURE 2. Stingray injury to the ankle (A) initially (B) 10 days later with minor local infection.

All 4 had been stung by various marine and fresh water catfish and agreed these were generally worse than scats. One person had been injured by the freshwater whipray, most likely *Himantura chaophraya*. He was stung on the little finger causing severe pain radiating up the arm, with associated chest and back pain lasting 1 hour.

**DISCUSSION**

This is the first prospective study of venomous fish stings. It characterised the types of fish that cause stings in tropical Australia and their clinical effects. Although there was no standard approach to treatment in this study, the effectiveness of first aid and different medical treatments was examined.

Morbidity in the study was low, with only 2 cases having significant infection, and only 1 patient being admitted to hospital. In the majority of cases there was local pain, less commonly erythema and swelling. Most patients were discharged within 4 hours of presentation. The few large series of venomous fish stings also report a low incidence of significant morbidity. Despite most injuries being minor, the potential for more severe injuries remains. More significant injuries can occur in a number of situations and should be managed accordingly:

1. Stingray injuries to the trunk: significant morbidity and mortality can result from penetrating trauma to internal organs.
2. Secondary infection: patients susceptible to infections (eg, diabetics), wounds penetrating joint or tendon spaces and wounds that are not cleaned or managed appropriately initially.

Discussion with fish handlers suggest a much larger number of persons are injured by venomous fish and do not seek the majority of these stings the fish were identified. Hot water was used regularly by 2 persons, and one had no knowledge of the effects of hot water, despite more than 100 stings.

All 4 reported stings by scats, mainly *Selenotocota multifasciata*, the silver scat. One person had suffered hundreds of stings, mainly collecting and sorting fish of all sizes. Significant stings occurred with fish larger than 1 cm, and severity increased with size. In general they caused severe immediate pain for 5 to 15 minutes, which decreased over 30 to 60 minutes. There was rarely bleeding, and no swelling or redness. Regional lymphadenopathy occurred in more severe stings. This was confirmed by the other 3 persons. One person had been stung on the face while in the aquarium causing severe pain, but no redness or swelling. Interestingly all 4 reported no reduction in effects with repeated scat stings. They confirmed that scats were commonly caught in throw nets.

FIGURE 3. Embedded spine in finger after a catfish injury.
medical attention. One study reported a commercial catfish industry that had 50 stings a daily, treated by the company nurse only.6 This suggests that the majority of venomous fish injuries are minor and infection is uncommon.

There are a large number of venomous fish in tropical Australia.15 The majority of stings were from stingrays and catfish, which has been previously observed in other parts of Australia and the Americas.15,18 In a number of cases experienced fisherman were able to identify the fish. The types of fish involved was consistent with the experience of 4 people regularly in contact with fish who had suffered numerous stings. There were no stings by fish kept in domestic aquariums, such as the lion fish, Pterois volitans, a common cause of stings in one US study.7

Catfish from the family plotosidae probably caused the majority of stings in the Darwin region.17 In particular the striped catfish, Plotosus lineatus, is an important member of this family and can cause significant injuries.19,20 Other commonly reported catfish in the region are from the family Ariidae17 which are reported to cause minor effects.20 Ariidae have a worldwide distribution and plotosidae occur in the Indopacific region, so are important in a large part of the world.14 Other families have a more restricted distribution such as the icthyoridae, common freshwater catfish in the US, and siluridae that occur throughout Europe and Asia.5,21

With stingrays, the length and size of the spine means there is an increased risk of significant trauma. The majority of injuries are to the lower limb from stepping on the stingray in shallow water, although injuries occur to the hands when they are caught, or divers may sustain injuries to the torso.12,13 In one patient the likely stingray involved was either the blue-spotted maskray, Dasyatis kuhlii, or the blue-spotted fantail ray, Taeniura lymma, common tropical inshore stingray species.10 that both occur in Darwin Harbor.19 In the other cases the animal was not well visualized or seen at all. Other stingrays occurring in the region that may be implicated in injuries include the estuary stingray, D. fluviarum, some species of maskrays (Dasyatis spp), the cowtail ray Pastinachus sephen, a number of whiprays (Himantura spp), and the white-spotted eagle ray, Aetobatus narinari.10,17 This differs from southern temperate Australian areas where stingrays (Urolophidae) are more commonly implicated in injuries.10,18 In other parts of the world similar families of stingrays are involved. In the US the main offender on the West Coast is the round stingray (Urolophus halleri), and along the southeast coast is the southern stingray (D americana).1,2,5

S. multifasciata is locally known as the silver scat, but is also referred to as the striped butterfish (Australia) and the spadefish (US).22 S. multifasciata inhabit inshore coastal areas; often near cities (east, north, and western Australia and New Guinea), and are also a favourite aquarium fish, particularly in the US.22 They are silvery fish with greenish backs4 and grow up to 35 cm in size. They have 12 dorsal, 4 anal, and 2 ventral spines with venom glands.23

There is reference made to stings by this fish in some reviews.4,19,22-24 One sting in the prospective study was from a silver scat in a throwing net, and another sting was suspected to be by this fish, based on the patient’s description and fishing location. Multiple stings were reported by 4 persons interviewed giving a useful impression of the clinical effects. However, in this study the effects appeared to increase with fish size, contrary to previous reports from Queensland and one study on gland structure.23

The closely related spotted butterfish or spadefish (US), Scatophagidae argus, also occurs in the region. This fish causes fewer stings because it is less commonly caught and does not often raise its spines when handled. Although both these species of fish are favourite aquarium fish, there are no previous reports of such stings in the international literature.2,25 It may be responsible for some aquarium fish stings in the US.

There remains some controversy over the treatment of venomous fish stings, and there are recent reviews which deal with this.2,4 In this study hot water was effective in 73% of cases when used. In cases where hot water does not effectively control the pain, then either analgesics and/or local or regional anaesthesia are appropriate, particularly in cases where the wound is explored.

There remains no consensus on the treatment of wounds after venomous fish stings. It is generally agreed that stingray wounds have the greatest potential to cause necrosis and infection. Some investigators suggest exploration and even excision of the wound to remove all foreign material.3 Injuries by other fish probably do not need exploration, but there is little evidence to support this approach.

The use of prophylactic antibiotics in venomous fish stings is not of proven benefit. In one study, with limited follow-up, antibiotics were not routinely used, and in cases followed up, this appeared to be satisfactory.3 Prophylactic antibiotics are not recommended, unless the wound is large or there is considerable foreign material.15 Prevention of infection by careful cleaning of the wound is more important.

The author thanks Dr Bart Currie for his support of this work and for reading the manuscript. He also thanks the staff of the emergency department of Royal Darwin Hospital for their involvement. Thanks to a number of local fisherman and commercial fish collectors for their information about the local marine life and past stings. Finally thank you to staff at the NT museum and Patricia Kailola for providing information on fish and stingrays in the region.

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