Aquatic Antagonists: Stingray Injury Update

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PRACTICE **POINTS**

- Acute pain associated with stingray injuries can be treated with hot water immersion.
- Stingray injuries are prone to secondary infection and poor wound healing.

Stingrays cause more sting-related injuries than any other fish. Their venom and mechanism of injury lead to painful, poor-healing wounds that often become infected. Stingray injuries are further complicated by retained barbs and foreign bodies, which also may lead to considerable morbidity. Most stingray injuries can be treated with hot water immersion, wound debridement, and prophylactic antibiotics, while some may require more extensive treatment and surgical intervention at a tertiary care center. Educating patients about avoidance strategies, such as wading through water with a shuffling gait and wearing protective leg guards, may help decrease stingray injuries.

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Incidence and Characteristics

Stingrays are the most common cause of fish-related stings worldwide.[1] The Urolophidae and Dasyatidae stingray families are responsible for most marine stingray injuries, including approximately 1500 reported injuries in the United States annually.[1,2] Saltwater stingrays from these families commonly are encountered in shallow temperate and tropical coastal waters across the globe and possess dorsally and distally located spines capable of injuring humans that step on them (Figure 1).[1,3] Freshwater stingrays (Potamotrygonidae family)(Figure 2) are not present in North America but rather inhabit lakes and river systems in South America, Africa, Laos, and Vietnam.[4] Although recent incidence is unknown, Marinkelle[5] estimated that thousands of stingray injuries occurred annually in the freshwater of Columbia during the 1960s. Unfortunately, the annual worldwide incidence of stingray injuries is generally unknown and is difficult to estimate, in part because injuries often go unreported.

Stingrays are dorsoventrally flattened, diamond-shaped fish with light-colored ventral and dark-colored dorsal surfaces. They have strong pectoral wings that allow them to swim forward and backward and even launch off waves.[3] Stingrays range in size from the palm

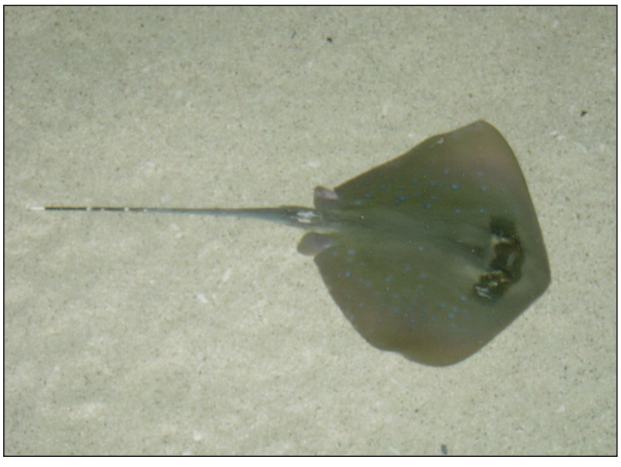

FIGURE 1. *Neotrygon kuhlii,* formerly of the genus *Dasyatis,* is a saltwater stingray native to the tropical Indo–West Pacific region. It is known as the blue-spotted stingray. Saltwater stingrays often blend with the underlying sand.

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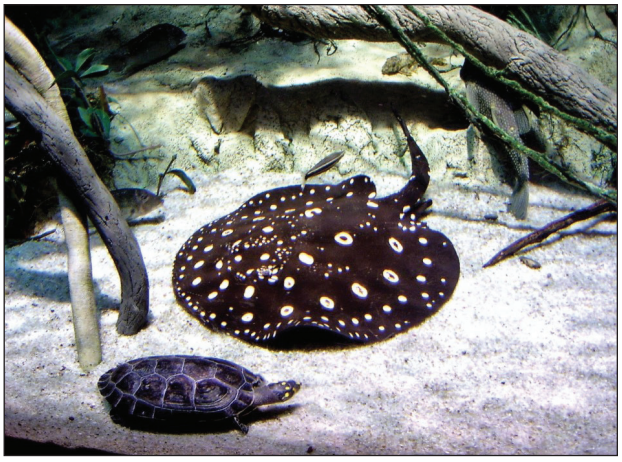

FIGURE 2. *Potamotrygon leopoldi* is a freshwater stingray native to the Xingu River Basin in Brazil.

of a human hand to 6.5 ft in width. They possess 1 or more spines (2.5 to >30 cm in length) that are disguised by much longer tails.[6,7] They often are encountered accidentally because they bury themselves in the sand or mud of shallow coastal waters or rivers with only their eyes and tails exposed to fool prey and avoid predators.

Injury Clinical Presentation

Stingray injuries typically involve the lower legs, ankles, or feet after stepping on a stingray.[8] Fishermen can present with injuries of the upper extremities after handling fish with their hands.[9] Other rarer injuries occur when individuals are swimming alongside stingrays or when stingrays catapult off waves into moving boats.[10,11] Stingrays impale victims by using their tails to direct a retroserrate barb composed of a strong cartilaginous material called vasodentin. The barb releases venom by breaking through the venom-containing integumentary sheath that encapsulates it. Stingray venom contains phosphodiesterase, serotonin, and 5′-nucleotidase. It causes severe pain, vasoconstriction, ischemia, and poor wound healing, along with systemic effects such as disorientation, syncope, seizures, salivation, nausea, vomiting, abdominal pain, diarrhea, muscle cramps or fasciculations, pruritus, allergic reaction, hypotension, cardiac arrhythmias, dyspnea, paralysis, and possibly death.[1,8,12,13]

Management

Pain Relief—As with many marine envenomations, immersion in hot but not scalding water can inactivate venom and reduce symptoms.[8,9] In one retrospective review, 52 of 75 (69%) patients reporting to a California poison center with stingray injuries had improvement in pain within 1 hour of hot water immersion before any analgesics were instituted.[8] In another review, 65 of 74 (88%) patients presenting to a California emergency department within 24 hours of sustaining a stingray injury had complete relief of pain within 30 minutes of hot water immersion. Patients who received analgesics in addition to hot water immersion did not require a second dose.[9] In concordance with these studies, we suggest immersing areas affected by stingray injuries in hot water (temperature, 43.3°C to 46.1°C [110°F–115°F]; or as close to this range as tolerated) until pain subsides.[8,9,14] Ice packs are an alternative to hot water immersion that may be more readily available to patients. If pain does not resolve following hot water immersion or application of an ice pack, additional analgesics and xylocaine without epinephrine may be helpful.[9,15]

Infection—One major complication of stingray injuries is infection.[8,9] Many bacterial species reside in stingray mucus, the marine environment, or on human skin that may be introduced during a single injury. Marine envenomations can involve organisms such as *Vibrio, Aeromonas*, and *Mycobacterium* species, which often are resistant to antibiotic prophylaxis covering common causes of soft-tissue infection such as *Staphylococcus* and *Streptococcus* species.[8,9,16,17] Additionally, physicians should cover for *Clostridium* species and ensure patients are up-to-date on vaccinations because severe cases of tetanus following stingray injuries have been reported.[18] Lastly, fungal infections including fusariosis have been reported following stingray injuries and should be considered if a patient develops an infection.[19]

Several authors support the use of prophylactic broad-spectrum antibiotics in all but mild stingray injuries.[8,9,20,21] Although no standardized definition exists, mild injuries generally represent patients with superficial lacerations or less, while deeper lacerations and puncture wounds require prophylaxis. Several authors agree on the use of fluoroquinolone antibiotics (eg, ciprofloxacin 500 mg twice daily) for 5 to 7 days following severe stingray injuries.[1,9,13,22] Other proposed antibiotic regimens include trimethoprim-sulfamethoxazole (160/800 mg twice daily) or tetracycline (500 mg 4 times daily) for 7 days.[13] Failure of ciprofloxacin therapy after 7 days has been reported, with resolution of infection after treatment with an intravenous cephalosporin for 7 days.[20] Failure of trimethoprim-sulfamethoxazole therapy also has been reported, with one case requiring levofloxacin for a much longer course.[21] Clinical follow-up remains essential after prescribing prophylactic antibiotics, as resistance is common.

Foreign Bodies—Stingray injuries also are often complicated by foreign bodies or retained spines.[3,8] Although these complications are less severe than infection, all wounds should be explored for material under local anesthesia. Furthermore, there has been support for thorough debridement of necrotic tissue with referral to a hand specialist for deeper injuries to the hands as well as referral to a foot and ankle specialist for deeper injuries of the lower extremities.[23,24] More serious injuries with penetration of vital structures, such as through the chest or abdomen, require immediate exploration in an operating room.[1,24]

Imaging—Routine imaging of stingray injuries remains controversial. In a case series of 119 patients presenting to a California emergency department with stingray injuries, Clark et al[9] found that radiographs were not helpful. This finding likely is due in part to an inability to detect hypodense material such as integumentary or glandular tissue via radiography.[3] However, radiographs have been used to identify retained stingray barbs in select cases in which retained barbs are suspected.[2,25] Lastly, ultrasonography potentially may offer a better first choice when a barb is not readily apparent; magnetic resonance imaging may be indicated for more involved areas and for further visualization of suspected hypodense material, though at a higher expense.[2,9]

Biopsy—Biopsies of stingray injuries are rarely performed, and the findings are not well characterized. One case biopsied 2 months after injury showed a large zone of paucicellular necrosis with superficial ulceration and granulomatous inflammation. The stingray venom was most likely responsible for the pattern of necrosis noted in the biopsy.[21]

Avoidance and Prevention

Patients traveling to areas of the world inhabited by stingrays should receive counseling on how to avoid injury. Prior to entry, individuals can throw stones or use a long stick to clear their walking or swimming areas of venomous fish.[26] Polarized sunglasses may help spot stingrays in shallow water. Furthermore, wading through water with a shuffling gait can help individuals avoid stepping directly on a stingray and also warns stingrays that someone is in the area. Individuals who spend more time in coastal waters or river systems inhabited by stingrays may invest in protective stingray gear such as leg guards or specialized wading boots.[26] Lastly, fishermen should be advised to avoid handling stingrays with their hands and instead cut their fishing line to release the fish.

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