Case Report: Iatrogenic Infection from Traditional Treatment of Stingray Envenomation

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Abstract. A 47-year-old man was stung on the left ankle by a stingray while on vacation on the Island of Bubaque, Guinea-Bissau. The affected limb was initially treated with an attempt to suck out the venom and application of chewed plant root. The following 3 days, local pain gradually diminished, but then high fever erupted together with generalized symptoms and intense pain from the ankle. After initiating antibiotic treatment, the patient was evacuated. Because of sustained symptoms and fever, the wound was surgically debrided, and culture revealed infection with oral flora bacteria. Attempts to suck out venom are not recommended.

INTRODUCTION

Stingrays are found worldwide in tropical and subtropical waters.¹ The fish are equipped with a barbed spine on their tail, and human injury most frequently occurs when a victim steps on it, resulting in the fish impaling its spine into the victim's foot or ankle. Morbidity is associated with both the direct injury inflicted from the spine and with venom diffusing from secreting cells on the spine.² Inspired by movies or because of common superstition, stingray victims are sometimes treated *on-site* with an attempt to suck out the venom. Here, we report a case where such traditional treatment of stingray envenomation caused severe infection by oral flora bacteria.

CASE REPORT

A previously healthy 47-year-old man of Danish nationality was on vacation on the Island of Bubaque in the archipelagos of Bijagós located in Guinea-Bissau, West Africa. While walking in shallow waters 2–3 m from the coastline, the victim was stung by a stingray, causing immediate intense pain laterally on the left ankle (Figure 1A and B).

After limping ashore, blood started to leak from the wound site. A local sailor offered his assistance and repeatedly attempted to suck out the venom. The sailor then fetched an unknown plant root which he chewed and applied to the wound with a compression band on top. The following hours the sting-victim kept calm because of slight dizziness, and the local pain gradually diminished. The plant root and the compression band were then removed, and the wound site cleaned. After a few days, the sting-victim went back to the capital Bissau, and pain in the ankle had almost perished (Figure 2A).

On day 4 after the incident, an onset of high fever (39°C) along with shivering and general malaise was observed. The wound site had become swollen and reddish (Figure 2B), and the tissue around the spine entry was necrotic. Antibiotic treatment with tablets of amoxicillin and ciprofloxacin was administered with some effect. On day 5, the temperature had

returned to normal and symptoms diminished. However, pus was still intermittently flowing from the wound.

Despite continued oral antibiotics, fever (39.8°C) relapsed on day 6 after the incident. The antibiotic regimen was changed to intravenous ceftriaxone and oral ciprofloxacin plus metronidazole. A computed tomography (CT) scan was performed in Bissau owing to suspicion of a retained spine and to rule out osteomyelitis, but this did not confirm the suspicion. The patient became septic and was evacuated to Denmark, where surgery was performed on the 10th day (Figure 2C and D). On excision, extensive deep necrosis was found in the wound and pus filled the peroneal tendon sheaths. The tendons were rinsed and surgical debridement of necrotic tissue was performed, but no pieces of retained spine were found by the surgeon. Tissue samples sent for culture revealed a mixed infection with *Streptococcus mitis*, *Eikenella corrodens*, *Actinomyces odontolyticus*, and *Enterococcus faecalis*—flora usually found in oral cavities.

The following weeks, the wound slowly healed from the bottom with the wound cavity open, using a vacuum sponge, and after 2 weeks of additional intravenous ceftriaxone, the patient was transferred to a regimen of oral amoxicillin/clavulanic acid for an additional 4 weeks. The wound successfully healed during the next months (Figure 2F), and the victim was able to return to his work as an infectious disease specialist 3 months after the incident. Sequelae after 8 months comprised decreased skin sensitivity on the lateral side of the ankle and a minor ankle inversion defect.

DISCUSSION

Stingrays are often found in warm shallow waters, where they hide burrowed in the sand.³ Although the fish are not aggressive, unfortunate bathers or fishermen may encounter a stingray while walking ashore. There are no accurate records of the number of sting-victims, but 750 to 2,000 injuries are reported each year in the United States alone.⁴

Impalement of a stingray spine typically causes damage and discomfort in the lower extremity, where more than 90% of injuries happen.⁵ Depending on the species and maturity of the stingray, the sharp and pointed spine may become up to 37 cm (14.5 inches) long. Because the edges of the spine are retroserrated, fragments of the spine may detach and remain as a foreign body, causing further tissue damage upon

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FIGURE 1. (A) Photo of a small stingray, *Fontitrygon* sp. (cf. *margaritella* or juvenile cf. *margarita*) found on Bubaque Island, Guinea-Bissau. (B) Demonstration of a stingray spine on the proximal part of the tail. More distally located spines may inflict more severe, lacerating tissue injuries. This figure appears in color at www.ajtmh.org.

withdrawal.^{2,3} A retained spine often results in prolonged morbidity.⁶ In extreme cases, a sting to the thoracic region has even caused pneumothorax⁵ and cardiac damage.⁷

The spine's underside has two grooves with venom-producing glands, and the venom is concentrated in a thin layer of skin covering the spine. Secretory cells produce serotonin, phosphodiesterase, 5'-nucleotidase, and other proteins. On impalement, the secreting cells are unroofed and the venom diffuses into the wound causing damaging effects locally through vasoconstriction, leading to ischemia and necrosis.^{8,9} The most frequent symptoms/signs after an injury are local pain, swelling, erythema, bruising, and inflammation. Generalized symptoms such as nausea, abdominal pain, shortness of breath, and signs of cardiac arrhythmias are rare (<5%).^{2,10} Our case experienced a light envenomation with only slight dizziness in addition to intense local pain.

Wound-site infection may arise from bacteria introduced by the spine itself or through secondary contamination with sea water. For example, *Stenotrophomonas maltophilia* was found in the wound of a 26-year-old male who had been fishing in South Africa and cleared within 2 weeks after administration of oral trimetoprim and sulfamethoxazole.¹¹ In a case report from Singapore, a 40-year-old man had been stung while swimming in shallow sea water. Culture revealed infection with *Shewanella*, and intravenous treatment with ceftazidime was started.¹²

A known complication to wound infection after stingray attacks is necrotizing fasciitis which was diagnosed in the right tibialis anterior muscle 3 days after a 43-year-old man from Florida had been stung. The causative agent, *Photobacterium damsela* was sensitive to doxycycline and cephalexin.¹³ Another case of necrotizing fasciitis in the lower extremity occurred in China, where a fisherman was treated with intravenous ciprofloxacin and amoxicillin-clavulanate against *Vibrio alginolyticus* infection.¹⁴ The heterogeneity of the aforementioned bacteria displays bacterial variation in both fish and waters where stingray injuries occur, and freshwater stingrays may introduce yet another range of bacteria.¹⁵

Our case had acquired infection with bacteria typically present in the oral flora. This was likely introduced by the sailor's attempt to orally suck out the venom and/or the application of chewed plant root.

Attempts to suck out venom have been debated not only for stingray injuries¹⁶ but also for treatment of snake bites,¹⁷ where venom is injected through hollow fangs. In popular media, numerous movies/series have presented dramatic scenes in which an energetic character successfully has been able to suck out venom thereby saving the victim's life. Perhaps this has added to the widespread misbelief that such treatment has a positive effect.¹⁸ While Although there have been no human trials to support attempts to orally suck out venom for any type of sting or bite, even mechanical suction devices applying negative pressure to the wound site have been shown to be ineffective in sucking out venom after snake bites.¹⁹ The wound canal after a stingray injury may be larger in diameter compared with that of a snake bite, and the stingray spine is usually much longer compared with snake fangs; thus venom could thus be deposited deeper in the tissue. A wider wound canal could also increase the risk of introducing oral flora bacteria.

Other alternative treatment options to be avoided are cryo- or electrotherapy, which may exacerbate tissue damage, prolonged hot water immersion therapy, and application of various plant roots or leaves.¹⁶

In general, there is very little evidence for treatment guidelines after stingray injury, but as the venom is heat labile it is recommended to submerge the affected limb in hot water (up to 45°C) for 30–60 minutes for pain relief.^{2,4,10,20} Applying infiltrative analgesics such as lidocaine has also been reported to relieve acute pain.²¹ Experts in the field recommend checking the wound canal for a retained spine and, if present, to surgically remove the spine and debride any necrotic tissue. If the spine is retained in a vital body part, it should be treated as a stab wound.^{2,4,10} Because the stingray spine is cartilaginous, a retained fragment may not be visible on traditional X-rays or CT scans, and investigation with MRI or ultrasound is advised. Because of the risk of secondary infection, antibiotic prophylaxis with a quinolone for 5–7 days has been suggested.² Patients not covered by tetanus vaccination should be provided this.¹⁵ Postoperative wound care must be carried out daily removing debris and fibrin. In case primary skin closure is not possible, a splint skin graft can be applied.

The human oral microbiome is extensive with hundreds of different bacterial species.²² Wounds exposed to human saliva through bite injuries have resulted in infection with both aerobic (streptococci, *Staphylococcus aureus*, *E. corrodens*) and anaerobic bacteria (*Fusobacterium*, *Peptostreptococcus*, *Prevotella*, *Porphyromonas*). It is recommended to treat such

FIGURE 2. (A) Day 3 after the incident; the ankle was swollen and discolored. Tissue surrounding the spine entry portal is commencing to look necrotic. (B) Day 7: The spine entry portal with surrounding necrotic tissue and widespread discoloration. (C) Day 9: The ankle presurgery. (D) Day 10: Surgical debridement of necrotic tissue. (E) Day 10: Postsurgery. (F) Five months after the incident: The wound has healed. This figure appears in color at www.ajtmh.org.

infections with oral amoxicillin/clavulanate, ampicillin-sulbactam, or ertapenem.²³

To our knowledge, this is the first report of an iatrogenic infection following traditional treatment of a stingray injury. Attempts to suck out venom are not recommended.

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REFERENCES

- Balhara KS, Stolbach A, 2014. Marine envenomations. *Emerg Med Clin North Am* 32: 223–243.
- Clark AT, Clark RF, Cantrell FL, 2017. A retrospective review of the presentation and treatment of stingray stings reported to a poison control system. *Am J Ther* 24: e177–e180.
- Meyer PK, 1997. Stingray injuries. *Wilderness Environ Med* 8: 24–28.
- Diaz JH, 2008. The evaluation, management, and prevention of stingray injuries in travelers. *J Travel Med* 15: 102–109.
- Suzuki T, Takada T, Fudoji J, 2017. Traumatic pneumothorax associated with penetrating neck injury caused by a stingray: a case report. *Wilderness Environ Med* 28: 119–121.
- O'Malley GF, O'Malley RN, Pham O, Randolph F, 2015. Retained stingray barb and the importance of imaging. *Wilderness Environ Med* 26: 375–379.
- Parra MW, Costantini EN, Rodas EB, Gonzalez PJ, Salamen OJ, Catino JD, Taber PM, Puente I, 2010. Surviving a transfixing cardiac injury caused by a stingray barb. *J Thorac Cardiovasc Surg* 139: e115–e116.
- Dehghani H, Sajjadi MM, Rajaian H, Sajedianfard J, Parto P, 2009. Study of patient's injuries by stingrays, lethal activity determination and cardiac effects induced by *Himantura gerrardi* venom. *Toxicon* 54: 881–886.
- Junior VH, Cardoso JLC, Neto DG, 2013. Injuries by marine and freshwater stingrays: history, clinical aspects of the envenomations and current status of a neglected problem in Brazil. *J Venom Anim Toxins Trop Dis* 19: 16.
- Hornbeak KB, Auerbach PS, 2017. Marine envenomation. *Emerg Med Clin North Am* 35: 321–337.
- Fino P, Onesti MG, Felli A, Scuderi N, 2015. Clinical examination and treatment of a leg ulcer caused by a stingray puncture. *Int J Low Extrem Wounds* 14: 183–186.
- Srinivasan S, Bosco J, Lohan R, 2013. Marine stingray injuries to the extremities: series of three cases with emphasis on imaging. *J Postgrad Med* 59: 309.
- Barber GR, Swygert JS, 2000. Necrotizing fasciitis due to *Photobacterium damsela* in a man lashed by a stingray. *N Engl J Med* 342: 824.
- Ho PL, Tang W-M, Lo KS, Yuen KY, 1998. Necrotizing fasciitis due to *Vibrio alginolyticus* following an injury inflicted by a stingray. *Scand J Infect Dis* 30: 192–193.
- Torrez PPQ, Quiroga MM, Said R, Abati PAM, França FOS, 2015. Tetanus after envenomations caused by freshwater stingrays. *Toxicon* 97: 32–35.
- Auerbach PS, 2012. *Wilderness Medicine*, 6th edition. Philadelphia, PA: Elsevier/Mosby, 1629–1633.
- Alberts MB, Shalit M, LoGalbo F, 2004. Suction for venomous snakebite: a study of "mock venom" extraction in a human model. *Ann Emerg Med* 43: 181–186.
- Hønge BL, Hedegaard SK, Cederstrøm S, Nielsen H, 2015. Hospital contacts after bite by the European adder (*Vipera berus*). *Dan Med J* 62: pii: A5022.
- Bush SP, 2004. Snakebite suction devices don't remove venom. *Ann Emerg Med* 43: 187–188.
- Bitseff EL, Garoni WJ, Hardison CD, Thompson JM, 1970. The management of stingray injuries of the extremities. *South Med J* 63: 417–418.
- Dormon F, 1985. Local nerve block after stingray injury. *Lancet* 326: 1131–1132.
- Dewhirst FE, Chen T, Izard J, Paster BJ, Tanner ACR, Yu W-H, Lakshmanan A, Wade WG, 2010. The human oral microbiome. *J Bacteriol* 192: 5002–5017.
- Stevens DL, Bisno AL, Chambers HF, Dellinger EP, Goldstein EJC, Gorbach SL, Hirschmann JV, Kaplan SL, Montoya JG, Wade JC, 2014. Practice guidelines for the diagnosis and management of skin and soft tissue infections: 2014 update by the Infectious Diseases Society of America. *Clin Infect Dis* 59: e10–e52.