


Late Presentation of a Retained Stingray Spine in the Plantar Medial Hindfoot

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Abstract

In the United States, approximately 2000 stingray injuries occur annually. The majority of reports on stingray injuries to the foot and ankle reflect acute injuries. Delayed presentation after stingray injury to the foot and ankle has not been reported. We present a case of a 29-year-old female who sustained a stingray injury to the left plantar medial hindfoot 14 months prior to presenting to our clinic with new-onset posteromedial ankle redness and swelling along the tarsal tunnel. Magnetic resonance imaging (MRI) revealed multiple linear foreign bodies at the quadratus plantae and tarsal tunnel. The patient underwent operative exploration with removal of multiple retained stingray spines. At her most recent follow-up at 3 months, she was able to resume her usual activities.

Level of Evidence: Level V, case report.

Keywords: delayed presentation, hindfoot, retained foreign body, stingray, tarsal tunnel

Case Report

Presentation

A 29-year-old healthy female presented to clinic in October of 2018 with new onset of left ankle redness and swelling at the posteromedial aspect of the ankle along the tarsal tunnel. She denied recent trauma, but recalled that she was stung by a stingray in the left plantar medial hindfoot in August 2017 while at the beach in New Jersey. The patient did not seek medical attention initially because pain from the sting resolved within 24 hours.

Approximately 3 months following the initial injury, the patient presented to an outside emergency department with worsening left medial ankle pain. Radiographs of the left foot and ankle were negative for bony pathology and no foreign body was visualized. She continued to have pain, and magnetic resonance imaging (MRI) was obtained in March 2018 at the recommendation of the patient's primary care physician. The radiology read was significant for an accessory navicular, posterior tibial tendon tenosynovitis, flexor hallucis longus (FHL) and flexor digitorum longus (FDL) synovitis, and a moderate ankle effusion. There was no mention of retained foreign body. She was treated in a controlled ankle motion (CAM) boot and completed a course

of physical therapy without improvement. Her symptoms remained stable until October 2018, when she developed a tender erythematous lump over the posteromedial aspect of her left ankle along tarsal tunnel, causing her to seek orthopedic treatment.

At the initial visit at our clinic, the patient had not experienced any other recent trauma and denied fevers or other constitutional symptoms. Physical examination of the left foot and ankle revealed a 2.5-cm fluctuant mass along the tarsal tunnel with overlying cellulitis. She had mild tenderness at the posterior tibial tendon proximal to the mass, and pain with range of motion at the ankle. The patient was able to bear weight with an antalgic gait on the left side. The remainder of the physical examination was unremarkable. She was instructed to

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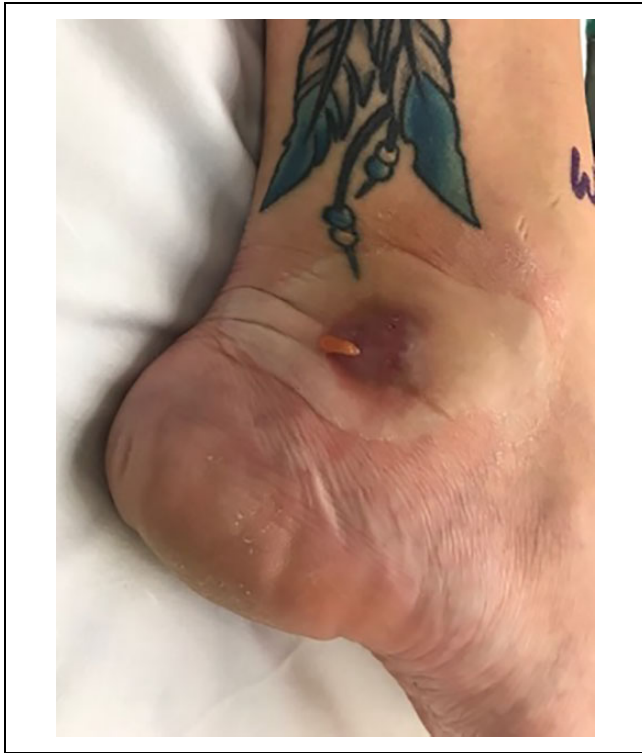


Figure 1. Swelling of posteromedial aspect left ankle with a sinus draining purulent fluid and surrounding cellulitis.

obtain an updated MRI. Oral antibiotics were prescribed to treat the cellulitis.

Two days later, the patient returned to clinic for follow-up. Thick, purulent fluid was draining from the inflamed area along left tarsal tunnel (Figure 1). She remained afebrile, and the remainder of her examination was unchanged. The white blood cell (WBC) count, erythrocyte sedimentation rate (ESR), and high sensitivity C-reactive protein (hsCRP) were all within normal limits (WBC 6.5 [normal $4.0-11.0 \times 10^3/\mu\text{L}$]; ESR 3 [normal $0-30$ mm/h]; hsCRP 0.5 [normal <7.4 mg/L]). The new MRI was reviewed, which showed 2-3 thin linear foreign bodies at the proximal aspect of the quadratus plantae and distal aspect of the tarsal tunnel, with associated subcutaneous edema of the medial ankle (Figure 2A and B). Of note, on closer review of the previously obtained MRI from March 2018 also demonstrated the presence of foreign bodies. At this point, operative exploration and extraction of foreign bodies under anesthesia were recommended.

Operative Technique

An incision was made along the medial hindfoot along the course of the tarsal tunnel centering at the draining wound. Purulent fluid was encountered just deep to the skin. The lacinate ligament was then identified and found to be extremely thickened. This was excised and sent to Pathology. Culture of the cloudy fluid was obtained and was sent for analysis. The

neurovascular bundle was identified and carefully retracted posteriorly using a blunt retractor with special care being taken to avoid excessive retraction. There was a small piece of the retained stingray barb superficial to the FHL tendon sheath and anterior to the neurovascular bundle. This was removed using forceps. The FHL tendon sheath was then incised. There was evidence of tenosynovitis surrounding the FHL tendon; however, the FHL tendon itself was intact, with no evidence of tear. Tenosynovectomy was performed along the FHL tendon, and the FHL tendon was then carefully retracted anteriorly. There was a large stingray barb just posterior to the FHL tendon, which was similarly removed using forceps (Figure 3A). Further exploration in deeper planes revealed multiple pieces of stingray barb in quadratus plantae, which were removed using a pair of forceps and a small curved mosquito clamp (Figure 3B). The wound was then irrigated with 3 L of gentamicin-containing solution using cystoscopy tubing. Two grams of Ancef was given intravenously by the anesthesia team after the soft tissue culture was obtained prior to removal of foreign bodies. The friable skin edges were excised using a no. 15 scalpel blade. Skin closure was then made with 3-0 nylon sutures and the patient was placed into a CAM boot. She remained weight bearing as tolerated in the CAM boot for six weeks postoperatively, at which time she weaned from the CAM boot into regular footwear.

Postoperative Course

Microbiology analysis of the intraoperative specimen was unrevealing. Gram stain showed occasional PMNs, but no organisms. Operative cultures finalized as no growth at 5 days. The pathology showed fibrous tissue with granulation tissue, acute and chronic inflammation, and granuloma formation. Acid-fast bacilli (AFB) and fungal stain were negative.

At 6-week follow-up, the patient's incision was well-healed (Figure 4). Other than mild numbness at the plantar-medial hallux, the patient's examination was unremarkable. At 12-week follow-up, she has resumed full activities except for running. She was subsequently discharged from the clinic and instructed to follow up as needed.

Discussion

Stingrays are responsible for more stinging injuries to humans than any other fish in the sea, affecting at least 2000 individuals annually in the United States alone.¹ These flattened, cartilaginous fish with muscular wings share their ancestral roots with sharks, and can range in size from several inches up to 12 feet long.^{1,5} The stingray's whip-like tail is uniquely structured, possessing 1 to 6 stiletto-sharp spines, also known as barbs, along its length.² Each spine is lined with retro-serrated edges and encased by a thin integumentary sheath, which serves to house the venom located along the underside of the spine.¹

Despite this powerful tail, stingrays are usually thought of as docile, nonaggressive scavengers who only attack out of self-defense when their habitat is unintentionally invaded

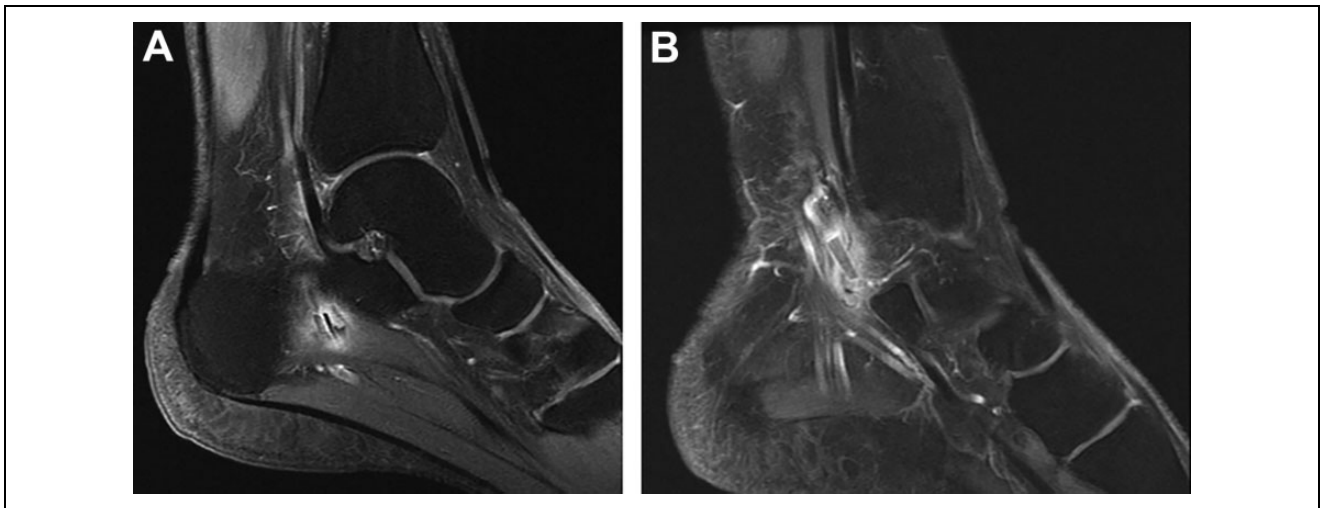


Figure 2. (A) Sagittal T2-weighted magnetic resonance image (MRI) of the left ankle showing 2-3 thin, linear low signal intensity foci within the quadratus plantae muscle, compatible with foreign bodies. (B) Sagittal section of T2-weighted MRI of the left ankle showing a large linear low signal intensity focus within the tarsal tunnel, compatible with a foreign body.

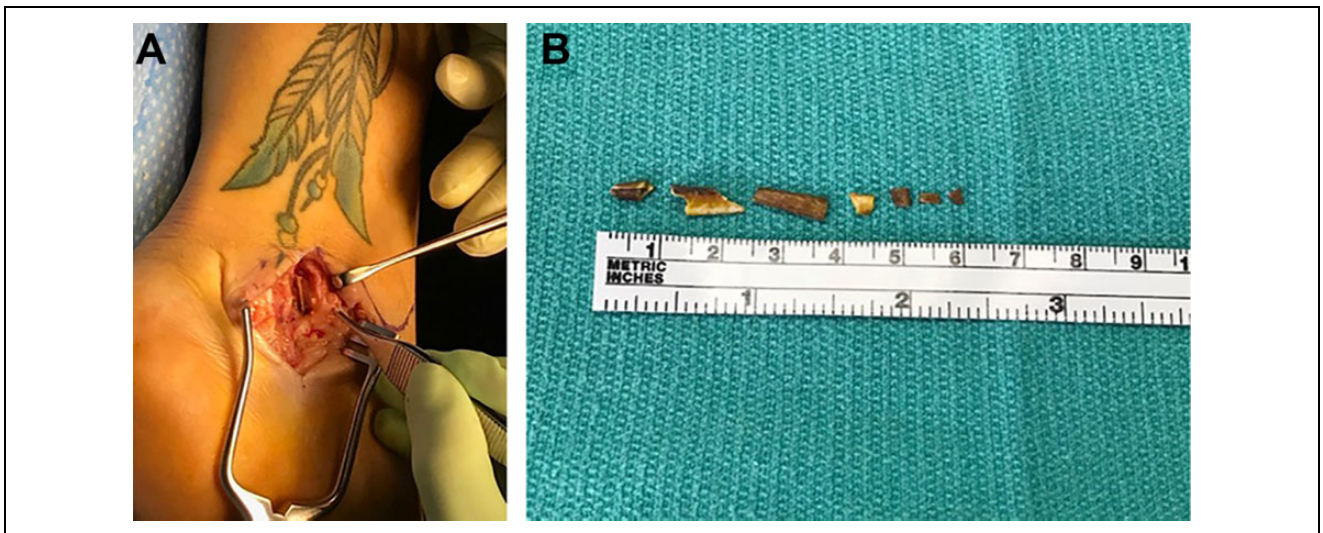


Figure 3. (A) Intraoperative image showing a large piece of retained stingray barb in tarsal tunnel. (B) Multiple pieces of broken stingray barb extracted from the patient.

during recreational and occupational activities. Most victims are young males in their 20s who sustain an injury to an extremity.^{3,12} The dorsal and plantar aspects of the foot as well as the ankle and lower leg are the most commonly implicated body parts among unsuspecting beachgoers or divers who step on a stingray buried in the sand.^{5,12} Fishermen are also susceptible to hand injuries, sustained while disentangling stingrays from hooks or nets.⁵

When disturbed, the stingray's tail reflexively whips forward in an effort to embed a spine into the victim.² On contact, a 2-part injury occurs.³ First, there is direct trauma to the affected body part in the form of a laceration or puncture wound. The second part of the injury is caused by envenomation. As the stingray spine plunges into a victim's skin,

the integumentary sheath containing the stingray's venom is ripped open, and venom is released into the wound.⁵ The venom, which is composed of heat-labile 5'-nucleotidase, phosphodiesterase, and serotonin, can cause both local and systemic symptoms. Classically, envenomation causes localized pain and swelling that peaks within an hour of injury.¹ Systemic signs of envenomation can include weakness, nausea/vomiting, diarrhea, tachycardia, arrhythmias, hypotension, syncope, seizures, muscle cramps or fasciculations, paralysis, and in rare cases, death.¹ Often, pieces of the spine itself or sand and debris from the surrounding environment remain lodged in the wound, increasing the risk of prolonged envenomation, infection, wound breakdown, and granulomatous foreign body reactions.⁵



Figure 4. Left ankle at postoperative week-6 follow-up appointment showing a well-healed incision.

The management of stingray injuries should begin immediately. Initial treatment focuses on identifying the extent of anatomic damage, reducing the effects of the venom, controlling pain, and preventing infection.¹³ Following the assessment of cardiopulmonary stability, the wound should be irrigated to remove non-embedded spine fragments and debris. Initial irrigation may be performed with seawater, though it is preferred to soak the wound in hot water up to 45° C (113° F) for 30 to 90 minutes as the hot water is believed to promote breakdown of the heat-labile venom.^{1,5} If the spine is retained and located superficially within the wound, it may be removed at the scene to minimize exposure to venom. However, in the rare circumstance that the spine deeply penetrates the abdomen, chest, or neck, it should be left in place and secured until the patient can be evaluated in an operating room.¹

Following transfer to a medical facility, patients should receive tetanus prophylaxis and pain control should be initiated.⁵ Oral or parenteral analgesics, non-epinephrine-containing local anesthetics, and regional nerve blocks may be necessary to achieve adequate analgesia, though hot water immersion alone has also been found to be effective.^{1,4} In addition to these standard methods to alleviate pain, a single case report from Australia found that pain control can also be achieved by applying half of an onion bulb to the stingray wound.¹⁶

Once pain is controlled, the wound should again be irrigated and explored to evaluate for retained spine

fragments or debris. Radiographs of the affected body part can should be obtained to rule out the presence of gas in the tissues, suggestive of bacterial infection, and for further evaluation of retained fragments.^{1,15} Although multiple studies have found hyperdense, radio-opaque pieces of retained spine on plain film x-ray, fragments are not always visibly apparent as the spine itself is composed of a cartilaginous material known as vasodentin.^{5,11,15} Ultrasonography can be utilized in cases with high index of suspicion for a retained foreign body despite negative radiographs, as it has been shown to be effective in identifying radiolucent objects in wounds.⁹ MRI also has utility in cases of established infection¹⁰ or when a retained spine is not visualized on plain radiographs, as was the situation in our case report.

Prophylactic antibiotic therapy should be initiated in the emergency department, directed at common marine bacteria including staphylococcal, streptococcal, and *Vibrio* species.³ Although evidence on the efficacy of prophylactic antibiotics is limited, a higher rate of return visits to the emergency department with symptoms suggesting wound infection among patients who did not receive antibiotics prior to discharge from their initial visit following a sting has been reported in the literature. Both a 5-day course of quinolone therapy as well as a short course of trimethoprim-sulfamethoxazole has been recommended for prophylactic treatment.⁵

The majority of reports on stingray injuries to the foot and ankle reflect acute injuries, and delayed presentations such as this case are rare. Of these delayed presentations, authors have described multiple reports involving wound complications related to infection and one case of acquired adult flat-foot deformity, all of which occurred within 1-2 months following the initial sting.^{6-8,10} None were associated with a retained spine.

This case describes complications in the foot and ankle from a retained stingray spine in the tarsal tunnel sustained from a sting more than 1 year prior to presentation. Interestingly, a chronically retained stingray spine was also implicated the case of a 44-year-old man who presented with new coronary artery occlusion, found to be caused by a retained stingray spine that had been implanted when the patient was stabbed in the chest with a stingray spine 17 years before presentation.¹⁴ Both cases demonstrated the potential for stingray spines to migrate over time.

This case is unique because of the extended delay in diagnosis and treatment of a retained stingray spine in the foot and ankle. It also emphasizes both the importance of obtaining a detailed history and the need to always personally review the patient's diagnostic images in the context of the injury or trauma history.


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