The Journal of Emergency Medicine, Vol. ■, No. ■, pp. 1–5, 2018

0736-4679/$ - see front matter

https://doi.org/10.1016/j.jemermed.2018.04.035

Selected Topics: Toxicology

A PROSPECTIVE STUDY OF STINGRAY INJURY AND ENVENOMATION OUTCOMES

Toby Myatt, MD,* Brian J. Nguyen, BS,* Richard F. Clark, MD,†‡ Christanne H. Coffey, MD,† and Charles W. O'Connell, MD†‡§

*University of California San Diego School of Medicine, La Jolla, California, †Department of Emergency Medicine, University of California San Diego, San Diego, California, ‡Division of Medical Toxicology, University of California San Diego, San Diego, California, and §Scripps Clinic Medical Group, La Jolla, California

Corresponding Address: Toby Myatt, University of California San Diego School of Medicine, 9500 Gilman Drive, La Jolla, CA 92093

☐ **Abstract—Background: Stingray injuries result in thousands of emergency department visits annually. Objectives: This study aimed to assess the complication rate and outcome of field treatment with hot water immersion. Methods: This was an on-site, prospective, observational study. Subjects were enrolled after having been stung by a stingray. A trained researcher obtained the following information: age, sex, health conditions and medications, and wound description. The efficacy of hot water immersion on pain was recorded. Patients were contacted on postinjury days 3, 7, and 14 for follow up. Results: Twenty-two subjects were included. No obvious foreign bodies were observed in wounds. Ten subjects were treated with hot water immersion and povidone-iodine, 12 with hot water immersion alone. Ongoing symptoms or complications were noted at the 3-day follow-up in 6 of 22 subjects (27.3%). One subject was diagnosed with cellulitis on post-sting day 8 and was treated with antibiotics. Ongoing symptoms or complications were reported more commonly in patients treated with hot water and povidone-iodine compared with those treated with hot water alone ($p = 0.056$). There was a significant difference in wound size between those with and without ongoing symptoms at the 3-day follow-up ($p = 0.0102$). No wounds <1 cm developed any complications. Average duration of water immersion was 73.6 min (range 35–145 min). The mean pain score pretreatment was 7.36 and posttreatment was 2.18, with an average decrease of 5.18 (95% confidence interval 4.22–6.15). Conclusion: Stingray injuries responded well to hot water immersion for pain control. Skin and soft tissue infection was diagnosed in 1 of 22 patients (4.55%).**

☐ **Keywords—marine envenomation; stingray**

Reprints are not available from the authors.

INTRODUCTION

Stingray injuries are implicated in thousands of emergency department visits annually in the United States, and are a major source of marine vertebrate-inflicted injury. A stingray's tail possesses a serrated barb, and inadvertent human contact can cause it to whip its tail in defense, causing either a laceration or puncture wound to the victim. Penetration by this barb may result in a glandular secretion of venom (1). Although most of these wounds result in a superficial tissue injury, there have been cases of wounds to certain anatomic areas that have led to complications such as arterial bleeding and spinal cord injury (1). Envenomation occurs in as many as 75% of cases in which the victim is stung (2). The venom contains several components, including serotonin, 5-nucleotidase, and phosphodiesterase. The serotonergic component of the venom is associated with the excruciating pain experienced by the victim after envenomation, and the 5-nucleotidase and phosphodiesterase serve to enzymatically degrade local tissue (3). Envenomations can result in systemic symptoms, including nausea, vomiting, diarrhea, muscle damage, cardiac dysrhythmias,

RECEIVED: 13 March 2018;
ACCEPTED: 12 April 2018

hypotension, seizures, and rarely death (4). Fragments of the spine can be embedded within the injury site leading to soft tissue infections and poor healing (4,5).

The current treatment of stingray envenomation involves irrigation and immersion of the wound in hot saline or fresh water heated to 43°C to 46°C (109°–115°F), which is thought to denature the heat-labile venom and provide relief in patients (4). Aside from the venom effects, the victim may also be exposed to numerous pathogenic microbes including Vibrio, Streptococcus, Staphylococcus, Aeromonas, and Clostridium species via the barb and surrounding aquatic environment. Multiple case reports have suggested that a significant number of people who presented to emergency departments or clinics with a stingray injury returned with infection when not treated with prophylactic antibiotics (2–4,6,7). However, prophylactic antibiotics after stingray exposure remains controversial because other studies suggest that the wounds are minor and antibiotics unnecessary (2). Some suggest that antibiotic prophylaxis is currently only recommended for deep penetrating wounds, wounds with significant foreign bodies, or for those victims who are immunocompromised (8).

Previous studies at this time are limited because of their retrospective nature in a health care setting. In our experience, many cases of stingray envenomation may not be seen by a health care provider. The objective of this study was to prospectively analyze and characterize on-site stingray envenomations and effects, examine the utility of hot water immersion, and detail the natural history of these injuries.

METHODS

Patients

We performed an on-site, prospective, observational study of consented beachgoers who presented to lifeguard stations with stingray injuries at a local Southern California beach from May 2015 to August 2016. Subjects of all ages were eligible for enrollment, with subjects <18 years of age entered only with parental consent. A trained researcher stationed at the beach would enroll patients and collect the following survey data from each subject: age, sex, descriptive characteristics of injury, presence or absence of obvious foreign body, health conditions, and medications. Because of the frequency of stingray stings at our beaches, the standard practice of lifeguards at these sites is to treat obvious stings on site with hot water immersion of the affected extremity. Some lifeguards at their own discretion will also apply 10% povidone-iodine wipes to the sting area. Characteristics of water immersion in each case were recorded. The duration of hot water immersion and pain score measured on an 11-item numeric rating scale from 0 to 10 before and after treatment was recorded. Subjects were contacted via telephone survey on postinjury days 3, 7, and 14 to assess pain score and any ongoing symptoms, treatments, or complications of their injury.

Statistical Analysis

Student's *t*-test (paired and unpaired), Pearson correlation coefficient, and either chi-squared or Fisher's exact tests were calculated for the appropriate variables. All statistical analysis was performed using SPSS software (IBM Corporation, Armonk, NY). This study was approved by our Human Research Protection Program.

RESULTS

The study group was comprised of 22 patients (n = 17 males) with a mean age of 29.7 years (range 17–55 years). Table 1 shows the breakdown of study group demographics. No subjects reported a significant medical history of immunocompromised state, vascular insufficiency, or the use of prescription antibiotics or medications. All injuries occurred to a lower extremity. Wound locations were distributed in the following regions of the lower extremity: plantar foot (n = 8), first digit (n = 7), medial foot (n = 3), ankle (n = 3), and lateral foot (n = 1). None of the wounds were initially determined by visual or tactile inspection to contain a retained spine or other foreign body. Mean wound size measured along the longest skin plane axis was 8.6 mm (range 2–20 mm). Details of wound descriptions are outlined in Table 2.

Ten patients were treated with hot water and 10% povidone-iodine wipes, while 12 patients were treated with hot water alone, done at the discretion of the lifeguards and not randomly assorted. The average duration of water submersion was 73.6 min (range 35–145 min). The pain score was significantly improved in each case upon hot water submersion treatment. The average pain score pretreatment was 7.36, and the average pain score

Table 1. Breakdown of Subject Group Demographics

Demographics	N = 22
Gender, n	
Male	17
Female	5
Age in years, n	
<18	1
18–24	9
25–34	7
35–44	1
45–54	3
≥55	1