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Marine Envenomations

Introduction

Fish and coelenterate stings are the most common causes of marine envenomations in humans.[1] Most hazardous marine organisms are found in temperate or tropical oceans, particularly the Indo-Pacific region.[2,3] Utah reports far fewer marine envenomations than the national average, however, increased travel and the importation of marine organisms for aquariums have increased risk of marine stings in Utah.

Venomous Fish

Fish reported to sting humans include Lionfish, scorpionfish, stonefish, stingrays, and catfish.[1,4,5] Stings range from non-venomous to lethal. The components of fish venom are not well characterized. They are primarily composed of proteins and polysaccharides of various sizes. The toxic and painful components tend to be large, unstable proteins that are rapidly destroyed by heating. Therefore, the primary method of decontamination is soaking the appendage in hot water for 30-90 minutes. Venoms can retain full potency for at least 24 to 48 hours after the death of the fish. Fish venoms usually act directly on muscle tissue and have little to no effect on the nervous system or on the coagulation profile.[1-3,6]

Scorpionfish

Scorpionfish include the sculpin commonly found along the California coast. Envenomations are most likely to occur after a fish is caught and is handled improperly, or a swimmer touches or steps on one hiding among the rocks. Envenomations are moderate to severe, but are rarely lethal. Stings are immediately painful, peaking in 60 to 90 minutes if not treated. Pain typically persists for 6 to 12 hours, but may persist for days.[1,2,5]

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Lionfish

The family Scorpaenidae contains hundreds of species which are divided into three groups; zebra fish (or lionfish), scorpionfish, and stonefish, based on the structure of their venomous organs. Lionfish stings are the most common cause of marine envenomations reported to the Utah Poison Control Center (UPCC), and are the type of envenomation in which Utah health care professionals are most likely to be involved in the initial treatment. Lionfish are the least venomous of all scorpionfish and are commonly kept in salt-water aquariums. They are capable of inflicting painful, but relatively mild wounds. Most injuries are self-limiting and can be treated at home.[1-3,5,6]

Stonefish

Stonefish are among the most venomous fish in the world. Over 60 fatalities have been reported in Australia. Stonefish venom has been compared to cobra venom in potency. It can paralyze both skeletal and smooth muscle due to direct muscle toxicity. Stonefish are found in the Indo-Pacific region and not in U.S. coastal waters. Stonefish antivenin is produced and distributed in the Indo-Pacific regions. In the U.S., clinicians can locate antivenin with the help of a regional poison control center. The usual dose of the antivenin is one vial per sting. Wound healing can be delayed up to several months in some cases. Numbness may persist for weeks.[1-3,5,6]

Stingrays

In America, stingrays probably sting humans more frequently than any other fish. Stingrays are commonly found in tropical, subtropical, and warm temperate oceans. Eleven species are found in U.S. coastal waters. Stingray envenomations typically occur when a wader steps on a stingray resting on the sea floor. The stingray reflexively whips its tail upward and extends the stinger. This usually produces a laceration or puncture-wound in the foot or leg of the victim. The stinger is covered by a cartilaginous sheath that breaks apart and releases venom as it penetrates the skin of the victim. The sting results in immediate intense pain and variable amounts of bleeding. The pain peaks after 30-60 min and may last up to 48 hours. Venom, mucous, pieces of the sheath, and even fragments of the spine can be released in the wound, and large lacerations can be formed. After initial treatment, the extremity should be elevated until edema resolves.[1-3,5,9]

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Methamphetamine Manufacturing in Utah

Methamphetamine is a synthetic and very potent amphetamine derivative. It produces CNS stimulation, a euphoric "high", and is widely abused. Overdose can result in seizures, hypertension, hyperthermia, intracranial hemorrhage, myocardial infarction, and stroke. Methamphetamine is a schedule II controlled substance and its production is illegal. In recent years it has become increasingly easy to produce methamphetamine, especially with numerous Internet sites providing step-by-step recipes. Now "cooks" with little to no chemistry background are handling hazardous chemicals and performing potentially dangerous procedures that often end in explosions, fires, and severe trauma. These "labs" are often located in homes where small children are present. Utah has been ranked from first to third in the nation for illegal methamphetamine manufacturing sites per capita. The warning signs of a potential "meth lab" are:

- Unusual, strong odors: ammonia, solvents, "cat urine".
- Residence with windows blacked-out.
- Heavy traffic at unusual times of day.
- Excessive trash: antifreeze containers, lantern fuel cans, red-stained coffee filters, drain cleaners.

Chemicals commonly used in the manufacture of methamphetamine include:

- Solvents: ether, acetone, alcohol, benzene, chloroform, toluene
- Precursors: phenylpropanolamine, pseudoephedrine, ephedrine ("cold tablets", "bronchodilators")
- Iodine crystals
- Red phosphorous (matches)
- Mercuric chloride
- Acids: hydrochloric, sulfuric
- Lye, alkaline drain cleaners
- Propane cylinders, white gasoline, camp stove fuel.
- Fluorinated hydrocarbons (Freon™)
- Batteries/lithium

In addition to potential methamphetamine toxicity, innocent children or adult substance abusers may be exposed to the above chemicals and should be evaluated for possible "hazardous materials" exposures. Information about the toxicity of these and other chemicals involved in the manufacture of methamphetamine can be obtained by consulting the Utah Poison Control Center.

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Catfish

Most catfish found in the U.S. are freshwater fish and are capable of inflicting painful stings that resolve in a few hours. The Indo-Pacific region contains the most venomous species of catfish. Catfish stings are caused by the spines found in the dorsal and pectoral fins and not by the sensory whiskers. Stings are most likely to happen after a fish is caught and handled improperly.

Treatment

General wound care principles apply to all fish stings. A quick reference can be found in Table 1. Wounds should be irrigated with the available water (seawater in many cases) to remove debris and venom. The affected area should then be soaked in hot water for 30-90 minutes to reduce pain and inactivate the venom. The injured person may have difficulty judging the temperature of the water, so care must be taken not to scald the skin. All patients should receive the appropriate anti-tetanus agent if needed. In the ED, fragments of spine and other debris may need to be removed. Large wounds may require debridement and possibly closure. Supportive care may be required in severe envenomations.[1-7] In most cases, Utah health care professionals will be dealing with delayed presentations of injuries that occurred while the person was visiting a coastal area. The main concern at this point is removal of fragments remaining in the wound and prevention of infection.

Infected wounds should be cultured for aerobes and anaerobes. The laboratory should be notified that a marine acquired organism might be present. Special culture media is required for isolation. Antibiotic choice should be guided by culture results. Prophylactic therapy should cover the vibrio species (a common infecting organism). Ciprofloacin or sulfamethoxazole-trimethoprim is recommended for oral administration and third generation cephalosporins offer good coverage for IV administration.[1,5,8]

Coelenterates

Coelenterates include the corals, sea anemones, jellyfishes, and hydroids. Of the over 11,000 species, approximately 200 are hazardous to humans. Coelenterates contain thousands of specialized stinging cells (nematocysts) capable of penetrating the skin with harpoon-like threads and injecting venom upon contact. The potency of venom varies from species to species. The venom is composed of many protein fractions, some of which have been shown to be cardiotoxic, neurotoxic, and dermatonecrotic. The venom may also contain histamine, prostaglandins, serotonin, and kinin-like factors. Reactions are often instantaneous, but can be delayed. They usually consist of burning, itching, and urticaria. Various types of skin lesions may develop after a sting, depending on the type of organism and the extent of the contact. Systemic manifestations are rare, except for the most toxic organisms. Anaphylaxis is becoming more common possibly due to the increasing number of people with previous contact, and sensitization to coelenterate venom.[11,12]

The Portuguese man-of-war, sea nettle, and the box jellyfish (sea wasp) can inflict serious and potentially life-threatening stings. Seventy-two deaths from box jellyfish have been recorded in Australian and Asian waters. Portuguese man-of-war and sea nettles have caused deaths in U.S. and Caribbean waters.

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Fire corals, feather hydroids, and cabbage-head jellyfish are common causes of minor stings. Untreated stings resolve in 3-7 days. Most sea anemones sold for aquariums have little or no venom.[10,11]

Treatment

Therapy for most coelenterate stings is the same. First the area is rinsed with seawater (freshwater may cause additional firing of nematocysts). The area should be soaked for 15-30 minutes in 5% acetic acid (vinegar) to inactivate any unfired nematocysts. The vinegar will generally not relieve pain. Any tentacles should be removed using forceps or a gloved hand. Removal of the remaining nematocysts can by accomplished by applying a paste of baking soda, flour, or shaving cream, and scraping the area with a sharp knife or shaving the area with a razor. When dry, a topical corticosteroid may be applied for several days to treat the dermatitis. Chironex antivenin (produced and distributed in the Indo-Pacific regions) may be used to treat box jellyfish envenomations.[1-3,10,11]

Sea Urchins

Sea urchins are commonly kept in marine aquariums. Venomous species are not commonly sold for aquarium use. The most common injuries result from tissue penetration by sharp spines, causing local tissue reactions and a burning sensation. The site of injury is often stained purple by a harmless dye secreted by many sea urchins.

Treatment

Spines should be removed immediately. This is often a difficult task due to the brittleness of the spines. Soaking the wound in hot water may help expel some spines from the body. Vinegar has been used to dissolve superficial spines, but is not effective at dissolving the embedded spines. Spines will eventually be absorbed by the body, but increase the risk of infection. Special concern must be taken if spines have penetrated near a joint. Severe synovitis may result if not removed.[1,10]

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Table 1 - Treatments for Marine Envenomations [1,5,10]

Marine Organism	Detoxification	Treatment
Stingray; Lionfish; Scorpionfish; Catfish	Submerge injury in hot water for 30-90 min.	Irrigation with normal saline. Exploration and debridement. Administer antibiotics and analgesics as indicated. Give appropriate antitetanus agent. Observation for 3-4 hours to rule out systemic envenomation. Elevate extremity until edema has receded.
Stonefish	Same as outline for stingray	Same as outlined for stingray. Stonefish antivenin for severe systemic reactions.
Fire coral; Hydroids; Anemones	Irrigate with seawater (not fresh water). Topical 5% acetic acid (vinegar). Shave affected area.	Topical corticosteroid cream for dermatitis.
Portuguese man-of-war; Sea nettles	Same as for fire coral. Use forceps or gloves to remove tentacles.	Topical corticosteroid cream for dermatitis. All patients with systemic symptoms should be observed for 8 hours. Severe systemic symptoms mandate hospitalization with supportive care.
Box jellyfish	Same as for Portuguese man-of-war	Same as for Portuguese man-of-war. Give Chironex antivenin. Supportive care for hypotension and respiratory depression.
Sea Urchin	Hot water. Removal of any spines or pedicellariae.	Exploration and removal of any spines.

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*CSPI denotes Certified Specialist in Poison Information.

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Summary

Although marine envenomations are uncommon in Utah, health care professionals should be prepared to treat delayed presentations of fish and coelenterate stings, and acute presentations of lionfish stings. Please feel free to contact the UPCC for guidance in treating marine envenomations.

Benjamin Semadeni, PharmD

Public Education Materials

The UPCC is pleased to announce that Heather Foulger, MS, CHES has joined the staff as the new outreach education provider. Please contact her at (801) 585-7187 or heather.foulger@hsc.utah.edu to assist with your patient education needs. Poison prevention display boards, brochures, telephone stickers, emergency action cards, videos, posters, and drug look-a-like displays are available for checkout and purchase.

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