REVIEW ARTICLE

Fish Envenomation: Neglected Hazard in Aquariums

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Abstract

Around 1200 species of marine fish are venomous. Venomous fishes pose a significant health problem to certain populations in the world and are important neglected environmental diseases. Keeping fish in an aquarium is a popular hobby throughout the world. One in ten households possesses aquariums as their hobby. Aquariums are a convenient option for those living in flats and, more generally, those in rented accommodation, where keeping cats, dogs and caged animals is often banned. These tanks are stocked with wildlife extracted from the world's freshwater sources and also from oceans. Rapid growth of marine ornamental industry has made available a lot of marine and venomous fishes in the markets and being marketed as an aquarium fish. This can lead to potential envenomation among general public. Fortunately, most of the incidents were trivial and require no medical attention. However, a few fish stings cases may be serious and sometimes fatal outcomes may occur if they are not managed properly. Fish venoms possess cardiovascular, neuromuscular, oedematic and cytolytic activity. This paper reviews the presenting symptoms and treatment options for envenomation from the most common and deadly marine specimens, aquarists are likely to encounter and their preventive measures.

Introduction

Fish constitute almost half the numbers of vertebrates on earth and approximately 22, 000 species of fish are contained in some 50 orders and 445 families.[1] They live in all types of water, but over 90% of species live in the marine environment. Many people over the world depend on fishes or products made from fishes for their food and economic livelihood. The beauty of many fish species are highlighted in aquariums, fish stores and in home collections. As of 1996, aquarium keeping is the second-most popular hobby in United States. The 2015-2016 APPMA National Pet Owners Survey reported that Americans own approximately 95.5 million freshwater fish and 9.5 million saltwater fish. An estimated 13.3 million US household owned an aquarium.[2] Around 36 million fishes were estimated to be kept in aquaria in Germany. The hobby has a strong popularity in Europe, Asia, and North America. In the United States, 40% of aquarists maintain two or more tanks.[3] Aquariums are a convenient option for those living in flats and, more generally, those in rented accommodation, where keeping cats, dogs and caged animals is often banned. These tanks are stocked with wildlife extracted from the world's freshwater sources and also from oceans. In contrast, to the previous estimates of 200 venomous fishes, around 1,200 fishes in 12 clades are presumed to be venomous based on a phylogenetic study.[4] The rapid growth of marine ornamental industry has placed potentially dangerous marine specimens at the hands of the general public increasing the chances of severe envenomation in them.

Epidemiology of Fish Envenomation

Around 40 000 to 50 000 marine envenomation occur worldwide each year.[5] The American Association of Poison Control Centers 2010 estimates about 1800 aquatic exposures every year,[6] although the actual number of envenomation that results from home aquarium specimen remains unknown as these cases are mostly under reported. Several factors contribute to under-reporting. Victims of marine envenomation who are unaware of the toxicity of some marine animals may not seek medical attention unless the condition is severe. Moreover, treating physicians may not consult or they report these injuries to the toxicology center. While fatalities are rare, some exotic aquarium specimens had also been reported to cause death in humans. Moreover, hobbyists, unsuspecting adults and children are at risk for envenomation from venomous fishes in aquariums.[7]

Problem Statement

There are no studies specifically considering the injuries taking place in aquariums but there are ample case reports and few studies on marine envenomation to highlight this potential environmental hazard in the present era of increasing marine adventure leisure activities and growing aquarium industries.

A 3-year retrospective review on venomous fish sting cases reported to the Hong Kong Poison Information Centre (HKPIC) showed that out of the 33 cases of marine envenomation, twelve were confirmed to be stung by catfish (Plotosus lineatus), 7 by stonefish (Synanceia verrucosa) and 4 by lionfish (Pterois volitans).The remaining cases included waspfish (Hypodytes rubripinnis), stingrays (Taeniura meyeni), rabbitfish (Siganus canaliculatus), silver scat (Selenotocota multifasciata) and other unknown fish. Most patients were stung on the hands (n=30). All patients complained of pain at the sting site. Other presenting symptoms were wound swelling (n=28), erythema (n=13) and numbness (n=13). In terms of complications, there were

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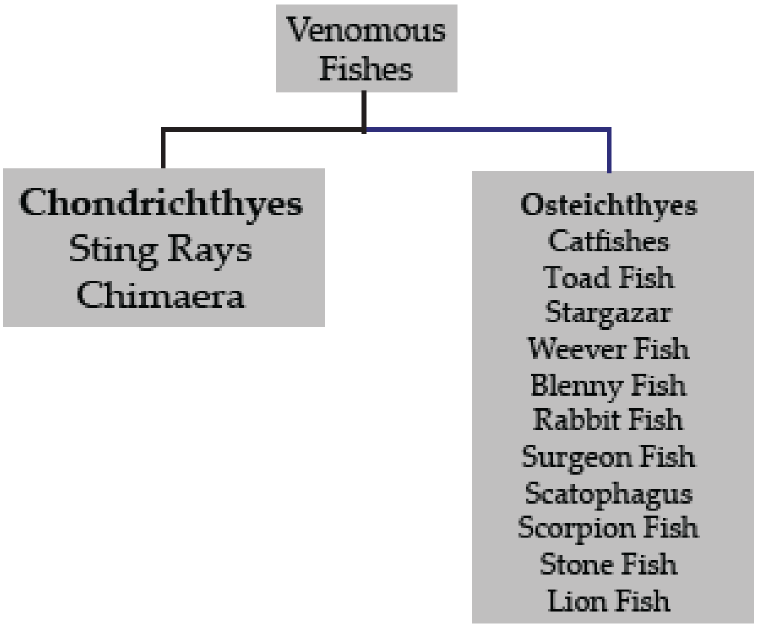

Fig. 1: Some known venomous fishes[4]

3 cases of cellulitis, 1 case of sub-acute tenosynovitis and 1 case of abscess formation over the sting area. All of them required admission to hospital for parenteral antibiotic treatment. There was also 1 case of retained catfish spine shown on plain radiograph. There was no mortality.[8]

A study was taken in Israel, to characterize and assess the extent of injuries caused by marine organisms along their Mediterranean coast. Data were obtained from a survey of injuries from marine organisms among their professional fishermen and from medical records provided by the Israel Poison Information Center. The results pointed out that injuries caused by marine organisms are not rare in Israel, but most cases are not severe. The most common injuries reported by fishermen were caused by stingrays (30%), weever fish (22%), rabbit fish (13%), and marine catfish (10%). Only 28% of the injured fishermen went to hospital. Most fishermen tend to treat such injuries themselves and sought medical help only when an unknown venomous fish was involved. Most cases of severe toxicity were due to secondary infection. Common sources of injuries identified were cleaning and preparing fish for consumption, during leisure water sport activities, handling marine aquaria and during fishing. Most case records obtained from poison center were graded as minor severity (85%) and were treated symptomatically.[9]

In a regional toxicology Centre in the US state of Michigan, 23 patients were treated for Lionfish stings (*Pterois sp.*) during the period 1979–1988. All cases involved aquarists. All of the patients were stung on the hand or a finger and presented with signs of envenoming. Pain and local swelling were the most common symptoms. Life-threatening systemic effects of the venom did not occur.[10] A similar series was documented in another toxicological Centre in San Francisco where they treated 45 Lionfish stings (primarily *Pterois volitans*) during the period 1979–1983. All cases involved aquarists except one person. Pain and local swelling were the main symptoms. Systemic effects occurred in 6 patients.[11]

In recent years, owing to the increased use of skin and scuba diving as leisure activities there has been an increase in the number of admissions to emergency departments of injuries caused by marine animals. This was well shown in a retrospective, descriptive study of patients with marine animal injuries who presented to Victorian emergency department, Australia. The results were that most (65.9%) injuries occurred during leisure or sport, and 72 (35.1%) occurred in a place of recreation. Spikes, spines, and barbs caused 82 (40.0%) injuries, and stings caused 54 (26.3%) injuries.[12]

Risky Behaviours for Fish Envenomation

Fishermen were the common victims who get stung while emptying their nets or removing fish from a fishhook. Bathers and divers are another group at risk. They are usually stung in the foot by bottom-dwelling venomous fish while wading in water. However, accidents do also occur when victims needlessly touch or bother venomous fish. On the other hand, accidents may also occur outside of the water, while preparation of edible fish and in aquariums while cleaning their fish tanks.[13]

Venomous Fishes

Fishes are generally regarded as venomous if they possess a traumatizing apparatus such as spines which are capable of both puncturing the skin and depositing venom within wound.[14] Around 1200 species of fish are considered as venomous.[4] Fish represent a superclass, comprising of 3 classes, Cyclostomata (cyclostomes or jawless fishes), Chondrichthyes (cartilaginous fishes, sharks, rays, skates and chimaeras) and Osteichthyes (bony fishes). Fish with venomous spines are found mostly among the cartilaginous fishes (in particular rays and skates, less so sharks and chimaeras) and among the bony fishes.[14] Venoms are complex mixtures of species, subspecies, or even geographic-variant–specific substances that are pharmacologically highly active and can cause a wide range of clinical signs and symptoms which can be grouped into 7 classes: local, auto-pharmacological, anti-hemostatic, neurological, muscular, cardiac, and renal effects. Venom effects are predominantly species-specific, which makes it difficult to transfer observations from animals to humans. Unlike venomous animals, animals classified as poisonous lack an injection device, instead they possess toxins that are dispersed in their body tissues and get activated when the animal is ingested.[15,16]

Venom Apparatus

In order to be classified as venomous, a fish must not only secrete a noxious substance from specialized secretory glands, but also possess some form of specialized delivery apparatus. With the exception of the sabre-toothed blenny fish (Meiacanthus nigrolineatus) which possesses venomous canine teeth,[17] the venom apparatus in most fishes invariably consists of spines that may be located on the dorsal (the most common), pectoral, operculum, shoulder, pelvic, anal and caudal areas of the fish, depending on the species.[18] Venomous spines are those which remain in close association with cells containing venom and are capable of entering a wound when the spine sheath gets ruptured. The spines may have a median dorsal or a median ventral ridge with venom glands arranged along the grooves. Some venomous fishes have serrated grooves which can produce lacerations in victims. Most other spines are hollow to allow passage of the venom into the wound.

Venom glands are comprised of concentrations of unicellular glands, three types of glands are found, a) mucus glands b) clavate glands c) sacciform glands. Mucus glands have a slimy secretion and clavate cells have a proteinaceous secretion, both these glands need to be ruptured before their contents are released. These secretions get released on damage to the gland while fish handling. Sacciform glands release their venom through an apical pore without the gland being ruptured.[19] In some species e.g.stonefish (Synanceia spp.), these venomous spines are highly developed, with distinct venom glands and venom ducts closely associated with the spine.[20] In other species, the venom apparatus is poorly developed with a spine which is loosely associated with the venomous secretory products. Almost, the venom apparatus of all venomous fish consists of the same basic structure of a spine, associated with venom secreting cells covered by an integumentary sheath. Venom is delivered when the spine pierces the tissue of the victim, rupturing the integumentary sheath enclosing the spine.[21] In addition to venom apparatus, many species of fish are able to secrete substances from their skin, known as Icthyocrinotoxins.[22] These substances are capable of repelling or incapacitating other marine animals and are also thought to possess antibiotic activity, protecting fish from the invading microorganisms in the marine environment. Although it has been suggested that these icthyocrinotoxins may also enter a wound during the envenomation process, the lack of specialized delivery apparatus makes it difficult to classify these secretions as venoms.[23]

Aquarium Fishes Causing Potential Envenomation

Lion Fish

The most dangerous among the venomous fishes known, belong to Scorpaenidae family and, they are divided in to three groups typified by different genera: Pterois (lionfish), Synanceja (stonefish) and Scorpaena (scorpionfish).[24] Lionfish are originally inhabitants of tropical waters of the Indo-Pacific region. In recent years it has disseminated over the Atlantic Ocean, USA, in several Caribbean countries (Bermuda, Bahamas, Cuba, Dominican Republic, Jamaica, Puerto Rico, Turks and Caicos, Cayman Islands, Belize, Haiti, U.S. Virgin Islands, Mexico, Aruba, Curaçao, and Bonaire) and more recently in South America (Colombia and Venezuela).[25,26] They are known by other names like Turkey fish, Dragon fish, Scorpion fish, Fire fish, Feather fishes, Butterfly fishes, Zebra fishes and Devilfishes.[27] Lionfish can have different colours (red, green, red, navy green, brown, orange, yellow, black, maroon or white) and present with long and slender spines covered by an epithelial sheath that contains venom glands in the grooves of upper two-thirds of the spine. The venom flows to the wound when the ray of the fin penetrates the skin of the victim and the epithelium is broken. There are 12 to 13 rays or spines in the dorsal fin, two in the pelvic fin and three in the anal fin. The pectoral spines do not have venom.[25] Lionfishes are popular aquarium fish and thus envenoming is common in aquarium handlers. The majority of the reported envenomation occurs in the upper extremities of the victims. The main symptom is the excruciating local pain, the pain increases in 1 to 2 hours and typically persists for 6 to 12 hours. It may radiate throughout the root of the affected limb. Moreover, the painful process can last even for weeks. There is marked inflammation, with erythema, edema and warmth. In some cases, there can be local cyanosis, paleness, vesicles and blisters. Rarely, the sting site can present with skin necrosis. Lionfish venom may provoke systemic manifestations such as cardiac effects and blood pressure changes and are thought to be due to nitric oxide release. In humans, Pterois venom usually causes systemic symptoms like nausea, vomiting, cold sweating, fever, dyspnea, convulsions, abdominal pain and syncope. Paralysis of the limbs and cardiac failure are observed infrequently. There are no published reports of death, as the venom has not shown to be lethal to healthy humans. The development of anaphylaxis and severe infections are always a possiblity and require immediate emergency medical treatment.[28-31]

Rabbit Fish

Siganidae family are popularly called as rabbit fish, fox face or spine foot. There are 30 species all over the world and are distributed in reefs among sea grasses, mangroves, and estuaries and also in shallow lagoons of tropical and subtropical coastal environments including southern Korea, Japan, Southeast Asia, Australia, Indo–Pacific regions, Hong Kong, Taiwan and Red Sea.[32,33] These fish are appreciated as food items by people in the Indo-pacific and eastern Mediterranean.[34] They have prominent face stripes which led to the common name fox faces. The majority of fishes of the family have bright and unique colour patterns with large, dark eyes and small rabbit-like mouths. These species have uniform feature with pelvic fins, which are formed from two spines, with three soft rays between them dorsal fin bears 13 spines with 10 rays behind, while the anal fin has seven spines and nine rays behind; the fin spines are equipped with well-developed venom glands. Care must be taken during aquarium maintenance and cleaning, as rabbit fishes are often easily frightened and will use their venomous spines in defense. Their venom is not life-threatening to adult humans, but causes immediate, local, intense pain, soft tissue edema and a variable extent of bleeding. The crude venom of rabbit fish possesses hemolytic activity on chicken, sheep, goat and human blood.[35] There are few case reports of secondary infections following rabbit fish sting, gas gangrene caused by Gemella morbillorum and a case of necrotizing fasciitis due to vibrio damsel. Both these cases responded well with appropriate antibiotic therapy and

Fig. 2: (A) Pterois volitans (lion fish); (B)siganus vulpinus (rabbit fish); (C) Scataphags Argus (spotted scat); (D) plotosus lineatus (catfish)

wound management.[36,37]

Spotted Scat

The Spotted Scat (Scatophagus Argus) has a large distribution; they are commonly found throughout the Indo-Pacific region and in India. Most seen for sale are usually collected near Thailand. This fish is commonly known as Argus Fish, Leopard scat, Red Scat, Spotted Butter Fish, Ruby Scat, Green Scat, Common scat, and Spadefish.[38] Scats have a quadrangular and laterally compressed body. They are greenish brown in colour with white belly and black dots of varying sizes all over the body. The average length of S. Argus is about 200 mm, and they can grow up to a length of 350 mm.[39] The beautifully spotted rhombic body makes it preferable as an attractive aquarium fish, while the taste and quality ranks it as a good edible fish. Scats are venomous fishes and the venom apparatus comprises of 11 dorsal spines, 4 anal spines and a pair of ventral spine, elongated venom glands and an integumentary sheath enveloping all. The spines are very sharp and pointed, accommodating a pair of venom glands in each spine.[40] Scats are not aggressive and they don't try to inflict a wound actively. However the fishermen and aquarists get stung accidentally and more frequently while handling them. The envenoming appears within 5-10 minutes as excruciating local pain disproportionate to the size of the injury, swelling, redness and throbbing sensation that extend to the limbs followed by dizziness.[41] The severity of the presentation varies depending on the amount of venom injected, and the size of the fish. Larger, the fish, more amount of venom can be injected.[42] The biochemical nature of the venom of S. Argus has been found to cause hemolysis in human erythrocytes. In addition, when tested on mice, the venom appears to be "cytolytic, oedematic, nociceptive, myotoxic and proteolytic leading to tissue damage and pain.[43]

Catfish

Catfish (order Siluriformes) are a diverse group of ray-finned fish with prominent barbells, resembling that of a cat's whiskers. Catfish range in size and behavior from the heaviest and longest, the Mekong giant catfish from Southeast Asia and the second longest, the wels catfish of Eurasia, to a tiny parasitic species commonly called the candiru, Vandellia cirrhosa. Many of the smaller species, particularly the freshwater genus Corydoras, are important in the aquarium.[44] Catfish species live inland or in coastal waters of every continent except Antarctica. Catfish are most diverse in tropical South America, Asia, Africa and Europe. More than half of all catfish species live in the Americas. They are found in freshwater environments, though most inhabit shallow, running water.[45] The stinging catfish Heteropneustes fossilis has become a popular aquarium fish and is available in almost every pet shop. A great number of species of marine catfish, including Plotosus lineatus (the oriental catfish) and Galeichthys felis (the common sea catfish) and several other species of freshwater catfish are capable of human envenomation.[46] Venom is delivered through a single dorsal spine and two pectoral spines. Clinically, a catfish sting is comparable to that of a stingray. The marine catfish envenomation is generally more severe than those of their freshwater counterparts. Venomous catfish have a sharp and stout sting immediately in front of the soft-rayed portion of dorsal and pectoral fins. Stings are derived from fin rays and are covered by a thin integumentary sheath. There is no external sign of the venom glands, which are located in a series of sharp recurring teeth capable of cutting into a victim's flesh, helping the venom to be absorbed and often seeding serious infections. The stings of the catfish are very dangerous once they have been erected.[47] In catfish, the pectoral fins aid the fish in its defense mechanism against predators. The ability of catfish to inflict extremely painful wounds with their pectoral and dorsal stings has been well known for many decades. The venom in the spines remains active for days, so discarded spines and even refrigerated specimens should be treated with caution.

Catfish sting envenomation is a frequent cause of morbidity among anglers, fishermen, food processors, and aquarists.[48-50] Catfish have two toxicity mechanisms: the first is linked to sting penetration and rupture of the venom glandular tissue surrounding the sting, whereas the second, called icthyocrinotoxicity is associated with the production of toxins in the entire fish skin.[51] The venom of catfish is a complex composition of hemolytic, dermonecrotic, oedema-producing, and vasospastic factors and contains several amino acids, 5HT, 5-nucleotidase, and phosphodiesterase. Although these stings are often innocuous, significant morbidity may result from stings, including severe pain, retained foreign bodies, infection, respiratory compromise, arterial hypotension, and cardiac dysrhythmias. There are few case reports on freshwater catfish stings by immersion of hand into the catfish aquarium. Other complications include, severe tissue necrosis, necrotizing fasciitis, radial artery injury, ulnar nerve deficit, and chronic tenosynovitis of hand

Properties of Fish Venoms

The chemical nature of piscine venoms is poorly understood. The loss of toxicity seen when these venoms are subjected to common denaturing agents suggests that proteins constitute the major toxic component of these secretions. Fish venoms are usually mixtures of heat-labile high molecular weight proteins with systemic toxic effect and low molecular weight amines which cause inflammatory reactions.[1] Although there is a complex balance between different components of the venom response, similarities exist between the responses to the venoms of all species of fish. The most potent effects of piscine venoms are on the cardiovascular system. All piscine venoms produce profound cardiovascular changes, both in vitro and in vivo. These include changes in blood pressure and endothelium dependent smooth muscle relaxation, as well as inotropic and chronotropic responses.[52-54]

Envenomation symptoms such as paralysis, muscles spasms, and prolonged weakness clearly demonstrate that fish venoms also targets the neuromuscular system. Mice injected with *P. volitans* venom in experimental conditions showed skeletal muscular weakness indicative of neuromuscular activity.[55] Based on the convulsions and paralysis observed in experimental conditions on exposure to *S. Argus* venom, explained the neurotoxic nature of the venom.[42] Intense pain and severe edema are the major symptoms common to the vast majority of fish Envenomation. Various substances were postulated for this property including kinin like substance, substance recruiting inflammatory mediators but still studies are needed to the understand the nociceptive properties of fish venoms.[56] Studies have confirmed that piscine venom has myotoxicity, as indicated by an increase in serum creatine kinase in mouse models following injection of the crude venom.[42] Hemolysis caused by fish venom exhibits species sensitivity, like that of other animal venoms. Venom from the catfish *Arius maculatus* is approximately four times potent hemolytic to chicken blood than to blood from sheep and humans.[57] In addition to their hemolytic activity, fish venoms also possess the ability to lyse other cell types.*S. Argus* venom has been found to cause the lysis of HeLa cells and platelets.[42] In fish venoms, it has even been suggested that proteolytic enzymes could be partially responsible for the extreme lability of the venom components and they have been confirmed. Fish venoms have also been shown to contain a number of enzymes other than proteases. *S. Argus* venom has both alkaline and acid phosphatase activity, as well as phosphodiesterase activity [58]. Hyaluronidase is a common venom enzyme and facilitates the distribution of toxic components by breaking down the structurally important hyaluronan around the envenomation site. Hyaluronidase activity has been found in several different fish venoms. These include stonefish, soldier fish, lionfish, weever fish, and stingrays.[56,59,60] As previously stated, no fish venoms have been found to exhibit phospholipaseA2 activity.[59] However, *S. Argus* was recently shown to possess phospholipase C activity which is suggested as a haemolytic agent.[61] Piscine venoms have shown lability with regards to heat, pH, lyophilisation, storage, and repeated freezing and thawing.[54]

Clinical Features

Despite their wide taxonomic range, the venom apparatus and pharmacology are similar throughout most venomous fish species.[4,62] Envenomation incurs a large range of symptoms that have occasionally been shown to cause fatalities. The most notable symptom is extreme pain disproportionate to the size of the injury.[11] The pain, in addition to being severe, may also radiate up the affected limb to the regional lymphatic vessels. Edema and erythema are also relatively common[51] and in some cases vesicles may form around the wound.[63] Systemic symptoms resulting from fish stings include ischemia, muscle spasms, tissue necrosis, prolonged weakness, and nausea, as well as paralysis of the affected limb, hallucinations, loss of perception, hypotension, tachycardia, and respiratory distress.[64,65] Slow healing and necrosis have been observed following envenomation.[66] Death is rare even though, if it occurs it will do so within the first several hours following contact.[67] The extent of the damage from envenomation can vary according to the species, number and depth of envenomation sites, and individual reaction to the venom components.[63] Secondary infections are also known to occur, leading to addition damage.[24,68,69]

Pre Hospital Care

Pre hospital personnel who come in contact with such injuries should be properly educated on marine envenomation. In case of an underwater accident, victims must be brought ashore as quickly as possible, because panicking as a result of severe pain and the systemic effects of venom increases the risk of drowning. Access to marine aquaria, puncture wounds and extreme pain should always arouse suspicion of a potential marine envenomation. Identification or description of potential marine species responsible for the envenomation should be obtained. Irrigation of the wound with clean water and transport the victim to the nearest medical facility should be done early as possible. They should recognize serious systemic symptoms and establish intravenous access in the unaffected extremity, administer oxygen, institute Cardio-pulmonary resuscitation (CPR) and treatment for anaphylaxis, if required.[7]

Treatment

Hot Water Immersion- Primary Treatment

The primary treatment of venomous fish sting is to inactivate the heat-labile venom by immersing the injured body parts in hot water for 30-90 minutes. Two theories have been proposed to support this management. First theory showed that at temperatures over 43°C, venom lost its lethality more rapidly and as longer the exposure time. However, no significant loss of lethality was seen after exposure to temperatures less than 39°C. An alternative theory is that hot water immersion causes modulation of pain receptors in the nervous system leading to a reduction in pain. Established pain hypotheses such as the gate control theory and the diffuse noxious inhibitory control theory have also been proposed as possible mechanisms of action for hot water immersion. This treatment modality appears to be safe.[70] It is an inexpensive, and there is only a single recorded case of significant thermal burn from over 200 cases of the use of hot water immersion.[11] The most commonly referenced methods of application are thermal packs, basins of hot water, and hot showers. The choice depends on the availability of the methods. Application of hot, but not scalding, water (42–45°C) for 30–90 minutes or until the pain resolves, seems to be standard advice, but some patients may find such temperatures difficult to tolerate. The best method is to use the highest temperature that can be applied safely and that is tolerable.[71] Lau et al. found that thermal insulators (standard coolers) were able to maintain water temperature effectively for a full 30 min alleviating the difficulty of maintaining hot-water at an appropriate temperature on site otherwise.[72] Other methods, include the use of reusable hot packs instead of water, continual hot-water input (such as from a shower).

Supportive Measures

Victims of marine envenomation require supportive care and sometimes the administration of anti-venom in certain situations. Cardio-pulmonary resuscitation (CPR) and other resuscitation measures are rarely required. Initial history should include a description of the marine species responsible for the envenomation, coexisting medical conditions, and drug and horse serum allergies. Gentle removal of visible spines, the application of direct pressure to control bleeding and the administration of analgesia may also be indicated. The site of envenomation should be examined for the presence and number of puncture wounds, retained spines, edema, erythema, and ecchymosis. Puncture wounds surrounded by a ring of cyanotic tissue, vesicle formation, rapid tissue sloughing and hypesthesia have been associated with Scorpaenida envenomation.[73] Early excision of blisters has been advocated based on the notion that blisters may contain residual active venom effecting on-going dermal necrosis.[29] Limb elevation, to reduce edema, and early mobilization, to mitigate joint stiffness, has been recommended. The use of pressure immobilization technique is not recommended.[74] No specific laboratory tests are recommended for the management of marine envenomation.

Whenever possible, a local nerve block with an anaesthetic is most effective. Regional anesthesia with a long acting agent such as bupivacaine offers reliable, prompt, and prolonged anesthesia. Regional anesthesia also reduces the risk of accidental thermal burn from heat immersion and facilitates procedures such as spine removal, irrigation and wound debridement and exploration. Parental analgesics may be indicated when wound location prohibits regional analgesia or for persistent pain. Opiate analgesics may be required.[75] Cryotherapy is contraindicated.[76] Severe hypotension may respond to adrenaline (epinephrine), bradycardia to atropine.[77] Antibiotic treatment should be considered for serious wounds and for envenomation in immune-compromised hosts.[47] The initial antibiotics should cover Staphylococcus and Streptococcus organisms. The most common marine pathogens involved are facultative anaerobic Gram-negative bacteria such as Vibrio vulnificus.[78] Bacteremia resulting from wound infection with Aeromonas or Vibrio is more likely in patients with diabetes, cirrhosis, or the immune-compromised. Ciprofloxacin can be preferred as it covers Vibrio and Aeromonas. Aeromonas is common in freshwater environments.[79] A marine animal injury is an indication for tetanus prophylaxis and should be considered based on patient's immunization history.[47]

Plain radiographs of the injured site due to fish sting are required for suspected embedded foreign bodies. In cases of cartilaginous fish such as stingray and catfish, ultrasound and even magnetic resonance imaging may be indicated to detect the cartilaginous parts.[79] Complete blood picture, ECG, culture of wounds, with special request for marine micro-organisms for infected wounds may be required in some cases. Mechanical injury, remaining fragments of spines, and tissue damage caused by injected venom may require surgery. Anti-venom is available for stonefish sting. It is a horse anti-stonefish toxin immunoglobulin-G with clearly established efficacy for analgesia and diminution of tissue damage due to stonefish toxin. It is indicated for envenomation by stonefish with significant local pain or presence of systemic symptoms.[80] The use of the stonefish antivenin is not routinely recommended because of potential adverse effects and the limited toxicity of these stings. The dose depends on the number of stings and is the same for adult and children. It is given intramuscularly and can be repeated when necessary. In general, one ampule (2000U) Stonefish Antivenom is given IM for puncture wounds from one or two spines. For three to four spine envenomation two vials are administered. Known allergy to horse serum remains a contraindication for stonefish anti-venom. In case of severe systemic envenomation, it can be diluted and infused intravenously.[81] There is no anti-venom for other fish stings however; in vitro studies have shown stonefish (Synanceia spp.) antivenin cross reacts with components of lionfish venom.[82,83]

Prevention

Inexperienced fishermen should take care when handling venomous fish and use thick, sturdy gloves. When preparing venomous fish for cooking, the fins should be carefully removed; the venom continues to be active even after the fish has been killed.[65] It is better to swim in shallow water rather than wade. In addition, shoes with sturdy soles should be worn. A diving mask allows clear visibility under water. Other advice to divers is not to swim or dive in murky water or in stormy weather, not to touch venomous or unknown fish, especially if it is brightly coloured or has sharp or pointed spine; or has sharp teeth. Never reach for submerged rocks with bare hands or feet and to seek immediate medical care if stung by venomous fish. In aquariums, precautions should be aimed at minimizing exposure to dangerous marine specimens while cleaning tanks. Avoidance of toxic species in homes and offices frequented by young children, chronically ill, or compromised individuals should be strongly considered. Marine aquarium enthusiasts should purchase marine animals from a well-informed dealer and inquire about the potential toxicity of animals prior to purchase. Contact the local Poison Control Center in case of queries regarding venomous fishes or its sting.

Conclusion

Toxicology centers forecast a great growth in the number of cases of such exposure in the coming years due to the exploding fashion to keep tropical fish in home aquariums. Fish envenomation in aquariums mostly cause minor injuries, but offer the potential for lethal sequelae.Most often this involves acutely painful fish stings that respond well to hot water immersion, analgesics and appropriate wound care. Effective educational activities on this subject among professional fishermen, divers and in aquarium users are necessary to reduce sufferings. Many serious incidents can be avoided through an increase in public education and awareness. It is therefore important to identify and assess the hazards posed by various aquatic organisms in a given region and bring the results to public attention. In order to assess the extent of the phenomenon of injuries by marine organisms objectively, there is a need to maintain an organized database.

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