

Clinico-epidemiologic Study on Marine Envenomations and Injuries in South Iran, Persian Gulf Coasts

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Abstract

Background: The Persian Gulf is a suitable habitat for various types of marine species. This study was conducted with the aim of determining the epidemiology and clinical findings of injuries inflicted by marine creatures in the Persian Gulf, south Iran.

Methods: In this retrospective cross-sectional study, medical records of patients with diagnosis of marine animal exposures treated at 6 referral clinics in Bushehr province, south Iran, during 2009-2014 were studied.

Results: Ninety-eight patients were studied whose mean (SD, Min - Max) age was 23.6 (7.0, 14-57) years. The majority of patients (91, 92.9%) were men. Scorpionfish stings were the most common cause of injuries (56.1%) followed by jellyfish stings (22.4%), stingray stings (13.3%) and sea urchin stings (8.2%). In most cases (60.2%), the location of injury was on lower limbs. The most common symptom was pain. Marked local swelling was detected in 69.1% of scorpionfish stings and 100% of stingray stings. Itching and hives were seen in 100% and 36.3% of jellyfish stung patients. Gastrointestinal manifestations were the most common systemic effects. Muscle cramps and transient local paralysis were reported in 38.7 % and 23 % of stingray patients, respectively. Serious systemic effects were rare except for symptomatic hypotension in a scorpionfish sting patient and syncope in a stingray sting patient. The vast majority of patients (93.9%) recovered without notable sequels. Secondary dermal infections were only observed in 1 stingray inflicted victim and 4 sea urchin stung victim. No death occurred.

Conclusion: Scorpionfish attacks are the common cause of marine animal exposures in south Iran and should be taken seriously. Men at young ages are the victims of this environmental and occupational hazard.

Keywords: Bites and Stings; Epidemiology; Indian Ocean; Iran; Marine Toxins

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INTRODUCTION

Over one hundred species of venomous fishes and a large number of invertebrates living in aquatic environments can pose danger to humans in different ways. These animals mostly inhabit warm seas including the Indian and the Pacific Ocean (1,2). Due to suitable ecology, the Persian Gulf and the Gulf of Oman provide favorable habitats for these venomous animals (1,3).

The injuries caused by marine animals are commonly reported in the Persian Gulf coastline and are usually manifested with pain, swelling, lesions, dermal necrosis or even systemic effects. These injuries are caused by teeth capable of breaking the skin and tearing the flesh, such as shark attacks, or fangs capable of piercing the tissues such as aquatic snakebites (1,3). In addition, marine injuries can also be inflicted by stings commonly seen in fish of the order Siluriformes and Scorpaeniformes (4). Most of the victims of marine animal attacks are fishers, divers and aquatic athletes,

who may need prolonged periods of recovery, which in many cases may lead to social and economic difficulties (5,6).

There is a lack of clear evaluations of marine injuries and envenomations in Iran. This study was conducted with the aim of determining the epidemiology and clinical findings of injuries inflicted by marine creatures in the Persian Gulf, south Iran.

METHODS

Setting and ethics approval

This retrospective cross sectional study was performed under the title of a joint research project supervised by AJA University of Medical Sciences and Bushehr University of Medical Sciences. The study was approved by ethics committee of both universities (No. 693313).

Study subjects

Catchment area of the study included six different referral clinics for navy and diving injuries, which all located in Bushehr province, Iran (Figure 1). In these clinics, most of the patients are managed as outpatients; while they will be referred to tertiary

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care hospitals, if they develop severe systemic or local manifestations. All the available medical records in regard to stings, bites and injuries inflicted by aquatic animals in this region from the beginning 2009 to beginning 2014 were reviewed by two investigators (by I.N. and A.T.B.).



Figure 1. Catchment area of the study (The Persian Gulf coastline, Bushehr province, south Iran)

Data collection

A checklist containing the variables based on study objectives was designed and completed for each case. The variables included age, gender, offending species, location of the lesion, clinical manifestations and treatments given to the patients. The offending animal in each case was retrieved from the medical record according to the reported species. The majority of offending animals in the region are identified according to clinical findings, the lesion appearance and the patient's history. In stingray attacks a long stinger usually remains in the affected site. The vast majority of jellyfish injuries are associated with hives or boils. Sea urchin and scorpionfish injuries are commonly identified by the phenotype of their spines remaining in the affected site; nonetheless, scorpionfish attacks are commonly accompanied with systemic effects (1,7). In small number of cases, victims or their companions were able to capture the offending species, while sometimes they could only capture a photo from the animal. Incomplete documents (those without reported offending animal) were excluded.

Statistical analysis

Analyses were performed using the Statistical Package for the Social Sciences for Windows (SPSS Inc., Chicago, IL, USA). Results are expressed with frequency and percentage.

RESULTS

Patients' demographics

A total of 115 medical records were retrieved, from which 17 cases were excluded due to incomplete data. Ninety-eight patients finally included in this study whose mean (SD, Min - Max) age was 23.6 (7.0, 14-57) years. The majority of patients (91, 92.9%) were men.

Offending animals

Scorpionfish (Scorpaenidae) stings were the most common cause of injuries (55 patients, 56.1%) followed by jellyfish

(Cnidaria) stings (22 patients, 22.4%), stingray (Dasyatidae) stings (13 patients, 13.3%) and sea urchin (Echinoidea) stings (8 patients, 8.2%).

Clinical findings

In most cases, the location of injury was on lower limbs (59 patients, 60.2%) followed by upper limbs in 23 patients (23.5%) and the rest of the body (head, neck and trunk) in 16 patients (16.3%).

The local and systemic effects of the injuries are summarized in table 1. The most common symptom was pain, as it was seen in almost all cases except for 9 scorpionfish stings. Pain resisted for one week in two sea urchin stung patients. Marked local swelling was detected in 69.1% of scorpionfish stings and 100% of stingray stings. Itching and hives were seen in 100% and 36.3% of jellyfish stung patients, while there was no such signs in other patients.

Gastrointestinal manifestations including nausea, vomiting and diarrhea were the most common systemic effects. Muscle cramps and transient local paralysis were reported in 38.7 % and 23 % of stingray patients, respectively. Serious systemic effects were rare except for symptomatic hypotension in a scorpionfish

Table 1. Local and systemic effects of marine animal exposures according to offending species

	Offending species			
	Scorpionfish (n= 55)	Jellyfish (n = 22)	Stingray (n = 13)	Sea urchin (n = 8)
Local effects				
Pain	46 (87.3)	22 (100)	13 (100)	8 (100)*
Swelling	38 (69.1)		13 (100)	
Paresthesia	31(56.4)	8 (36.3)		
Erythema	11 (20.0)	18 (81.8)		3 (37.5)
Cellulitis	4 (7.3)			
Ecchymosis	2 (3.6)			
Lymphangitis	1 (1.8)			1 (12.5)
Pruritus		22 (100)		
Hives		8 (36.3)		
Secondary infection			4 (30.7)	1 (12.5)
Granuloma				1 (12.5)
Systemic effects				
Gastrointestinal manifestations	20 (36.4)	2 (13.6)	3 (23.1)	3 (37.5)
Agitation	4 (7.3)			
Perspiration	3 (5.5)		3 (23.1)	
Fatigue	2 (3.6)			
Hypotension	1 (1.8)			
Muscular cramps			5 (38.7)	
Paralysis			3 (23.1)	
Dizziness			3 (23.1)	
Syncope			1 (7.7)	

* In two cases, resistant pain was found that lasted for about one week

sting patient and syncope in a stingray sting patient.

Treatments and outcomes

Procedures, commonly carried out to treat the patients suffering were only recorded for 16 patients. In these cases, local lidocaine was the most common drug used, which was administered to 10 patients. Other medications used were anti-histamines, corticosteroids, antibiotics and morphine. The vast majority of patients (93.9%) recovered without notable sequels. Secondary dermal infections were only observed in patients stung by stingrays (1 patient, 7.7%) and sea urchins (4 patients, 50%). Granuloma was detected in second metacarpophalangeal joint of hand of a patient resulting from a residual sea urchin spine. It manifested with pain and reduced range of motion after two months. It was eventually removed by debridement surgery. In general, no death was reported among the victims.

DISCUSSION

In the current study, medical records of 98 patients with diagnosis of marine animal injuries treated at referral clinics in Bushehr province, Iran, during 2009-2014 were studied. It should be noted that the number of cases registered in this period is much lower than the reality. This is due to the fact that the majority of victims of marine animal exposures are treated as outpatient in the regional clinics, and thus, no medical file is routinely filled out for them. Hence, according to reliable literature (8), existing national protocols for venomous bites (3,9), and local experience; a medical algorithm for immediate management of marine animal exposures has been recently proposed (Figure 2) (7). This algorithm is intended to determine the treatment pathway for healthcare providers either at the scene, or in case of patient's admission to primary or secondary care hospitals, prior to referral to tertiary care hospitals. Based on this algorithm, each case of marine animal injury should be reported to higher health authorities and medical universities in the region (7). Therefore, we are hopeful that future evaluations of epidemiology of marine injuries in the region can depict the situation more clearly.

Marine exposures mainly involves men at young ages (10-12). In this respect, Ngo et al found that the average age of their patients with marine animal injuries was 28 years and 80% were men (11). Age and gender distribution in the present study, was similar to these figures. With respect to the fact that most of victims inflicted with marine animals are people whose jobs make them vulnerable to the dangers of open waters (13), such as fishermen, and also those who choose seaside resorts for recreation; such distribution pattern in age and gender seems reasonable.

Scorpionfish

In this case series, the most common offending animal was scorpionfish. This species is commonly found in the muddy shores of the Bushehr province and the area of Khur-e-Musa, south coasts of Iran. Pain, swelling and erythema are the common clinical findings in these patients. Lee et al reported 8 patients with stonefish (which is also in the same order of Scorpaeniformes) envenoming who developed local progressive edema and pain in the affected organ in almost all cases, but erythema was not prominent (12). The toxins extracted from Scorpaeniformes including capillary permeability factor and hyaluronidase, are responsible for progressive edema (14,15).

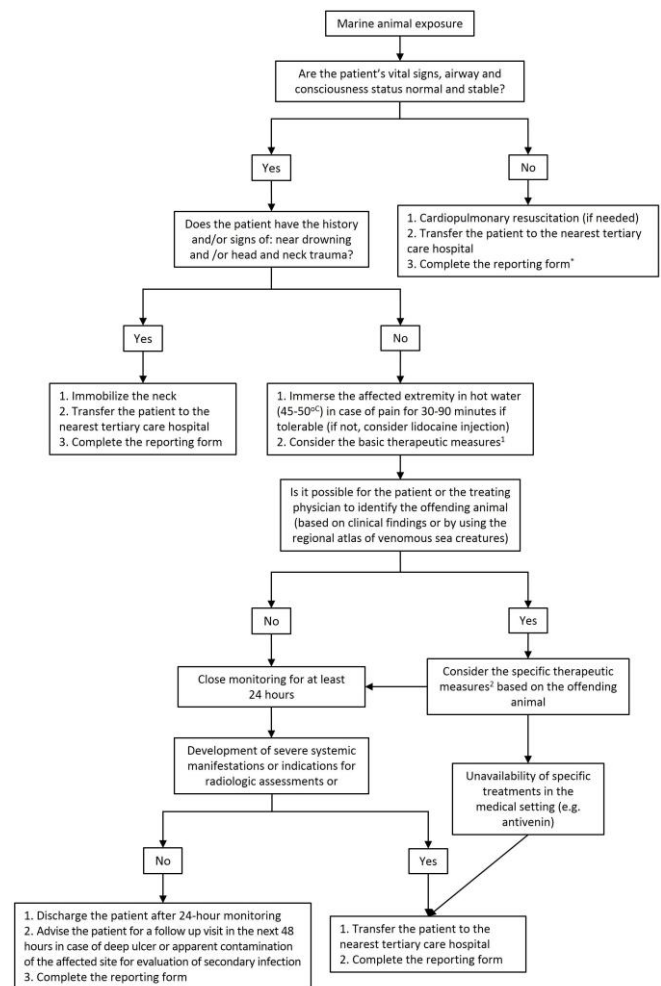


Figure 2. Proposed medical algorithm for management of marine animal exposures in Iran, Adopted from Tashakori et al (7)

* A checklist has been developed for reporting each marine animal exposure to healthcare authorities. This form includes patient's demographics, victim's activity at the time of exposure (e.g. diving, swimming, fishing), offending animal species (if identifiable), clinical findings, disease course, treatments, reasons behind referral to tertiary care hospital (if required)

¹ Basic therapeutic measures include: immobilization of the affected extremity, washing the puncture or bite site, lidocaine injection if hot water immersion was not effective to control pain, removal of spines, tetanus prophylaxis, topical or broad spectrum antibiotics based on the severity of the wound

² Specific therapeutic measures, which are given according to the offending animal, for example include snake antivenom therapy for venomous sea snakebites, antihistamines for jellyfish encounters, intubation for severe neurotoxic stings and bites, etc.

The other major toxin in the venom of this order is trachynilysin, which can elicit massive acetylcholine release from motor nerve endings and increase both cytosolic Ca²⁺ and catecholamine release from chromaffin cells (16). Hence, muscarinic signs such as perspiration which was present in 7.3% of our scorpionfish envenomed patients can occur. In addition, Scorpaeniformes' neurotoxins can induce endothelium relaxation through the release of nitric oxide (15), an effect manifesting with

symptomatic hypotension in one of our patients.

Jellyfish

The second most prevalent inflictions were caused by jellyfish in the current study. Burning pain, itching and local erythema were the most common manifestations in the stings caused by these animals (17-19). Hive, which was present in the majority of our cases, is a species-specific manifestation for jellyfish stings. Severe systemic effects following stings by common Persian Gulf jellyfish species are rarely seen (17-19). Gastrointestinal manifestations were the only systemic effects that we found in our study.

Stingray and Sea urchin

Penetrating injuries from spiny-finned fishes including stingrays or sea urchins are painful and associated with morbidities. The major problems associated with these injuries are (19,20): (a) multiple retained spines within the injury site in case of sea urchin attacks, which can cause persistent pain and sometimes granuloma, (b) life-threatening thoracoabdominal penetrations due to large stingers of stingrays, and (c) delayed healing and secondary infection due to the stings by both creatures. For removal of the spines, especially if deep, referral to a tertiary care setting with surgical management has been recommended (19).

As opposed to injuries by the other two species, in lesions caused by stingrays and sea urchins, secondary infections are possible. In this regard, Clark et al found higher incidence of secondary infections in patients with stingray exposures who failed to receive prophylactic antibiotics (21).

LIMITATIONS

Due to outpatient management of the majority of marine animal exposures in south Iran, it seems that available documents were fairly small in comparison to the true prevalence of the injuries by aquatic creatures. In fact, there are higher number of marine animal exposures in the region, but due to lack of effective reporting system, the data are missed, and thus filling out reporting forms according to the algorithm (7), has been proposed. Authors propose conducting prospective studies for future investigations. Moreover, sea snake bite envenomations were not included in this study. This can be either due to the same problem (lack of proper reporting) or due to low prevalence of such inflictions, as they are not common in south Iran (3).

CONCLUSION

To the best of our knowledge and according to the available literature, this was the first study on the epidemiology of marine animal exposures in the Persian Gulf region. Men at young ages are the victims of this environmental and occupational hazard. Scorpionfish attacks are the common cause of marine exposures in this region and should be taken seriously. To have a clearer picture of the status of this health threat, each marine animal exposure should be regularly reported to higher health authorities and medical universities in south Iran.

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REFERENCES

- Williamson JA, Fenner PJ, Burnett JW, Rikin J. Venomous and poisonous marine animals: a medical and biological handbook. Sydney: New South Wales University Press; 1996.
- Fernandez I, Valladolid G, Varon J, Sternbach G. Encounters with venomous sea-life. *J Emerg Med* 2011;40:103-12.
- Monzavi SM, Dadpour B, Afshari R. Snakebite management in Iran: Devising a protocol. *J Res Med Sci* 2014;19:153-63.
- Reckziegel GC, Dourado FS, Garrone Neto D, Haddad Junior V. Injuries caused by aquatic animals in Brazil: an analysis of the data present in the information system for notifiable diseases. *Rev Soc Bras Med Trop* 2015;48:460-7.
- Haddad Jr V, Favero Jr EL, Ribeiro FA, Ancheschi Bda C, Castro GI, Martins RC, et al. Trauma and envenoming caused by stingrays and other fish in a fishing community in Pontal do Paranapanema, state of Sao Paulo, Brazil: epidemiology, clinical aspects, and therapeutic and preventive measures. *Rev Soc Bras Med Trop* 2012;45:238-42.
- Louis-Francois C, Mathoulin C, Halbwachs C, Grivois JP, Bricaire F, Caumes E. Skin complications of stonefish envenomation in 6 travellers returning from the Indo-Pacific maritime region. *Bull Soc Pathol Exot* 2003;96:415-9.
- Tashakori Beheshti A, Khoshdel AR. Study on clinical symptoms, diagnosis and management of patients with aquatic animal attacks in the Persian Gulf coasts, south Iran [Research Project]. Tehran, Iran: AJA University of Medical Sciences; 2015.
- Isbister GK. Managing injuries by venomous sea creatures in Australia. *Aust Prescr* 2007;30:117-21.
- Monzavi SM, Salarian AA, Khoshdel AR, Dadpour B, Afshari R. Effectiveness of a clinical protocol implemented to standardize snakebite management in Iran: initial evaluation. *Wilderness Environ Med* 2015;26:115-23.
- Silva GC, Sabino J, Alho CJ, Nunes VL, Haddad Jr V. Injuries and envenoming by aquatic animals in fishermen of Coxim and Corumba municipalities, state of Mato Grosso do Sul, Brazil: identification of the causative agents, clinical aspects and first aid measures. *Rev Soc Bras Med Trop* 2010;43:486-90.
- Ngo SY, Ong SH, Ponampalam R. Stonefish envenomation presenting to a Singapore hospital. *Singapore Med J* 2009;50:506-9.
- Lee JY, Teoh LC, Leo SP. Stonefish envenomations of the hand--a local marine hazard: a series of 8 cases and review of the literature. *Ann Acad Med Singapore* 2004;33:515-20.
- Courtenay G, Smith DR, Gladstone W. Occupational health issues in marine and freshwater research. *J Occup Med Toxicol* 2012;7:4.
- Ziegman R, Alewood P. Bioactive components in fish venoms. *Toxins (Basel)* 2015;7:1497-531.
- Khoo HE. Bioactive proteins from stonefish venom. *Clin Exp Pharmacol Physiol* 2002;29:802-6.
- Sauviat MP, Meunier FA, Kreger A, Molgó J. Effects of trachynilysin, a protein isolated from stonefish (*Synanceia trachynis*) venom, on frog atrial heart muscle. *Toxicol* 2000;38:945-59.
- Reese E, Depenbrock P. Water envenomations and stings. *Curr Sports Med Rep* 2014;13:126-31.
- Auerbach PS. Envenomation by Aquatic Invertebrates. In: Auerbach PS, editor. *Wilderness Medicine*. 6 ed. Philadelphia, USA: Elsevier Mosby; 2012. p.1596-628.
- Berling I, Isbister G. Marine envenomations. *Aust Fam Physician* 2015;44:28-32.
- Perkins RA, Morgan SS. Poisoning, envenomation, and trauma from marine creatures. *Am Fam Physician*. 2004;69:885-90.
- Clark RF, Girard RH, Rao D, Ly BT, Davis DP. Stingray envenomation: a retrospective review of clinical presentation and treatment in 119 cases. *J Emerg Med* 2007;33:33-7.