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The first study of snake and Scorpion envenomation in Qeshm Island, South of Iran

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Abstract

Although, Snakes are useful for control of hurtful small animal like rodents, they can injure human through their bites. Moreover, they don't tend to strike man unless irritated them. This study carried out over data of snake/scorpion bite cases between 2011 and 2017 in Qeshm Island, south of Iran. Of which, 687 (86.19%) were stung by scorpions and 110 (13.85%) were bitten by snakes. The most injured persons reported in July and May for scorpion and snake bites. 56.83 % of victims lived in rural areas. Hand and feet were the most involvement parts of the body in scorpionism and snake bite respectively. Shepherd or people that worked in camel or sheep husbandries in desert/open areas were more bitten by venomous predators. Buthid scorpion is the distinguished family in Qeshm county. It sounds the scorpion envenomation was higher than central and north regions of Iran in comparison with other views.

Keywords: venomous snake, scorpion, bite, qeshm island, Iran

Introduction

Order Scorpionidae (Arachnida) include 1500 species from 18 families and they are widespread except Antarctica. Among them, Buthidae family accounts more dangerous arthropod for human ^[1]. Scorpion venom incorporates a mixture of cardipotoxins, nephrotoxins, hemolytic toxins, phospholipase-A, hyaluronidase, acetylcholine esterase, histamine, serotonin and particularly neurotoxins ^[2]. It commonly causes intensive symptoms such as cardiac arrhythmias, arterial hypertension, acute pulmonary edema, respiratory failure, cardiovascular manifestation, acute inflammatory reaction and even death ^[3]. In general, symptoms of scorpion sting depend on the dosage of toxin, size, and age of the stung people and the season in which scorpion biting ^[4]. Iran is a Middle East country richness in term of scorpion species because of various climate conditions in any landscape of it ^[5] so that they consist of 30 species and 18 sub-species from 17 genera with two families are as follows: Buthidae and Scorpionidae. There are 7 species considered medically important in Iran (*Hemiscorpius lepturus*, *Odontobuthus doriae*, *Buthotus saulcyi*, *Buthotus sach*, *Andrectonus crassicauda* and *Mesobuthous eupous*). They disperse in different parts of this county with arid and semi-arid climate but more abundant in the south and southwest Iran ^[6]. *Hemiscorpius lepturus* is the more threatening scorpion in the southwest of Iran that native people called "Gaodim" ^[7]. Khuzestan province is the predominant province of scorpionism ^[8] followed by Hormozgan and Kerman provinces which two-thirds of stung people documented from these zones ^[9]. Many pieces of evidences presented that the majority of scorpion envenoming arises during the hot seasons (spring and summer) moreover, 15–24 age group were the most involved victims in this territory ^[10]. However, polyvalent anti-scorpion serum provided 5 ml ampoules by Razi Vaccine and Serum Research Institute used to treat the individuals who stung by 6 risky scorpion species in Iran ^[11]. Over, 500 species of venomous snake (Reptilia) cause a serious problem throughout the world, particularly in tropical areas such as Southeast Asia, sub-Saharan Africa, and Latin America. The snakebite leads to arrhythmias, neurotoxic paralysis, gangrene, nervous system disorder even death depending on the species of snake, size, age and type of venom (cytotoxins, neurotoxins, and hemotoxins) ^[12]. All venomous snake belong to four families are as follows: Viperidae, Arctaspidae, Elapidae and Colubridae ^[13]. Viperid venoms assemble symptoms such as local pain and swelling, coagulopathy, necrosis, and regional lymphadenopathy ^[14]. Myoglobinuria and Rhabdomyolysis may cause AKI (Acute Kidney Injury) in envenomed cases with viperid snake. Notably, AKI is an important difficulty which precipitates mortality ^[15]. Furthermore,

The Phospholipases A2 (PLA2s) is the main components of Viperidae toxin that has myotoxic activity induce skeletal muscle necrosis and rhabdomyolysis [16]. It is estimated that 5.4 million people are bitten by snake each year of which 81,1000 to 138,000 mortality and morbidity occurred. Moreover, amputations and disabilities result from snake envenoming in all continents [17]. Totally, 69 species of snakes have been identified in Iran. Of these 36 species are classified as non-venomous, 25 species are known as venomous and 8 species category into semi-venomous. Viperidae (pit vipers and true vipers) and the Elapidae families serve as the important venomous snake in Iran [18]. Viperid snake is high diversity family including *Vipera lebetina*, *Echis carinatus*, *Pseudocerastes persicus*, *Vipera albicornuta*. Elapidae family, particularly *Naja naja oxiana* diversely adapted to all of this country [19]. In Iran, the recorded data shows that the incidence of snakebites is 4.5-9.1 per 100,000 and the mean death was 6 to 12 each year [20]. Two studies have been conducted about scorpion/snake fauna in our research area so far. Buthidae was identified as the major family in Qeshm island [21]. Also Hydrophiinae family of sea-snake addressed in Hara marine forest of our study place [22] but no information is available relating to land snake in this region. We carried out this study in order to gain a pattern of snakes and scorpionism in Qeshm Island, Hormozgan province, Iran. In addition, this research is first work conducted at this site. The outcome can aid health authorities to improve successful interventions for treatment stung people also recognize the ecology of these creatures.

Material and Methods

Targeted study area

We carried out a retrospective research in Qeshm island. It's the largest island in the strait of Hormuz in the southern coast of the Persian Gulf, Hormozgan province, south of Iran. Our study site consists of 140,573 population in 1,491 km² area (26°41'43"N 55°37'06"E). The average temperature is 27⁰c and the warmest seasons are spring and summer. The average rainfall is very low the same as other tropical areas (183.2 mm). As regarding Qeshm is the important free economic zone (FEZ) in Iran, the more commercial services and exportation/importation of goods performed by local or migrants [23]. Some of the local people involved in fishing and dhow construction and the rest of them deal with economic services and trade. Hara marine forest (mangrove forest of Qeshm) is the most eco-tourist attraction on this island. Some of the indigenous people use the mangrove forest related to of fishing (mainly shrimp).

Required Date

We collected and organized the epidemiological factors of this retrospective study of control and prevention of diseases and victims who referred to Qeshm island's hospital, Hormozgan province during 2011-2017. This research was approved by the research ethics committee of Hormozgan University of Medical Sciences (HUMS). Informed consent was confirmed by each individual or guardian. Databases were registered and arranged into Excel software systemically by health cares and authors. Then all information transferred into SPSS v 24. Our work surveyed the distribution of snake and scorpion envenomation in terms of many variables such

as age, sex, residency, site of bite/sting, time, month and year of bite.

Results

Overall, 797 persons have been bitten by venomous creatures. Scorpion sting cases included 687 (86.19%) and 110 (13.8%) individuals bitten by snakes (Figure 1) Of 687 injured people, 62.44% were male and 37.55% were female that inhabited in urban (42.35%) and rural areas (56.91%) (P=.000) (Table 1). The 21-35 age class of lifespan (53.71%) were more suffer scorpion bite (P=.000). Also, a significant relationship was revealed between ages and month of bite (P=.020). The most incidence rate of scorpionism was 112 (16.3) belong to 21-35 years old in July (Figure 2). Hand was the majority of an organ that attacked by scorpions as was shown 44.68% followed by feet (42.35%), trunk (7.5%) as well as head and neck (5.38%) (Table 1).

Table 1: The determinant factors of study related to venomous creatures (scorpion & snake)

Variable	Sub-Variable	Envenomation		Outcome (percent)
		Scorpion	Snake	
Gender	Male	429	92	521 (65.37)
	Female	258	18	276 (34.62)
Residency	Urban	292	48	340 (42.65)
	Rural	391	62	453 (56.83)
Age Group	≤5	38	7	45 (5.64)
	6-20	231	37	268 (33.62)
	21-35	369	46	415 (52.07)
	>36	49	20	69 (8.65)
Time of bite	1-6 a.m.	227	21	248 (31.11)
	7-12 a.m.	149	28	177 (22.2)
	1-6 p.m.	131	23	154 (19.32)
	7-12 p.m.	180	38	218 (27.35)
Site of bite	Head & Neck	37	2	39 (4.89)
	Hand	307	49	356 (44.66)
	Feet	291	52	343 (43.03)
	Trunk	52	7	59 (7.4)
	Historical of bite	-	16	2
		687	110	797

Most of the victims enrolled in April-September for both snake/scorpion envenomation (P=.001, P=.000). Current finding presented that more stings occurred at 1-6 a.m. (33.04%) (P=.040). In term of snake bite, 83.63% of injured people were male and 16.36% were female. Furthermore, 62 (56.36%) of people that referred to clinical centers were villagers and 48(43.63%) were lived in urban regions of Qeshm island (P=.024) (Figure 3). The majority of snake bite were reported in May (16(14.54%). Feet (47.27%) were the predominant part of the body associated with the snake bite. Hand was ranked after feet with a partially different (44.54%). The 21-35 age category was more injured from snakebite the similar with scorpion sting (Figure 4). The 34.54% of victims were reported at 7-12 p.m. during the day. Notably, 16 (2.32%) of scorpion bite cases had the historical of bite. In contrast, 2(1.81%) of snake bite cases were bitten once again. No human death was recorded and all cases received anti-venom vials.

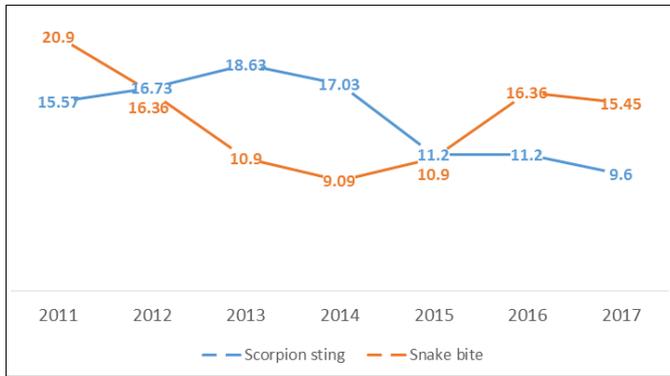


Fig 1: Percentage of all reported cases over 2011-2017, Qeshm island (no. 797)

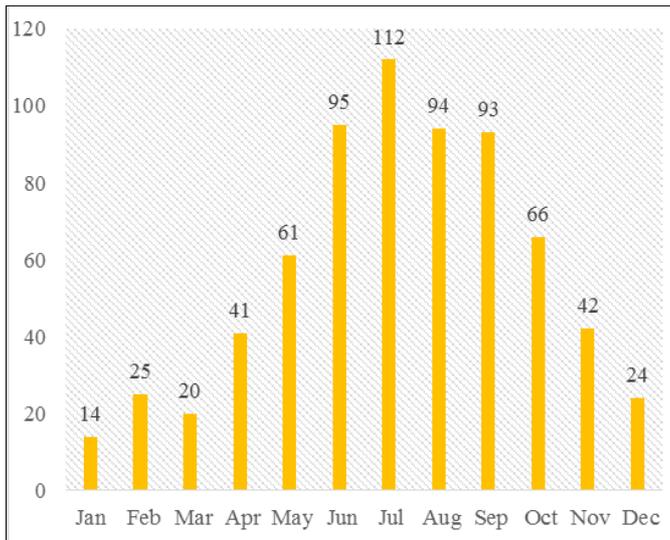


Fig 2: Distribution of Scorpion stung cases by month

Discussion

The present research was shown that the number of scorpion sting was dramatically declined during the study periods. Most people worked in building construction in order to the commercial and residential application. The economic rate has been grown in Qeshm Island as an important economic zone in Iran recent years. Indeed, some of the human dwellings have developed toward modernization in the rural regions. It means houses are made of durable material and the crevice or cracks removed in the walls therefore, they are barrier for burrowing and soil-dwelling scorpions and venomous predators. According to our view, the more scorpionism occurred at 1-6 a.m. followed by 7-12 p.m. (Table 1). This result agrees with another study [24]. Basically, they are nocturnal stingers, hide in their shelter during the photoperiodic part of the day and emerging at night to hunt small insect for feeding [25]. They enter to human places and seek or ambush for a long time in order to capture prey by their pedipalps. Scorpions even abscond in shoes, attics, under carpet or cloths, any holes and humid points inside the home. It's more likely that they accidentally bite human in this circumstance. Thus, hand and feet more accessible bulks of body for scorpion sting. Our knowledge presented that hand and feet consist 90% of the injured site (Table 1). The previous studies supported this finding [26]. On the other hand, scorpions were more abundant in warm and hot seasons (spring and summer) in our project (P<0.05) since Qeshm county has a hot climate in the south of Iran (Figure 2). This outcome is consistent with other studies [8, 27]. The scorpion species are richness in grassland of Qeshm island [28].

Interestingly, they are more active in high-temperature range and eventually increase interaction with human [29]. Other factors affect behavior and ecological niche pattern of carnivorous scorpion e.g. rainfall, altitude, slope, soil features and vegetation cover [30, 31]. In fact, they are known as 'equilibrium arthropod ecologically' [32]. Debris and scraps have been assembled in the yard of some rural and suburban areas due to building construction subsequently males bitten by snake or scorpions when they translocate trashes. Ramkan village has numerous palm gardens and restricted Palm trees have been cultivated in Suza city of Qeshm island. Pesky reptile and arthropods hide beneath foliage, bark or rotten palm tree. People who worked in these places more likely exposure to scorpion/snake bites. Furthermore, they harbor into livestock forage in barn/storehouse. In some instance these creatures trapped in the fishing tackle that kept in storage places. Nevertheless, males were the majority injured cases as 292 (36.63%) of all persons were male of which 64.45% lived in rural areas in both of snake and scorpion bite (Table 1) (Figure 3).

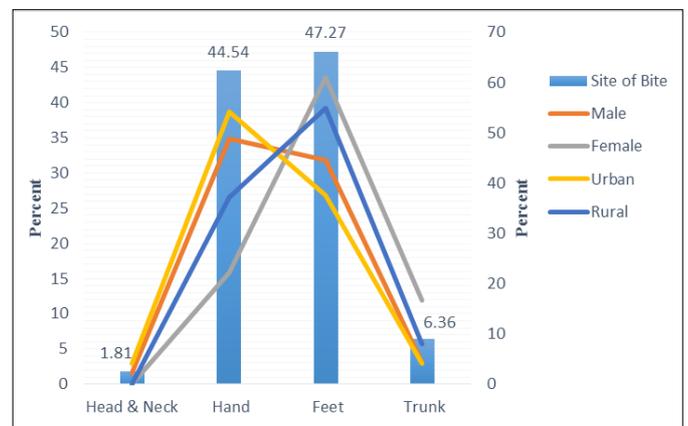


Fig 3: Percentage of recorded envenomed people by snake based on demographic variables

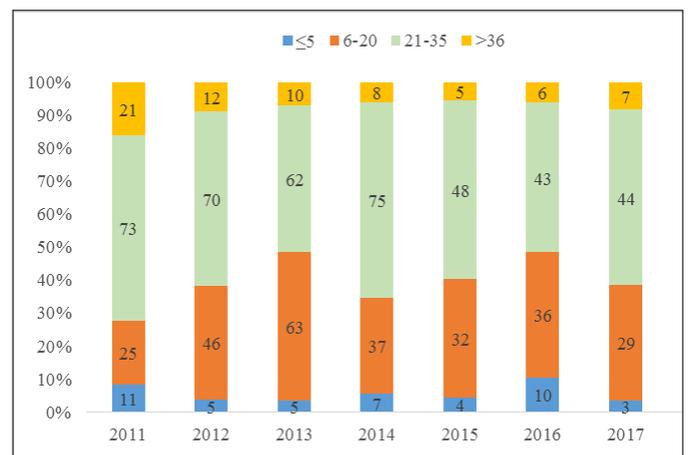


Fig 4: The outline of Age group categories injured by snake over year

Also, working ages (21-35) was the privileged group of reported victims for snake scorpion bites (Figure 1 & 4). This finding has also been reported in previous surveys [33, 34]. Some stings occurred in the desert of Suza of Qeshm island. Herein, Shepherd or nomadic people who dealt with camel or sheep husbandry more imperiled scorpion shelter. Moreover, traditional nomads were bitten by snakes in open areas when they moved herds for grazing. *Mesobuthos eupeus* and *Androctonus crassicauda* comprised 29.42.6% and 45.47% of

scorpion species respectively. The rest of them were unknown species. They don't dig a burrow and found throughout the Qeshm Island, Hormozgan province. *Hemiscorpius lepturus* (Liochelidae) was another species that caught in 2009 [35]. *Odeontobuthus doriae*, *Hottentotta saulcyi*, *Compsobuthus mattheiseni*, *Simonoides farzanpay* and *Androctonus crassicauda* from Buthidae and *Scorpio maurus* (Scorpionidae) were detected in other districts of Hormozgan province. *Hottentotta jayakari* was identified during north coastal of Persian Gulf. Moreover, *H. Jayakari* and *M. eupeus* have been documented from other islands of Persian Gulf [36]. It's considerable that *Nebo henjamicus* (Diplocentridae) is restricted to the Henjam Island, adjacent to Qeshm Island in the Persian Gulf [37]. *Androctonus crassicauda* is the most pernicious scorpion owing to local and systemic effects of its toxin [38] dispersed in arid and semi-desert regions in the south, central and southwest of Iran extensively [39]. *Mesobuthos eupeus* is widely spread species in the northern geographical areas toward the south of Iran, Middle East and Central Asia [40, 41]. *Hemiscorpius lepturus* is known as the mortal scorpion in Khuzestan province [42]. It has been established in the holes or crack of muddy walls with high moisture also has seen in the stone house or building that built by rugged materials in rural and suburban regions of southwest of Iran [43]. In summery Buthid scorpion are the largest families have medical importance particularly fatal species i.e. *A. crassicauda* and *H. lepturus* (Hemiscorpiionidae) in Iran. Besides, 16 (2.32%) of scorpion bite cases have been bitten once more. It approves that the incidence of scorpion rate in our study site is rather high. The majority of snakebite enrolled in hot months (May-September). This schema is in accordance with another study [44]. A few studies accomplished on the identity and fauna of local poisonous snakes in this island albeit, the south and southwest of Iran are more involvement with snakebite and their envenomation [45]. The annulated sea snake, *Hydrophis cyanocinctus* (Hydrophiinae) was tracked down in the Hara protected area (mangrove forest) in Qeshm island, and coastal water of Persian Gulf so far [46]. The sea snakes of Persian Gulf are thought to be more venomous reptiles than land snake due to more neurotoxin compounds of their venom. Although their fangs are short thus, the dosage of released venom has not fatal impact on human [47]. More studies are required to clarify the fauna of land species of snakes in Qeshm and other islands of Persian Gulf. According to previous views, *Echis carinatus sochureki* (Viperidae) poses the most serious snake in Iran followed by *Viper lebetina*, *Pseudocerastes persicus* and *Naja naja oxiana* (Elapidae) [47]. Saw-scaled viper (*E. carinatus sochureki*) is responsible for hemo nephrotoxic injury in tropical territories including coagulopathy, hypotension, acute renal failure [48] and acute pancreatitis [49] are common complications that required urgent medical attention.

Conclusion

Fortunately, anti-snake/scorpion venom is accessible in all clinical centers even remote areas in Iran. Similarly, the death of bites decreased in recent years. Maybe this result is indebted to anti-venoms while the frequency of stung people has not changed significantly. Some people sleep on the ground without a shield. Evidences show that snake or scorpions cruel under a fishing net. Also, they hide in the hole of timber associated with dhow construction. Some playful children try to direct snake toward the corner to capture them curiously. Moreover, they walk barefoot particularly in week

light places of the house. As a result, envenomation is preventive through avoid of harass the snake or venomous creatures shelter, if it possible. We should remind these hunters are necessary for the balance of our environment and even useful for control of the possible infectious rodents' population.

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