

Original Article**Epidemiology of Snake, Spider and Scorpion Envenomation in Mashhad, Khorasan Razavi, Iran (2004-2011)**Majid Khadem-Rezaiyan¹, Seyed Reza Moallem², Reza Afshari^{*3}

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ABSTRACT

Backgrounds: Envenomation is common in Asia including Iran that induces morbidity and mortality. This study investigated the epidemiological characteristics of cases with snake, spider and scorpion bites.

Methods: In this cross-sectional design, epidemiologic data of admitted cases to the Toxicology Department of Imam Reza Hospital of Mashhad, Iran were analyzed across a 7-yr period, from 2004 to 2011. SPSS was used for data analysis.

Results: This study reports 686 admissions due to animal envenomation with an incidence rate of 2.9 per 100000. Mean (SD, min-max) age of admitted patients was 30 (19, 1-90) yr, and 471 (69%) were male. Snakebite (n, percentage, annual incidence) (299, 44%, 1.3 per 100000) and spider bite (188, 27%, 0.8 per 100000) and scorpion sting (126, 18.4%, 0.5 per 100000) were most frequent cases. Overall, case fatality rate was 0.09 per 100000 which were due to scorpion and unknown bite. No cases of snakebites died in this period. The highest age-specific incidence rate was 4.6 per 100000 and related to 10-20 yr of age.

Conclusion: Animal envenomation is frequent in this area and a matter of health concern. While deaths related to snake bite are no longer reported-presumably due to using effective anti-venom - managing unknown and scorpion bites need to be addressed. Envenomation was not overtly an age-specific event in this province.

Keywords: Envenomation, Epidemiology, Scorpion, Snake, Spider.

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INTRODUCTION

Venomous bites and stings cause notable morbidity and mortality in Asia [1-3]. They induce a variety of adverse effects ranging from a mere skin scratch (dry bite) to lethal consequences such as disseminated intravascular coagulation, paralysis, anaphylactic shock, and death [4,5].

As the exact cause of envenomation is not always clear [6], it is important to know the geographical distribution of envenomation and the frequency in which they happen [6,7]. Defining the epidemiology of animal toxicities could also help developing preventive measures particularly for high incident areas [8-10] to reduce the risk of these accidents by providing information regarding the patterns of bites and stings to people living in high-risk areas such as rural communities [2]. Moreover,

this information could be used for training medical students [10,11], and to proportionately equip medical centers to antivenoms. [10,11]

Khorasan Razavi is the second populous province of the Iran (8% of whole country) ranked 4th regarding the land area. Local weather is diverse, but overall a large part has a semi-arid climate condition, in which some deadly genera of venomous animals such as *Andrectonus* scorpions are found [3].

We epidemiologically characterized animal bites and stings in the 1990s in the province in outpatient settings [9]. Animal bites and stings were more common in warmer months of the year. The average crude rate of outpatient referral due to poison exposure toxicities in Mashhad was 3.9 per 1000 population per year in the 1990s including scorpion (19 per 100000), snake (2 per 100000) and

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spider (1 per 100000) envenomations [9]. This trend was similar in early 2000 [12,13], but was not updated in recent years.

The aim of this study was to study the epidemiological features of the animal envenoming cases admitted to the toxicology department of Imam Reza Hospital of Mashhad, which is the only toxicology department of the province. This study focuses on cases that were admitted for 1 day or more, which the rates are understandably lower than previous outpatient reports.

MATERIALS AND METHODS

Mashhad University of Medical Sciences Ethics Board [MUMS-88594] approves this study.

In this cross-sectional study, data were analyzed across a 7-yr period, from 20 Mar 2004 to 21 Mar 2011 (Iranian calendar). We included all cases of animal envenoming, admitted in the only toxicology department of the province. Cases defined by visiting toxicologists and other causes for admission was ruled out.

The diagnosis was classified based on the International Classification of Diseases, Tenth Revision (ICD-10) and all cases categorized under "T63" category (Toxic effect of venomous animals) entered the study.

Data were analyzed according to age, sex, marriage and occupational status, date (month of the year) and weekday in which the animal envenoming happened, as well as the outcome of treatment.

The target population was the urban and rural residents of Mashhad City including tourists. Annual trends are based on a calculation of rates per 100000 inhabitants of Khorasan Razavi Province using census data for the year 2006 as a reference value [14,15]. SPSS version 11.5 (Chicago, IL, USA) was used for data analysis. Descriptive analysis is presented with frequency (percentage) and means (standard deviation). Independent sample *t*-test and Chi-square test were used for inferential analysis. All tests are two-tailed, and $P < 0.05$ was considered as statistically significant.

RESULTS

Annual Trends

There were 686 admissions due to animal envenoming during 2004 to 2011 (about 1.3% of total admissions). This equals to an incidence rate of 2.9 per 100000. The highest admissions in descending order were due to: snakebite (n,

percentage, annual incidence) (299, 44%, 1.3 per 100000) and spider bite (188, 27%, 0.8 per 100000) and scorpion sting (126, 18.4%, 0.5 per 100000) were most frequent cases followed by other arthropods (n, percentage) (44 cases, 6%), unspecified venomous animal (17 cases, 3%), other venomous animals (7 cases, 1%), other reptiles (3 cases, 0.4%), and toxic fish (2 cases, 0.3%).

Fig. 1 shows that spider, snake and scorpion envenomation had relatively a similar trend. Animal envenoming was highest in 2006. More than 96% of patients were fully recovered.

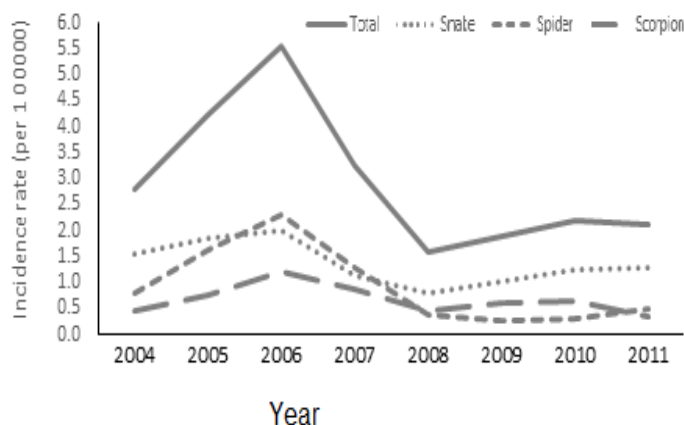


Figure 1. Animal envenomation incidence rate in Mashhad during 2004-2011 (n=686).

Gender

Sixty-nine percent of cases (471) were male. Fig. 2 shows that both genders had followed a similar incidence trend during the study period.

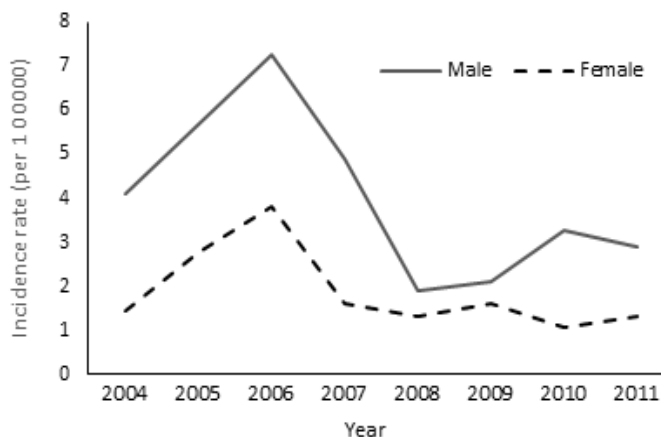


Figure 2. Incidence rate of animal intoxication in two genders from 2004 to 2011.

Deaths

In this period, only two cases died because of envenomation including one individual was bitten by scorpion (case fatality rate: 0.9% of admitted cases), and one case was unknown bite (case fatality rate: 16.7%). Case fatality rate was 0.5% in men and zero in women among admitted cases. This is equal to a mortality rate of 0.13 per 100000 and 0.09 per 100000 in the male and both sexes population.

Age

Mean (SD, min-max) age of admitted patients was 30 (19, 1-90) yr. There was no gender difference in age ($P=0.230$).

Most patients were in 20-30 age groups (182, 26%). However, the highest age-specific incidence rate (ASIR) was in 10-20 yr followed by >60 age group considering the age pyramid. The frequency of admissions was higher in males than females in all age groups ($P=0.015$) (Table 1).

Table 1. Frequency of admitted patients in each gender and the age-specific incidence rate.

	Admission		ASIR ($\times 10^5$)
	Male	Female	
<10 yr	44(9)*	35(16)	2.9
10-20 yr	95(20)	41(19)	4.6
20-30 yr	136(29)	46(21)	4
30-40 yr	61(13)	28(13)	2.7
40-50 yr	50(11)	28(13)	3
50-60 yr	33(7)	23(11)	3.3
>60 yr	52(11)	14(7)	4
Total	471(100)	215(100)	3.5

*Data is represented as Frequency (Percentage)

Occupational and Marriage Status

Fifty-six percent (312) of cases were married. The occupations with the highest incidence of animal envenoming were self-employed (167, 36%) in men and housewife (118, 55%) in women.

Months

Most admissions happened in summer (57%) with a peak in July (29.7%). Mode of admissions was Saturdays (109, 16%).

DISCUSSION

This study determined the recent epidemiological characteristics of envenomation in Khorasan Razavi Province of Iran. Snakes, spiders, and scorpions together caused almost 90% of the 24 h or more

admitted envenomation, with snakes being accounted for nearly half of the overall incidence. Only 2 cases died. The reported incidence (2.9 per 100000) is higher than Carbon Monoxide poisoning (1.9 per 100000) but lower than alcohol poisoning (3.3 per 100000) in the same settings [14, 16].

While the average crude rates of snake and spider bites were similar to our finding from the 1990s, the rate of scorpion stings was an order of magnitude less than our previous report [9]. The reason is that while we are reporting admitted cases in the current study, our previous report was related to hospital outpatient cases. As almost all snake and spider bites are admitted, these rates turned out to be similar. However, scorpion bite is usually treated in outpatient settings and are not admitted in Khorasan Razavi, which explain the difference.

Similar to the current study, reports from Turkey and other provinces of Iran suggest a male dominance [1, 2, 17-19]. Male bites and stings are reported to constitute 60%-75% of the accidents happening in these regions. This could be because men are more involved in outdoor activities like farming and therefore are more accessible to venomous animals. However, there are other studies from Brazil and Texas, which report that women are at a higher risk of envenomation, especially from spiders [20,21].

This study is also in accordance with the results of many other studies, which found out that young adults and the age of 20-40 are more at risk of envenomation [17,19, 20]. However, in our study, population above 60 yr of age have had the second largest age-specific incidence rate. This finding is not shared by many other studies. The reason could be related to the fact that farmers in old ages are still working in this province. No other study had reported a similar finding in this age group.

Similar to other studies from India, U.S, Turkey and another part of Iran, envenomation peak in summer and usually in the warmest month of the year [2, 4, 19]. When the weather is warm, venomous animals, as well as humans, are more active outdoors. Moreover, certain snakes lay eggs only in the summer and their eggs also hatch in summer, which increases the risk of snakebites in this season. The seasonal peak could be related to rain and agricultural activities as well [8].

In this study, snakes caused the most accidents, which is different from our previous findings [9]. The reason is that we included the cases admitted for 24 h or more. Scorpion stings are mainly managed in outpatient setting excluded from our data. Studies from Africa and other parts of Asia

have reported 4 to 162 annual fatalities per 100000 population each year [4, 8], which is far higher than our findings. This could be related to different species and availability of effective anti-venoms in Iran.

Snakebites mostly happen in tropical developing countries, while in high-income societies, most snake bites occur when people keep exotic snakes as pets [8].

An annual incidence of 4.5 to 9.1 snakebites per 100000 population was reported from Iran from 2002-2011 [2]. With a case, mortality rate was reported to be 0.12%, which is much less when compared to reports from India and Bangladesh [2, 8]. We reported an annual incidence of 1.26 snakebites per 100000 population, which is about five times less than the average national reports. No mortalities from snakebites happened during the 7-yr period of the study, as effective anti-venom was available to all patients. Snakes of this region are less dangerous as compared to other areas. Interestingly, the incidence of snakebites in Iran peaked at 2006, which is in accordance with our findings regarding animal envenomation. The lowest snakebites were reported in 2010, our data suggest that the least envenomation happened in 2008 and 2010 [2].

Admitted scorpion stings were less common as compared to snakebites in Khorasan Razavi Province. Iran has the most diversity of scorpions among Middle East countries. Most of Iran's scorpion population lives in the southern and southwest region of the country because of their semi-warm climate [3, 22]. Nationally 140 scorpion stings happen per 100000. Among them, ten to fifteen percent lead to hospitalization with an approximately 1% case fatality rate [23]. In the 7-yr period of this study, one of the two deaths was caused by scorpion sting, which is equal to a case fatality rate of 0.9%, slightly lower than other parts of Iran. Compared with other countries in the Middle East, Iran has the second highest rate of scorpion stings in the region after Israel with 200 stings per 100000 population. Saudi Arabia, Turkey, Southern Anatolia, and Oman had a less frequent rate of scorpion sting, with reports ranging from 90 in Saudi Arabia to 16 in Oman. The low frequency of stings in some countries could be associated with high urbanization.

In our study, the third cause of hospitalizations was spider bites. Spider bites cause only a few fatalities around the world and therefore they are of less clinical importance compared with the other envenomations [4]. Spider bites are common in

some parts of the world such as Brazil, Central and South America, Australia, and Tasmania [8]. Spider bites, especially those caused by *Latrodectus tredecimguttatus* are relatively common in the northeast parts of Iran. We previously reported 56 hospitalizations due to black widow spider bite during a 12-month period in Mashhad alone [17]. Although they rarely result in fatalities, latrodectism can cause severe pain and incapacitating syndromes that might last for several days or weeks [24]. The important clinical feature of spider bites is the fact that patients might not be able to see and describe the spider for the physician. Thus, physicians must be trained to be able to distinguish spider species by the signs and symptoms of the patient (6). This is especially true in regions with a high incidence of spider bites like Khorasan Razavi Province. Black widow spider (*Latrodectus tredecimguttatus*) bites are not usually reported from other parts of this country, suggesting a geographical inhabitant of spiders. Other arthropods, reptiles and venomous animals and the cases with envenomations of unspecified venomous animals together caused less than 10% of all envenomations in this study. Other arthropods were accountable for 44 envenomations in the 7-yr period.

Chemicals, despite of their health-related risks [25], could be used to limit contact between humans and arthropods [26], but unlike other medical topics, a considerable gap exists on how to public exposure could be prevented in this country. Improving public health literacy and risk communication are essential for successful implementation of preventive measures [27, 28].

One of the strengths of this study was calculating ASIR of the snakebites to accurately determine high-risk groups. As the wide age range of admitted patients shows, another positive point was the fact that all hospitalizations of the province are included in this study as this center acts as the sole toxicology department in the province.

Since this study addressed the hospitalized cases of envenomation, it does not enable us to determine the exact epidemiology of all envenomations (i.e. outpatients). Besides animal species were not known. A chunk of the envenomations is treated using traditional medicine, not included in this study.

CONCLUSION

The age-specific incidence rate in Khorasan Razavi Province is modestly more frequent in younger adult males as well as old ages. The

incidence of these envenomations was similar to other countries in the region. The pattern of snake, scorpion and spider bites and stings are similar to each other, suggesting an environmental effect. Provided incidence could be used for future studies. Additionally, we would like to emphasize a need to develop a national risk communication protocol for bites and stings.

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