

Epidemiological Profile of Snakebite in Iran, 2009-2010 Based on Information of Ministry of Health and Medical Education

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ABSTRACT

Background: Snake bite is one of the significant health problems in the tropical and subtropical regions. It is a common medical emergency in Iran. The current study was conducted to characterize related risk factors for snake bite accidents.

Methods: This research was a descriptive retrospective study. Data were collected by gathering snake bite records of 42 Medical Sciences Universities in Iran from March 2009 to March 2010. Information included: age and sex of the victims, region of incident, site of bite and outcome.

Results: The results showed that the majority of snake bite patients were male (66.1%). The age distribution of patients indicated that the greatest rate of snake bites occurred among the 25-34 years old. Of 5172 snake bite, 2851 (54.7%) observed on lower limbs, 12019 (38.9%) on upper limbs and 303(5.8%) on head and Trunk and 20 (0.3%) unknown site. The average incidence of snake bite was estimated 6.9 Per 100,000, however, the highest and the lowest affected cases were observed in Semnan province (with incidence of 111.6 per 100000 individuals) and Rafsanjan, Sabzevar cities (with incidence of 0 per 100000), respectively. The mortality and recovery rates of cases with and without anti venom, was evaluated (0.12%, 99.88%) and (0.4%, 99.6%) respectively.

Conclusion: The high incidence of snake bites in some of provinces of Iran suggests the necessity of preventive programs for minimizing the incidence.

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► *Implication for health policy/practice/research/medical education:*
Epidemiological Profile of Snakebite in Iran

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1. Introduction:

Snakes are venomous animals of the class Reptilia. These animals that are found in all continents except Antarctica, are known to cause problems in tropical and subtropical regions. Snake bite and consequences represent an important emergency particularly in children, in many countries (1, 2). Venomous snakes have a pair of enlarged, hollow teeth, called fangs, located in front of their upper jaw. These fangs contain a venom channel (like a hypodermic needle) or groove, along which venom can be introduced deep into the tissues of their prey. When an individual is bitten, venom is injected either subcutaneously or intramuscularly (3). The clinical symptoms in snake bite are typically variable, depending on factors such as Snake's species, amount of injected venom, season, age and physical conditions of injured patient; It may be mild as brief local responses or as dangerous as severe physiological changes which might lead to death. The consequences of snake bites, such as pain and infection can be localized or systemic; shock, acute kidney injury, coagulation disorders, rhabdomyolysis and cardiac muscle damage are some expected complications (4-6). More than 3500 species of snakes have been found around the world, less than 10% of which are venomous (7-10). In Iran, 83 species of snakes have been identified, of which 45 species are non-venomous, 27 species are venomous and 11 species are semi-venomous (1, 2, 10). Snake bite is a serious public health problem in different parts of Iran, especially in rural areas. The recorded number of snake bites from 2001 to 2008, were approximately 5000 to 7000 per year, of which, approximately 7 deaths were reported each year in this country.

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Snake envenomation patterns, depending on the species, can vary among the eight different families common in Iran, named Elapidae, Cluberidae, Crotalidae, Hydrophidae, leptotyphlopidae, Typhlopidae, Boidae and Viperidae. Among these families Elapidae, Viperidae and Hydrophidae, Colubridae can cause mild to severe envenomation, neurotoxicity, vasculotoxicity, myotoxicity and infection (11-14). At least six species have been implicated in envenoming of human and considered medically important in Iran. These snakes include *Echis carinatus*, *Naja naja oxiana*, *Vipera lebetina*, *Vipera albicornuta*, *Akistrodon halys* and *Pseudocerastes persicus*. *Echis carinatus* (Viperidae) because of wide distribution is the most medically important snake in Iran (10, 11). Even though Snakes are abundant in many parts of Iran, envenomation arising from Snake bite is not fully defined by clinical signs, symptoms and epidemiological aspects and the purpose of this study was to appraise these aspects. This retrospective study aimed at describing the incidence and geographic location of snake bite injuries in Iran provinces, and to assess the magnitude and distribution of the problem in order to optimize prevention and treatment.

Geographic characteristics of Iran

Iran an Asian country with a population of



Fig. 1. It shows geographical status of Iran provinces.

over 75 million is regarded as one of the Middle East countries. It is located between latitudes 24° and 40° North, and longitudes 44° and East, with an area of 1,648,195 km. In the framework of Asia, Iran is the largest country in the Middle East. Iran, the 18th largest country in the world, a land of mountains and deserts is situated between Caspian Sea on the north, Persian Gulf and the Oman Sea on the south (Fig. 1). Iran possess a large forest in the north which forms a subtropical condition and two sandy and dry deserts, “Kavir Namak” and “Kavir Lut” in the east which cover a vast part of the country and provide a natural environment for most venomous and non-venomous creatures; While the southern of country is low flat land, there are two mountain: Alborz and Zagros. Alborz with Damavand summit, which rises to over 5,600 m, is located in the north and Zagros mountain chains located in the middle and central part of country with severe heavy snowfall winter and a temperature below zero. The Caspian coastal plain has humid summers and rarely freezing winters, but the Persian Gulf and Oman Sea coastal plains exhibit very humid and hot summers with mild winters. The rainfall ranges from 135 to 355 mm annually. Because of these reasons, Iran has a variety of soils and continental type of climate, ranging from arid or semiarid, to subtropical (Iran Province, 2012).

2. Materials and Methods:

This research was a descriptive retrospective study. Data gathered based on information of Ministry of health and medical education from the files of outpatient or hospitalized persons referred to the health centers and hospitals of 42 universities of Medical Sciences from all parts of Iran, during March 22nd 2009 to March 21st 2010 were evaluated. Gender and age of the snake bite victim, patient background, antivenom treatment, bitten part of body, and geographical location (rural/urban) included variables were evaluated in terms of epidemiological

viewpoints. The information was gathered and recorded in a designed checklist.

3. Results:

During March 2009 to March 2010, 5172 cases of snake bite were recorded. Of all, 72.3% was related to rural and the rest were in urban regions. Men with 66.1% were the more affected gender.

The age group of 25–34 years was by far the most commonly affected group (19.1%), however, the least number of patients (6.3%) belonged to the age group of 55–64 years. Table 1 shows age and gender distribution of bitten patients by snake in Iran during March 22nd 2009 to March 21st 2010. Of 5172 snake bite, 2851 (54.7%) occurred on lower limbs, 12019 (38.9%) on upper limbs and 303 (5.8%) on head and Trunk and 20 (0.3%) unknown site (Table 2).

The average incidence of snake bite was estimated 6.9 Per 100,000, however, the highest and the lowest affected cases were observed in Semnan province and Rafsanjan, Sabzevar cities with incidences of 111.6 and 0 per 100,000 individuals, respectively. Other nine provinces including Kermanshah, South Khorasan, Hormozghan, Sistan and Baluchestan, Bushehr and Kerman and Khuzestan, Lorestan and Ghazvin with incidences of 37.2, 32.5, 31, 29.6, 22.6, 21.3, 17.6, 10.8, and 8.3 per 100,000 individuals were the next important snake bite priority within the country respectively (Table 3 and Fig. 2).

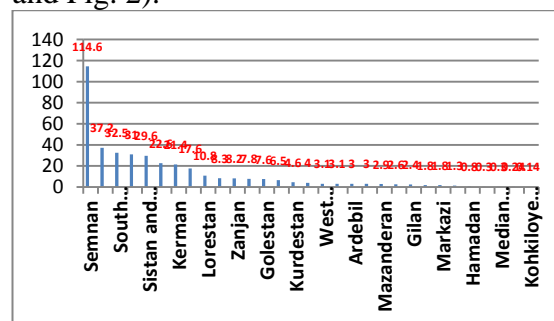


Fig. 2. Snake bite incidence per hundred thousand populations in Iran, during March 2009 to March 2010, based on province.



Fig. 3. *Vipera lebetina*. Personal picture collection of the first author (R. Dehghani).



Fig. 4. It shows *Echis carinatus*.



Fig. 5. *Pseudocerastes persicus*. Personal picture collection of the first author (R. Dehghani).



Fig. 6. It shows *Walterinnesia aegyptia*.

Totally 15373 antivenom vials were used,

Table 1: Epidemiological characteristics of snake bites in Iran, 2009-2010.

Age (yr) group	Male	Female	Total	%
0-4	340	131	471	9.1
5-9	231	194	425	8.2
10-14	222	125	347	6.7
15-24	595	319	914	17.7
25-34	562	422	984	19.1
35-44	592	165	757	14.6
45-54	379	195	574	11.1
55-64	225	101	326	6.3
>65	274	100	374	7.2
Total (%)	3420 (66.1)	1752 (33.9)	5172	100

indicates the coverage of 297 vial/100 affected cases. Of 5172 snake bite cases, antivenom serum were not administered in 4.9% of cases and 95.1% of patients received it; in 69.3% of cases antivenoms were administered intravenously, 24.9% intramuscularly and the rest were unknown.

Most of the snake bites whether recovered or died occurred during the summer and at night. Based on results, the incidence of snake bite deaths is calculated to be 0.135% (7/5172). Of all, five died following administration of antivenom during 6-12 hours after snake bite and 1 victim had not received antivenom immediately after bite. 85.75% of deaths occurred in Khuzestan and the rest in Hormozghan province. The time elapsed between snake bite and injection of antivenom were less than 6 hour in 55.7% of cases, 6-12 hour in 15.7% of cases, more than 12 hours in 23.66% and the rest of individuals had not received any anti venom. The mortality and recovery rates of cases with and without anti venom, was evaluated (0.12, 99.88%) and (0.4, 99.6%) respectively.

Table 2: Snake bite among the studied cases in Iran, based on bitten part of body.

Biting site	Patients (n)	%
Head and trunk	303	5.8
Hands	2019	38.9
Legs	2851	54.9
Unknown	20	0.3

Table 3: Snake bite incidence per hundred thousand populations in Iran, during March 2009 to March 2010, based on province and ranking from higher to lower grade.

Grade	Province	Incidence
1	Semnan	114.6
2	Kermanshah	37.2
3	South Khorasan	32.5
4	Hormozgan	31
5	Sistan and Baluchestan	29.6
6	Bushehr	22.6
7	Kerman	21.4
8	Khuzestan	17.6
9	Lorestan	10.8
10	Ghazvin	8.3
11	Zanjan	8.2
12	North Khorasan	7.8
13	Golestan	7.6
14	Charmahal e, Bakhtiari	6.5
15	Kurdestan	4.6
16	Ilam	4
17	West Azerbaijan	3.1
18	Isfahan	3.1
19	Ardebil	3
20	Yazd	3
21	Mazandaran	2.9
22	Fars	2.6
23	Gilan	2.4
24	Qum	1.8
25	Markazi	1.8
26	East Azerbaijan	1.3
27	Hamadan	0.8
28	Tehran	0.3
29	Median Khorasan	0.3
30	Alborz	0.24
31	Kohkiluyeh and Boyer-Ahmad	0.14

4. Discussion:

Snake bite is a common medical emergency in Iran and the epidemiological features and management of these cases varies in some instances at different regions (15). The results of this study indicated that there were 5172 cases of snake bites in Iran during March 22nd 2009 to March 21st 2010 with incidence of snake bite was 6.9 cases per 100,000. Results of this study showed that most of the snake bite patients were male (66.1%) so men are at greater risk of snake bite than women in Iran. The male to female ratio was 1.9:1.

This result resembles to a research in Southern India which 60.55% were male and male to female ratio was 1.5:1 (16). More percentage of male victims was reported in a study in Brazil which 80.3% of victims were male (17); de Roodt AR *et al* in a Argentinean research during the period between 1979-2003 reported that males were most affected by snake bites (70%) (18); similar to a study in Costa Rica that Seventy-two percent of the victims were male (19). On the other side, some studies reported lower percentages of male victims for example a study in Turkey which Of the total 125 cases, 54.4% were male (20). There are few reports that women were more affected than men as Magar *et al* reported in Nepal (21).

As mentioned, men were the most victims of snake bite in almost all studies because of working outside the home and more favorable environment for snake bite than women.

The average incidence of snake bite was estimated 6.9 per 100,000, however, Semnan province had the highest affected cases (111.6 per 100,000 individuals) and Rafsanjan, Sabzevar cities with incidences of and 0 per 100,000 individuals had the lowest. Other nine provinces including Kermanshah, South Khorasan, Hormozgan, Sistan and Baluchistan, Bushehr and Kerman and Khuzestan, Lorestan and Ghazvin with incidences of 37.2, 32.5, 31, 29.6, 22.6, 21.3, 17.6, 10.8, and 8.3 per 100,000 individuals were the next important snake bite priority within the country respectively.

Snakes are cold-blooded animals; therefore they are mostly found in areas with warm climates. In these areas there is a greater chance to encounter a snake with human. Based on distribution of venomous snakes, *Echis carinatus*, *Vipera lebetina*, *Pseudocerastes persicus* and *Walterinnesia aegyptia* are the most probable venomous snakes in Iran (Fig. 3-6).

Snake bite is a neglected disease that afflicts the most impoverished inhabitants of rural areas. It is an important

epidemiologic factor that rural communities are at greatest risk for snake bite. 72.3% of snake bite cases occur in rural areas of Iran provinces. It is concordant with studies of other areas. Unfortunately the most mortality and morbidity occur particularly in rural tropics too (22-25).

Snake bites occurred in all age groups in Iran; however the majority of cases were observed in the age group of 15-54 years old (62.5%); in general, the greatest rate of snake bites occurred among people aged 25-34 years old. It can be explained by highest time of work in mentioned age group; whereas lowest rate was reported among the 55-64 years old patients (6.3%) in this study. In a study in India age group 21-50 years old were the most affected age (26). In another study which 90 cases of *Crotalinae* (*Bothrops* and *Crotalus* genera) and two cases of *Micrurus* snake bite were included between 1993 to 1995, the most victims were males between 20-30 years old (27). A research on 231 snake bitten patients hospital admission of children below 10 were the most frequent than other age groups (28). A survey in western Nepal has reported that active population between 10 to 40 years old were the most affected inhabitants (29).

Snake bite is variable seasonally and geographically within different countries. In several studies rainy seasons (June to October) are accounted as the most time affected by snake bite (24, 30, 31). Cruz *et al* in a research between 1984 and 1999 reported that the most snake bites occurred from October to March (32). Data collected in our study revealed that the highest number of snake bites occurred between June and September which is concordant with the earlier studies.

In current study, upper and lower limbs were at higher risk of snake bites compared with the head and trunk. Lower limbs have been reported as the most frequent site for snake bite in several researches (33-38).

In our study, antivenom was administered in more than 95% of patients and

approximately 70% were administered intravenously. In 5 years study in Mashhad on 108 patients with snake bite, the antivenom except one patient, who developed mild hypersensitivity reaction, was administered with noticeable safety; during median of 2 days (1-7) admission; the median (range) of antivenom vials administered was 5 (1- 25) (39). Cezaretly *et al* in an epidemiological and clinical research on snake envenomations in Turkey between 1995 and 2004, reported that of all 550 snakebite cases Approximately one third (34.2%) were treated symptomatically, while 36.8% required antivenom therapy along with and without symptomatic treatments (40).

An Indian study on pit viper bites among two years reported that more than 90% of patients received Specific anti-snake venom and about 4-32 antivenom vials were administered to each patient, on average 11.1 vials per patient (41).

These different range of antivenom administration and in particular high percentage of patients whom antivenom were administered to in our country may be resulted of some reasons for example severity of envenomation due to snake species and special climate, some unnecessary or even harmful attempts which might be performed because of low awareness about correct and effective initial efforts for such these patients that sometimes may lead to mild to severe complications which make health care stuff to take inessential steps for example antivenom administration.

Approximately 4500-6500 individuals are affected by snake bite in Iran with 3-9 deaths every year based on recent reports of Iranian Ministry of Health and Medical Education (42).

Based on results of current study, the incidence of snake bite deaths is calculated 0.135% (7/5172). Of all, five died following administration of antivenom during 6-12 hours after snake bite and 1 victim had not received antivenom immediately after bite. 85.75% of deaths occurred in Khuzestan and the rest in

Hormozghan province. The mortality and recovery rates of cases with and without anti venom, was evaluated (0.12, 99.88%) and (0.4, 99.6%) respectively.

Monterio *et al* in their research in India reported 6.5% fatalities in study group. Of the two, one patient had received a tourniquet as a first aid measure, while the other had received no first aid. (41); on the other side we observe no death in survey of Cezaretly *et al* on 550 patients among nine years study (40) similar to Iranian research on 110 patients in Mashhad during five years (39).

It could be concluded that although most of snake bitten patients recovered, death rate is noticeable in some provinces such as Khuzestan and Hormozghan and sounds it could be minimized by more attention and stronger awareness of general population along with health care personal specially at first level aid; So we believe that snake bite problem should be considered more seriously in future researches. Further and stronger education is required to minimize incidence and complications of snake bite in Iran with special emphasis on emergency medical staff for identification of venomous and non-venomous snakes as an essential primary step in particular at regions with high incidence of snake bite. Developing standard protocols on management of snake bite by native species could make a significant improvement in treatment of bitten cases in different regions in Iran as it is developing in some parts (43).

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