

**Epidemiological study of snakebites in Ardabil Province (Iran)**

Esmail Farzaneh<sup>1</sup>, Nasrin Fouladi<sup>2</sup>, Yousef Shafae<sup>3</sup>, Zahra Mirzamohammadi<sup>4</sup>, Farnaz Naslseraji<sup>5</sup>, Omid Mehrpour<sup>6</sup>

<sup>1</sup> Forensic Medicine and Toxicology Specialist, Associate Professor, Faculty of Medicine, Department of Internal Medicine, Ardabil University of Medical Sciences, Ardabil, Iran

<sup>2</sup> Ph.D. of Community Medicine, Associate Professor, Faculty of Medicine, Department of Community Medicine, Ardabil University of Medical Sciences, Ardabil, Iran

<sup>3</sup> Plastic Surgery Specialist, Assistant Professor, Faculty of Medicine, Department of Plastic Surgery, Iran University Of Medical Sciences, Tehran, Iran

<sup>4</sup> General Practitioner, Ardabil University of Medical Sciences, Ardabil, Iran

<sup>5</sup> Resident of Gynecology and Obstetrics, Faculty of Medicine, Ardabil University of Medical Sciences, Ardabil, Iran

<sup>6</sup> Fellowship of Medical Toxicology, Associate Professor, Medical Toxicology and Drug Abuse Research Center (MTDRC), Birjand University of Medical Sciences, Moallem Avenue, Birjand, Iran

**Type of article:** Original

**Abstract**

**Introduction:** Average annual incidence of snakebite worldwide is between 5.5 to 1.2 million, and at least 125,000 of them are fatal. In Iran, around 4,500-11,000 snakebites occur annually, and a small number of them are fatal. Snake bites can cause intoxicity and immediate death in patients, and the aim of this study was to investigate the epidemiological study of snakebites in Ardabil Province.

**Methods:** This study was a cross-sectional that has been done on 67 snakebite patients who were admitted to the Imam Khomeini Hospital of Ardabil during 2008-2013. Information included: age and sex of victims, region of incidence, site of bite, hospitalized duration and symptoms. Data analyzed by descriptive statistical methods using SPSS version 19.

**Results:** There was significant difference between the two sexes ( $p=0.001$ ). There was no significant difference between the mean age of male and female victims ( $p=0.68$ ). Most of the victims were in the age group of 20-29 years (34.3%). All snakebites happened in rural areas. There was no significant relation between gender of victims and the residential location of victims ( $p=0.32$ ). Most snakebites happened during 11 a.m. to 4 p.m. (32.8%). Most of the snakebites occurred in spring and summer seasons. Results showed that most of the bites in yearly months was seen in the summer season and the difference between seasons is significant. ( $p=0.0001$ ). Most snakebites, with 38 cases (56.7%), were observed on lower limbs and among them right limbs with 20 cases (52.6%) had the greatest number. There was significant difference between organs of bites in victims because the most organs were in the right lower limb ( $p=0.002$ ). Of all cases, 66 (98.5%) were injured by a species of viper snake. All patients, showed symptoms of pain, swelling, erythema and ecchymosis bite. Twenty-seven (40.3%) of all cases, suffered fainting. Nausea and vomiting were two other common symptoms. The antidote used in patients was  $5.1 \pm 1.3$  vials. The mean incidence rate of snakebite was an estimated 4.1 per 100000.

**Conclusions:** Possible risk factors include male gender and young age. It was also found that the stings reach peak in the morning and noon. These reports are all in rural areas, and mostly occurred in the warm months. Snakebites in rural parts around Ardebil were prevalent. Severe side effects were rare, but the incidence of other complications was common among the victims.

**Keywords:** Snakebite, Poison, Epidemiology

**Corresponding author:**

Associate Professor Dr. Omid Mehrpour, Medical Toxicology and Drug Abuse Research Center (MTDRC), Birjand University of Medical Sciences, Moallem Avenue, Birjand, 9713643138 Iran.

Tel: +985632381270, Email: [omid.mehrpour@yahoo.com.au](mailto:omid.mehrpour@yahoo.com.au)

Received: September 19, 2016, Accepted: January 20, 2017, Published: March 2017

iThenticate screening: December 26, 2016, English editing: February 09, 2017, Quality control: March 08, 2017

© 2017 The Authors. This is an open access article under the terms of the Creative Commons Attribution-NonCommercial-NoDerivs License, which permits use and distribution in any medium, provided the original work is properly cited, the use is non-commercial and no modifications or adaptations are made.

### 1. Introduction

Snakebite and its consequences represent major medical emergencies particularly in children. The World Health Organization (WHO) in 2009 assigned one of its priorities to increase medical services to the victims of snakebite (1). On average, the incidence of snakebite in the world is between 2.1 to 5.5 million per year and in Iran this rate was 6.9 per 100000 (2). Snakebite is one of the major health problems in the community, especially in rural communities, and the recorded number of snakebites from 2001 to 2009, were approximately 5000 to 7000 per year, of which, approximately 7 deaths were reported each year in Iran. In Mahshahr, Iran, a report showed 900-1000 cases of snake bites with 1-2 annual deaths (3, 4). The study in Mahshahr showed that the highest and lowest rates of snake bites happening in 30-39 and 0-9 age groups and most of them were male (5). 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. At least six species of snakes in Iran, are important in the clinical toxicity of snakebite (6-7). The clinical symptoms caused by in snakebite are typically variable and severity of complications depending on factors such as species of snake, amount of injected venom, season, age and physical condition of the injured person. The consequences of snake bites, such as pain and infection can be localized or systemic; shock, acute kidney disorders, coagulation disorders, rhabdomyolysis and heart muscle damage are some expected complications (8). Studies have shown that snakebite happens mostly in hot and rainy seasons and the incidence of snakebite is higher in rural areas and outside of the cities (1, 9-13). Most snakebite victims are men and people aged 15-54 years which is related to the fact that men spend more time in nature and outdoors (14, 15). Studies also show that most of the bite sites are on lower limbs and the least bite sites are related to head and neck (16, 17). The average incidence of snakebite in Iran was estimated to be 6.9 per 100000 and Ardabil province, with incidence of 4.1 per 100000, is the country's 19th rank of snakebite incidence (1, 2) and according to hospital evidence, snakebite in Ardabil province is relatively high. Because of the necessity of a rapid response to the patients, and knowing the complications in these patients are vital in the prognosis of them, the aim of this study was an epidemiological investigation of snakebite in Ardabil province.

### 2. Material and Methods

This research was a cross-sectional retrospective study. Data were collected by gathering 67 snakebite cases in Ardabil province during 2008-2013. Information included: age and sex of victims, region of incidence, site of bite, hospitalized duration and symptoms. Information about the patients was collected and extracted from the archives of the hospital. The type of snake, based on oral explanation taken from the patient, the type of wound caused on the patient's body and the caused local and systemic symptoms were identified by a poisoning and forensic expert. Collected data were analyzed using descriptive statistical methods such as Mean  $\pm$  SD and statistical tests of chi-square and t-test by SPSS version 19 (SPSS Inc. Chicago, Illinois, USA).

### 3. Results

Of the snakebite victims, 51 cases (76.1%) were men and the rest were female and there was significant difference between the two sexes ( $p=0.001$ ). The average age of the patients was  $35.6 \pm 16.5$  years. The mean age of male victims with  $35.14 \pm 16.5$  year was similar to mean age of female victims with  $37.13 \pm 18.8$ , with no significant difference between two sexes ( $p=0.68$ ). Most of the victims were in the age group of 20-29 years (34.3%). All snakebites happened in rural areas. The greatest number of snakebites happened in the villages around Ardabil. There was no significant relation between gender of victims and the residential location of victims ( $p=0.32$ ). Most snakebites happened during 11 a.m. to 16 p.m. (32.8%). Most snakebites occurred in spring and summer seasons. Results showed that the most bites occurring in yearly months was seen in the summer season and the difference between seasons is significant. ( $p=0.001$ ). Most snakebites, with 38 cases (56.7%), were observed on lower limbs and among them, right limbs with 20 cases (52.6%) had the greatest number. There was significant difference between organs bitten in victims because most organs were in the right lower limb ( $p=0.002$ ). In all, 66 cases (98.5%) of the victims had been bitten by a species of viper and 1 victim (1.5%) had been bitten by a cobra. Victims were hospitalized for an average of 5.4 days. Most of the victims rested for 3-5 days in the hospital and only 5 cases were in the health centers for more than 10 days. In terms of local symptoms, pain symptoms were observed in all the patients. Swelling, erythema and ecchymosis bite were observed in all cases of bites by viper snakes. Bite sites were observed and one of the victims, in addition to the above-mentioned symptoms, Bull hemorrhagic was reported in the bite site (Table 1). In terms of systemic symptoms, 27 cases had weakness. Most of the victims were treated by 5 vials of antidote. Average antidote used in victims was  $5.1 \pm 1.3$  vials. The mean incidence rate of snakebite was an estimated 4.1 per 100000.

**Table 1.** Incidence of clinical symptoms in patients injured by snakebite in Ardabil Province Table 1. Incidence of clinical symptoms in patients injured by snakebite in Ardabil Province

Symptoms		n (%)
Local symptoms	Pain	67 (100)
	Inflation	66 (98.5)
	Erythema	66 (98.5)
	Ecchymosis	66 (98.5)
	Bull hemorrhagic	1 (1.5)
Systemic Symptoms	Lethargy	27 (40.3)
	Nausea	11 (16.4)
	Vomiting	11 (16.4)
	Vertigo	3 (4.5)
	Tachycardia	2 (3)
	Acute compartment syndrome (ACS)	2 (3)
	Other symptoms	8 (12)

#### 4. Discussion

In a study conducted by Dehghani, 96% of snakebite victims were male (3); according to the report of Brunda's study, the ratio of male to female in snakebite victims was 3 to 1 (18). In this study, which is the first study of its kind in Ardabil province, men had been bitten more than women by snakes, and in this study male to female ratio was estimated as 3.2 to 1. In a study conducted by Zamani et al., the average age of the snakebite victims was estimated as 28.3 years and the age range of 20-30 years had more victims than other age groups (10). Also, Dehghani et al., in a study, showed that age group of 15-24 and 35-44 years have the most snakebite victims (3). In the study conducted by Brunda et al., most snakebites happened in the age group of 20-50 years (18). In line with the mentioned studies, the present study also found that the average age of snakebite victims was  $35.6 \pm 17$  years and most snakebites happened in the age group of 20-29 years. Several studies showed that most snakebites occurred in rural areas and outside of the cities (18-22). In the present study, all reported snakebite cases happened outside of the city around Ardabil and in rural areas. Snakebite time during the day and night is important, and has been largely ignored in the studies, and results of studies are sometimes contradictory. In the study conducted by Halsha, most of the snakebites occurred during the day (70.5%) but according to the study of Rahman in Bangladesh, most of snakebites occurred at night (4, 11). Possible causes of this difference may be due to differences in lifestyle and types of snakes in the different regions. In this study, the majority of snakebites occurred in the morning and evening between the hours of 8 a.m. – 3 p.m. The possible reason for this is that the rural work activities generally happen at this time. At the beginning of the study, and based on the expected assumption, a hypothesis was given on the dominant frequency of snakebites in hot seasons. Other similar studies supported the hypothesis so that in the study performed by Brunda, most of snakebite in India happened in autumn and summer seasons (18). In a research conducted by Dehghani, the majority of snakebites occurred between May and September (3). Similar results were observed in the studies of Zamani and Halesha (10, 23). In the present study, the most biting sites were on lower limbs and this result was in line with other studies (1, 18). In the books and texts related with snakes and snakebite, vipers are venomous snakes and they are also the most dominant snake species in the northwest of the country and Ardabil. In this study, 98.5% of the cases were bitten by vipers and only one case was bitten by a Cobra. Studies showed that localized systemic symptoms can be usually found in all the bitten patients. In the present study, it was revealed that the general localized symptoms such as pain, erythema and ecchymosis could be seen in all patients. Also, weakness and fatigue, nausea and vomiting are common systemic symptoms in victims (8). Due to complications and disorders of snakebite victims, study quality and quantity of treatment process of the victims, the emotional and financial costs exposed to the patients and medical staff can help to improving treatment process of the victims. In this study, the victims were hospitalized for an average of 5.4 days and an average of around 5 vials of antidote was used for the victims. The mean incidence rate of snakebite in Ardabil province was estimated as 4.1 per 100000, which were lower than many provinces in Iran (2). Limitation: The present study had some limitations. Recognition of snake types was difficult in some cases. Although, expert toxicologist examined the cases to determine the type of snake bites.

#### 5. Conclusions

In this study, all snakebites happened in the morning and evening, in rural areas and among rural men working outdoors, mostly in warm months. Villages around Ardabil were the most important areas of snakebite incidence. It

is recommended that snakebite high-risk groups should be trained for prevention and emergency action by different methods. Given the higher prevalence of snakebite in rural areas of Ardabil province, better equipping health centers in these areas for mechanisms to deal with snakebites for minimizing the incidence is essential.

**Acknowledgments:**

The result of this study was from medical doctoral thesis of Zahra Mirzamohammadi in Ardabil University of Medical Science, and financially supported by the Ardabil University of Medical Science.

**Conflict of Interest:**

There is no conflict of interest to be declared.

**Authors' contributions:**

All authors contributed to this project and article equally. All authors read and approved the final manuscript.

**References:**

- 1) Monzavi SM, Dadpour B, Afshari R. Snakebite management in Iran: Devising a protocol. *J Res Med Sci.* 2014; 19(2): 153-63. PMID: 24778670, PMCID: PMC3999602.
- 2) Dehghani R, Dadpour B, Mehrpour O. Epidemiological Profile of Snakebite in Iran, 2009-2010 Based on Information of Ministry of Health and Medical education. *International Journal of Medical Toxicology and Forensic Medicine.* 2014; 4: 33-41.
- 3) Dehghani R, Rabani D, Panjeh Shahi M, Jazayeri M, Sabahi Bidgoli M. Incidence of Snake Bites in Kashan, Iran During an Eight Year Period (2004-2011). *Arch Trauma Res.* 2012; 1(2): 67-71. doi: 10.5812/at.6445. PMID: 24396746, PMCID: PMC3876526.
- 4) Eslamian L, Mobaiyen H, Bayat-Makoo Z, Piri R, Benisi R, Naghavi-Behzad M. Snake bite in Northwest Iran: A retrospective study. *J Anal Res Clin Med.* 2016; 4(3): 133-8. doi: 10.15171/jarcm.2016.022.
- 5) Kassiri H, Naghibzadeh R, Kavosi-Asl P. An Epidemiological Study of Patients with Snake Biting in the Health Centre of Bandar Mahshahr, SW Iran. *Asian Journal of Animal and Veterinary Advances.* 2012; 7: 268-72.
- 6) Basharat M, Abbasi F. Snakebite in Iran: diagnosis, prevention, treatment. *Journal of Medical Council of Iran.* 2009; 27: 63-7.
- 7) Dehghani R. *Environmental Toxicology.* Tehran Tak Derakhat and Kashan University of Medical Sciences. 2010; 389-45.
- 8) Chippaux JP. Epidemiology of snakebites in Europe: a systematic review of the literature. *Toxicon.* 2012; 59(1): 86-99. doi: 10.1016/j.toxicon.2011.10.008. PMID: 22056768.
- 9) Afshari R, Khadem-Rezaiyan M, Balali-Mood M. Spider bite (latrodoctism) in Mashhad, Iran. *Hum Exp Toxicol.* 2009; 28: 697-702. doi: 10.1177/0960327109350668. PMID: 19812122.
- 10) Zamani F, Dehdari T, Ahmadi K, Taghi-Rahdari M, Ashrafi A, Babaei A. Investigation of temporal pattern of scorpion sting and snakebite incidence in patients referred to Masjedsaleiman's main hospital, during 24 months from 21 March 2008 to 20 March 2009. *Journal of Safety Promotion and Injury Prevention.* 2014; 1(4): 190-7.
- 11) Rahman R, Abul Faiz M, Selim Sh, Rahman B, Basher A, Jones A, et.al. Annual Incidence of Snake Bite in Rural Bangladesh. *PLoS Negl Trop Dis.* 2010; 4: 860. doi: 10.1371/journal.pntd.0000860. PMID: 21049056, PMCID: PMC2964284.
- 12) Brunda G, Sashidhar RB. Epidemiological profile of snake-bite cases from Andhra Pradesh using immunoanalytical approach. *Indian J Med Res.* 2007; 125: 661-8. PMID: 17642502.
- 13) Ariaratnam CA, Sheriff MH, Theakston RD, Warrell DA. Distinctive epidemiologic and clinical features of common krait (*Bungarus caeruleus*) bites in Sri Lanka. *Am J Trop Med Hyg.* 2008; 79(3): 458-62. PMID: 18784244.
- 14) de Roodt AR, De Titto E, Dolab JA, Chippaux JP. Envenoming by coral snakes (*Micrurus*) in Argentina, during the period between 1979-2003. *Rev Inst Med Trop Sao Paulo.* 2013; 55(1): 13-8. doi: 10.1590/S0036-46652013000100003. PMID: 23328720.
- 15) Hansson E, Sasa M, Mattisson K, Robles A, Gutiérrez JM. Using geographical information systems to identify populations in need of improved accessibility to antivenom treatment for snakebite envenoming in Costa Rica. *PLoS neglected tropical diseases.* 2013; 7(1): e2009. doi: 10.1371/journal.pntd.0002009. PMID: 23383352, PMCID: PMC3561131.
- 16) Shetty AK, Jirli PS. Incidence of Snake bites in Belgaum. *J Indian Acad Forensic Med.* 2010; 8: 139-41.

- 17) Rao CP1, Shivappa P, Mothi VR. Fatal snake bites - sociodemography, latency pattern of injuries. *J Occup Med Toxicol.* 2013; 8(1): 7. doi: 10.1186/1745-6673-8-7. PMID: 23522302, PMCID: PMC3614463.
- 18) Brunda G, Sashidhar RB. Epidemiological profile of snake-bite cases from Andhra Pradesh using immunoanalytical approach. *Indian J Med Res.* 2007; 125: 661-68. PMID: 17642502.
- 19) Warrell DA. Snake bite. *Lancet.* 2010; 375: 77-88. doi: 10.1016/S0140-6736(09)61754-2.
- 20) Alirol E, Sharma SK, Bawaskar HS, KuchU, Chappuis F. Snake bite in South Asia: a review. *PLoS Negl Trop Dis.* 2010; 4(1): e603. doi: 10.1371/journal.pntd.0000603. PMID: 20126271, PMCID: PMC2811174.
- 21) Rahman R, Abul Faiz M, Selim Sh, Rahman B, Basher A, Jones A. Annual Incidence of Snake Bite in Rural Bangladesh. *PLoS Negl Trop Dis.* 2010; 4(10): e860. doi: 10.1371/journal.pntd.0000860. PMID: 21049056, PMCID: PMC2964284.
- 22) Harrison RA, Hargreaves A, Wagstaff SC, Faragher B, Lalloo DG. Snake Envenoming: A Disease of Poverty. *PLoS Negl Trop Dis.* 2009; 3(12): e569. doi: 10.1371/journal.pntd.0000569. PMID: 20027216, PMCID: PMC2791200.
- 23) Halesha B, Harshavardhan L, Lokesh AJ, Channaveerappa P, Venkatesh K. A study on the clinico-epidemiological profile and the outcome of snake bite victims in a tertiary care centre in southern India. *J Clin Diagn Res.* 2013; 7(1): 122-6. doi: 10.7860/JCDR/2012/4842.2685. PMID: 23450135, PMCID: PMC3576766.