

An epidemiologic survey of animal bites in Shemiranat, Tehran, 2009-2012

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Summary

Animal bites are serious threats to human health due to their subsequent fatal infections such as rabies. The increasing rate of occurrences, the expanding number of animal bites and the distribution of rabies in many provinces of the country is alarming, necessitating further attention to control the disease and performing research on its different aspects. All records of animal bites referred to the clinic during 2010 to 2012 were included in this study. The obtained data were analyzed by descriptive statistics and Chi-square test. Of 1875 registered cases, 65% were men and 35% were women. The mean age of the patients was 33.18 ± 17.15 years in both genders. There was no death record due to rabies. Most of patients (97%) lived in urban areas. The highest number of bites was occurred at the age of 20-29 years (33%) and the highest frequency of bites happened in spring (29%). There was a significant ($P < 10^{-6}$) relationship between the number of bites and season, favoring spring (29%). Most cases of animal bite caused by dogs (67%). The incidence was occurred more in rural areas (96%) than urban areas (68.1%). The most common bitten parts of the body were upper extremities (65%) followed by lower extremities (27%). The head, face and neck injuries were more common in age group <10 years than other age groups. In this study 1419 cases (76%) had superficial bites, and 33 cases (18%) had deep bites. Mean and standard deviation of delay time in receiving the anti-rabies vaccines was 15.4 ± 26 hours. Considering the high cost of anti-rabies serum and vaccination, it is essential to take necessary measures to reduce the incidence of animal bites. Educational activities along with the promotion of nongovernmental sector cooperation can play a significant role in controlling this problem.

Keywords: Animal bite, Rabies, Shemiranat.

Introduction

Animal bite is a public health problem which may lead to transmission of fatal

infections such as rabies. Globally more than 10 million people receive preventive rabies treatment due to animal bites. Preventive treatment after exposure, include washing the

wound, administration of rabies immunoglobulin and early vaccination. Washing the wound and vaccination in the first hours after the bite can prevent the disease and subsequent death (Dadipour et al., 2009).

In general, to control rabies, several factors should be taken into account. First step includes data collection, monitoring, surveillance and epidemiological investigation (Aldavood et al., 2011).

Determination of the epidemiology of rabies in each region could help to perform and design the guidelines for regional control of the disease and providing a model to use in a larger scale in population. It is obvious that without having enough knowledge about risk factors for rabies, prevention and eradication will not be possible (Sabouri et al., 2012). Tehran province with climatic variations and numerous species of rabies reservoirs have significant importance (Fayaz et al., 2011). There is no investigation about epidemiology of animal bite in this region. The goal of this study to determine animal bite epidemiology based on a surveillance of recorded data in Shemiranat Health Center.

Materials and Methods

Shemiranat city is situated in the northernmost region of Tehran with cold, mountainous and semi-humid climate. Health Center of Shemiranat covers 15 smaller

health centers, 16 health posts and 27 health houses.

Study design and data collection

This study was a case series study of the data collected using passive surveillance system in the Shemiranat region. The data collection form was used to gather information. Study population includes all patients who were referred to this center due to animal bite.

The recorded parameters were as follows: age, sex, location, the time that preventive treatment starts, the species of animal involved, location, number, and severity of injury. To prevent bias, data entry in form and software were done by different people. Patients' were fallen into seven groups according to their age. Types of wound were classified into five groups with superficial, deep, superficial and deep together, semi-deep and unknown.

Statistical analysis

All data were analyzed by descriptive statistics such as frequency distribution, percentage, mean and standard deviation and chi-square test, t-test, Logistic Regression using SPSS version 21.

Results

Total number of registered cases during the study was 1875 of which 65% and 35% were men and women, respectively (Table 1). The death rate due to rabies was reported to

be zero. Mean±SD age of patients was 33.18±17.15 and there was no significant difference (P=0.57) among men and women. The frequency of registered cases was significantly (P<0.001) varied between age groups.

The most frequent age groups were 20-29 years (Table 1). The percentage of registered cases in spring, summer, fall and winter were significantly (P<0.001) varied. In total 73% of clients lived in the area covered by Shemiranat Health Center. Just 3% of patients were from rural area. The most cases of animal bite were related to dog and were followed by cat (Table 1).

Dog bites in rural area were significantly more than urban area. Instead, rodent and cat bites in urban area were seen more than rural area (P<0.001) (Table 2). Men were more frequently bitten by dog and wild carnivores while women were often bitten by cat, rodents (Mice, Rabbit, Hamster, Squirrels) and monkey (P<0.001) (Table 2). The frequency of attacks by domestic dogs and rodents were significantly more than stray dogs and rodents. Upper limbs were most abundance bitten organ (Table 1).

Children in age group under 10 years, compared to other groups, were significantly (P<0.001) more bitten in head, face and neck area. When the involved animal was dog, the frequency of head, face and neck, lower

limbs and other organs injuries were more than cases bitten by cat. In contrast, the upper limbs were more (P<0.001) injured by cats (Table 2).

There was no statistically significant relation between residential location and bitten organ. In 76% patients the ulcer was shallow. The frequency of deep ulcer in men were significantly (P<0.05) more than women while it was vice versa for shallow ulcer (Table 1).

More than 85% were used water and soap for washing ulcers and about 60% of them used at least one disinfectant agent for cleaning the bitten site. There were no significant relation between gender and; disinfectant agent and method of disinfectant. In more than 71% of patients the bitten site was bare. In this study, 54% patients have completed their treatment period (Table 1).

The delay in treatment was 15.6±26 hours (for 934 accessed data) (Table 1). There was no significant difference between residential location and delay in treatment. In bitten cases, 23.2% were received human anti rabies immunoglobulin and 61.7% needed tetanus vaccination.

Fate of attacking animal (in dog and cat cases) was not known in 77% cases. The attacked animal was dead in 14 cases. The diagnostic tests were positive just in one dog.

Table 1. Descriptive analysis of bitten patients registered in Shemiranat Health Center, 2010-2012.

	Category	Frequency	%	Max	Min	Median	Mean	SD
Gender	Woman	662	35.3				-	
	Man	1213	64.7				-	
Age	<10	133	7					
	10-19	212	11					
	20-29	612	33					
	30-39	323	17					
	40-49	203	11					
	50-59	203	11					
Residence	≥60	184	10					
	Rural	59	3				-	-
Season	Urban	1816	97				-	-
	Spring	544	29					
	Summer	503	26.8					
	Fall	479	25					
Attacking animal	Winter	349	18.6					
	Dog	1248	67				-	-
	Cat	468	25				-	-
	Mice, Rabbit, Hamster, Squirrels	96	5				-	-
	Monkey	31	1.7				-	-
	Wolf, Fox, Jackals	8	0.4				-	-
	Horse & Donkey	5	0.3				-	-
	Human	3	0.2				-	-
	Bat, mink, raccoon	3	0.2				-	-
	Type of animal	Wild animal	482	26				-
Domestic animal		1385	74				-	-
No. of ulcers per person	-	-	-	30	1	2	2.4	2.4
Site of bite	Upper limbs	1215	64.8				-	-
	Lower limbs	496	26.5				-	-
	Upper and lower limbs	16	0.9				-	-
	Head, face and neck	60	3.2				-	-
	Other organs	78	4.2				-	-
Type of ulcer	Shallow Men	893	74.2					
	Shallow Women	526	80.2					
	Deep Men	237	19.7					
	Deep Women	100	15.2					
	Both Men	67	5.6					
	Both Women	26	4					
	Semi-deep Men	7	0.6					
	Semi-deep Women	4	0.6					
Type of treatment	Wash by soap and water	1592	85				-	-
	Disinfectant material	1077	57.4				-	-
Delay in treatment	≤24	794	85				7.8	7.6
	>24, ≤72	125	13.4				46	12.4
	>72	15	1.6				162.5	75.3
Fate of attacking animal	Not known	1318	77					-
	Dead	14	0.8					-
	Live	381	22.2					-
Type of dead animal	Dog	7	50					-
	Cat	7	50					-

Table 2. Univariate analysis of the species of attacking animals in relation to the gender and residence of the patients and the site of bite in registered cases of Shemiranat Health Center during 2010-2012.

Groups		Species of attacking animal (%)					p
		Dog	Cat	Rodent	Monkey	Wild carnivores	
Gender	Women	59.1	32.5	6.1	2.1	0.2	10 ⁻⁶
	Men	72	21.3	4.7	1.4	0.6	
Residence	Rural	96	2	2	-	-	10 ⁻³
	Urban	68.1	26.5	5.4	-	-	
Site of bite	Upper limbs	55.8	83.5	-	-	-	10 ⁻⁶
	Lower limbs	34.7	11.4	-	-	-	
	Upper and lower limbs	1.2	0.2	-	-	-	
	Face and neck	3.6	2.4	-	-	-	
	Other organs	4.7	2.6	-	-	-	

Discussion

This study is the first assessment on collected surveillance data in Shemiranat Health Center. The mean age of registered patients in this study was higher than similar studies in national and international scale (Dadipour et al., 2009; Amiri et al., 2009; Charkazi et al., 2013). Based on data from general census of population and housing in 2006, number of aging people in north and northeast was high (National Population and Housing Census, 2011) and this finding is justifiable by considering that high range of registered cases in Shemiranat Health Center were from this region. In this study, 65% of the registered cases were men which was in accordance with some studies (Dadipour et al., 2009; Aldavood et al., 2011; Riahi et al., 2012; Dehghani et al., 2013; Simani et al., 2002; Majidpour et al., 2003) and differed with some other studies (Freeman et al., 2005; Pandey et al., 2002; Quiles-cosme et al., 2000). This gender difference is due to more contact with animals, more conscious risk taking, spending more time outdoors

(Riahi et al., 2012) and more assertive in getting involved by animals (Rezaeinasab et al., 2007) in men compared to women. Furthermore, large number of employed men rather than women and more cautiousness of women at work or outdoors could be some other reasons (Riahi et al., 2012). There was no gender difference in regard to the age of patients in this study. In a study in USA, the bitten men have lower mean age than women (Freeman et al., 2005) contrarily, in a study in Turkey, mean age of patients in men was higher than women (Kilic et al., 2006).

The frequency of registered cases was high in age group 20-29 years which were similar to other three reported studies in Tehran and Tabas (Aldavood et al., 2011; Eslamifar et al., 2008; Riahi et al., 2012). Some other studies also showed different frequency in various age groups (Dadipour et al., 2009; Aldavood et al., 2011; Fayaz et al., 2011, Bahonar et al., 2008; Dehghani et al., 2013; Razaeinasab et al., 2007). It is notable that, none of these results were based on the incidence rate. In past two decades, the

structure of age has significant effect on Iranian and the population growth was declined (decrease in young and increase of aging population). Based on the census in 1996 and 2006, Iranian population has been in transition (National Population and Housing Census, 2011). Therefore, this population transition must be considered interpreting age differences. The incidence rate of animal bite was not calculated in this study. The incidence rate was taken into the account in limited studies (Sabouri et al., 2012; Majidpour et al., 2012). At the present study, 97% of registered cases were lived in urban area. This finding was in conflict with other studies (Dadipour et al., 2009; Sabouri et al., 2012; Fayaz et al., 2011; Eslamifar et al., 2008; Riahi et al., 2012; Bahonar et al., 2008; Amiri et al., 2009; Charkazi et al., 2013; Dehghani et al., 2013; Razaenasab et al., 2007; Majidpour et al., 2012). Since, neither in the present study nor in other reports the incidence rate in urban and rural area was not determined, this conflict is not interpretable. Based on 2011 census, as more than 90% of people lived in urban area of Tehran and Shemiranat area, the finding of this study is justifiable.

The most frequent animal bites were occurred in spring in the present study as reported by some similar studies in Iran (Dadipour et al., 2009; Eslamifar et al., 2008). Season difference was not evident in some other studies (Riahi et al., 2012; Amiri et al., 2009). Animal bite was reported in spring and winter in a study (Bahonar et al., 2008) in which the more effort of animal to find food was proposed as the reason of its increase in winter. The correlation between

season and the number of ulcers was not evident in this study as was found in AghGhala (Charkazi et al., 2013). In this study, the most animal bites occurred by dog which immediately followed by cats. This finding was similar to some previous studies (Riahi et al., 2012; Amiri et al., 2009; Dehghani et al., 2013; Quiles-cosme et al., 2000). Men are bitten by dogs more often than women (3 versus 1), whereas women are more often bitten by cats (3 versus 1) (Eslamifar et al., 2008). Similar to other previous studies, frequency of animal bite by domestic dogs was higher than stray dogs in this study (Eslamifar et al., 2008; Fayaz et al., 2011; Riahi et al., 2012; Dehghani et al., 2013). Lack of controlling and removing of stray dogs and poor management of domestic dogs could be the reasons of this result. In this study, 65% and 27% of registered cases had ulcers in upper and lower limb, respectively that was in agreement with studies in Iran and overseas (Eslamifar et al., 2008; Riahi et al., 2012; Quiles-cosme et al., 2000). However, legs and hands were reported to be the more frequent bitten organ by numerous Iranian studies (Dadipour et al., 2009; Sabouri et al., 2012; Fayaz et al., 2011; Bahonar et al., 2008; Amiri et al., 2009; Dehghani et al., 2013; Majidpour et al., 2012; Razaenasab et al., 2007). Availability of the legs to be bitten by animal, using legs as the first physical defense part of body and differences in anatomical classification of bitten organ are some attributed reasons for the observed variations in various findings (Charkazi et al., 2013; Sabouri et al., 2012; Dehghani et al., 2013). However the most frequent attacked areas were legs and hands together indicating

that these organs have high risk of being targeted by animals. In children result is different, as shown in this study, the percent of injury in areas of head, face and neck were in higher in children than adults. In this regard, Pandey and et al (2002) found similar results of this study.

There was no correlation between residential status and attacked organs in the present study. While Amiri and Khosravi (2009) showed more injuries in legs and hands in rural and urban areas, respectively in Shahrood.

In this study, 76% of ulcers were superficial and only 18% of them were deep wounds. This finding was in coordination with other studies (Dadipour et al., 2009; Fayaz et al., 2011; Eslamifar et al., 2008; Riahi et al., 2012; Amiri et al., 2009). This finding shows that proper notification about rabies has resulted in rabies risk to be taken seriously by patients despite suffering from superficial wounds. In the present study, no gender differences were found in the method of washing the ulcers, type of disinfectants and completion of the treatment. This finding shows that washing and disinfecting the wounds are as important practice for men as for women. A total of 50% of registered cases received rabies preventive treatment till 5 hours after attack. Fayaz and et al (2011) revealed that 60% of patients received rabies preventive treatment till 6 hours after bite. There was no correlation between delay in receiving treatment and residential area. This correlation was shown in Shahrood (Amiri and Khosravi, 2009). This conflict could be due to higher developmental parameter such

as education, access to information, health and treatment, economic, infrastructural and etc. in Tehran province compared to other provinces.

Based on the accessed data, fate of 77% of attacked animals was unknown and 22% were reported to be alive after 10 days. These proportions in Shahrood city were 15.6 and 82.3 percent respectively (Amiri and Khosravi, 2009). The higher percent of live animals after attack was due to the involvement of some other animals such as donkey, sheep and etc. as attacking animals in the calculations. The chasing animal fate till 10 days was specially done for wild and domestic carnivores.

One of the main problems in relation to the prevention and control of rabies is the lack of consistent care and regular reporting. This problem has led to lacking accurate and update information on this field (Bahonar et al., 2008). Collection, analysis and evaluation of epidemiological data are more important in planning, organizing and controlling rabies (Sabouri et al., 2012). Rabies is a serious outcome in animal bite patients. Eight countries in Asia (Japan, Malaysia, Hong Kong, Singapore, Taiwan, Qatar, Bahrain and the United Arab Emirates) have eradicated the rabies (Sabouri et al., 2012). Rabies with an incidence rate of 0.05 per million in humans is endemic in Iran and it is relatively controlled by efficient PEP treatments. However, it is endemic in dogs as well as wild animals (<http://www.meereb.info>). Due to imposed cost of each animal bite to health care system, preventative measures to avoid animal bites

should be a priority practice (Riahi et al., 2012). Management of rabies because of economic and social outcomes is a major priority for Ministry of Health and Medical Education (Eslamifar et al., 2008). Based on socio-economic and residential area differences the epidemiology of animal bite is varying, and some confounders such as age and occupation may also be effective in causing these differences (Eslamifar et al., 2008). Most recent studies showed increasing number of animal bite (Sabouri et al., 2012, Zeynali et al., 1999; Charkazi et al., 2013; Dehghani et al., 2013; Razaenasab et al., 2007). This increase is attributed to following reasons:

- Increase of public awareness about dangers of animal bite by implementing educational programs.
- Improvements in the health care and in monitoring and reporting system, and increasing number of health centers that has facilitated access of bitten patients to this centers.
- Reduction in the activity of stray dogs euthanized committee (Charkazi et al., 2013) and consequently increase in stray dog number.
- Moving the neighboring wild animals into residential areas due to ecological changes (Razaenasab et al., 2007).

The successful methods for controlling rabies in wild animals are used in various countries which can be useful in Iran too (Fayaz et al., 2011).

Expansion of veterinary clinics for vaccination of pet dogs, observation of the suspected biting animal, and public education campaigns (together with the application of post exposure prophylaxis [PEP] following a dog bite) during the 1950s and 1960s were simple and effective strategies for the management of rabies in dogs in United States. However, these strategies were not directly applicable to the management of rabies in wildlife (Hanlon et al., 1999). The control program of rabies in wildlife includes: removing the reservoir species, eradication of rabies in reservoir species; protecting sensitive species against rabies infection from reservoirs. In addition, activities that can be reduce opportunity and possibility of confronting wild animals with humans must be implemented. For example, proper management of waste disposal, removal and destruction of nests of these animals from nearby residential areas and proper food storage are some successful strategies (Rupprecht et al., 2001).

In order to prevent animal bites and to perform early preventive treatment, more educational activities in health sector should be performed. All responsible institutions and organizations, especially the media, including radio, television and newspapers, national and local education, municipalities, veterinary organization, universities and health and medical centers, can play a major role in this mobilization. The Ministry of Health and Medical education as a custodian of this

program, should take over the task of planning and creating a harmony between all responsible units. This education must include below centerpieces.

- Educating the public, especially children, adolescents and youth about how to deal with domestic, stray and wild animals.
- Specific training of pet owners about vaccinations, collar placement and how to deal with these animals inside and outside the home.
- Training of administrators and municipal officials about how to reduce the number of stray dogs and vaccination of dogs without killing them.
- Cooperation and public participation in environmental sanitation and waste collection and landfill.

References

- Aldavood SJ., Akbarein H., Bahonar AR., Janani AR., Hosseini Shokouh SJ. and Dabbagh Moghaddam AZ. (2009). Rabies in Iran. Tehran: *Mashgheshab*, [Persian].
- Amiri M. and Khosravi A. (2009). Animal bites epidemiology in Shahroud city. *Journal of Knowledge & Health*, 4(3), pp. 41-43. [Persian]
- Bahonar AR., Bokaie S., Khodaveirdi KH., Nikbakht Boroujeni G. and Rad M. (2008). A Study of Rabies and the Frequency of Animal Bites in the Province of Ilam, 1994-2004. *Iranian Journal of Epidemiology*, 4(1), pp.47-51. [Persian]
- Charkazi A., Behnampour N., Fathi M., Esmaeili A., Shahnazi H. and Heshmati H. (2013). Epidemiology of animal bite in Aq Qala city, Northen of Iran. *Journal of Education and Health Promotion*, 2:13.
- Dadipour M., Salahi R. and Ghezelsofla F. (2009). Animal bite epidemiology of stigma in the city during 2003-2005 (short report). *Journal of Gorgan University of Medical Sciences*, 11(1-29), pp.76-9. [Persian]
- Dehghani R., Sharif MR., Sharif AR., Moghimi A., Ashaari A. and Hosseini MA. (2013). Epidemiology of Animal Bite in Samirom in 2008 to 2012. *Iranian Journal of Infectious Diseases and Tropical Medicine*, 18(61), pp.45-48. [Persian]
- Eslamifar A., Ramezani A., Razzaghi-Abyaneh M., Fallahian V., Mashayekhi P. and Hazrati M. (2008). Animal bites in Tehran, Iran. *Archives of Iranian medicine*, 11(2), pp.200-202.
- Fayaz A., Fallahian V., Simani S., Eslamifar A., Mohammadian A. and Hazrati M. (2011). Epidemiological characteristics of persons exposed to rabies in Tehran referred to Pasteur Institute of Iran during the years of 1993-1994 and 2008- 2009. *Research in Medicine*, 35 (3), pp.168-173.
- Freeman AJ., Senn DR. and Arendt DM. (2005). Seven hundred seventy- eight bite marks: analysis by anatomic location, victim and biter demographics, type of crime, and legal disposition. *Journal of Forensic Sciences*, 50, pp. 1436 – 1443.
- Hanlon CA., Childs JE. and Nettles VF. (1999). Recommendations of a national working group on prevention and control

- of rabies in the United States. *Journal of the American Veterinary Medical Association*, 215(11), pp.1612-1619.
- Kilic B., Unal B., Semin S. and Konakci SK. (2006). An important public health problem: rabies suspected bites and post exposure prophylaxis in a health district in Turkey. *International Journal of Infectious Diseases*, 10(3), pp. 248-254.
- Majidpour A., Arshi S., Sadeghi H., Shamshirgaran S. and Habibzadeh S. (2003). Animal Bites: Epidemiological Considerations in Ardabil Province, 2000. *Journal of Ardabil University Medical Sciences*, 3 (4), pp.39-43. [Persian]
- Majidpour A., Sadeghi-Bazarganib H. and Habibzadeh S. (2012). Injuries due to animal bites: A descriptive study. *Journal of Clinical Research & Governance*, 1(1), pp.22–24.
- National Population and Housing Census. (2011). Selected Findings. Tehran, Statistical Centre of Iran, Office of the Head, Public Relations and International Cooperation, 2011, Serial No. of the SCI's publications:4575. [Persian] Available from URL:<http://www.amar.org.ir>
- Pandey P., Shlim DR., Cave W. and Springer MF. (2002). Risk of possible exposure to rabies among tourists and foreign residents in Nepal. *Journal of Travel Medicine*, 9(3), pp.127-31.
- Quiles-Cosme GM., Perez-Cardona CM. and Aponte-Ortiz FI. (2000). Descriptive study of animal attacks and bites in the municipality of San Juan, Puerto Rico, 1996 – 1998. *Journal of the University of Puerto Rico Medical Sciences*, 19, pp. 39 – 47.
- Report of the Third Meeting of the Middle East and Eastern Europe Rabies Expert Bureau (MEEREB) accessible at "<http://www.meereb.info/sites/default/files/3rd-meereb-meeting-2015-report.pdf>."
- Rezaeinasab M., Rad I., Bahonar AR., Rashidi H., Fayaz A., Simani S., Haghdoost AA., Rad F. and Rad MA. (2007). The prevalence of rabies and animal bites during 1994 to 2003 in Kerman province, southeast of Iran. *Iranian Journal of Veterinary Research, University of Shiraz*, 8(4), pp.343-350.
- Riahi M., Latifi M., Bakhtyari M., Yavari P., Khezeli M. and Hatami H. (2012). Epidemiologic survey of animal bites and causes of delay in getting preventive treatment in Tabas during 2005–2010. *Toloe Behdasht Journal*, 11(1), pp.20–31. [Persian]
- Sabouri Ghannad M., Roshanaei G., Rostampour F. and Fallahi A. (2012). An Epidemiologic Study of Animal Bites in Ilam Province, Iran. *Archives of Iranian Medicine*, 15(6), pp. 356 – 360.
- Simani S., Fayaz A. and Janani A. Epidemiological survey of human rabies in Iran 1995-1999. *Iranian Journal of Infectious diseases and Tropical Medicine*, 7(16), pp.42-48.
- Zeynali M., Fayaz A. and Nadim A. (1999). Animal bites and rabies situation in Iran. *Archive of Iranian Medicine*, 2(3), pp.120-124. [Persian]
- Rupprecht CE., Stohr K. and Meredith C. (2001). Infectious diseases of wild mammals. *Iowa State University Press, Ames, Iowa, USA, Rabies*, pp.3-36.

