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Epidemiology of animal bite injuries in North of Fars province in Iran

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ABSTRACT

Objective: To investigate the epidemiological situation of animal bites in Rostam city of Fars province.

Methods: This is a cross-sectional study. Cases of animal bites registered in health centers of Rostam city of Fars province from the beginning of 2014 to 2020 were analyzed using the census method. The tool for collecting information was the portal of the Ministry of Health and the registration offices of people who were referred to the rabies center.

Results: A total of 628 cases of animal bites registered in health centers of Rostam city of Fars province from the beginning of 2014 to 2020. The mean age of the injured was (31.3 ± 20.2) years. Of the total injured cases, 414 (65.9%) were male, and 491 (78.2%) lived in villages. Most of the cases were bitten by dogs (n=420, 66.8%) and the upper limb was involved in 280 (55.2%) cases. In addition, an increasing trend was observed in the incidence of animal bites from 2015 to 2020.

Conclusions: The incidence of animal bites in Rostam City is high, and most of the cases occur in rural areas. Considering the injuries caused by animal bites, the risk of rabies transmission, and the high costs of vaccination and serum therapy, it is necessary to hold control, educational, and vaccination programs.

KEYWORDS: Injury; Animal bites; Rabies; Incidence; Epidemiology; Iran

1. Introduction

Animal bites and related diseases, along with serious health consequences, can impose a large economic burden on countries. An animal bite is characterized by biting, grabbing, or clawing by a pet, domestic, or wild animal[1]. The rabies virus causes an acute and fatal neurological infection in humans and other mammals and is transmitted mainly through the saliva of rabid animals through bites or scratches[2,3]. Dog bites account for more than 90% of all bite cases[4,5], and more than 90% of rabies deaths are due to human bitten by dogs[6]. Animal-bite injuries on the head and face are dangerous due to the proximity of these parts to the central nervous system. Rabies encephalitis with a fatality rate of 100% occurs following the onset of clinical symptoms[7]. Lack of reliable data and unawareness of the burden and risk factors associated with human

Significance

Rabies is one of the important zoonotic diseases and is endemic in Iran, where thousands of people receive free rabies prevention treatment every year in north of Fars province in Iran. Our findings show the increasing trend of animal bites, the role of domestic animals in its occurrence, and the importance of paying attention to the anti-rabies preventive treatment program. Epidemiological periodic surveys are necessary to determine the trend of animal bites and evaluate control measures.

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rabies together may lead to a critical challenge for the formulation of policies and strategies to control the disease and has been considered a major reason for underinvestment in rabies control measures in these countries[8]. The increase in the number of animal bites compels governments to buy and stock more vaccines and medicines to prevent and treat diseases related to this phenomenon[9]. In Iran, a significant part of the country's health budget is used to provide rabies vaccines and immunoglobulin to meet the growing need for post-exposure prevention[10]. In Iran, the annual cost of vaccination with three doses of rabies vaccine is 11 665 dollars, and a total of 12 million dollars is spent on rabies prevention treatment through vaccination[11]. Reports estimate that more than 10 million cases of bites are treated annually, with the majority of cases reported from Asia and Africa, and dogs are responsible for the majority of cases[9]. In 2015, it was estimated that annually 59 000 people die from rabies[8,12], with more than 99% of all deaths occurring in developing countries[13]. Asia bears the highest burden of rabies, and according to the World Health Organization, 31 000 deaths from rabies occur annually on this continent, which is about 56% of all global rabies-related deaths[13]. In Iran, rabies has been observed in all provinces, especially in the northern, northwestern, and northeastern provinces[1]. In the past years, more than 100 000 people are treated annually in Iran due to being bitten by animals, especially dogs[14]. In 2011, the prevalence of animal bites in Fars province was 154.4 per 100 000 people[15]. Considering the importance of urgent reporting of animal bites in Iran's care system program, like other categories of diseases urgent reporting, health managers should provide the necessary facilities and physicians should be trained in the use of modern technologies[16]. This study was carried out to investigate the epidemiology of animal bite cases over six years in Rostam city of Fars province, to identify high-risk people and the seasonal and temporal pattern of animal bites.

2. Subjects and methods

2.1. Study design and setting

The current study is cross-sectional, which reviewed a total of 628 cases of animal bites. The cases had been referred to the health centers of Rostam city for rabies treatment between 2015 and 2020. Rostam is one of the cities in Fars province, which is located in the northwest and has a population of 42 000 people.

2.2. Inclusion and exclusion criteria

Data related to animal bites were collected based on the checklists available from the records of the city health center. This means that all the cases that happened between 2015 and 2020 were included in the present study as a census, then the names of all the people were blinded and given to the researcher. Exclusion criteria are people who were not residents of Rostam City.

2.3. Data collection

The collected information comprised of demographic characteristics (*e.g.* age, sex, and occupation), area of living (rural or urban), type of bites (dog, cat, *etc*.), type of the animal (domestic, wild), post-bite condition of the biting animal (under supervision, alive, fugitive), the injured limb (lower, upper), type of wound (superficial, deep status), health services provision, the frequency of rabies vaccination (3 times, 5 times), and duration of vaccination. In this study, in order to control the information bias due to the reading of case files, the subjects under study were randomly contacted and asked for information about the bite.

2.4. Statistical analysis

Frequency and percentage were used to describe the categorical variables and mean, and standard deviation was used to describe the continuous variables. Chi-square test was used to determine the relationship between the type of injury and the variables related to the animal bite. We also calculated the incidence of animal bites per 10 000 people using the population of 2020 as the denominator. Due to the descriptive and cross-sectional nature of this study, we did not have confounding and interaction variables, and since all people were included in the study by the census, there was no missing. The SPSS version 26.0 was used for data analysis, and we set parameters in the confidence interval of 95%.

2.5. Ethical statement

This study was approved by the Ethics Committee of Shiraz University of Medical Sciences with IR.SUMS.SCHEANUT.REC.1401.073.

3. Results

3.1. Demographic characteristics

In the present study, a total of 628 animal bites occurred from 2015 to 2020, and the mean age of the injured was (31.3 ± 20.2) years with a range of 1 to 90 years. Of the victims, 414 (65.9%) were men. A total of 420 (66.8%) cases were bitten by dogs. A total of 170 (27.1%) and 168 (26.8%) of the bites occurred in winter and autumn, respectively. Additionally, 624 (99.4%) subjects had no history of rabies vaccination. In terms of the fate of biting animals,

most of those were monitored (n=302, 48.1%). The demographic information is presented in Table 1.

Table 1. Demographic characteristics (n=628).

Variables	*n*	%
Age (years)		
0-9	119	18.9
10-19	80	12.7
20-29	110	17.5
30-39	123	19.6
40-49	77	12.3
50-59	51	8.1
>60	68	10.8
Sex		
Male	414	65.9
Female	214	34.1
Living place		
Rural	491	78.2
Urban	137	21.8
Season		
Spring	143	22.8
Summer	147	23.4
Autumn	168	26.8
Winter	170	27.1
Job		
Free job	213	33.9
Student	149	23.7
Householder	147	23.4
Others	119	18.9
Fate of the biting animal		
Under supervision	302	48.1
Alive	158	25.2
Fugitive	152	24.2
Other	16	2.5
History of rabies vaccination		
No	624	99.4
Yes	4	0.6

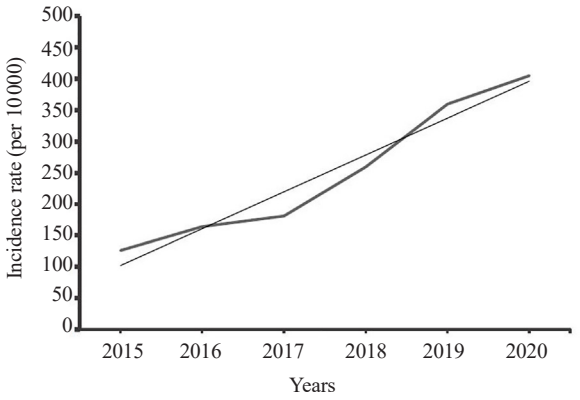

Figure 1. Incidence rate of animal bites per year in health center of Rostam city, Iran (2015-2020).

3.2. Treatment delay, therapy, animal, and injured body region in patients with different injury types

According to Table 2, 80.7% of the injuries occurred superficially. Out of superficially injured cases, 481 (94.9%) were referred to health centers in less than 48 hours, 472 (93.1%) did not receive serum therapy, 319 (62.9%) were bitten by dogs, 455 (89.7%) were bitten by domestic animals, and the upper limb was involved in 280 (55.2%) cases. There was no significant difference in treatment delay and animal status between patients with superficial injury and with deep injury. More patients with deep injuries received serum therapy and more deep injuries were caused by dog bites (P<0.01). More superficial injury occurred in the upper limbs while more deep injury occurred in the lower limbs (P=0.024).

Table 2. Treatment delay, therapy, animal, and injured body region in patients with different injury types (n=628, n, %)

Variables	Type of injury		χ^2	*P*
	Superficial (n=507)	Deep (n=121)		
Duration of visit to receive treatment (h)				
<48	481 (94.9)	116 (95.9)	0.206	0.65
≥48	26 (5.1)	5 (4.1)		
Serum therapy				
No	472 (93.1)	43 (35.5)	219.331	<0.001
Yes	35 (6.9)	78 (64.5)		
Animal species				
Dog	319 (62.9)	101 (83.5)	23.138	<0.001
Cat	171 (33.7)	14 (11.6)		
Others	17 (3.4)	6 (5.0)		
Animal status				
Domestic	455 (89.7)	110 (90.9)	0.147	0.701
Wild and feral	52 (10.3)	11 (9.1)		
Region of body injury				
Upper	280 (55.2)	53 (43.8)	5.119	0.024
Lower	227 (44.8)	68 (56.2)		

3.3. Trend of animal bites by years

According to the Cochran-Armitage test, the trend of animal bites in Rostam city has increased over six years, from 126 per 10 000 in 2015 to 404 per 10 000 in 2020 (Figure 1) (P<0.001).

4. Discussion

This cross-sectional study investigated the epidemiological characteristics of animal bites in Rostam City of Fars province and identified high-risk groups. The findings of this study demonstrated that the incidence of animal bites has increased in Rostam City. Therefore, the incidence increased from 126 per 10 000 in 2015 to 404 per 10 000 in 2020. The results of other studies conducted in Iran also found an upward trend that was consistent with the results of the present study[5,17]. Shamshirgaran *et al*. illustrated that the incidence of animal bites fluctuated during the study period with an increasing trend from 2005 to 2008 and a decreasing trend from 2011 to 2013[18]. The increase observed in our study may be contributed to the increased awareness in society, improvement in the quality of the care delivery system, the establishment of the rabies center, and the regular recording of data. In the present study, 65.9% of animal bites occurred in men, which was consistent with other studies[5,17,19], but the results of a study conducted in India showed that the occurrence of animal bites in men and women was almost similar[6]. The higher incidence of animal bites in men can be due to more men outside of the house for outdoor activities and subsequently more exposure to the risk of animal bites. In the present study, in terms of occupation, freelancers and students respectively displayed the highest rate of the animal bite. Bahonar *et al*. found that the prevalence of animal bites was higher among students than in other groups[20]. One of the reasons for the higher incidence of animal bites among students is that they elicit or trigger aggressive actions in animals due to their age and lack of knowledge about the reaction of biting animals.

A total of 19.6% of the injured victims in this study were aged 30 to 39. In a study conducted in northern Iran, most cases of animal bites occurred in the age group of 19-40 years[21]. These studies have shown that this age group is more vulnerable to animal bites. More activity outside the home environment and lack of experience and accuracy in dealing with animals can be one of the reasons. In another study that was conducted in Nigeria, about one-third of animal bites were reported in the age group of 1-10 years, which was inconsistent with the results of our study[22].

In our study, most cases of animal bites occurred in the rural areas (78.2%), which was consistent with a study conducted in Aq Qala of Golestan province and Bojnurd of North of Khorasan province in Iran[5,19]. However, Akosu *et al*. in Nigeria reported inconsistent results, which could be due to the greater awareness of the urban population and better recording of animal bite data in the areas under study[22].

In our study, the highest incidence of animal bites occurred in the winter and autumn. The results of a study in Najaf Abad of Esfahan province in 2020 demonstrated that the highest incidence of animal bites was observed in the spring and summer, and in another study in Iran, no significant difference was observed between different seasons of the year, which was inconsistent with our study[5,17]. Climate changes in different regions as well as the movements of domestic and wild animals for food could explain the increase in the incidence of animal bites in the winter and autumn seasons.

In the present study, most of the cases were bitten by dogs. In one study in Tunisia, the majority of animal bites were also caused by dogs (90.7%)[23]. This can be because most of our study population lives in rural areas. Also, the presence of stray dogs without a collar can be another reason for the higher incidence of dog bite injuries. Consequently, control of the dog population appears to be of high importance.

Concerning the type of injury, most cases of animal bites were superficial, which is similar to studies in Babol of Mazandaran province and Quchan of Razavi Khorasan province in Iran[24,25]. Our study showed most of the victims did not receive serum therapy, which was consistent with the study of Poorolajal *et al.*[26]. In our study, 73.3% of biting animals were reported alive and under supervision. In one study in Uganda, 34% of cases were killed and biting animals (dogs and cats) were recommended to be monitored for 10 days[27].

In this study, 95.1% of animal bite cases were referred to medical centers within 48 hours, indicating increased health education and awareness programs in the studied communities. Nikbakht *et al.* showed that most cases of animal bites did not report any delays in visiting rabies prevention centers[24].

In this study, 99.4% of the subjects had no history of rabies vaccination, which is in line with a study conducted in northern Iran[28]. In our study, the upper extremities were more affected by animal bite injury, which is not consistent with the study of Abbasi *et al.*[4] and Pattanayak *et al.*[6]. In other studies, the lower extremities were the most frequent site of animal bite injury[19,29].

Animal bites, in addition to having severe health consequences, place a heavy financial burden on countries' health systems. Since rabies is considered to be endemic in Iran, it is necessary to know the epidemiological patterns of animal bites in different regions to implement training and disease control programs. This study demonstrated that it is crucially important to carry out appropriate preventive measures, such as controlling the population of stray dogs and training health center personnel for the correct and principled implementation of the rabies program.

This study still has limitations. It is a descriptive study and therefore unable to determine the cause-and-effect relationship between

variables. It is also possible that not all people who have been bitten have gone to the rabies treatment center, which can lead to an increase in the number of bites and, as a result, change the trend of animal bites. The reason for this non-referral could be the lack of knowledge about the dangers of animal bites and rabies. Another limitation of this study is that it did not investigate the factors related to the delay in receiving rabies prevention services. Studies at wider levels and with higher sample sizes should be performed in the future.

Conflict of interest statement

The authors report no conflict of interest.

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Authors' contributions

HK: conceptualized the study plan, designed the study, managed the data, and edited and reviewed the manuscript. FJ: analyzed the data, interpreted the results, and wrote the manuscript. AKJ: managed the data and conceptualized the study plan. SA: compiled and prepared the final data set for analysis and reviewed the analysis and final version of the manuscript. AN: provided guidance in conducting the study and managed the data. TH: contributed to interpreting the findings and drafting the manuscript. All authors read and approved the final manuscript for publication.

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