



Pattern of animal bites and factors associated with delay in post-exposure prophylaxis in bitten people

Khaled Samiee-Roudi¹, Maryam Soltani²

1 Department of Health Education and Health Promotion, School of Public Health, Mashhad University of Medical Sciences, Mashhad, Iran

2 Razi Clinical Research Development Unit, Birjand University of Medical Sciences, Birjand, Iran

Original Article

Abstract

BACKGROUND: Since the epidemiology of animal bites and the relevant factors in post-exposure prophylaxis (PEP) are of great significance for preventing the deaths resulting from rabies and controlling the rabies disease, the main purpose of the current study is to account for the patterns of animal bites and factors associated with delay in PEP in bitten people.

METHODS: This cross-sectional study was conducted on all animal bites cases in Khaf city, Khorasan Razavi province, Iran, and included 553 cases of animal bites recorded from March 2014 to February 2016 in the healthcare centers. Chi-square test (or Fisher's exact test) was used to identify the factors associated with delays in PEP.

RESULTS: Results indicated that majority of the cases with animal bites were men (79.7%) aged from 21 to 60 years (48.5%). Due to the type of animal bites in all ages, the damages caused by dogs (85.2%) were greater than the damages caused by cats (9%) and other domestic or wild animals (5.8%). The frequency of delay in treatment was 14.4% in women and 5.2% in men ($P = 0.002$). The frequency of treatment delay in housewives (18.6%) and children under 6 years old (6.3%) was greater than that in other occupations ($P = 0.003$).

CONCLUSION: According to the current study's results, individuals' gender and occupation are among the main factors associated with delay in PEP. Therefore, identifying factors related to delay in treatment and providing people with the necessary education by health personnel are of considerable significance in prevention of unpleasant consequences of animal bites.

KEYWORDS: Bites, Post-Exposure Prophylaxis, Rabies

Date of submission: 22 Sep. 2017, *Date of acceptance:* 12 Dec. 2017

Citation: Samiee Roudi K, Soltani M. **Pattern of animal bites and factors associated with delay in post-exposure prophylaxis in bitten people.** Chron Dis J 2018; 6(4): 171-8.

Introduction

One of the major reasons of mortality all over the world is animal bites which can be prevented by quick treatment after the exposure. Rabies is caused by a rhabdovirus genotype 1 which is a widespread and lethal infection throughout the world. It is reported that in Asia, Africa, and Europe, rabies is mostly caused by dogs, while in United States

of America it is caused by bats.^{1,2} The main animal sources of transferring the rabies virus to human being are domestic dogs which are responsible for 90% of all animal bites in the world.³ Dog bite is widespread among men and cat bite is prevalent among women. Two thirds of deaths caused by cat bites take place among people aged 20 to 35, while two thirds of deaths caused by dog bites are among children or the youth.⁴ It is estimated that animal bites are the main reasons of 1.9 million lost years due to people's disability, and 6 billion financial losses in a year.⁵ Increase in

Corresponding Author:

Maryam Soltani

Email: maryam.soltani52@yahoo.com

the rate of animal bites, and increase in buying vaccines and other medicines by the government for preventing rabies and the relevant diseases will certainly increase the government's costs. Biting is an animal's instinctive behavior which is displayed when the animal feels fear or when its food is to be taken.⁶ Rabies is a deadly disease which can cause death by the progression of symptoms. Of course, after exposure to the rabid animal, a quick treatment can prevent the disease incidence. This activity is known as post-exposure prophylaxis (PEP).⁷

If there are multiple deep ulcers around the neck and head, especially in the endemic areas, there will be a dire need for vaccination and immunoglobulin. Washing the ulcer by water and soap for five minutes is an effective method for decreasing the number of viral parts of the body.⁷ Generally, due to the widespread vaccination of domestic dogs and cats, mandatory vaccination of human beings, and treatment by immunoglobulin, the number of deaths caused by rabid animals has decreased significantly in the world.⁸ However, some studies conducted in Iran reported that the incidence of animal bites has increased during the recent years. For example, in a study conducted in Ilam (west of Iran), the incidence of animal bites has increased from 34 cases in each 100000 individuals in 1999 to 98 cases in each 100000 individuals in 2008.⁹

In Rafsanjan, Iran, the incidence of animal bites has increased from 180 cases in each 100000 individuals in 2003 to 241 cases in each 100000 individuals in 2005.¹⁰ However, in Golestan province, Iran, the rate of cases with animal bites had a decreasing trend from 2005 to 2009.¹¹ Rabies is one of the most important viral zoonotic diseases because of its universal distribution,⁶ the frequency of outbreaks, high human and veterinary costs, high death rate, and the resulting high economic expenditures in different countries of the world every year.¹¹ In order to prevent and control the rabies disease,

the following programs should be implemented: doing the regular epidemiologic care programs, designing and improving the registration rules, issuing certificate for dog owners, vaccinating the dogs having owner, improving the public awareness of the disease, easy availability of preventing services, and effective and inexpensive vaccination of human beings.⁵ Since the epidemiology of animal bites and the relevant factors in PEP are of great significance for preventing the deaths resulting from rabies and controlling the rabies disease, the current study aims at determining the trend of animal bites and factors associated with its PEP in Khaf city, Khorasan Razavi province, Iran.

Materials and Methods

This cross-sectional study was conducted on all animal bite cases in Khaf city (Figure 1) and included 553 cases of animal bites recorded from March 2014 to February 2016 in the healthcare centers. Sampling method was based on census. The inclusion criterion included all people referring to healthcare centers for treatment and the exclusion criteria included the individuals who were bitten by animals but were not from khaf, where the population of this study came from. The main data-gathering instrument was a checklist including the following variables: age, gender, job (housewife, self-employed, rancher, student, children below 6 years, and other), residential area (urban or rural), animal (dog, cat, wild animal, other animals), vaccination program (3 dosage, 5 dosage), received vaccination dosage (0.5 ml, 1 ml), injury status (deep, superficial), the date of animal bites (month, year), type of animal (domestic, wild, stray), and injury area (hand, leg, abdominal parts, head, and face).

For the purpose of this study, a delay in the initiation of anti-rabies PEP was defined as the individuals who are exposed to animal bites, refer to health care centers for treatment 48 hours or later after the animal bite.¹²



Figure 1. Location of Khorasan Razavi in the map of Iran

The data were entered into the SPSS software (version 23, IBM Corporation, Armonk, NY, USA). Mean and standard deviation (SD) were used for descriptive statistics of the data and chi-square test (or Fisher’s exact test) was conducted for data analysis. P-values < 0.05 were considered to indicate statistical significance.

Results

553 cases of animal bites were recorded from March 2014 to February 2016. The cases' age range was from 1 to 80 years and the average age was 28.78 ± 9.10 years, the average number of ulcers was 1.59 ± 0.92 , 441 cases were men (79.7%), and 289 cases (52.6%) were from villages. 140 cases of animal bites (79.6%) received 3 dosages of vaccination and 495 cases (89.7%) received vaccination with 0.5 ml dosage. Most of animal bite cases (174 people, 31.8%) were observed during the evening time from 4 pm to 7 pm, and the lowest numbers (76 people, 13.7%) were observed from 8 pm to 4 am. In 2015, 234 cases of animal bites (42.3%) were reported in January and February (fall and winter seasons) (Figures 2 and 3).

Results indicated that majority of animal bite cases were men (79.7%) and the frequency of animal bite was higher in men aged from 13 to 20 and 21 to 60 compared to women. This difference was proved to be statistically

significant ($P = 0.001$).

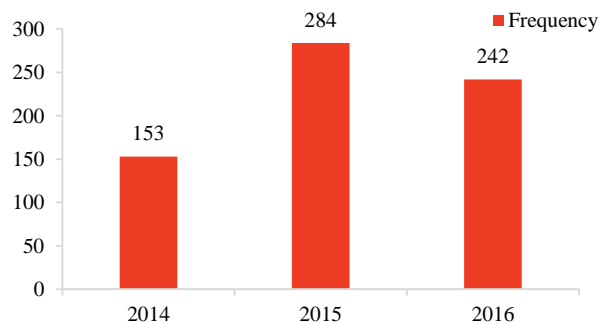


Figure 2. Trends of human rabies exposure cases across the study years

Considering animal type, injuries caused by dogs were 85.2% more than injuries caused by cats (9%) and other domestic and wild animals (5.8%).

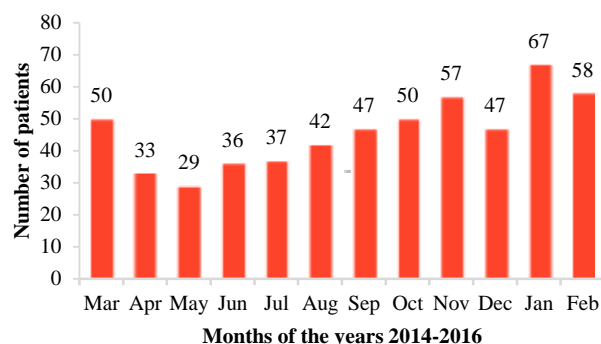


Figure 3. Cumulative monthly distribution of the cases presented for post-exposure prophylaxis (PEP) at healthcare centers, 2014–2016

Table 1. Distribution of injuries and type of animal within age categories

Variable	Age categories (year)				P
	> 60 [n (%)]	21-60 [n (%)]	13-20 [n (%)]	< 12 [n (%)]	
Total	52 (9.4)	268 (48.5)	106 (19.2)	127 (23.0)	0.001
Sex					
Male	31 (7.0)	219 (49.7)	96 (21.8)	95 (21.5)	
Female	21 (18.7)	49 (43.8)	10 (8.9)	32 (28.6)	
Injury status					0.182
Deep	14 (12.5)	50 (44.6)	18 (16.1)	30 (26.8)	
Superficial	31 (7.3)	211 (49.6)	87 (20.5)	96 (22.6)	
Type of biting animal					0.025
Dog	42 (8.9)	236 (50.1)	90 (19.1)	103 (21.9)	
Cat	2 (4.0)	21 (42.0)	11 (22.0)	16 (32.0)	
Other wild animals	8 (25.0)	11 (34.4)	5 (15.6)	8 (25.0)	
Bite area					0.001
Leg	24 (9.3)	130 (50.6)	47 (18.3)	56 (21.8)	
Hand	15 (7.0)	110 (51.7)	50 (23.5)	38 (17.8)	
Head and face	4 (21.1)	3 (15.8)	4 (21.0)	8 (42.1)	
Body	9 (14.0)	25 (39.1)	5 (7.8)	25 (39.1)	

That is to say, the frequency of injuries caused by dogs in people aged 21 to 60 was 50.1% higher than that by cats (42%) and other wild or domestic animals (34.4%). While in lower ages (12 and below), 32% of injuries were caused by cats, 21.9% were caused by dogs, and 25% by other wild or domestic animals. This difference was also statistically significant ($P = 0.025$).

Regarding the area of injuries in all ages, the injuries occurred in legs (46.5%) and hands (38.5%) were more than injuries in other parts of the body. In other words, 51.6% of hand injuries occurred in people from 21 to 60 years old, 23.5% occurred in people aged from 13 to 20 years. However, the rate of head and face injuries occurred in age groups less than 12 and above 60 were 42.1% and 21.1%, respectively; and the difference was statistically significant ($P = 0.001$).

Considering the intensity of injuries caused by animals, deep injuries occurred in groups less than 12 and more than 60 years old were more than the superficial injuries. However, the difference was not proved to be statistically significant ($P = 0.182$) (Table 1).

Results indicated that for PEP, 92.9% of the animal bite cases referred to healthcare centers in less than 48 hours and the rest referred after

48 hours. The frequency of delay in treatment was higher in women than men (14.4% in women and 5.2% in men, $P = 0.002$). Among the housewives, this rate was 18.6% and 6.3% for children below 6 years old. These frequencies were higher than the frequencies observed in the other professions ($P = 0.003$).

In addition, the frequency of delay in treatment during the summer was greater than other seasons (11.3%); and in people with superficial injuries, it was higher than that in people with deep injuries (8% against 4%). In people having injuries in their hands, this frequency was 9.9% more than people with injuries in other parts of the body; and in people injured by wild animals, the frequency of delay in treatment was 13.3% more than other cases. However, the differences were not proved to be statistically significant ($P = 0.165$) (Table 2).

Discussion

In order to control and develop organizational programs for animal bite incidences, considering trend and epidemiology of animal bite cases are of great significance. The patterns of animal bite reveal that majority of animal bite cases occur by dogs and cats. Due

to the number of animal bite records in healthcare centers of this area, a sharp increase is observed in 2015.

Table 2. Distribution of demographic and clinical characteristics of the bitten subjects, delay in the initiation of anti-rabies vaccination, and the factors associated with delay among animal-bitten patients, 2014-2016

Variable	Delay		P
	Present [n (%)]	Absent [n (%)]	
	512 (92.9)	39 (7.1)	
Sex			0.002
Male	417 (94.8)	23 (5.2)	
Female	95 (85.6)	16 (14.4)	
Place of residence			0.505
Urban	242 (93.1)	18 (6.9)	
Rural	268 (92.7)	21 (7.3)	
Age group (year)			0.532
≤ 12	119 (93.7)	8 (6.3)	
13–20	99 (94.3)	6 (5.7)	
21–60	244 (91.4)	23 (8.6)	
> 60	50 (96.2)	2 (3.8)	
Occupation			0.003
Child < 6 years	45 (93.8)	3 (6.2)	
Animal husbandry	58 (98.3)	1 (1.7)	
Self-employed student	171 (94.0)	11 (6.0)	
Housewife	124 (93.9)	8 (6.1)	
Other	57 (81.4)	13 (18.6)	
	57 (95.0)	3 (5.0)	
Season of bite			0.194
Spring	103 (93.6)	7 (6.4)	
Summer	102 (88.7)	13 (11.3)	
Fall	147 (95.5)	7 (4.5)	
Winter	160 (93.0)	12 (7.0)	
Injury status			0.136
Deep	107 (95.5)	5 (4.5)	
Superficial	389 (92.0)	34 (8.0)	
Bite area			0.165
Leg	242 (94.5)	14 (5.5)	
Hand	191 (90.1)	21 (9.9)	
Head and face	19 (100.0)	0 (0.0)	
Body	60 (93.8)	4 (6.2)	
Type of biting animal			0.243
Domestic	446 (94.1)	28 (5.9)	
Wild	13 (86.7)	2 (13.3)	
Stray	31 (88.6)	4 (11.4)	

This issue can be related to inappropriate vaccination of dogs or lack of exact reporting during 2014. Moreover, results indicated that

majority of animal bite cases took place in fall and winter seasons. This finding is in line with the findings of Yibrah and Damtie¹³ and in contrast with results of the studies conducted in Nigeria, Tanzania, and New York.^{14–16} Various factors including changing geographical situations of different areas and the changeable weather conditions of such areas will lead to seasonal changes of animal bite cases.

According to the current study's results, although the age range of patients was from 1 to 80 years, the animal bite incidence had the highest rate in people aged 21 to 60 years. Moreover, results revealed that majority of animal bite cases were men and the frequency of animal bite in men aged 13 to 20 and 21–60 years was higher than that in women. This was also confirmed by some other studies' findings.^{2,3,17–21} Salve et al. reported that majority of animal bite cases referring to anti-rabies clinics were young men.²² The higher prevalence of animal bite during a specific age range in men rather than in women can be due to some factors such as men's higher exposure to hazards, spending most of their time outdoors, and accepting the hazards.² Therefore, it can be concluded that affecting the active group of people in society, this disease can cause economical loss for the country.

According to the current study's results, in all ages, the injuries caused by dogs were greater than those caused by cats and other domestic or wild animals. That is to say, in the age range of 21 to 60 years, the frequency of injuries caused by dogs was greater than that caused by cats and other wild or domestic animals. However, in ages below 12 years, the injuries caused by cats were greater than those caused by dogs and other wild or domestic animals. Similarly, Moore et al. reported that the frequency of dog bites was higher than that of cat bites.²³ Dehghani et al. also confirmed that majority of animal bite cases took place by dogs, especially the domestic ones.⁶ In another

study conducted in Shahrood, Iran, Amiri and Khosravi reported that 79.1% of animal bites were caused by domestic dogs.²⁴

In their study, Ramos et al. indicated that 93.2% of cases in need of PEP were bitten by dogs.²⁰ The high rate of animal bites by dogs refers to the residents' interest for keeping dogs at home for protecting their sheep or cattle. Therefore, these people's high exposure to dogs can lead to injuries or damages caused by this animal. According to the reports recorded in the city's healthcare centers, playing with cats and disturbing them while eating food can cause injuries or damages to children.

Regarding the area of injuries caused by animal bites, hand injuries had the highest frequency among people aged 13 to 60 years; while in lower ages, like children, and higher ages, like the elderly, the frequency of injuries was higher in head and face. This finding was similar to the results of some related studies.²⁵⁻²⁷

In the study carried out by Ramos et al., the most common areas of injuries was legs,²⁰ but in the another study done by Dwyer et al., areas around head and neck were reported to be the most common areas of injuries caused by animal bites.²⁵ The high rate of head and face injuries in children refers to some factors such as their emotional relations with dogs, dogs' curiosity to know the human body, children's lack of knowledge and their inability for protecting against dog attacks, and keeping dogs at home.²⁸ Results indicated that for PEP, 92.9% of the cases referred to healthcare centers in less than 48 hours, but the rest of the cases referred after 48 hours. The reference of majority of animal bite cases for PEP in less than 48 hours is because of some factors including the high number of animal bites occurring in this area, people's awareness of the significance of quick treatment which is developed by health personnel's educational programs, and the high number of domestic animals such as dogs due to the specific working conditions in this area.

The frequency of delay in treatment was higher in housewives and children rather than men, and this finding corresponded to the results of a study carried out by Esmailzadeh et al.² Moreover, the results revealed that due to lack of awareness in exposing to animals, low educational level of housewives in this area, and long distances of healthcare centers to this area, we observed delay in treatment or PEP in these groups. Therefore, regarding animal bite hazards and consequences, there is a dire need to provide adequate education to these groups especially housewives.

Conclusion

According to the results of the current study, most of animal bite cases are observed in fall and winter seasons. In addition, individuals' gender and profession are among the most important factors associated with delay in PEP. Therefore, identifying the factors related to delay in treatment and providing people with the required education by health personnel are of considerable significance in preventing the unpleasant consequences.

Strengths and weaknesses of the study: As a strong point, since this is a population-based study, the results can be generalized to the whole area where the study was conducted. However, this is the first study carried out on animal bites in this area. That is why the imprecise reports recorded in healthcare centers of the area can be considered as the weak points of this study.

Conflict of Interests

Authors have no conflict of interests.

Acknowledgments

We would like to express our deep gratitude to the Vice-Chancellor of the Health Network for their warm welcoming, providing the research data, guiding the data collection, and providing other relevant information.

References

1. Hemachudha T, Ugolini G, Wacharapluesadee S, Sungkarat W, Shuangshoti S, Laothamatas J. Human rabies: Neuropathogenesis, diagnosis, and management. *Lancet Neurol* 2013; 12(5): 498-513.
2. Esmaeilzadeh F, Rajabi A, Vahedi S, Shamsadiny M, Ghelichi Ghogh M, Hatam N. Epidemiology of animal bites and factors associated with delays in initiating post-exposure prophylaxis for rabies prevention among animal bite cases: A population-based study. *J Prev Med Public Health* 2017; 50(3): 210-6.
3. Hasler B, Hiby E, Gilbert W, Obeyesekere N, Bennani H, Rushton J. A one health framework for the evaluation of rabies control programmes: a case study from Colombo City, Sri Lanka. *PLoS Negl Trop Dis* 2014; 8(10): e3270.
4. Rothe K, Tsokos M, Handrick W. Animal and human bite wounds. *Dtsch Arztebl Int* 2015; 112(25): 433-42.
5. Teklu GG, Hailu TG, Eshetu GR. High incidence of human rabies exposure in northwestern tigray, Ethiopia: A four-year retrospective study. *PLoS Negl Trop Dis* 2017; 11(1): e0005271.
6. Dehghani R, Sharif A, Madani M, Kashani HH, Sharif MR. Factors influencing animal bites in Iran: a descriptive study. *Osong Public Health Res Perspect* 2016; 7(4): 273-7.
7. Poorolajal J, Babaee I, Yoosefi R, Farnoosh F. Animal bite and deficiencies in rabies post-exposure prophylaxis in Tehran, Iran. *Arch Iran Med* 2015; 18(12): 822-6.
8. Kularatne SA, Ralapanawa DM, Weerakoon K, Bokalamulla UK, Abagaspiya N. Pattern of animal bites and post exposure prophylaxis in rabies: A five year study in a tertiary care unit in Sri Lanka. *BMC Infect Dis* 2016; 16: 62.
9. Sabouri Ghannad M, Roshanaei G, Rostampour F, Fallahi A. An epidemiologic study of animal bites in Ilam Province, Iran. *Arch Iran Med* 2012; 15(6): 356-60.
10. Sheikholeslami NZ, Rezaeian M, Salem Z. Epidemiology of animal bites in Rafsanjan, southeast of Islamic Republic of Iran, 2003-05. *East Mediterr Health J* 2009; 15(2): 455-7.
11. Charkazi A, Behnampour N, Fathi M, Esmaeili A, Shahnazi H, Heshmati H. Epidemiology of animal bite in Aq Qala city, northern of Iran. *J Educ Health Promot* 2013; 2: 13.
12. Joseph J, N S, Khan AM, Rajoura OP. Determinants of delay in initiating post-exposure prophylaxis for rabies prevention among animal bite cases: Hospital based study. *Vaccine* 2013; 32(1): 74-7.
13. Yibrah M, Damtie D. Incidence of human rabies exposure and associated factors at the Gondar Health Center, Ethiopia: A three-year retrospective study. *Infect Dis Poverty* 2015; 4(1): 3.
14. Abubakar SA, Bakari AG. Incidence of dog bite injuries and clinical rabies in a tertiary health care institution: A 10-year retrospective study. *Ann Afr Med* 2012; 11(2): 108-11.
15. Mazigo HD, Okumu FO, Kweka EJ, Mnyone LL. Retrospective analysis of suspected rabies cases reported at bugando referral hospital, mwanza, Tanzania. *J Glob Infect Dis* 2010; 2(3): 216-20.
16. Blanton JD, Bowden NY, Eidson M, Wyatt JD, Hanlon CA. Rabies postexposure prophylaxis, New York, 1995-2000. *Emerg Infect Dis* 2005; 11(12): 1921-7.
17. Eslamifard A, Ramezani A, Razzaghi-Abyaneh M, Fallahian V, Mashayekhi P, Hazrati M, et al. Animal bites in Tehran, Iran. *Arch Iran Med* 2008; 11(2): 200-2.
18. Bahonar A, Bokaie S, Khodaveirdi K, Nikbakht Boroujeni G, Rad M. A study of rabies and the frequency of animal bites in the province of Ilam, 1994-2004. *Iran J Epidemiol* 2008; 4(1): 47-51. [In Persian].
19. Rezaeinasab M, Rad I, Bahonar A, Rashidi H, Fayaz A., Simani S, et al. The prevalence of rabies and animal bites during 1994 to 2003 in Kerman province, southeast of Iran. *Iranian Journal of Veterinary Research* 2007; 8(4): 343-50.
20. Ramos JM, Melendez N, Reyes F, Gudiso G, Biru D, Fano G, et al. Epidemiology of animal bites and other potential rabies exposures and anti-rabies vaccine utilization in a rural area in Southern Ethiopia. *Ann Agric Environ Med* 2015; 22(1): 76-9.
21. Deressa A, Ali A, Beyene M, Selassie BN, Yimer E, Hussen K. The status of rabies in Ethiopia: A retrospective record review. *Ethiop J Health Dev* 2010; 24(2): 127-32.
22. Salve H, Kumar S, Sa R, Rai SK, Kant S, Pandav CS. Feasibility of sustainable provision of intradermal post exposure prophylaxis against rabies at primary care level-evidence from rural Haryana. *BMC Health Serv Res* 2014; 14: 278.
23. Moore DA, Sischo WM, Hunter A, Miles T. Animal bite epidemiology and surveillance for rabies postexposure prophylaxis. *J Am Vet Med Assoc* 2000; 217(2): 190-4.
24. Amiri M, Khosravi A. Animal bites epidemiology in Shahroud city. *Knowledge Health* 2009; 4(3): 41-43. [In Persian].
25. Dwyer JP, Douglas TS, van As AB. Dog bite injuries in children-a review of data from a South African paediatric trauma unit. *S Afr Med J* 2007; 97(8): 597-600.

26. Aghahowa SE, Ogbevoen RN. Incidence of dog bite and anti-rabies vaccine utilization in the, University of Benin Teaching Hospital, Benin City, Nigeria: A 12-year assessment. *Vaccine* 2010; 28(30): 4847-50.
27. Schalamon J, Ainoedhofer H, Singer G, Petnehazy T, Mayr J, Kiss K, et al. Analysis of dog bites in children who are younger than 17 years. *Pediatrics* 2006; 117(3): e374-e379.
28. Toure G, Angoulanguoli G, Meningaud JP. Epidemiology and classification of dog bite injuries to the face: A prospective study of 108 patients. *J Plast Reconstr Aesthet Surg* 2015; 68(5): 654-8.