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Short Communication

Public Health Section

Seasonal Variation in Incidence and Severity of Dog Bites in a Union Territory of Northern India

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ABSTRACT

Introduction: Dog bites pose a serious but underestimated public health problem in developing countries like India as it causes millions of injuries and thousands of deaths among its sufferers due to risk of rabies transmission. Studying their seasonal pattern and variations would help in understanding their determinants and guide in formulating policies to contain this problem and eventually help in achieving elimination of rabies.

Aim: To study the seasonal pattern and variations in incidence of dog bites and its association with severity in union territory of Northern India.

Materials and Methods: A retrospective study was carried out at an Anti-Rabies Clinic (ARC) providing pre and post-exposure prophylaxis for rabies in Union Territory of Chandigarh, Northern India. All the cases of dog bite registered at the clinic for receiving post-exposure prophylaxis during the time period of 1st January to 31st December 2015 were examined from records and classified across the seasons according to timing of the bite to look for seasonal pattern and variation. Categories of all the dog bites registered as per WHO classification (Category II and III) of bite severity were also extracted from the records and were tabulated across the seasons. The severity of the dog bites was then correlated with the seasonality. One-Way analysis of Variance (ANOVA) was applied for comparing mean number of dog bites per month across the seasons. The chi-square test was applied to determine the statistical significance between the dog bite severity across the seasons.

Results: A total of 853 cases of dog bite were registered at the clinic for post-exposure prophylaxis during the reference period. Mean number of dog bite cases per month were recorded highest in the spring season (90.0±16.9) followed by winters (82.5±13.0), the difference across the seasons being statistically significant (F value=5.26, p=0.02). Severity wise too, Category III bites were reported significantly more during spring (57.7%) and winter seasons (65.2%) as compared to summer and autumn seasons (χ^2=12.87, p=0.005).

Conclusion: The present study provides the evidence that dog bites in a union territory of Northern India have wider seasonal variation. A significantly higher number of cases were observed in spring and winter seasons compared to other seasons which require further investigations.

Keywords: Anti-rabies clinic, Post-exposure prophylaxis, Seasonality, World health organisation

INTRODUCTION

Dog bites in human are serious public health problem and are well documented worldwide [1,2]. It poses a huge medico-social problem as these attacks result in millions of injuries and thousands of deaths due to risk of rabies transmission [3]. As per World Health Organisation (WHO) report, about 10 million people are bitten by animals around the world, are considered for prophylaxis and treatment against rabies and almost 50,000 people die from this disease annually [4]. Dogs are main source of human rabies deaths as up to 99% of all rabies transmissions to humans are attributable to dogs [5].

Approximately, 1 in 20 dogs will bite a human being during the dogs' lifetime [6]. Dog bites are often underestimated public health problem and are poorly understood [7]. Most of the dogs usually don't bite a human; however, under certain circumstances, any dog is capable of inflicting harm. Children are the most common victims of dog bites, especially in cases which prove fatal [8]. About one-half of all reported dog bite cases involve the dog owned by the victim's family or victim's neighbours [9].

The consequences of dog bites to humans are multifaceted and vary from person to person. The most common issue is the direct physical injury, sometimes the injuries may cause permanent disfigurement of the victims, requiring reconstructive surgery [10-12], psychological trauma and post-traumatic stress [13-15], and rarely attacks can be fatal too [2,8]. Dog bites may also cause a large economic expenditure for treatment, emergency hospitalisation and post-exposure prophylaxis for rabies [1,16-19]. Globally, more than 15 million people receive rabies prophylaxis each year, mainly for dog bite injuries [20]. In most of the countries, management of dog bite cases includes rabies post-exposure prophylaxis. This cost, and cost from wound management, antibiotic and tetanus prophylaxis can result in a substantial healthcare burden. These measures and costs further underscore the need for more attention to research and prevention of dog bites. According to Schalamon J et al., for planning proper prevention strategies, it's important to understand the circumstances and characteristics of the dog bites [15].

Human rabies continues to be endemic in India and according to estimates; about 20,000 persons die of this disease every year [21]. A majority of these deaths (about 97%) are attributed to bites from dogs [21]. Incidence of rabies in India is almost constant for a decade without any recognisable declining trend, and reported incidence is possibly an underestimation of true incidence as rabies is still not a notifiable disease in India [22].

Seasonality of dog bites is poorly understood. Majority of the studies assessing seasonality of dog bites are from developed countries and there is lack of literature on this aspect from developing countries like India [9,23-29].

The current study was undertaken to assess the seasonal pattern and variations in incidence of dog bites and its association with the severity of the bites in a union territory of Northern India. The study findings would help in formulating policies to reduce the incidence of dog bites and therefore would help in attaining the goal of rabies elimination from India.

MATERIALS AND METHODS

This retrospective record based study was undertaken at the Anti-Rabies Clinic (ARC) of Civil Dispensary (CD), Sector-38, Union Territory (UT) of Chandigarh. The dispensary is located in one of the urban sectors of Chandigarh and is of a level of urban Primary Health Centre (PHC). It serves as Urban Health and Training Centre (UHTC) for Department of Community Medicine, Postgraduate Institute of Medical Education and Research, Chandigarh. The Anti-Rabies Clinic provides both pre and post-exposure prophylaxis for rabies in Chandigarh for cases of animal bites and is run by Department of Community Medicine, PGIMER in collaboration with Municipal Corporation, Chandigarh through its resident doctors posted there.

Ethical clearance for this study, as per institute norms was obtained from the Institutional Ethics Committee (IEC) of Postgraduate Institute of Medical Education and Research (PGIMER), Chandigarh (INT/IEC/2016/000178) and permission to access the data of anti-rabies clinic was obtained from Senior Medical Officer of the Civil Dispensary, sector 38, Chandigarh.

Reference period of one year (2015) was considered for the study. The study was conducted in the month of March 2016 for a duration of one month. The registration and follow-up records at the anti-rabies clinic were examined from 1st January 2015 to 31st December 2015 for all cases presenting to the clinic for rabies post-exposure prophylaxis. The registration details available at the clinic includes name age, sex and address of the victim, date of animal bite, type of animal, in case of dog, pet or stray dog, category of the exposure, dosing schedule of anti-rabies vaccine and actual dates of vaccination. From the records maintained at the clinic, cases of dog bites were extracted, their category of exposure was noted and their number was calculated for each month from January to December. These numbers were then classified as per seasons. Classification of seasons was based on the established pattern of season in this region. The months from November to February were classified under the winter season, months of March and April were the spring season, months from May to August were classified as summer season and lastly, the months of October and November were grouped as autumn season [30].

The severity of the dog bites was assessed using the WHO classification of animal bites as follows: Grade 0 = no apparent injury seen, Grade 1 = skin scratch with no bleeding, Grade 2 = minor wound with some bleeding, and Grade 3 = deep, multiple injuries or any wound requiring suturing [31]. As only those cases which required post exposure prophylaxis were registered at the clinic, the total registered cases didn't include Grade I bite exposure which don't require the prophylaxis and, therefore, the dog bites were categorised only into Category II and III bite exposures. The severity of the dog bites was then compared across the seasons.

STATISTICAL ANALYSIS

The results were expressed as number and percentages of total cases of dog bites across the months and seasons and as a mean±Standard Deviation (SD) for number of dog bite cases per month across the seasons. One-way analysis of variance (ANOVA) was applied for comparing mean number of dog bite cases per month across the seasons. The chi-square test was applied to determine the statistical significance between the dog bite severity across the seasons. For all statistical analysis, $p<0.05$ was considered statistically significant.

RESULTS

A total of 1073 cases of animal bites were registered for post-exposure prophylaxis at the anti-rabies clinic from 1st January to 31st December 2015 out of which 853 (79.4%) cases were of dog bites. Highest number of dog bite cases (330, 38.7%) was registered during winter season followed by summer season (220, 25.9%) [Table/Fig-1]. The mean number of cases was highest in the spring season (90.0±16.9) followed by the winter season (82.5±13.0) [Table/Fig-2]. The mean number of dog bites across seasons were significantly different (F=5.26, p=0.02).

Seasons/Months	No. (%) of dog bites registered
Winter	**330 (38.7)**
November	70 (8.2)
December	76 (8.9)
January	84 (9.8)
February	100 (11.7)
Spring	**180 (21.1)**
March	102 (11.9)
April	78 (9.2)
Summer	**220 (25.8)**
May	68 (8.0)
June	60 (7.0)
July	50 (5.9)
August	42 (4.9)
Autumn	**123 (14.4)**
September	56 (6.6)
October	67 (7.8)

[Table/Fig-1]: Classification of dog bite cases across the months and seasons (N=853).

Seasons	Mean no. of dog bite cases per month X±SD*	F-value	p-value
Winter	82.50±13.00	5.26	0.02
Spring	90.0±16.97		
Summer	55.0±11.37		
Autumn	61.5±7.77		

[Table/Fig-2]: Comparison of mean no. of dog bites across the seasons (N=853).
*X- Mean, SD-Standard Deviation

Severity wise, Category III bite exposure constituted 65.2% of all dog bites in winter season and 57.7% in spring season as compared to 50.0% in summer season [Table/Fig-3]. This difference in severity of dog bites across the seasons was statistically significant too (p=0.005).

Seasons	No. (%) of having category II exposure	No. (%) having category III exposure	χ^2	p-value
Winter	115 (34.8)	215 (65.2)	12.87	0.005
Spring	74 (42.3)	106 (57.7)		
Summer	110 (50.0)	110 (50.0)		
Autumn	54 (43.2)	69 (56.8)		

[Table/Fig-3]: Comparison of severity of dog bites across the seasons (N=853).

DISCUSSION

This study is one of the few studies from India which specifically assessed the seasonality of dog bites. The studies on seasonality of dog bites available from literature [9,16,23-29] are summarised in [Table/Fig-4]. The present study found significantly higher incidence of dog bites cases in spring and winter seasons compared to the other seasons. A previous study from Dadar and Nagar Haveli, India found that the maximum number of dog bites cases occurred in the pre-monsoon season (40.8%) followed by post-monsoon period [23]. Pre-monsoon period consists of winter (January and February) and spring (March and April) seasons in India. Another study from Maharashtra, Western India showed that the maximum number of animal bite cases was seen in the months of March and April followed by February similar to our findings [24]. Another study from South Bhutan reported that the dog bite incidences were significantly more during the spring months followed by winter months similar to the present study findings [25].

Authors and year(s) of study	Study title and year of publication	Study area	Main findings
Bashar MA et al., 2015 (current study)	Seasonal Variation in Incidence and Severity of dog bites in a union territory of Northern India. JCDR. 2019.	UT of Chandigarh	A significantly higher incidence of dog bites was observed in spring and winter seasons compared to other seasons. Severity wise too, dog bites were more severe in winter and autumn months compared to other months.
Khan V et al., 2012 [23]	A study on dog bite incidence in Union Territory of Dadra and Nagar Haveli, India. Journal of Applied and Natural Science. 2014;6(1):38-40.	UT of Dadra & Nagar Haveli, India	Majority (40.8%) of the dog bite incidents occurred during the pre-monsoon period (1-20 weeks).
Kulkarni SK 2011-16 [24]	Trend of Animal Bite Victims Reported to Anti Rabies Vaccination Clinic At a Tertiary Care Hospital Nanded, Maharashtra. Journal of Dental and Medical Sciences. 2016;15:36-39.	Maharashtra, India	Majority of animal bite cases attending anti-rabies vaccination clinic are in pre-monsoon months.
Tenzin DNK et al. 2009-10 [25]	Dog bites in humans and estimating human rabies mortality in rabies endemic areas of Bhutan. PLoS Negl Trop Dis. 2011;5(11):e1391.	Bhutan	Incidence of dog bites were significantly more during the spring months (March-May) followed by winter months (December-February).
Mengistu F et al., 2008-09 [26]	Total case of dog bites to humans and seasonal patterns of the bites. Ethiop Vet J. 2011;15:103-08.	Addis Ababa, Ethiopia	The highest average value of total dog bites was observed in the autumn months in both the years. Mean of bites are significantly different between seasons in both years together.
Ndon JA et al., 1989-91 [9]	Incidence of dog bites in Milwaukee, USA. Wis Med J.1996;95, 237-41.	Milwaukee, United States	Majority of the dog bite incidents (67%) occurred during the spring and summer months.
Omoke NI et al., 2006-15 [27]	Incidence and pattern of dog bite injuries treated in the emergency room of a teaching hospital South East Nigeria. Afr J Med Health Sci. 2018; 17:35-40.	South East Nigeria	Majority of the attacks occurred during dry season.
Ostanello F et al., 2000-02 [28]	Incidence of injuries caused by dogs and cats treated in emergency departments in a major Italian city. Emerg Med J.2005;22: 260-26.	Italy	Peak incidence of both dog and cat bite/scratches was in the warm season between May and August.
Weiss HB et al., 1992-94 [16]	Incidence of Dog Bite Injuries Treated in Emergency Departments. JAMA. 1998;279(1):51-53.	United States	There was a non-significant trend toward a seasonal distribution of dog bite incidence injuries, with the highest rates observed during the summer months.
Vucinic M et al., 2008-18 [29]	Children are victims of dog bites due to irresponsible dog ownership, parenthood and managers of school institutions in Serbia. Journal of Veterinary Behaviour (2019).	Serbia	Children sustained the greatest number of dog bites during the spring months (37%) and the lowest in the summer (14%).

[Table/Fig-4]: Studies on Seasonality of Dog bites available from literature [9,16,23-29].

However, a study from Ethiopia found that maximum cases of dog bites occurred in the months of autumn followed by summer [26]. This difference in seasonality from our findings may be due to different pattern of seasons in India and Africa affecting canine behaviour. Another study from South east Nigeria, Africa assessing incidence and pattern of dog bite injuries treated in the emergency room of a teaching hospital found that majority of dog bite were observed in the dry summer season [27]. Similarly, a study by Ostanello F et al., from Italy reported peak incidence of both dog and cat bite/scratches in the warm season with 45.2% and 50.2% of the cases respectively [28], presenting between May and August. However, a study from United States found that there was a non-significant trend toward a seasonal distribution of dog bite incidence, with the highest rates observed during the summer months [16]. A recent study from Serbia reported that children sustained the highest number of dog bites during the spring months (37%) and the lowest in the summer (14%) [29]. However, some other studies from developed countries have reported that most dog bite incidents among children occur during the months of spring and summer seasons [1,16,28]. Such observations have been explained by behavioural changes: more interaction occurs between pets and children during the warmer months in developed countries of temperate zone with less parental supervision, consequently increasing the risk of bite incidents [27].

Severity wise too, dog bites were more severe in winters and springs with significantly higher proportion of Category III bite exposures being observed in these seasons compared to other seasons in our study.

A survey by Ndon JA et al., in Milwaukee, USA disclosed that the majority of the dog bites occurred during the spring months [9]. It is during these months that dogs are breeding and hence male dogs in a group follow a bitch for mating. Provocative actions and interference made by people especially children during this time might be contributing to higher bite.

Dog bite prevention strategies include appropriate restraint of dogs in public places and reducing the number of stray dogs roaming in the community (animal control) and teaching people to refrain from behaviours likely to provoke bites.

LIMITATION

The study, however, has few limitations. One-year reference period may not be sufficient to establish the seasonal pattern of dog bites. Further studies with longer observation period are required to establish the seasonal pattern/variation and seasonal trend of dog bites in India.

CONCLUSION

The current study provides the evidence that dog bites in a union territory of Northern India have wider seasonal variation. A significantly higher number of cases were observed in spring and winter seasons compared to other seasons which require further investigations. Policy actions and interventions should be planned to keep in mind this seasonality of dog bites for containing this public health problem as to reduce the injuries due to the bites and this would also help in eventually eliminating rabies from India which would eventually help in eliminating rabies.

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