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Research Article

Epidemiological Pattern and Trends of Animal Bite Cases: A Record-Based Study from a Tertiary Care Hospital in Central India

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I N F O

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A B S T R A C T

Introduction: Animal bites not only lead to rabies-related deaths but also place substantial demands on resources needed for wound care and vaccination. To support the World Health Organization's aim of eradicating dog-mediated human rabies by the year 2030, robust epidemiological surveillance is essential for accurately assessing disease impact and trends.

Objective: To assess the epidemiological patterns and the trends of animal bite cases reported to the Anti-Rabies Clinic at a tertiary care hospital in Nagpur, Maharashtra, Central India

Methods: This record-based retrospective cross-sectional study analyzed animal bite cases reported to the Anti-Rabies Clinic from January 2022 to June 2024, at a tertiary healthcare center in Nagpur. The study spanned two months, encompassing all reported animal bite cases during the specified period.

Results: Among reported cases, 88.13% were categorized as severe (Category III) bites, with dogs responsible for 87.69% of incidents. Children under 18 years and young adults, particularly males (66.11%), were more susceptible to animal bites. Seasonal analysis indicated an increase in cases, with the highest frequency observed in summer.

Conclusion: Stray dog bites, especially unprovoked, still remain a major public health concern, disproportionately affecting young males and children, with cases peaking during summer and monsoon seasons as demonstrated in the present study. To address this, it is essential to implement population control measures and mass immunization for stray dogs, promote pet vaccination, conduct regular educational programs, and align vaccine supply with seasonal bite trends across healthcare facilities.

Keywords: Animal Bites, Rabies, Epidemiology, Seasonal Trend

Introduction

Rabies is one of the most important fatal viral zoonotic diseases. It is 100% fatal but yet entirely preventable.[1] A neurotropic virus belonging to the genus Lyssavirus in the Rhabdoviridae family is the causative agent of rabies. It is most commonly transmitted by the bites of infected animals, which introduces the virus into skin wounds or mucous membranes.[2] More than 3.3 billion people worldwide are at risk of animal bites, representing an important public health concern.[3] The disease annually causes 55,000 human deaths worldwide; 30–60% of cases and fatalities occur in children under 15 years of age, while around 15 million post-exposure vaccinations are administered globally.[4]

The WHO's South-East Asia region has the highest exposure to rabies in the world, with approximately 1.4 billion people exposed to it. In India, where every animal bite can potentially be rabid, approximately 17.4 million bites annually cause 20,000 deaths, accounting for about 35% of the global burden. In 2023, Maharashtra recorded 30 rabies-related fatalities, a significant increase from 10 deaths in 2019. The rise in reported cases is largely attributed to enhanced surveillance and improved reporting systems. Over the past few years, the state has seen fluctuations in rabies-related deaths, with 29 cases in 2022, 19 in 2021, and 23 in 2020. Animal bite cases rise following natural disasters like floods and droughts, and in various seasons because of behavioral changes in animals.[1,3,5]

Animal bites not only contribute to mortality caused by rabies, but they also represent significant demands on manpower, finances, and time spent on wound care and vaccination efforts.[6] The World Health Organization, with the Global Alliance for Rabies Control, has targeted the elimination of dog-mediated human rabies by 2030. For this purpose, understanding the epidemiology and trends of rabies becomes essential.[3]

Strong epidemiological surveillance is required to reliably assess disease burden, morbidity, mortality, and trends, as these factors are critical to the success of any elimination campaign. Policymakers can create tailored policies, awareness campaigns and logistical support, to manage animal attacks during particular periods with the use of these characteristics and seasonal tendencies.[1,7]

Thus, this study focused on analyzing epidemiological patterns and trends of animal bite cases reported to an Anti-Rabies Clinic at a tertiary care hospital in Nagpur, Maharashtra, Central India.

Materials and Methods

The present record-based retrospective study was conducted at the Anti-Rabies Clinic of a government tertiary health care center in Nagpur, Maharashtra, located in central India. The period of the study was two months, from June to July 2024.

Accurate records of all patients visiting the anti-rabies clinic were maintained by trained hospital staff in patient record registers and were also digitally entered and stored. This secondary data, covering the period from January 2022 to June 2024, i.e. thirty months, was collected after obtaining the required permissions and institutional ethical clearance. The cases, where complete data or information was not available or was missing, were excluded from the study. Records from January 2023 to June 2024 were analyzed to identify the epidemiological patterns, while the data from January 2022 to June 2024 were evaluated to interpret the trends of animal bite cases.

The records contained information such as the socio-demographic information of the patient, information about the animal bite event and details regarding the wound care practices and post-exposure prophylaxis received. For the analysis, winter was considered from December to February, summer from March to June, monsoon from July to September, and the remaining months were classified as autumn.

Ethical Considerations

The study received approval from the Institutional Ethics Committee of Government Medical College, Nagpur, vide approval letter No. 3573/EC/Pharmac/GMC/NGP. Additionally, administrative permission to access the data from the anti-rabies clinic was secured from the institute's authorities. As secondary data analysis was employed in this research, there was no need to obtain informed consent. Nonetheless, measures were taken to ensure that the confidentiality of the data collected was maintained.

Statistical Analysis

The collected data was entered into a Microsoft Excel spreadsheet and periodic data validation checks were conducted. Data was analyzed using Microsoft Excel and the results were illustrated using tables and appropriate diagrams. Quantitative variables were expressed in terms of mean and standard deviation and categorical variables were expressed in terms of percentage.

Results

Comprehensive records were available for 5,955 new cases of animal bites reported to the anti-rabies clinic between January 2023 and June 2024. Table 1 illustrates the distribution of these cases across different age groups. Among the reported cases, 1,646 (27.64%) involved children under 18 years, while 697 (11.7%) were adults aged 60 and above. Males accounted for 66% of the cases, with females constituting the remaining. The majority of bite victims were from urban areas during the mentioned timeframe.

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Table 1.Demographic Characteristics and Overview of Animal Bite Incidents

N = 5955

Characteristics			Frequency (%)	
Age (in years)	≤ 10		968 (16.25)	
	11–20		1023 (17.18)	
	21–30		1342 (22.54)	
	31–40		828 (13.90)	
	41–50		678 (11.38)	
	51–60		490 (8.23)	
	61–70		392 (6.58)	
	≥ 71		234 (3.94)	
Gender	Male		3937 (66.11)	
	Female		2018 (33.89)	
Animal involved	Dog		5222 (87.69)	
	Cat		450 (7.56)	
	Monkey		132 (2.22)	
	Others		151 (2.53)	
Status of animal involved	Stray	Dog	3088	3397 (57.04)
		Cat	299	
		Others	10	
	Pet	Dog	2134	2291 (38.47)
		Cat	151	
		Others	06	
	Wild	Monkey	132	267 (4.49)
		Others	135	
Nature of bite	Provoked	Stray	618 (10.38)	
		Pet	1002 (16.83)	
		Wild	24 (0.40)	
	Unprovoked	Stray	2779 (46.66)	
		Pet	1289 (21.65)	
		Wild	243 (4.08)	
Category of bite	Category I		37 (0.62)	
	Category II		670 (11.25)	
	Category III		5248 (88.13)	
Wound management practices	None		878 (14.74)	
	Home remedies		247 (4.15)	
	Running water + soap		3908 (65.63)	
	Antiseptics		922 (15.48)	

Most of the reported animal bite incidents were caused by dogs, accounting for 87.69% of the cases. Cats and monkeys were responsible for 450 (7.56%) and 132 (2.22%) cases, respectively. More than half of the animals involved were stray in nature, making up 57.04% of the incidents, while 38.47% were pets and the rest 4.49% involved wild animals. Specifically, among the dog bite cases, 3088 (59.13%) were attributed to stray dogs, with the remaining bites caused by pet dogs. Among pet animal bites, 43.7% were provoked in nature, whereas 81.8% of stray animal bites were unprovoked.

Among the 5,222 dog bite cases presented to the anti-rabies clinic, 3088 (59.13%) were stray dog bites and the remaining 2134 (41.67%) were pet dog-mediated events.

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The majority (3745, 71.72%) of the dog bite events were of an unprovoked nature. Among pet dog bites, 915 (42.88%) were provoked in nature.

Most of the bites were classified as Category III (88.13%), with 11.25% falling into Category II. A significant number of patients (3908, 65.63%) promptly managed their wounds using running water and soap, either on their own or at a primary care point. However, the use of traditional home remedies, such as applying turmeric to the wound, was still observed in 247 cases (4.15%), while 878 patients (14.74%) did not perform any immediate wound care practice or first aid.

Overall, among the cases reported during the study frame, the most prevalent bite site observed was the lower limb (53.88%), followed by the upper limb (36.15%). Bites on the head and neck region were reported in 231 cases (3.88%). Figure 1 illustrates the distribution of animal bite cases reported as per the site of the bite. Bites on the head and neck, trunk and abdomen, and multiple sites were more frequently observed in children and adolescents under 18 years of age, with incidences of 58%, 56.25%, and 44.08%, respectively (Figure 2).

An analysis of the monthly trends in cases reported to the anti-rabies clinic for 2022 and 2023 showed a rise in animal bite cases from March to May. This was followed by a decline until September, with a gradual increase in the subsequent months (Figure 3). Seasonally, the majority of dog bites were reported in the summer (35.8%), followed by 26.97% during the monsoon season, and 23.63% in the winter as illustrated in Figure 4.

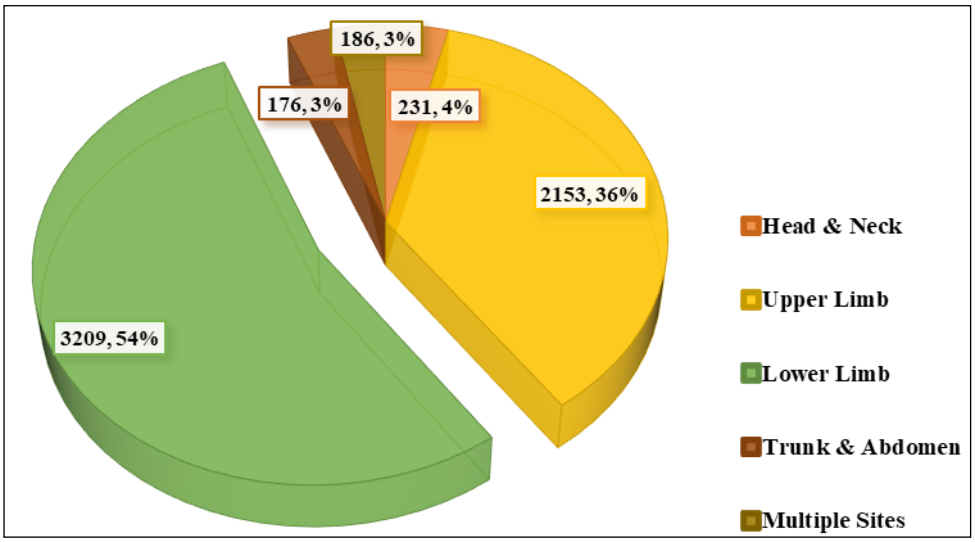

Figure 1.Distribution of Animal Bite Cases as per the Site of Bite (N = 5955)

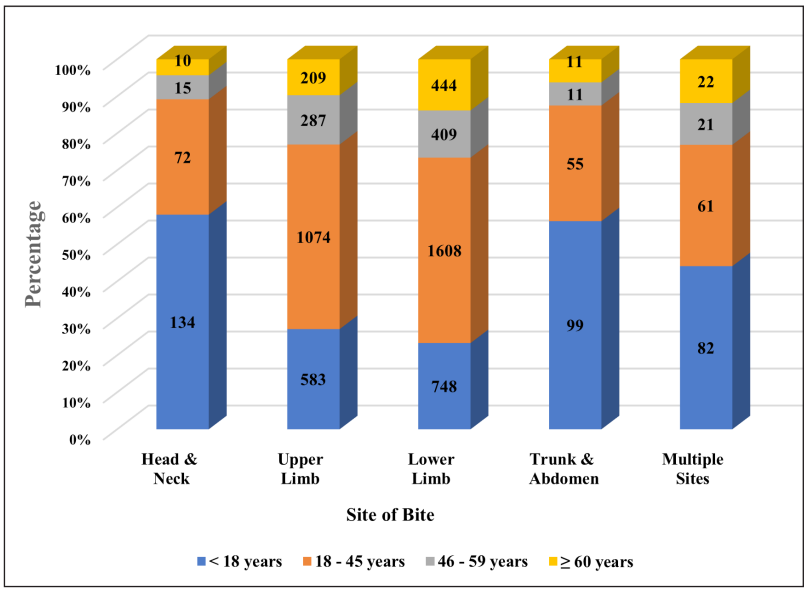

Figure 2.Distribution of Animal Bite Cases as per Patient's Age and Site of Bite (N = 5955)

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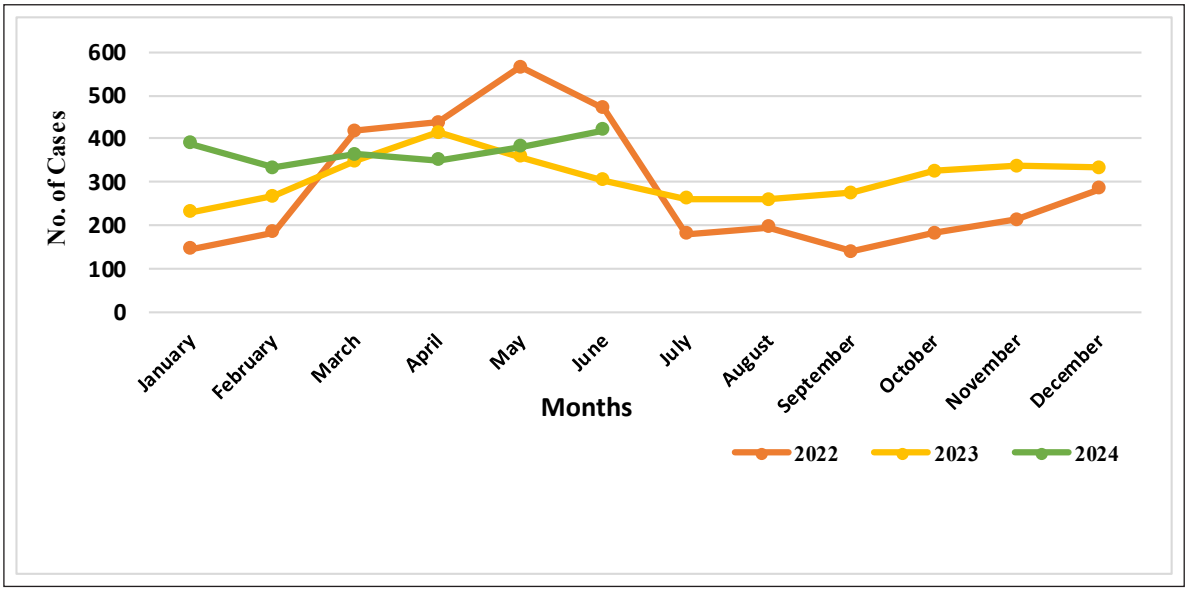

Figure 3.Month-Wise Distribution of Animal Bite Cases during the Study Years

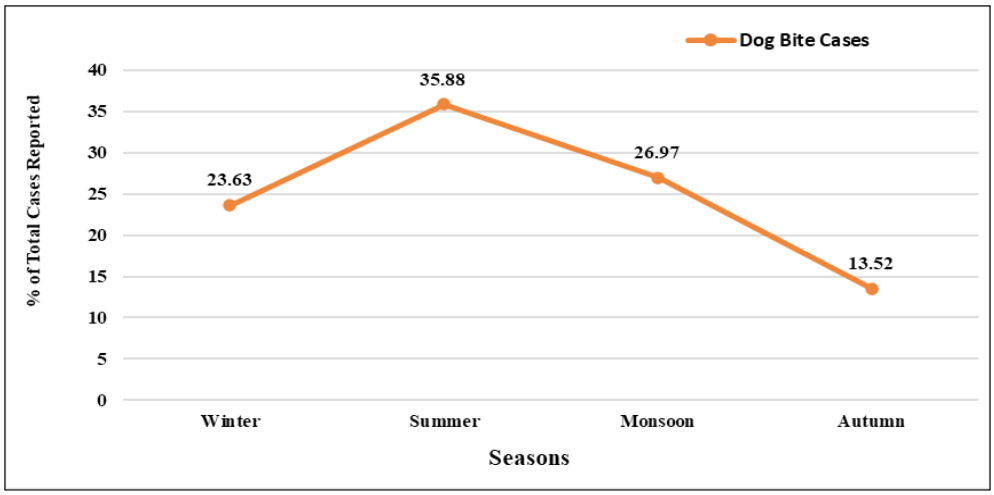

Figure 4.Season-Wise Distribution of Dog Bite Cases Reported during the Study Years

Discussion

Out of the 5,955 cases reported to the anti-rabies clinic during the study, the majority of bite victims were between the ages of 20 and 50 years. This age group is typically more active and engaged in outdoor work and other activities, which likely increases their exposure to animal bites. Most of the victims were male (66.11%), which can also be attributed to similar reasons. Comparable findings were observed in studies by Sreenivas et al. and Kinge and Supe.[8,9]

A considerable proportion of bite victims (27.64%) were from the pediatric age group, highlighting their vulnerability to this potentially fatal disease. Previous studies have similarly emphasized the increased risk of animal bites among children.[2,10,11] Sharma et al., in their research on seasonal trends of animal bites, noted that children's shorter stature makes them particularly susceptible to such incidents.[1]

In this study, dogs were responsible for the majority of bites (87.69%), with a significant proportion of the incidents involving stray animals (57.04%). These findings align with those reported by Sachdeva et al., Jethani et al., Marathe and Kumar, and Jain et al., who observed similar trends in their research conducted across different regions of the country.[4,5,7,11] However, the proportion of stray dog bites in this study was lower compared to the findings reported in the aforementioned studies.

Although the majority of bite incidents were unprovoked (72.39%), a significant portion of bites from pet animals, particularly pet dogs, were provoked. These bites likely occurred during interactions such as playing with, feeding, or inadvertently irritating the animals. This is further supported by the observation that most upper limb bites were caused by pet animals rather than strays. A similar observation was also reported by Gowda et al. in their hospital-based study.[6]

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The majority of bites in this study were classified as Category III (88.13%), with Category I bites being the least reported. These results are consistent with the findings of Jethani et al., Gowda et al., and Ain et al., in which most animal bite cases were categorized as the WHO Category III.[5,6,12] In the present study, a significant proportion of animal bite victims (65.63%) promptly managed their wounds using running water and soap. This finding is comparable to the 69.8% reported by Harish et al.,[13] though it is notably higher than the 48% observed by Kumar et al.,[14] where fewer victims practiced prompt wound care, either on their own or at a primary healthcare point. In the present study, turmeric was the most commonly applied home remedy over bite wounds.

In this study, the majority of bites occurred on the lower limbs (53.88%), likely due to their easy accessibility. However, bites to the head, neck, trunk, and abdomen were more commonly reported among children and adolescents compared to other age groups. The shorter stature of children, combined with their heightened vulnerability and dependency, makes them more susceptible to facial bites and multiple injuries or bites, increasing their risk of contracting the disease. Similar findings have been reported in other studies investigating the epidemiology of animal bites.[2,4,11,14,15]

On analyzing the seasonal trends, it was observed that the highest number of animal bites occurred in summer (35.88%), followed by monsoon (26.97%) and winter (23.63%) seasons. Autumn reported the lowest incidence of animal bites during the study period. This finding contrasts with other studies that reported a higher incidence of animal bites in winter, followed by summer.[1,2] Meanwhile, some research has observed a peak in animal bite cases during the spring and a decline during the monsoon season.[3,5] This study was conducted at one of the three government tertiary care health centers located in Nagpur, Maharashtra. The data variations might be due to the exclusion of animal bite cases reported to the other two tertiary health care centers. Consequently, the present study may not fully capture the actual trend of animal bite cases within the district.

Limitations

The present study also has certain limitations. A single hospital-based study may not be generalizable to all settings, especially as the present study was done in a tertiary healthcare facility. This study utilized a record-based data analysis, which serves as a limitation of the present research study.

Conclusion

Animal bites, in particular dog bites, still remain a serious public health challenge in the country. The findings of the present study are in alignment with similar conclusions. Males, belonging to the pediatric age group and young adults were found to be more vulnerable to animal bites in the present study. The majority of the bites were from stray dogs and were unprovoked in nature. Seasonal trends analysis depicted that animal bite cases were most frequently reported during the summer, followed by the monsoon season in our study.

A more in-depth understanding of the epidemiology and seasonal patterns of animal bite occurrences would require a multicentric community-based observational study involving all levels of the healthcare system. The present research emphasizes the overwhelming need to plan and implement prevention strategies to curb the incidence of animal bite cases. In this regard, population control measures and mass immunization programs should be carried out, particularly among stray dogs aligning with the internationally accepted One Health approach. Pet vaccination promotion is also equally important. Information, Education, and Communication (IEC) activities should be regularly undertaken in the schools as well as in the community concerning the risks of animal bites, the necessity of early wound management and the importance of post-exposure prophylaxis. In addition, vaccines and immunoglobulins demand and logistics in healthcare facilities should be stratified against the seasonal trend of animal bites in the region.

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Declaration of Generative AI and AI-Assisted Technologies in the Writing Process: Artificial Intelligence tools were utilized to assist with literature searches and refining the language during the preparation of this manuscript. Nonetheless, the authors retain full responsibility for the accuracy and authenticity of the article's content, and AI was employed solely to enhance the original material

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