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ORIGINAL ARTICLE

A Descriptive Analysis of the Patients Presenting with Mammalian Bites in the Emergency Department of the Lady Reading Hospital, Khyber Pakhtunkhwa, Pakistan

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ABSTRACT

BACKGROUND

Animal and rodent bites are a common occurrence in Pakistan, but little is known about the characteristics of the injuries incurred and the patient pattern in the Khyber Pakhtunkhwa province of Pakistan. This study aims to describe the injuries caused by the animal and rodent bites, and characteristics of the patients presenting at the emergency department.

METHODOLOGY

This cross-sectional study is based on a retrospective analysis of the records of patients presenting at the animal bite clinic from Jan-June 2018 at the Emergency Department, Lady Reading Hospital using R statistical software. All patients presenting to the clinic during this period with a history of the mammalian bite were included in the study.

RESULTS

A total of 5054 cases of mammalian bites presented to the emergency department during the study period, out of which 83% belonged to the Peshawar district. Four out of five patients were males, and the mean age of the patients was 20 years (SD=15.26). More than 80% of bite cases were seen in patients less than 30 years of age, including both genders. The prevalence of dog bites was highest at 78.40%-followed by rat bites at 16.30% and 5.30% by other animals. 52% of bites were caused by stray animals. Upper and lower extremities were predominant sites of bites in contrast to back, head, and chest regions. The most frequent exposure category was Category II, i.e. nibbling of uncovered skin and abrasions for 3 out of 4 cases (77.20%), followed by Category III, i.e. single or multiple transdermal bites and/or contamination of mucous membranes (4.10%). Category I was the least frequent, i.e. touching or feeding of animal or human cases and licks on intact skin (2.30%). Around 79.40% patients were treated with anti-rabies vaccine (ARV) + tetanus toxoid (TT) + antibiotics (Category II patients by dogs and other animals), 16.40% with TT + antibiotic (mostly rat-bite patients) and 4.20% with ARV + TT + Immunoglobulin+ Antibiotics (all category III patients by dogs and other animals).

CONCLUSION

Bites by dogs and rats constitute the vast majority of cases presenting at the Lady Reading Hospital, Peshawar and signify the enormity of this public health problem at the population level. A coordinated and targeted response with multi-sectorial interventions is direly needed to decrease the burden of disease and mortality due to animal bites in Khyber Pakhtunkhwa, Pakistan.

KEYWORDS

Mammalian bites, Dog bites, Rat bites, Rabies, Emergency department

INTRODUCTION

Globally, one of the commonest presentations in the emergency departments of hospitals and health centers are the injuries caused by the bites of various mammals like dogs, cats, monkeys, rats and even humans.[1-3] These animals and rodents are the vectors of a myriad of diseases. The burden of disease and mortality caused by their bites is enormous and poses a significant public health problem particularly in low and middle-income countries. Mammalian bites can cause tearing of body parts, wound infections, disfigurement, scarring and important zoonotic diseases like rabies, rat-bite fever, and cat-scratch disease etc.[2-5] Of these, rabies is one of the most deadly diseases caused by the bites by mammals like dogs, cats, monkeys, and bats. Worldwide, around 59,000 precious human lives are lost annually due to rabies predominantly through

domestic dogs.[6, 7] The disease is under-reported and under-estimated, however, based on existing data of World Health Organizations (WHO) Expert Consultation Report on rabies in 2018, it shows that the disease is endemic in low and middle- income countries (LMICs) of Asia and Africa including Pakistan (Figure 1).[6, 7] Asia bears the major brunt with 59.60% (35,172) of human deaths due to dog-transmitted rabies, followed by Africa with 36.40% (21,476) human deaths.[7] Among the Asian

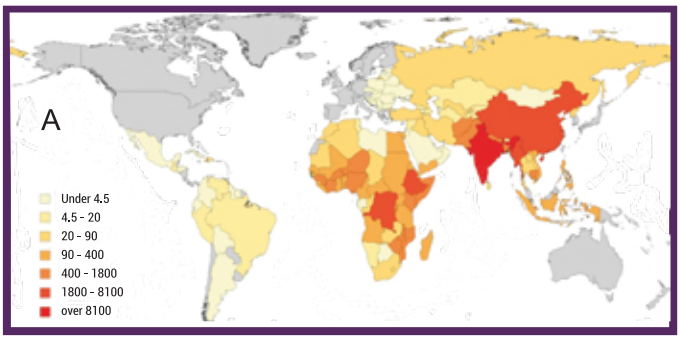


Figure 1. The global burden of human deaths due to the dog- transmitted human Rabies WHO Expert Consultation on Rabies, third report. Geneva: World Health Organization; 2018 (WHO Technical Report Series, No. 1012). License: CC BY- NC-SA 3.0 IGO.

countries, the rural communities in Pakistan, India, and Bangladesh have the greatest numbers of rabies related death and suffering.[7, 8]

A great majority of Pakistan's rural population lives in close interaction with dogs and domestic animals and thus prone to their bites. The incidence of dog bites is high in Pakistan and an estimated 2000 – 5000 precious lives are annually lost due to rabies.[9-12] However, rabies and dog bites are still a huge problem in Pakistan with a lack of surveillance and an organized response.[9-11] Furthermore, due to religious reasons, unowned or stray dogs seem more common in Pakistan as opposed to pet dogs and thus are most likely unvaccinated.[13] Besides, other factors leading to high disability and premature loss of lives and productivity caused by dog-mediated rabies in Pakistan and other LMICs include not only low dog vaccination rates but also aspects related to the cost and availability of post-exposure prophylaxis (PEP). [6, 7, 10, 14] The disease is entirely preventable through mass awareness, vaccination of dogs and institution of early and appropriate post-exposure prophylaxis (PEP) after the bite, yet it remains one of the most ignored diseases with huge health and economic implications.[6]

Apart from dogs, bites from other small mammals like rats and mice also pose a significant health risk due to their disease causing potential, for instance, tetanus and rat bite fever which may also prove fatal if untreated.[1, 15] Other diseases transmitted by mammalian bites include tularemia, plague, sporotrichosis, blastomycosis, and sepsis.[3] Although domestic rat bites have not been known to cause rabies but there has been a rare instance of rabies transmission by wild rat bites.[16,17] . There have been reports regarding a high number of rats in Peshawar — the capital city of the Khyber Pakhtunkhwa province of Pakistan — with a growing number of rat bites cases attending the hospitals.[18-21] There have also been incidents of deaths due to rat bites in Peshawar.[20, 22]

Despite the significance of the topic from a public health perspective, there is a dearth of studies regarding the pattern of animal bite injuries presenting at the emergency departments of hospitals in the Khyber Pakhtunkhwa (KP) province of Pakistan. Of the three public sector tertiary care hospitals in KP, Lady Reading Hospital is the largest and serves as the leading referral center for all its districts. Its emergency department (ED) is one of the largest and busiest in entire Pakistan in terms of the flow of patients. Patients with a myriad of medical and surgical emergency conditions visit this ED each day. Consequently, this study aims to investigate the characteristics of the patients presenting with the history of animal and rodent bite at the animal bite clinic of the ED, LRH including their age, gender, and locality for the period Jan-Jun 2018. It aims further to determine the prevalence of bites due to different types of mammals, characteristics of their bite like topographical location, exposure category and treatment regimen received. It further intends to explore any differences related to age and gender.

METHODS

This cross-sectional study is based on the retrospective analysis of the data of patients presenting at the animal bite clinic at the Emergency Department of the Lady Reading Hospital, Peshawar, Pakistan.

The animal bite/vaccination clinic is located at the ED, LRH and provides services in the morning shift on weekdays to all the patients visiting the hospital with a history of mammalian bites. The clinic is staffed by two technicians and is equipped with a cold chain. The Anti-Rabies Vaccine (ARV) used is the purified Vero Cell vaccine (Abhayrab - manufactured in India) and is provided by the government free of cost to the patients. The ARV and Tetanus Toxoid (TT) vaccines are kept in the refrigerator in adequate quantities. Mechanism for monitoring the cold chain are in place. Electricity breakdown does not occur in the hospital, and there are back up mechanisms in place in case of power failure. Patients are provided with the ARV and TT vaccines free of cost at this clinic, however, due to non-supply of the Anti-Rabies Immunoglobulin (RIG) by the government, patients with category III exposure have to buy it out of pocket expenses from the local market. Purified Equine Immunoglobulin

(ERIG) is used in such a case (Equirab – manufactured by India).

The study focuses on the patients presenting at this clinic between Jan-Jun 2018.Records of all the patients who had presented to the animal bite clinic with a history of the animal, rodent bite during the study period were included in the study. Data was taken from the patient register. Data entry in the SPSS database was done from the patient records whilst preserving their anonymity and confidentiality by a graduate student between Jul-Aug 2018. The quality of data entry was cross-checked.

Sample size calculation

Daniel formula for sample size was used as follows:

$n=Z^2 P (1-P)/d^2$

Where n = sample size,

Z = Z statistic for a level of confidence, (1.96 for 95%level of confidence)

P = expected prevalence or proportion (in the proportion of one, Incidence in KP of 8/100 or 0.8)

And d = precision (in proportion of one; if 5%, d = 0.05)

The sample size was calculated with 95% level of confidence and 5% precision. By taking the prevalence of animal bites as 50% in Pakistan p=0.15 while Z=1.96 (for 95% level of confidence), and d= 0.05, the sample size calculated was 295 (3.8416*0.8*(0.24)/.0025 =295). However, we included a total of 5054 patients in the study as their data could conveniently be collected and analyzed

Quantitative variable such as age ranging from 1-90 years was later on categorized into 6 categories: children under 5 years, 6-12 years, 13-18 years, 19-45 years, 46-65 years and older than 65 years.

Gender was recorded as males and females. Month was recorded as a categorical variable ranging from Jan to June.

The information regarding area/district was based on patient's origin from the 29 districts of KP and one option for others including neighboring country Afghanistan. These were recoded into 7 main districts for ease in data analysis owing to small numbers of patients from other districts. The location of patients in the Peshawar district was divided into 53 options of residential areas. Owing to low numbers from many locations, this variable was finally recoded into 8 categories.

Regarding exposure to animals,13 different animals/rodents were included such as dog, rat, cat, donkey, horse, monkey, pig, jackal, rabid human or rabid cow, wolf, mongoose and others. All the animals apart from dogs and rats were recoded as 'others' due to their low numbers. The animals were further categorized into stray and pet animals. The site of bite was also recorded.

This exposure category was classified according to the World Health Organization's (WHO) classification [7] into

Category I: Touching or feeding animals and human cases; licks on intact skin

Category II: Nibbling of uncovered skin, minor scratches or abrasions, licks on non-intact skin

Category III: Single or multiple transdermal bites, scratches/contamination of mucous membranes.

Type of treatment given:

Three types of treatment encompassed of Antirabies vaccine (ARV) + tetanus toxoid (TT) + antibiotic; ARV + TT + antibiotic + Antirabies immunoglobulin and lastly TT + antibiotics.

Statistical methods

R statistical software (version 3.2.4) with 'R Commander statistical package' (version 2.1-7) was used for the analysis. The SPSS data files were imported to R. A p-value of < 0.05 was taken as significant. Relative and absolute frequencies were used to describe participants' characteristics and the distribution of various variables. The age of the participants was analyzed both as a numerical and categorical variable. Two- way contingency tables with Pearson's Chi-square test and multi-way tables were done to assess the frequency distribution of the various variables and assessing their mutual association and differences between the groups. Graphs and tables were made to understand the data better. Missing values were negligible keeping in view the total sample size (ranging from 1-9 on various variables) and the possibility of these

causing bias is close to none. There were 830 missing values on the variable exposure category predominantly rat-bite cases.

Ethical considerations

Ethical approval for the study was obtained from the Ethical Review Board, Lady Reading Hospital, Peshawar. As this was a retrospective analysis of the data, patient consent in particular for this study was not taken at the time to data collection but every effort was made to maintain confidentiality and patient anonymity by giving a numerical ID number to each patient. The research study is not likely to harm the study participants in any way, rather it is expected to benefit the population by understanding the phenomenon better, by informing policy-makers on the subject and helping design better strategies. Thus, this study satisfies the principles of medical research involving human subjects as laid down under the Declaration of Helsinki.[24]

RESULTS

A total of 5054 participants were included in the study. The background characteristics and distribution of study variables among the study participants are shown in Table 1. The age of study participants ranged from 1-90 years with a median of 17 and a mean age of 20 years (SD=15.26).

Table 1. Frequency distribution of demographic characteristics of participants and study variables among patients attending the animal bite clinic

Characteristic / study variable	Valid value n (%)	Missing value n (%)
Age		
Under 5 years	875 (17.31)	
6-12 years	1225 (24.24)	
13-18 years	629 (12.45)	
19-45 years	1954 (38.66)	0
46-65 years	341 (6.75)	
Over 65 years	30 (0.59)	
Gender		
Male	4100 (81.10)	
Female	953 (18.90)	0
Month		
January	830 (16.40)	
Februay	798 (15.80)	
March	942 (18.60)	0
April	851 (18.80)	
May	913 (18.10)	
June	720 (14.20)	
Area/District		
Peshawar	4205 (83.20)	
Khyber & Kurram agency	234 (4.63)	
Charsadda	217 (4.29)	
Afghanistan	113 (2.24)	0
Mohmand Agency	87 (1.72)	
Nowshera	69 (1.37)	
Other areas	129 (2.55)	
Location in Peshawar District		
Bada Bera	394 (7.80)	
Chamkani	228 (4.51)	
Ormor	214 (4.23)	
Warsak road	178 (3.52)	5 (0.10)
Yaka Toot	159 (3.10)	
Dala Zak road	145 (2.90)	
Bakhshi Pul	128 (2.50)	
Other areas (47 areas)	4035 (79.84)	
Source animal/rodent type		
Dog	3961 (78.40)	
Rat	826 (16.30)	
Other (rabid cow or human, cats, donkey, horse, monkey, pig, jackal, wolf, and mongoose)	266 (5.30)	
		01 (0.00)
Type of animal		
Stray	2607 (51.56)	
Pet	2441 (48.36)	6 (0.08)
Site of bite		
Left-arm	1606 (31.80)	
Left leg	1571 (31.10)	
Right leg	823 (16.30)	
Right arm	727 (14.40)	9 (0.20)
Back	116 (2.30)	
Head	102 (2.00)	
Chest	57 (1.10)	
Abdomen	27 (0.50)	
Multiple regions	16 (0.30)	
Exposure category		
Cat II: Nibbling of uncovered skin, minor scratches or abrasions, licks on non-intact skin	3902 (77.20)	
Cat III: Single or multiple transdermal bites, scratches/conta mination of mucous membranes	206 (4.10)	*830 (16.40)
Cat I: Touching or feeding animals and human cases; licks on intact skin	116 (2.30)	
Type of treatment given		
**ARV + TT + Antibiotic	4013 (79.40)	
#TT + Antibiotic	830 (16.40)	1 (0.00)
ARV + TT + Immunoglobulin + Antibiotic	210 (4.20)	
ARV + TT + Immunoglobulin + Antibiotic	210 (4.20)	

Note: The absolute frequency distribution of each variable sums up to 5,054 and percentages to 100% *Rat-bite cases were not classified in the WHO exposure category, thus showing as # missing values ** ARV: Anti Rabies Vaccine TT: Tetanus Toxoid

Most of the dog bite cases belonged to areas that are outskirts of Peshawar i.e. Bada bera, Chamkani, Warsak road, Ormor, Dala Zak road, Kohat road, Charsadda road, Shabqadar, Ashab Baba, Hazar Khwani, Nahqay Kharkay, and Khazana. Of the inner walled city areas, Yakatoot had the most cases of dog bites. Additionally, most of the rat-bite cases belonged to areas of inner walled Peshawar city i.e. Yakatoot, Qissa Khwani, Hashtnagri, Ramdas and Ganj gate. Other areas for the majority of rat bites were: Peshawar inner city like Gul Bahar, Haji camp, and outskirts of Peshawar i.e. Hazar khwani, Shero Jhangay, Laday Sarak, Patang chowk, Pajagi road and from Nothia Cantt area.

During the six months study period, dog bites were on the top of the list of bites (78.40%), followed by rat bites (16.30%). Bites by other domestic and wild animals were a distant third (5.3%). As shown in the figure below, there was a mildly decreasing trend in dog bites between Jan–Jun 2018 with peak cases in Mar. In the case of bites by rats, a linear trend was observed with a peak number of cases in May. A mildly increasing trend in warmer months was observed in bites by other animals. The sudden peak of cases by other animals in May 2018 was due to the clustering of cases in Bada Bera village from exposure to a rabid cow

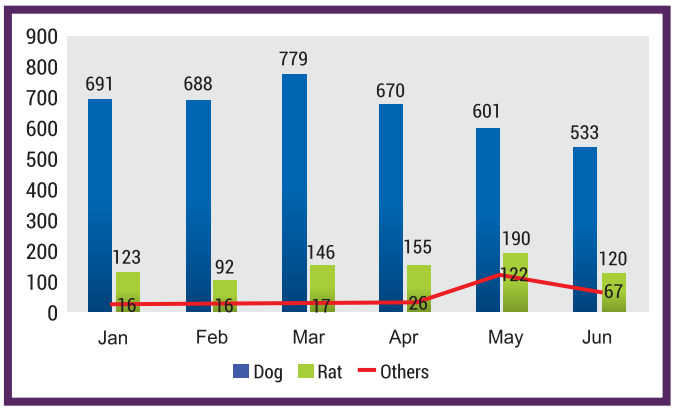


Figure 2. The caseload of mammalian bites in patients attending the animal bite clinic (n=5054)

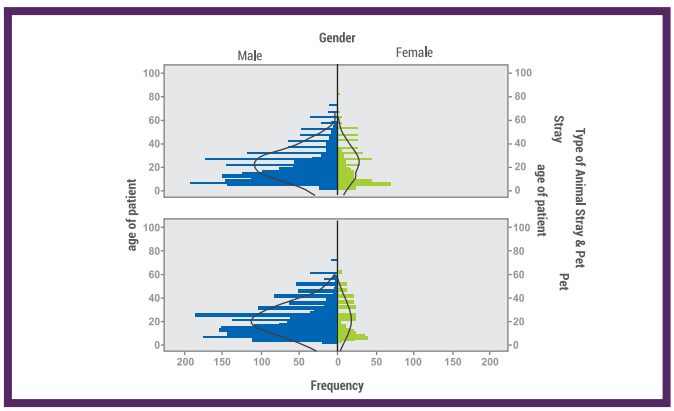


Figure 3. Population pyramid concerning the gender and type of animal in patients attending the animal bite clinic (n=5054)

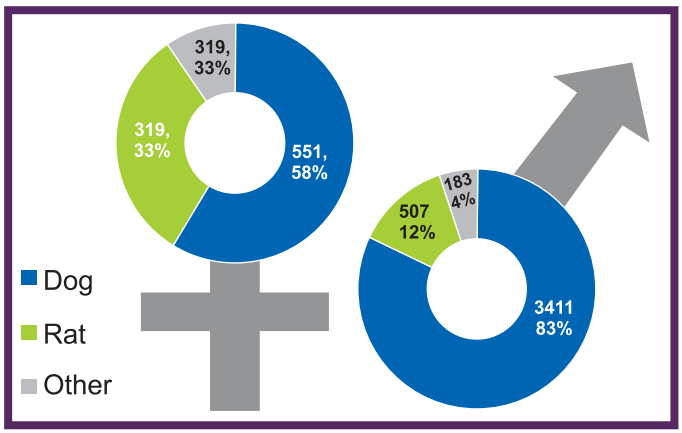


Figure 4. Gender differences in the type of animal biting 2018 (N=5054)

In both genders, dog bite was the commonest with a higher preponderance in males as compared to females (83% vs. 58%). On the contrary, rat bites and bites by other animals were more common in females (Figure 4).

The results of cross-tabulations between gender and type of animal show that males had almost equal proportions of being bitten by stray and pet animals (49.60% vs. 50.40 % respectively), whereas females had a high proportion of being bitten by the stray animals (60.02%) as compared to pet animals (39.0%). The difference between these groups was statistically significant using the Pearson Chi square test (p-value 0.000). Furthermore, of the total

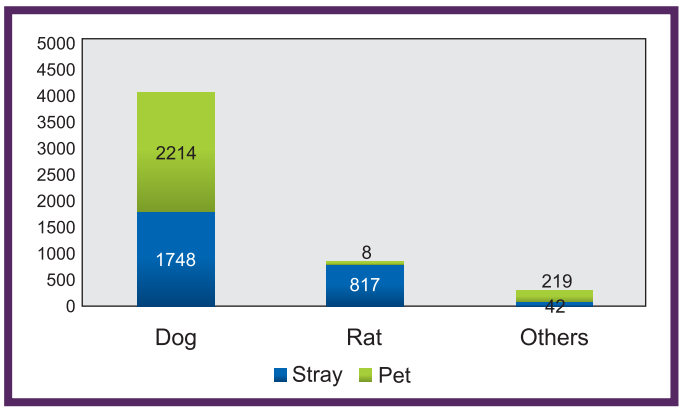


Figure 5. Distribution of type of animal (pet or stray) in various biting animal categories (N=5048)

patients bitten by dog, 44% (n 1748) were bitten by stray dogs, while 56% (n 2214) by pet dogs. 84% (n 219) of bites by other animals like cats, horses, and donkeys were caused by pet animals whereas 16% (n 42) by stray animals (figure 5).

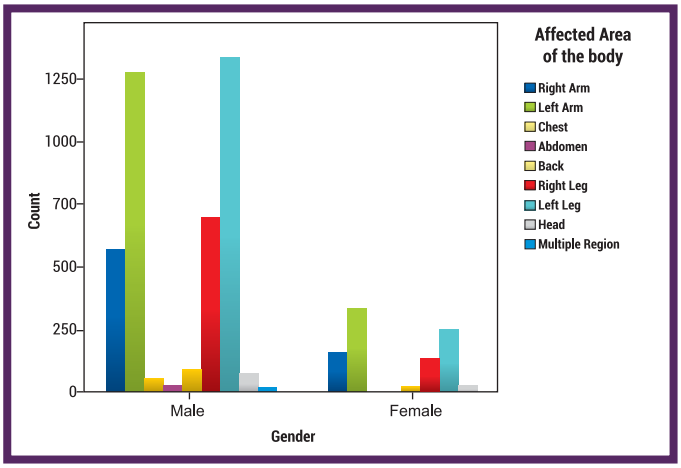


Figure 6. Distribution of gender and part of the body bitten (n=5054)

Right and left upper limbs were predominantly affected in both genders followed by right and left lower limbs (figure 6). Males had higher proportions of injuries to the back, head, chest and multiple regions as compared to females. The differences between the groups were statistically significant.

Furthermore, cross-tabulation between the type of animal and topographical location shows that in both stray and pet animals, predominantly upper and lower extremities were bitten. While in patients bitten by stray animals, there was a higher proportion of injuries on head & multiple regions. Besides, there was an increased proportion of

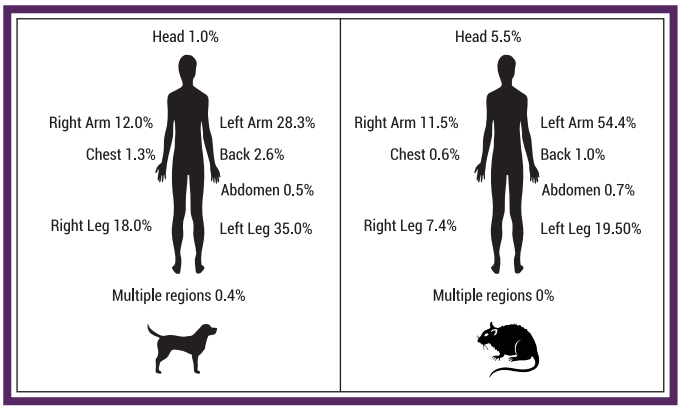
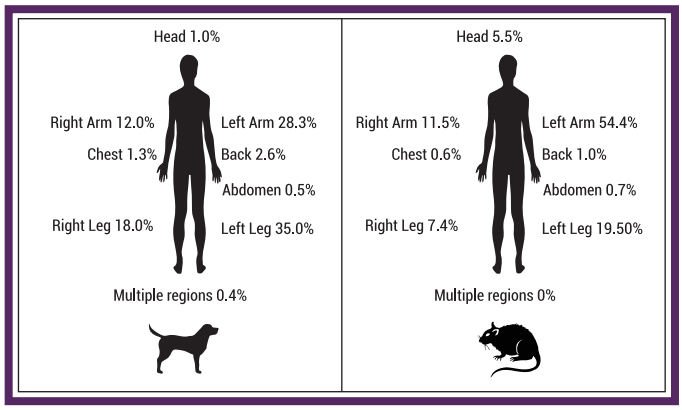


Figure 7. Topographical distribution of bites by dogs and rats in patients attending the animal bite clinic (N=4788)

cases being bitten on the chest by pet animals in contrast to stray. The differences between the groups were statistically significant.

The percentage distribution of patient body areas affected by dog and rat bites respectively is shown in Figure 7. Left arm and leg were primarily involved in bites by both dogs



and rats. On the other hand, chest and back were more frequently injured by dog bites, whereas head in rat bites.

The predominant exposure category in both pet and stray animals was category II i.e. nibbling of the exposed parts and abrasions, while almost all the cases of exposure I category were caused by pet animals (figure 8). In contrast, all category III exposure cases with multiple injuries, blisters, and exposure to mucous membranes were caused by stray animals. The differences between the groups were statistically significant.

Additionally, exposure category II i.e. nibbling of the uncovered skin and abrasions was the major method of transmission in case of bites by dogs and 'other' animals (n= 3891, 92.40% cases), followed by single or multiple transdermal lesion or exposure to mucus membranes (n=206, 4.90% cases). The right arm was most frequently involved in exposure I category i.e. touching or feeding rabid human or cow (these constituted a total of 2.7 % cases). In this category, almost all the cases (115 out of the

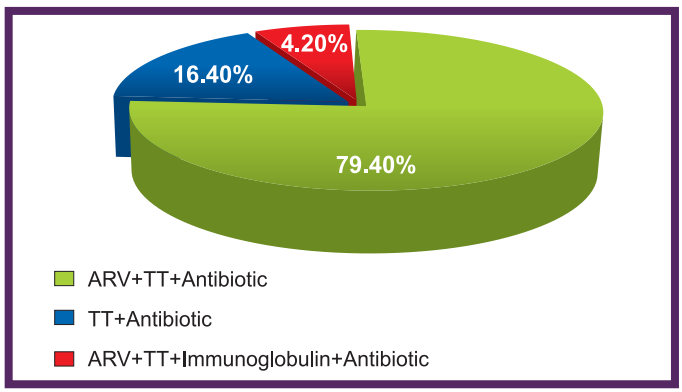


Figure 9. Percentage of type of treatment provided to patients attending the animal bite clinic (N=5054)

total 116) were through contact with a known rabid cow. Upper & lower extremities on both sides and head regions were involved more in single or multiple blisters or mucous membrane lesions as compared to the chest, abdomen, and back. Note that in this study rat bites were not classified according to WHO exposure category (i.e.

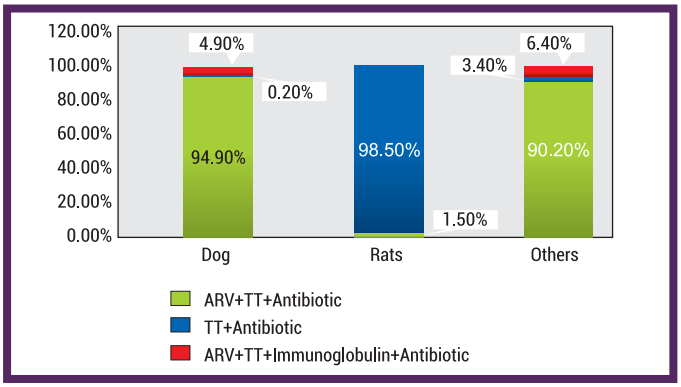


Figure 10 Distribution of the type of treatment received and type of mammalian bite in patients attending the animal bite clinic (N=5053)

this classification applies to bites by domestic and wild animals capable of causing rabies. Rabies due to rats is extremely rare and domestic rats are not known to cause rabies. [16,17,21]

Of the total patient, 79.40% patients were treated with Antirabies vaccine (ARV) + tetanus toxoid (TT) + antibiotics (mostly category I and II patients), 16.40% with TT + antibiotic and 4.20% with ARV + TT + Immunoglobulin + antibiotics (almost all category III patients) as shown in Figure 9.

On further analysis, it was found that patients bitten by dogs were predominantly given ARV + TT + antibiotic regimen, followed by ARV + TT + antibiotic + Immunoglobulin. Rat bites patients received antibiotics + TT. Patients with bites from cats, donkeys, monkeys, and other wild animals received ARV + TT + antibiotics as seen in Figure 10.

Furthermore, ARV + TT + antibiotic + Immunoglobulin treatment was mainly provided in bites by stray dogs, indicating that the bites of stray dogs involved more of single or multiple transdermal blisters and mucous membrane injuries as compared to the pet animals. Males had a higher proportion of transdermal blisters and mucous membrane exposure and thus had a higher proportion of cases treated with ARV, TT, Antibiotic and ARV immunoglobulin as compared to females. The differences between the groups were statistically significant as shown by Pearson Chi square test (P-value 0.000).

DISCUSSION

The study shows a high caseload in ED, LRH due to animal bite cases primarily due to dogs (78%) followed by the rats (16%), and other animals including cats (6%). Another study in eight Asian countries, including Pakistan, India, and Bangladesh also shows that majority of patients presenting at rabies prevention centers were bitten by dogs (84%) followed by cats (12.5%).[25]

The overall male-female ratio of the animal bite was high at around 4:1 in this study and is comparable to another multicenter study in Pakistan that found a dog-bite ratio of 4.9:1 in males versus females.[26] In this study, males had a higher prevalence of bites by dogs, whereas females had a greater occurrence of rat bites and bites by other animals (mostly domestic animals like cats and cows). It shows that Pakistani males were largely the victim of mammalian bites probably because of the socio-cultural factors, whereby they have greater mobility and women have much stricter mobility outside the confines of home.[26] They were more exposed to dog bites, while women because of being more at home had a higher likelihood of being bitten by domestic animals and rats. A review of studies in the US also showed that males were more often bitten than females probably because of their higher likelihood of coming in contact with dogs and also because often they prefer dogs more as pets as compared to females.[27] Another study in Chile also found that 53% of the bitten patients were male.[2]

Regarding the severity of the bite, in the present study, it was found that bites to male patients were more likely to be category III, involving the head, chest and multiple regions and associated with stray dogs indicating that males suffered serious injuries as compared to females. Around 17% of cases were in children under 5 years, and around half of the bite victims were under 18 years in this study. It also shows that children under 5 years were also bitten more by stray dogs. A review of 9 studies in the US also revealed that children were more frequently bitten than adults, with a higher proportion in children <10 years as compared to older children.[27] Also, the proportion of fatal dog bites was higher in the young age group, probably because of their inability to protect themselves.[3, 27] Another study in Chile also found that children aged 6-10 years made the highest proportion of cases.[2]) A multi-center, multi-country study in Asia (including Pakistan) showed that 43% of patients presenting at the rabies prevention centers were under 18 years of age.[25] In another study in Pakistan, around 63% of the bitten patients were under 18 years of age, and their authors opine that this high caseload in a young age group may be due to their provocative or playful but an unintentionally threatening behavior towards dogs coupled with an inability to protect themselves.[3, 26]

A study in Pakistan found that 31% of patients presenting with dog bites at the Civil Hospital, Karachi was the result of inciting the animals i.e. walking near a bitch with puppies, inadvertently stepping on a dog and beating the dog.[28] This study also found an association between provoking the animals and the higher likelihood of getting category three injuries on high-risk areas of the body.[28] The higher likelihood of children being bitten by dogs could also be due to their higher frequency of contact with dogs.[27]

The present study shows that males had almost equal proportions of being bitten by stray and pet animals, whereas females had a high proportion of being bitten by stray animals as compared to pet animals. Other studies have shown a higher preponderance of bites occurring in the domestic environment by owned animals.[2] A review article on the characteristics of dog bites reveals that owned dogs are more likely to cause severe and non-severe bites to their owners.[27] Owners can be at high risk as they are more likely to approach dogs, often quite fearlessly.[27] This article also narrates that pet dogs were larger and delivered serious and numerous bites to head, face and neck as compared to stray dogs.[27]

Concerning bite location, this study found that upper and lower extremities were the most frequent sites, a finding that is consistent with other studies.[2, 3, 27] One study found that pet dogs are more likely to bite on the face, head, and neck, whereas, un-owned dogs on the hands.[27] Other studies have demonstrated a higher likelihood of injury to the face and scalp in younger age victims.[2, 3, 5]

In the current study, the second commonest cause of bites was due to rats. A previous study by Fatima et.al assessed the risks of rodent bites during the 2016 rat-bite epidemic in Peshawar, based on geospatial estimates of rat-bite patients from the Lady Reading Hospital.[21] This study was carried out during a period of rat epidemic, whereby a total of 1747 cases were registered at the ED, LRH from Jan – Aug 2016 with around 7-10 patients daily. Almost all these patients had the history of sleeping on the floor.[18, 21] Fatima et.al showed that the majority of patients belonged to the old city area of Peshawar which is the same as our study.[21] It could be due to factors like urbanization, dense population, distance from roads and water channels that affects rats' distribution and activity.[21] Variations in the natural habitat, poor hygienic conditions, improper disposal of food and solid waste, faulty sewage, presence of grain godowns, proximity to roads, and long-distance transport of freight are some factors related to urbanization that contribute to rats infestation and biting incidents.[21]

In the present study, almost all the exposure I category cases were the result of touching or feeding rabid human or animal cases, and these were treated with the ARV, TT immunization and antibiotics even though WHO does not recommend treatment in exposure I category. In literature, PEP over-treatment has been documented and there seem to be a few probable motives behind it.[7, 14] For instance, PEP in such cases may be directed to reduce the anxiety and fear in the patient and their relatives for developing the universally fatal disease rabies, if untreated.[7] In Pakistan, healthcare workers often face social pressure for prescribing irrationally on behalf of patients and their relatives who visit the hospital. When probed, the authors found that almost all of these were cases where a large number of villagers had category I exposure to a rabid cow on the occasion of wheat threshing in the village (Bada Bera). Despite reassurance to these patients that rabies is not likely to be transmitted in this case, the health workers at the study setting had to provide ARV to all these patients for prophylaxis and patient satisfaction. Additionally, often the source dogs are not available for observation or quarantine and no one knows their probability of having rabies.[7, 29] In such cases, all patients should receive immediate wound treatment and Antirabies prophylaxis.[7] Human to human rabies transmission has not been confirmed except in cases of organ transplant and perinatal transmission[7]. Other possible routes include biting and exposure of mucosal surfaces or non-intact skin with infectious material from a human case.[7]

Likewise, under treatment is also an issue as far as dog bite management is concerned.

Other studies in Pakistan have also documented gaps in knowledge of health care workers regarding correct exposure classification, treatment, and documentation.[26, 28, 29] In the present study, all category II patients received ARV, TT and antibiotics and all the category III exposure cases received ERIG apart from ARV, TT, and antibiotics. However, other studies have documented inadequate wound wash and care and lack of RIG provision to category III patients, increasing the patients' likelihood of getting rabies.[25, 28, 29] Globally, the animal bite incidence is 0.5 – 1% and it is quite common to have bites, licks, and abrasion from exposure to animals like dogs, who may be non-rabid even in a rabies endemic setting.[7] It thus necessitates careful weighing of the risk of getting rabies, versus over or under-treatment. This is only possible through increased awareness of local disease epidemiology, surveillance and reporting, knowledge of the animal species, clinical features and availability of the biting animal for quarantine and testing.[7] Healthcare workers must be trained in the management of animal bites including administration of the vaccine and immunoglobulin.[28] Expert pre-prophylaxis consultations and use of algorithms to guide the healthcare workers can reduce the costs incurred by unnecessary treatment.[7, 14] Wherever possible, the risk posed by the animal must be assessed by trained personnel.[7]

WHO does not recommend dangerous nerve tissue-derived anti-rabies vaccine that is still being used in parts of India and Pakistan.[8, 10] A positive aspect in the management of dog bite cases at the ED, LRH was that a purified Vero cell culture vaccine — a safe and effective vaccine recognized by the World Health Organization (WHO) — was used. This vaccine is supplied in enough quantities to the secondary and tertiary care hospitals by the government and is given free of cost to the patients. Its stock-outs were infrequent but did occur recently[23] and need to be fully eliminated in the future. Furthermore, RIG is not provided to the public sector hospitals by the government. As rabies is undoubtedly deadly, appropriate wound care and PEP remain the mainstay of its management, thus there is a dire need to give priority to providing RIG (human or equine) to the public sector hospitals as it incurs huge out of pocket expenses to the poor. Furthermore, it is not known whether the RIG that is available in the local market in Peshawar, purchased by the patients themselves is potent or not. There are no checks on the cold chain of the local pharmacies and there are long hours of electricity breakdowns with no backup. There have been reports on ineffective vaccines being given to patients in a hospital in Karachi, Pakistan.[29]

To the best of the author's knowledge, at present, there is no animal bite control and awareness program in the province. Targeted interventions are required for the areas of Peshawar (inner city, old city, Nothia Cantt and outskirts) from where most cases of animal and rodent bites were reported. These include measures to control dog and rodent population, dog vaccination, public awareness regarding prevention of bites that focuses also on the symptoms of rabid animals, vaccination of pet animals and first aid wound care. Moreover, the ED LRH being the main referral hospital for cases from all over KP as well as Afghanistan needs particular strengthening in terms of support to its animal bite clinic, supplies of vaccines and immunoglobulin. To help healthcare workers in triaging, decision making and avoiding unnecessary PEP, algorithms for assessing rabies risk following a potential bite, keeping in view Pakistan's ecology and disease epidemiology, should be developed and displayed in the facilities providing treatment.

This is perhaps the first epidemiological study to determine the characteristics of mammalian bites in patients presenting to the EDs in KP, Pakistan and thus addresses the knowledge gap in this regard. Also, the sample size was high, and the data was of good quality, thereby giving findings of this study high internal validity. The results of the study can be safely generalized to the patient population presenting at the tertiary care facilities in the KP, and other provinces of Pakistan. Its generalizability to other settings in the subject to the viewer's discretion based on similarities in the context.

LIMITATIONS

The study is based on the hospital records of patients presenting with the animal bite at the ED, LRH, meaning that the sample may not be representative of the entire population whereby not all the patients present to the hospital. As the sample was not selected randomly from the population the possibility of selection/ascertainment bias cannot be ruled out. The type of patients visiting the tertiary care hospital may be different than those in the community at large. Many patients visit traditional healers, alternative medicines or opt for home treatment as well and may not present to tertiary care hospitals. Furthermore, the patients' characteristics may differ in that those with more serious injuries, those having financial and logistical access to the hospital and those who have better awareness visit the hospital. In addition, as bites are often underreported, thus the prevalence obtained by this study may be an underestimate. This study should be supplemented with research by sampling subjects in a wider population. Likewise, this study could not assess the circumstances of the bite, the animal behavior and whether it was quarantined, as well as any treatment received before coming to ED, LRH. Mixed method studies with the better design are further recommended.

CONCLUSION

This study demonstrates that a significant proportion of patients with mammalian bites (predominantly dog and rat bites) visit the ED, LRH daily. Even though the patients are provided with the best possible care at the hospital, this study highlights that there is a need to further strengthen the clinical services in this regard through the provision of uninterrupted supplies of vaccines, immunoglobulin and staff training. Also, commitment and multi-sectorial interventions are required to address the root causes of this public health concern and its prevention on a higher scale.

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