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ORIGINAL PAPER

Assessment of behavior and barriers of post-exposure prophylaxis for prevention of rabies in patients attending a tertiary care center in eastern India – a mixed method approach

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ABSTRACT

Introduction and aim. Rabies from animal bites, although preventable, is almost 100% fatal, with the dog being the most common infected animal. Several factors influence the timely initiation of post-exposure prophylaxis (PEP) which needs to be explored. This study aimed to determine the facilitating and inhibiting factors in initiating PEP among animal bite victims attending a tertiary care center in Eastern India.

Material and methods. A cross-sectional study was conducted among 150 consenting animal bite victims attending casualty and medicine as out-patients in a tertiary care hospital. A mixed-method study approach was undertaken to explore the facilitating and inhibiting factors for the timely initiation of PEP using a pre-tested and semi-structured questionnaire and in-depth interviews. Data were analyzed using SPSS software version 20.

Results. The most common biting animal were dogs (96.2%). Around 102 patients (68%) were males and 48 (32%) were females. Timely initiation of PEP was seen in 112 (74.7%) of the study sample while delay was seen in 38 (25.3%). The inhibiting factors were the absence of an accompanying person (54.67%), the absence of vaccines and immunoglobulins in the nearest health facility (50.67%), referral from other health facilities (44%) and preferred other modalities of treatment (24.67%). Delays in initiation of PEP was significantly associated with gender (p=0.018), place of residence (p<0.001), those living more than 20 km from a health facility (p=0.014), educational status (p<0.001), and those with monthly income <10000 INR (p<0.01).

Conclusion. Lower economic status, education, and accessibility to health facilities were major inhibiting factors causing a delay in the initiation of PEP. Further, community-based studies are warranted.

Keywords. animal bite, behavior, cost, delay, post-exposure prophylaxis, rabies

Introduction

India is endemic for rabies. Rabies is almost 100% fatal, with the dog being the most common biting animal.[1] Globally, dog-mediated rabies causes about 59,000 deaths, out of which 35% occur in India, thereby making it the country with the highest fatality in Asia and the second highest in the world.[2] Although cases of dog bites constitute a problem of considerable magnitude, not all victims of a dog bite seek timely medical help. Unquestionably, the community's level of knowledge and concern about dog bite injuries has an important role in dealing with this problem.[3] People have very basic knowledge or have a misconception about rabies and its prevention. There are many myths and false beliefs associated

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with wound management. These include the application of oils, herbs and red chilies on the wounds inflicted by a rabid animal, and faith in indigenous medicines that have unproven efficiency.[4] Rabies is a costly disease mainly because of the costs of post-exposure treatment (PET) in humans and vaccination programs in animals. Post-exposure treatment in humans accounts for the highest proportion of the costs of rabies control measures.[5] Though in our institution vaccines as well as immunoglobulin are given free of cost, still, it is presumed that multiple visits by the victims to the health center for vaccination may impose a financial burden. Although many articles were found regarding the awareness and knowledge of wound management and rabies, there is a lack of literature about the factors influencing the timely initiation of post-exposure prophylaxis (PEP) in animal bite victims. Also, there are very few studies on the indirect cost involved in PEP.

Aim

This study was undertaken to determine the various factors influencing the timely initiation of anti-rabies PEP. We have also tried to ascertain the first aid measures adopted to the victim's post-animal bite and the indirect cost involved in PEP.

Material and methods

This study was a hospital-based cross-sectional study conducted in the casualty and medicine department of Kalinga Institute of Medical Sciences (KIMS), a tertiary care center in Bhubaneswar, Odisha. The World Health Organization (WHO) has categorized contact with suspected rabies-infected animals into three categories: category I (no exposure) – animal licks on intact skin, contact while feeding or touching the animal, category II (exposure) – nibbling of exposed skin, small, non-bleeding scratches or abrasions, and category III (severe exposure) – one or more transdermal bites or scratches, animal lick saliva contaminating mucous membranes or broken skin, and exposures from direct bat contact. The intramuscular 5-dose regimen is followed for anti-rabies PEP at KIMS. According to the regimen, 0.5 mL of anti-rabies is administered intramuscularly (over the deltoid) on days 0, 3, 7, 14, and 28.[6] The victims are treated in casualty during the first visit and in the medicine department on an outpatient basis during subsequent follow-up visits. The cost of the anti-rabies vaccine is Rs. 400/dose and that of immunoglobulin is Rs. 300. The anti-rabies vaccine and immunoglobulin are provided to animal bite victims at the casualty and subsequent doses at General Medicine on an outpatient basis. All 150 animal bite victims presented to the hospital between April and June 2023 were included in the study through the universal sampling method. The selection of the study setting was a hospital keeping accessibility and follow-up of the animal bite patients in mind. Inclusion criteria: animal bite victims providing informed consent and patients available for follow-up. Exclusion criteria: re-exposure cases of animal bites for PEP. Before the study commenced, ethical clearance was obtained from the Institutional Ethical Committee (approval number: KIMS/KIIT/IEC/1325/2023). Informed consent was taken from all study participants and consent from parents if the victim was less than 18. A mixed-method study approach was undertaken to explore the facilitating and inhibiting factors for the timely initiation of PEP using a pre-tested and semi-structured questionnaire and in-depth interviews. For our study, the delay in the initiation of anti-rabies PEP was defined as starting the PEP schedule greater than or equal to 24 hours post-animal bite. Data were compiled into Microsoft Excel and analyzed using SPSS version 20 (IBM, Armonk, NY, USA). Descriptive data were interpreted as frequencies and percentages. The chi-square test was applied to determine the association between factors associated with delay in initiation of PEP. A p-value less than 0.05 was considered to be statistically significant.

Results

A total of 150 animal bite victims were interviewed. There were 126 adults and 24 children. Among the study populations, 74.7% (112) were males (97 adults and 15 children) and 25.3% (38) were females (29 adults and 09 children). The most common biting animal were dogs (96.2%). Around 67.3% were from urban areas and 83.3% were literate. Timely initiation (treatment initiation within 24 hours) of PEP was seen in 74.7% of the study sample while delay was seen in 25.3% of the study population. The inhibiting factors were the absence of an accompanying person (54.67%), the absence of vaccines and immunoglobulins in the nearest health facility (50.67%), referred from other health facilities (44%), and preferred other modalities of treatment (24.67%). Table 1 depicts the various inhibiting and facilitating factors associated with the timely initiation of PEP.

The most common site of the bite was the lower limb (56, 37.33%), in both adults and children. The most common category of bite was category II (81, 54%). Delay in initiation of PEP was significantly associated with gender ($p=0.018$), place of residence ($p<0.001$), those living more than 20 km from a health facility ($p=0.014$), educational status ($p<0.001$), and those with monthly income <10000 INR ($p<0.01$). Table 2 depicts the association between socio-demographic and clinical variables with timely initiation of PEP.

Concerning first-aid measures, the majority of the victims washed their wounds with soap (142, 94.67%), followed by washing with running tap water (136, 90.67%) and applying anti-septic cream (112, 74.67%). Around 19 (12.67%) applied turmeric paste while 6 (4%) applied chilly-oil paste. Table 3 further lists the different first aid measures undertaken by the animal bite victims.

Table 1. Factors influencing timely initiation of anti-rabies PEP

Inhibiting factors delaying timely initiation of PEP	Frequency, n (%)
Work pressure	31 (20.67)
Unaware of PEP	27 (18)
Lack of money	48 (32)
Lack of transport	22 (14.67)
Lack of drugs in the nearby health facilities	76 (50.67)
Referred to other health facilities	66 (44)
Lack of accompanying person	82 (54.67)
Confidence in alternate modalities of treatment	37 (24.67)
Facilitating factors favoring timely initiation of PEP	
Aware of the PEP	123 (82)
Easy access to health facilities	101 (67.34)
Peer pressure	27 (18)
Unknown status of previous vaccination	16 (10.67)

Table 2. Association between sociodemographic and clinical variables with timely initiation of PEP*

Factors affecting acceptance of early treatment		< 24 hours (n=112)	≥ 24 hours (n=38)	Chi-square (p)a
Gender	Male	82	20	5.524 (0.018)
	Female	30	18	
Residence	Urban	92	09	44.083 (0.00001)
	Rural	20	29	
Distance from health facility	<20 km	22	15	6.0047 (0.014)
	≥ 20 km	90	23	
Educational status	Illiterate	09	16	23.7124 (0.00001)
	Literate	103	22	
Monthly income	<10000 INR	11	18	25.6484 (0.00001)
	≥10000 INR	101	20	
Site of bite	Head/neck	10	11	9.6473 (0.022)
	Upper limb	43	12	
	Trunk	15	03	
	Lower limb	44	12	
Type of animal bite	Dog	105	35	0.1485 0.928
	Cat	05	02	
	Others	02	01	
Category of bite	I	02	04	30.3743 (0.00001)
	II	49	32	
	III	61	02	

* [a] – Chi-square test used to measure association

Table 3. First aid measures undertaken by the animal bite victims*

First aid measures after an animal bite	Frequency n (%)a
Applied nothing	25 (16.67)
Washed with stagnant water	14 (9.34)
Washed with running tap water	136 (90.67)
Washed with soap	142 (94.67)
Applied antiseptic cream	112 (74.67)
Applied chilly-oil paste	06 (4)
Applied turmeric powder/ paste	19 (12.67)
Any tablets (antibiotics, analgesics, etc.)	34 (22.67)

* [a] – total % age may be >100% because of multiple responses by the subjects

The indirect cost involved in anti-rabies PEP ranged between 650–3600 Indian Rupees in total. The factors responsible were mainly wage loss, transport, cost due to other medications, and cost of indigenous treatments. Table 4 shows the median cost and range of cost for each factor involved.

Table 4. Indirect Cost involved in anti-rabies PEP

Factor	The median cost in INR	Range
Cost for transport	400	200–1400
Cost of wage loss	700	600–2100
Cost of any other medications	300	150–900
Cost of traditional/indigenous treatments	200	100–250
Total cost	1100	650–3600

Discussion

The study was conducted among 150 animal bite victims visiting a tertiary care center for anti-rabies PEP. There were 74.7% males and 25.3% females. A preponderance of males was also seen in a study done by Puwar.[7] The cause could be attributed to males staying outdoors and taking risks more often. The most common biting animal was a dog, seen in 96.2% of victims. The less common biting animals were cats and monkeys. A similar prevalence was also reported by Joseph et al. with dogs being the most common biting animal.[8] Around 67.3% were from urban areas and 83.3% were literate. A majority of the victims, i.e., 75.33% resided more than 20 km from any health facility, which made timely access to PEP difficult. The most common site of the bite was the lower limb (56, 37.33%) followed by the upper limb (55, 36.67%). This was consistent with the findings of a study done by Khan et al., Esmaeilzadeh et al., and Puwar.[7,9,10] The most common category of bite was category II (81, 54%). A study by Wani et al. also reported category II as the most common type of bite.[5] A study by Joseph et al. however, reported category III as the most common type of bite.[8]

Prompt initiation of PEP is extremely essential because rabies is a 100% fatal disease. In our study, around 74.7% of the victims started PEP within the first 24 hours, while a delay was seen in about 25.3% of victims. Inferior findings were reported by studies done by Puwar, and Liu et al. with only 58% and 35.3% of animal bite victims reported to the health facility within 24 hours respectively.[7,11] Studies by Esmaeilzadeh et al. and Ganasva et al. reported superior findings where 85.9% and 80% of animal bite victims received PEP within 24 hours respectively.[10,12]

The inhibiting factors delaying prompt initiation of PEP in our study were the absence of an accompanying person (54.67%), the absence of vaccines and immunoglobulins in the nearest health facility (50.67%), victims referred from other health facilities (44%), and preference for modalities of treatment (24.67%). Referral to

other health centers because of the non-availability of PEP in the nearest health facility not only caused a delay in prompt initiation of PEP but also indirectly increased the overall expenditure due to added time and travel. A report by an anti-rabies clinic of a government hospital in Chennai has mentioned reasons like loss of wages, forgotten dates, distance from the health center, and incurred expenditure for the delay in initiation of PEP.[13] A similar study in the urban slums of Chennai reported wage loss and overlapping of school timings as reasons for delays in initiating PEP.[14] Prompt and timely initiation of PEP is essential for neutralizing the rabies virus and preventing its spread to the central nervous system.[15] The delay in initiation of timely PEP was significantly associated with gender (p=0.018), place of residence (p<0.001), distance more than 20 km from a health facility (p=0.014), educational status (p<0.001) and monthly income <10000 INR (p<0.01). Similar statistical significance was reported in various other studies.[5,16,17]

The majority of the victims in our study washed their wounds with soap (142, 94.67%), followed by washing with running tap water (136, 90.67%) and applying anti-septic cream (112, 74.67%). Around 19 (12.67%) applied turmeric paste while 6 (4%) applied chilly-oil paste. Around 16.67% of victims did not apply any first-aid measures. Similar findings were reported by Singh A. et al. who reported that 67% of animal bite victims washed their wounds with soap and water while 26% of victims believed in the application of herbal medicines (turmeric, chilly, etc.).[18] Puwar, in their study, also found that only 39.4% of animal bite victims washed their wounds correctly with soap and water. Around 60% of victims applied items like snuff, chili powder, tobacco, tea, and toothpaste over the wounds, which was quite alarming.[7] A study by Venkatesan et al. also reported around 36% of victims cleaned their wounds with soap and water and 21% applied irritants like lime, ash, onion, etc.[19] Several other studies in pan-India have also reported the application of irritants like turmeric, chilly, oil, etc. over bite wounds by victims.[20-22]

The indirect cost involved in anti-rabies PEP was Rs. 1100 ranging between Rs. 650–3600. The factors responsible were mainly wage loss, transport, cost due to other medications, and cost of indigenous treatments. A study by Ramya reported similar findings in their study where the indirect cost involved in PEP was around Rs. 1350 (IQR Rs. 1050–1750). The factors involved were travel expenses, loss of wages, and other expenses like food, etc.[23] Another study was done by Ravish in Bangalore who compared the economic burden of PEP in a government and private hospital and reported that the total median cost incurred by the victims at the Government hospital was Rs. 585 (IQR Rs. 444–725) and that in Private hospital was Rs. 5200 (IQR Rs. 4900–5701). This included both direct and indirect costs of PEP.[24] The economic burden affects compliance with PEP and hence indirectly causes delays in the timely initiation of PEP. Establishing more anti-rabies clinics at all levels of health care and ensuring the availability of vaccines and immunoglobulin is warranted. Conversion of the intramuscular route of the anti-rabies PEP schedule to the intradermal route can also reduce the number of visits to the health facility, thus reducing the indirect cost.

Study limitations

Since our study was hospital-based, the findings cannot be generalized to the whole community. Using these findings as a baseline, further robust community-based studies need to be planned to get more clarity on the research question. Also, animal bite victims who did not visit the hospital for vaccination could not be assessed and the reasons for no vaccination could not be evaluated. The selection of the study setting was a hospital keeping accessibility and follow-up of the animal bite patients in mind.

Conclusion

Despite the availability of affordable anti-rabies vaccination in India, several socio-demographic, economic (both direct and indirect cost), and accessibility-related issues hamper the timely and prompt initiation of PEP. The groups most likely to experience delay are female gender, rural habitats, those residing >20 km from a health facility, those illiterate, and lower socio-economic status. The application of turmeric powder and chilly oil paste over bite wounds shows the prevalence of myths and misconceptions about first-aid measures for animal bite wounds. Increasing awareness regarding the importance of timely PEP, debunking myths and misconceptions about wound management, and increasing the availability of more anti-rabies clinics at all levels of healthcare are warranted to reduce delay in seeking PEP and to reduce the economic burden for poor communities. Cost-effective and sustainable strategies like mass dog vaccination can also aid in curbing rabies at source.

Declarations

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Author contributions

Conceptualization, I.D. and P.S.P.; Methodology, I.D., R.N. and P.S.P; Software, I.D. and P.S.P; Validation, I.D. and P.S.P; Formal Analysis, I.D. and D.M.; Investigation, I.D. and P.S.P; Resources, I.D. and D.M.; Data Curation, I.D., R.N. and P.S.P; Writing – Original Draft Preparation, I.D. and R.N.; Writing – Review & Editing, P.S.P.,

B.K.B. and S.N.; Visualization, I.D. and P.S.P.; Supervision, B.K.B. and S.N.; Project Administration, I.D., R.N., P.S.P., B.K.B. and S.N.

Conflicts of interest

The author(s) declare no competing interests.

Data availability

Since it is sensitive data, it can be shared with the journal and reviewers upon request.

Ethics approval

All subjects gave informed consent for inclusion before participating in the study. The study was conducted under the Declaration of Helsinki, and the protocol was approved by the Ethics Committee of Kalinga Institute of Medical Sciences (KIIT/KIMS/IEC/1325/2023).

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