

Original Research Article

When every hour counts: reasons for delay in rabies post-exposure prophylaxis in a tertiary healthcare center in central India

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ABSTRACT

Background: Timely initiation and completion of post-exposure prophylaxis (PEP) following animal bite is critical to prevent rabies, a uniformly fatal but vaccine-preventable disease. Despite availability of effective vaccines, delays in initiation and administration of PEP are frequently reported in India. Objective was to describe the various reasons for delay in initiation and administration of PEP following animal bite.

Methods: A hospital based cross-sectional study was conducted among animal bite victims attending the anti-rabies clinic of GMC Nagpur from 10th June to 10th September 2024. Data were collected using a pre-tested structured questionnaire on socio-demographic profile, characteristics of the bite, and reasons for delay in seeking or receiving PEP. Descriptive statistics were used to summarize findings.

Results: A total of 184 animal bite cases were enrolled, of whom 86% experienced delay in initiation of PEP. Socio-economic distribution showed that more than two-thirds of participants belonged to the middle and lower-middle classes (69.6%), with very few from upper strata (1.1%). Dogs were the predominant biting animal (90.2%) with most common bite sites being hands (35.9%) and legs (25.5%). Major reasons reported for delay included referral to other health centers (22.8%), facility closed (17.9%) and non-availability of vaccine at local health facilities (16.3%).

Conclusions: Multiple individual, social, and system-related barriers contribute to delay in initiation and administration of PEP. Strengthening awareness campaigns, improving accessibility and uninterrupted availability of vaccines, and community-level counselling are essential to ensure timely prophylaxis and prevent rabies deaths.

Keywords: Animal bite, Barriers, Delay, Post-exposure prophylaxis, Rabies

INTRODUCTION

Rabies is a zoonotic disease caused by *Lyssavirus* and is one of the most fatal infectious diseases known.¹ It is transmitted through the bite, scratch, or lick of a rabid animal, mainly from warm-blooded carnivorous species. These include domestic animals such as dogs and cats, as well as wild animals like jackals, wolves, bears, and tigers.^{2,3} The virus is present in the saliva of an infected animal and gains entry through a wound or breach in the skin, spreading via peripheral nerves to ultimately infect the brain.^{1,4}

The incubation period is variable, most commonly ranging from 3 to 90 days, and is influenced by the

proximity of the bite site to the brain. Hydrophobia is a hallmark symptom of rabies, while other features include aerophobia and respiratory distress.⁵ Rabies has no known treatment and is almost invariably fatal once symptoms appear.^{1,5} It contributes to significant mortality worldwide, accounting for 59,000 deaths annually of which 95% burden is from Africa and Asia and in India 5700- 20,000 deaths annually contributing to 36% burden globally as estimated by WHO.^{6,7} Thus, becoming significant public health concern. Consequently, prevention remains the most effective strategy in combating rabies mortality, and the World Health Organization (WHO) has prioritized global rabies prevention.^{1,8}

Although incurable, rabies can be effectively prevented through timely and appropriate post-exposure prophylaxis (PEP). As per the National Rabies Control Programme (NRCP) guidelines, PEP should be initiated promptly, along with proper wound management.^{9,10} Wounds are classified into three categories: Category I: contact with intact skin- no need for anti-rabies vaccine (ARV) or rabies immunoglobulin (RIG). Category II: minor scratches without bleeding- ARV is required. Category III: Single or multiple wounds with bleeding or contact with mucosa- ARV along with RIG is recommended.

Accurate wound classification and timely PEP administration are crucial for complete protection against rabies. The Government of India emphasizes ensuring the availability of PEP at all health facilities to enable immediate initiation after exposure. However, various socio-cultural practices- such as applying turmeric, oil, or salt to wounds, dietary restrictions, and superstitious beliefs- often delay the initiation and uptake of PEP.¹¹⁻¹⁵

Therefore, the present study aimed to describe the various reasons for delay in initiation and administration of post exposure prophylaxis following animal bite.

METHODS

Study design and setting

A hospital-based cross-sectional study was conducted between 10th September and 10th October 2024 at the anti-rabies vaccination clinic (OPD No. 92) of Government Medical College and Hospital, Nagpur, a tertiary care center in Central India. The clinic provides comprehensive post-exposure prophylaxis (PEP) services. All animal bite patients were evaluated through detailed history-taking and wound examination, and categorized according to the World Health Organization (WHO) classification. As per category, appropriate PEP was administered, including tetanus toxoid (TT), anti-rabies vaccine (ARV), and anti-rabies immunoglobulin (RIG). The intradermal regimen of ARV consisting of four doses was the preferred schedule at the clinic.

Study population

The study included all animal bite patients attending the anti-rabies vaccination clinic during the study period and consenting to participate.

Sample size and sampling technique

The sample size was calculated using findings from a previous study by Wani et al, which reported that 20% of bite victims were unaware of PEP as a cause for delay. Taking a 95% confidence interval, 6% absolute precision, and using the formula $n = Z^2pq/d^2$, the required sample size was estimated at ~170. A total of 184 participants were eventually recruited using a consecutive sampling technique.

Data collection tool and procedure

Data were collected using a semi-structured, pre-tested questionnaire. Information was obtained on socio-demographic characteristics, animal bite history, and reasons for delay in initiation of PEP. Delay was defined as initiation of PEP more than six hours after the animal bite.

Data analysis

Data were entered in Microsoft Excel and analyzed using Jamovi v2.6 software. Categorical variables were summarized as frequencies and percentages.

Ethical considerations

Written informed consent was obtained from all study participants after explaining the purpose of the study.

RESULTS

Out of 184 study subjects, nearly two-thirds were males (65.8%) and the majority were urban residents (75.5%). Most respondents (69.9%) resided within 10 km of the hospital, suggesting relatively good geographical accessibility. However, despite proximity, delays were still reported, highlighting the influence of factors beyond distance. Socio-economic distribution showed that more than two-thirds of participants belonged to the middle and lower-middle classes (69.6%), with very few from upper strata (1.1%). This reflects the predominantly middle- and lower-income background of bite victims seeking PEP (Table 1).

Table 1: Distribution of study subjects according to socio-demographic characteristics.

Variables	Number	Percentage
Gender		
Male	121	65.8
Female	63	34.2
Residence		
Urban	139	75.5
Rural	45	24.5
Distance from hospital		
Less than 10 km	128	69.9
More than 10 km	56	30.4
Socio-economic status		
Upper	2	1.1
Upper middle	40	21.7
Middle	66	35.9
Lower middle	62	33.7
Lower	14	7.6

Dogs were the predominant biting animal (90.2%), followed by cats (5.4%) and monkeys (1.6%), consistent with established epidemiology of rabies exposures in

India. The most common bite sites were hands (35.9%) and legs (25.5%), which are highly innervated areas with increased risk of rabies transmission. A significant proportion (88.6%) of bites were category III, necessitating both vaccine and rabies immunoglobulin, indicating that most victims had severe exposures. Regarding time to hospital presentation, more than half (55.4%) reported within 6-48 hours, but 30.4% presented after 48 hours, underscoring substantial delays in accessing timely care (Table 2).

Table 2: Distribution of study subjects according to animal bite characteristics.

Variables	Number	Percentage
Site of bite		
Hands	66	35.9
Legs	47	25.5
Trunk	18	9.8
Thighs	12	6.5
Feet	12	6.5
Arms	11	6
Head	7	3.8
Legs and thighs	4	2.2
Legs and feet	2	1.1
Neck	1	0.5
Arms and hands	1	0.5
Hands and legs	1	0.5
Head and neck	1	0.5
Trunk and thighs	1	0.5
Type of animal		
Dog	166	90.2
Cat	10	5.4
Monkey	3	1.6
Others	5	2.7
Category of bite		
Category II	21	11.4
Category III	163	88.6
Time since bite (in hours)		
2-6	26	14.1
6-48	102	55.4
>48	56	30.4

The leading causes of delay were health system-related factors such as referral to other centers (22.8%), closure of OPD at the time of visit (17.9%), and non-availability of immunoglobulin at peripheral facilities (16.3%). Personal reasons such as work-related constraints (14.1%), lack of awareness about PEP (8.7%), and financial/transportation issues (3.2%) were also reported. Interestingly, 13.6% reported seeking care immediately after the bite, suggesting that system barriers, rather than individual negligence, played a major role in delayed prophylaxis (Table 3).

Figure 1 illustrates the distribution of animal bite victims according to the time elapsed before reporting for post-exposure prophylaxis (PEP). Only 26 patients (14.1%)

reported within 6 hours of the bite, reflecting prompt health-seeking behavior. More than half, 102 patients (55.4%), reported between 6 and 48 hours, indicating moderate delay but still within a manageable timeframe for PEP initiation. Alarming, 56 patients (30.4%) presented after 48 hours of exposure, representing a significant delay that increases the risk of rabies transmission. These findings emphasize that while the majority of victims sought care within two days, a substantial proportion still experienced considerable delays in accessing timely prophylaxis (Figure 1).

Table 3: Distribution of study subjects according to the reason for delay in initiation and administration of PEP following animal bite exposure.

Variables	Number	Percentage
Referral to other health centre	42	22.8
OPD closed	33	17.9
Lack of immunoglobulin at periphery	30	16.3
Work	26	14.1
Came within 6 hours after animal bite	25	13.6
Unaware about post exposure prophylaxis	16	8.7
Unavailability of person to accompany	6	3.3
Lack of money	5	2.7
Lack of transport	1	0.5

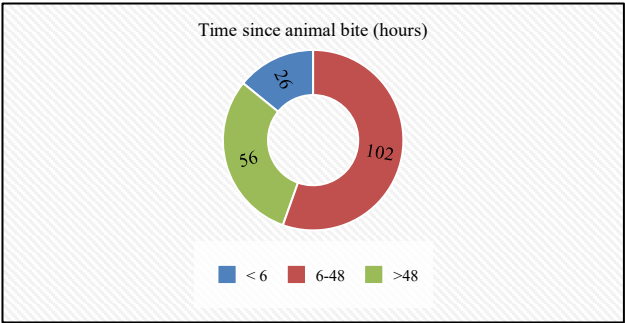


Figure 1: Time since animal bite.

Figure 2 depicts the distribution of delay in reporting for post-exposure prophylaxis (PEP) following animal bite, stratified by bite category. Among category II exposures, all 21 cases reported with a delay, while no patient presented within the recommended time. In contrast, among category III exposures, 137 cases (84%) reported late, while only 26 cases (16%) reported without delay. The findings highlight that delays were highly prevalent across both exposure categories, with particularly alarming patterns in category II cases where no timely reporting occurred. Despite the higher perceived severity of category III bites, the majority still reported after the recommended time window, underscoring systemic and behavioral barriers in seeking prompt PEP (Figure 2).

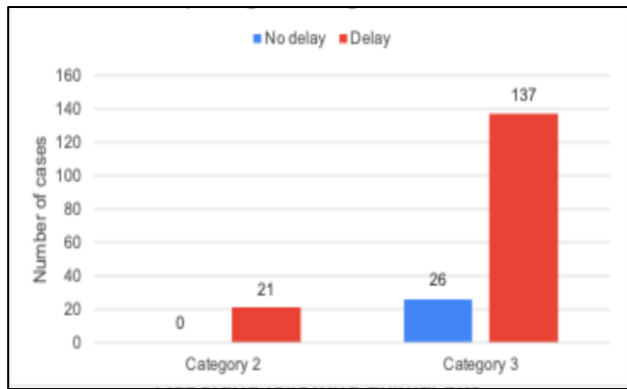


Figure 2: Reporting following animal bite.

DISCUSSION

In this study, we found that a substantial proportion of animal bite victims experienced delays in initiation and administration of post-exposure prophylaxis (PEP). The reasons span across personal, socio-demographic, and health-system factors. Below we discuss these findings in light of existing literature and implications for practice.

Comparison with other studies

Our findings are broadly similar to those reported in other Indian and international studies. For instance, Wani et al. in Kashmir found that many victims from rural areas, those living more than 10 km from anti-rabies clinics, and lower-income families had significant delays in PEP initiation.^{6,16} In Pune, a study observed a 25.14% prevalence of delay (≥ 48 hours) in PEP initiation; key determinants were gender, residence, type of biting animal, and non-availability of vaccine in peripheral hospitals.¹⁷ In eastern Uttar Pradesh, residence (rural), younger age, and type of biting animal were significantly associated with delayed PEP initiation.¹⁸

Studies outside India also echo similar barriers. A large cross-sectional study in Wuhan, China identified lack of knowledge, lower education, and misconceptions about rabies as major contributors to delayed care; despite clinics being relatively accessible, delays were common.¹⁹ Another Iranian study showed that deeper wounds tended to prompt earlier presentation, whereas bites by less-feared or “less serious” animals led to delays.²⁰

Interpretation of our results

Awareness and knowledge

One of the strongest factors in our cohort was lack of awareness about the need for immediate PEP. This aligns with Pune study (46.2% cited lack of knowledge as a reason for delay) and the Wuhan study showing low knowledge among less educated persons leading to delayed or improper wound treatment.^{17,19}

Geographic accessibility and transport

Distance to facility, travel difficulties, and non-availability of vaccine or immunoglobulin at peripheral centers featured prominently in our data. This is mirrored in Wani et al in Kashmir, where rural residence and long distances were significant. In Pune, unavailability of vaccine in peripheral hospitals was among the top reasons.^{6,16}

Health system issues

Facility hours (closed OPD), referral to other centers, unavailability of immunoglobulin etc., in your study indicate that system-level bottlenecks play a major role. These are also seen in other studies. For example, the Pune study flagged vaccine unavailability; Wuhan study flagged deficiencies in wound management and delays in the system.^{11,16-18}

Socio-demographic factors

Lower education, rural residence, possibly gender roles (e.g. females may have more constraints in mobility or work) are consistent determinants elsewhere.^{12,13}

Severity of exposure

It is often observed that category III or more severe exposures prompt more urgent action; less severe exposures may be undervalued. In several studies, deeper or more severe wounds had less delay because victims perceive greater risk.

Public health implications

The aggregate of our findings suggests that reducing delay in PEP requires multi-pronged interventions:

Awareness campaigns targeted especially in rural areas, among lower socio-economic and educational strata. Use mass media, local health workers, schools.

Decentralization of services: ensuring vaccine and immunoglobulin availability at more accessible peripheral centers; ensuring OPD/clinics have hours that accommodate people working during typical hours.

Transport and access support: possibly mobile clinics or community outreach; or linking bite victims to nearest centers without too much travel.

Strengthening health-system supply chain: ensuring vaccine/injectable RIG stock, avoiding referrals or closures.

Education of health providers: to ensure that people who present are counselled immediately re urgency, understand exposure category etc.

Limitations of this study are: as with most hospital-based studies, our sample excludes those bitten who never present to health facilities; thus, true delay in community may be even larger. Some socio-economic or behavioral variables (e.g., beliefs, prior experiences) may be inadequately captured.

CONCLUSION

In sum, our study adds to the evidence that delays in initiation and full administration of PEP are driven as much by health system gaps as by individual factors. To move toward the global “zero by 30” rabies elimination target, emphasis must be placed on improving awareness, access, and health system readiness.

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