

ORIGINAL ARTICLE

Medicine Science 2025;14(3):859-63

Rabies post-exposure prophylaxis in adult patients presenting to the emergency department: A retrospective study

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Received 18 June 2025; Accepted 04 August 2025

Available online 01 September 2025 with doi: 10.5455/medscience.2025.06.163

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Abstract

This retrospective cross-sectional study aimed to evaluate the clinical characteristics, risk categorization, and post-exposure prophylaxis (PEP) practices among adult patients who presented to the emergency department due to suspected rabies exposure. A total of 249 patients aged 18 years and older who received at least one dose of rabies vaccine between April 2024 and March 2025 were included. Data regarding demographic features, exposure types, animal characteristics, vaccination status, prophylaxis regimen, and tetanus management were collected and analyzed. The mean age was 33.8 years, and 53.4% of the patients were female. Most exposures (79.9%) involved animals that were either unidentified or had escaped, with cats being the most common species in higher-risk categories. According to national rabies guidelines, patients were classified into exposure categories I–III; no cases met Category IV criteria. While rabies vaccination was appropriately administered in most cases, deviations from guideline recommendations were observed. Notably, some low-risk patients received unnecessary prophylaxis, while rabies immunoglobulin was underutilized in certain high-risk cases. Tetanus prophylaxis was administered to the majority of patients, yet vaccination histories were often undocumented. The findings highlight both strengths and inconsistencies in clinical practice, emphasizing the need for stricter adherence to national rabies management protocols and improved documentation. This study contributes to the growing body of evidence supporting structured, category-based PEP implementation in emergency settings.

Keywords: Rabies, post-exposure prophylaxis, emergency department, vaccine, rabies immunoglobulin

Introduction

Rabies is an acute, fatal zoonotic disease caused by a *Lyssavirus* genus virus of the *Rhabdoviridae* family [1,2]. The virus is transmitted to humans primarily through the saliva of infected animals, most commonly via bites, and affects the central nervous system, leading to encephalitis. Since rabies is almost 100% fatal once clinical symptoms appear, post-exposure prophylaxis (PEP) is of vital importance [3,4].

According to the World Health Organization (WHO), approximately 59,000 people die from rabies each year, with the vast majority of these deaths occurring in Asia and Africa [5,6]. More than 95% of rabies cases are caused by dog bites, and individuals living in rural areas—especially children—are at higher risk [4,6]. In Türkiye, approximately 250,000 potential rabies exposure cases are reported annually, and an average of

1–2 confirmed rabies cases are observed each year [7].

Rabies prophylaxis is a treatment protocol that must be initiated as soon as possible after exposure. This protocol includes wound care, tetanus prophylaxis, rabies vaccination, and, when necessary, the administration of rabies immunoglobulin (RIG). According to the guidelines of the WHO and the Turkish Ministry of Health, the rabies vaccination schedule after potential exposure consists of four doses on days 0, 3, 7, and 14 for immunocompetent individuals. However, additional doses may be required in immunocompromised patients [7,8].

Emergency departments play a critical role in initiating and monitoring post-exposure prophylaxis for suspected rabies exposures. Among adult patients, the effectiveness of prophylaxis and adherence to the vaccination schedule directly influence treatment success. Nevertheless, unnecessary administration of

CITATION

Yildirim H, Kaya M, Yildiz Yucebas I. Rabies post-exposure prophylaxis in adult patients presenting to the emergency department: A retrospective study. *Med Science*. 2025;14(3):859-63.



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vaccines or immunoglobulin can impose additional costs and burdens on both healthcare systems and patients [1,4]. Therefore, evaluating the demographic characteristics, exposure types, prophylaxis compliance, and clinical outcomes of adult patients receiving rabies prophylaxis is of great importance for both clinical practice and public health.

The aim of this study is to evaluate the clinical characteristics, prophylaxis adherence, and treatment outcomes of adult patients who received and were followed up for rabies prophylaxis in the emergency department (ED). By identifying areas for improvement in the management of suspected rabies exposures, the study aims to contribute to the development of more effective and efficient rabies prophylaxis practices.

Material and Methods

Study Design and Setting

This retrospective cross-sectional study was conducted in the ED of a tertiary care hospital with an annual patient volume of approximately 182,000. The study included adult patients who presented to the ED and received rabies post-exposure prophylaxis (RPEP) between April 1, 2024, and March 31, 2025.

Patient Selection

Patients aged 18 years or older who presented to the ED for suspected rabies exposure and received at least one dose of rabies vaccine (RV) were included. Inclusion criteria were as follows:

- Presentation to the ED due to rabies-suspected exposure,
- Administration of at least one dose of RV,
- Complete and accessible medical records.

Exclusion criteria were:

- Patients under 18 years of age,
- Incomplete medical records or follow-up data,
- Individuals with previously completed full-dose rabies vaccination who did not require additional prophylaxis.

Data Collection

Patient data were retrospectively retrieved from the hospital information system and medical records. The following variables were collected: demographic characteristics (age, sex, comorbidities), details of the exposure (type of animal, vaccination status of the animal, urban or rural setting), rabies exposure category (I, II, III, IV), season of admission and clinical management (number of RV doses administered, use of RIG, and tetanus prophylaxis).

Statistical Analysis

All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) software, version 27.0.1 (IBM Corp., Armonk, NY, USA). Continuous variables such as age were expressed as mean ± standard deviation (SD), while categorical variables were presented as frequencies and percentages. Descriptive statistics were used to summarize the

demographic features, exposure characteristics, rabies exposure categories, and prophylactic interventions of the patients.

Ethical Considerations

This study was approved by the Non-Interventional Clinical Research Ethics Committee of Kütahya Health Sciences University (Approval No: 2025/05-08, dated 07 April 2025). All procedures adhered to the principles outlined in the Declaration of Helsinki. Due to the retrospective and anonymized nature of this study, the requirement for informed consent was waived.

Results

Patient Characteristics

A total of 249 patients who received RPEP in the ED during the one-year study period were included. The mean age of the patients was 33.8 years (SD±15.5). Of these, 133 patients (53.4%) were female and 116 (46.6%) were male.

Comorbid conditions were present in 46 patients (18.5%), while 203 (81.5%) had no known comorbidity. Prior completion of a full rabies vaccination schedule was noted in 48 patients (19.3%), whereas 201 (80.7%) had no prior full-dose vaccination history.

Regarding the animals involved in the exposures, the majority (79.9%, n=199) were reported as escaped or unidentified. A smaller proportion of cases involved animals that were owned and vaccinated under observation (5.6%, n=14), owned but unvaccinated (7.6%, n=19), stray and unvaccinated (5.6%, n=14), or stray and vaccinated (0.4%, n=1). Only two animals (0.8%) were confirmed dead or euthanized after the incident (Table 1).

Table 1. Demographic and clinical characteristics of the patients

Age	33.8±15.5	
Sex		
Male	116	46.6%
Female	133	53.4%
Comorbid condition		
Yes	46	18.5%
No	203	81.5%
Prior full-dose RPEP status		
Yes	48	80.7%
No	201	19.3%
Animal status		
Escaped, unidentified	199	79.9%
Dead or killed	2	0.8%
Owned, vaccinated, under observation	14	5.6%
Owned, unvaccinated, under observation	19	7.6%
Stray, vaccinated, under observation	1	0.4%
Stray, unvaccinated, under observation	14	5.6%

Values are presented as number (percentage) unless otherwise stated; Age is shown as mean±standard deviation; RPEP: rabies post-exposure prophylaxis

Seasonal Distribution of Presentations

Throughout the study period, the seasonal distribution of suspected rabies exposures was relatively balanced. The highest number of cases occurred in the spring (28.1%), followed by summer (24.3%), autumn (24.3%), and winter (23.3%) (Figure 1).

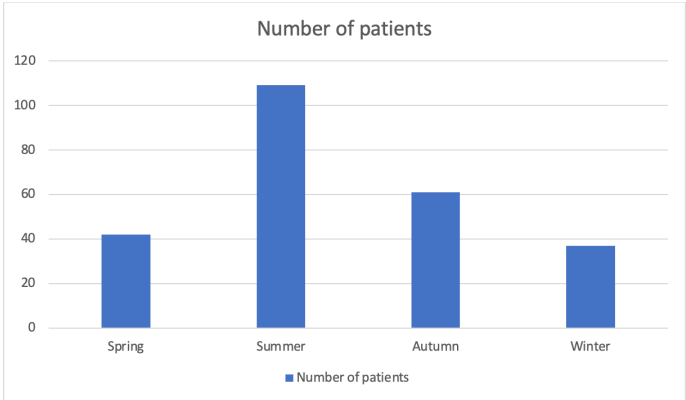


Figure 1. Seasonal distribution of patients presenting with suspected rabies exposure; Spring: March-May, Summer: June-August, Autumn: September-November, Witer: December-February

Exposure Categories and Clinical Management

Patients were categorized into rabies exposure risk levels based on the national guidelines of the Turkish Ministry of Health. Although four exposure categories exist, no cases fell into Category IV; therefore, only Categories I to III were included in the analysis. Among the 249 patients, 11 (4.4%) were classified as Category I, 60 (24.1%) as Category II, and 178 (71.5%) as Category III (Figure 2). Four doses of RV were most frequently administered across all categories: 90.9% in Category I, 56.7% in Category II, and 60.1% in Category III.

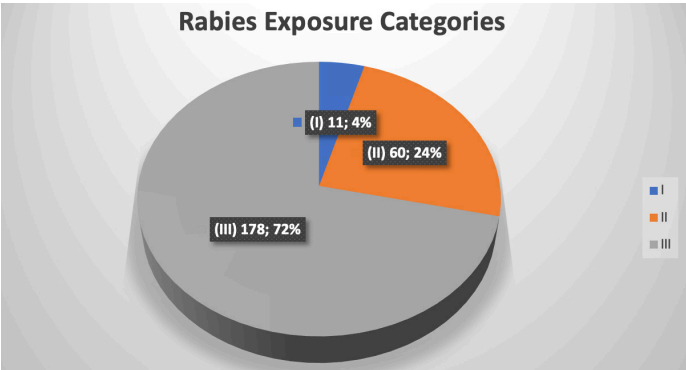


Figure 2. Distribution of patients according to rabies exposure categories

RIG was given to 10 patients (5.6%) in Category III and 1 patient (9.1%) in Category I. None of the Category II patients received RIG. Tetanus prophylaxis was applied in 72.5% of Category III cases, 75% of Category II, and 54.5% of Category I cases.

Most exposures occurred in urban areas across all categories. Cats were the most commonly involved animals in Category II (85%) and III (71.3%), while dogs were more frequent in Category I (45.5%) (Table 2).

Table 2. Comparison of rabies exposure categories (I, II, III) in terms of vaccination, prophylaxis, and patient characteristics

Category	I	II	III
RV doses administered, n (%)			
0	0 (0)	2 (3.3)	0 (0)
1	1 (9.1)	5 (8.3)	11 (6.2)
2	0 (0)	8 (13.3)	17 (9.6)
3	0 (0)	11 (18.3)	43 (24.2)
4	10 (90.9)	34 (56.7)	107 (60.1)
RIG administered, n (%)			
Yes	1 (9.1)	0 (0)	10 (5.6)
No	10 (90.9)	60 (100)	168 (94.4)
Tetanus prophylaxis, n (%)			
Yes	6 (54.5)	45 (75)	129 (72.5)
No	5 (45.5)	15 (25)	49 (27.5)
Place of RSE, n (%)			
Urban	9 (81.8)	47 (78.3)	149 (83.7)
Rural	2 (18.2)	13 (21.7)	29 (16.3)
Type of animal, n (%)			
Cat	6 (54.5)	51 (85)	127 (71.3)
Dog	5 (45.5)	9 (15)	45 (25.3)
Others	0 (0)	0 (0)	6 (3.4)

RV: rabies vaccine, RIG: rabies immunoglobulin, RSE: rabies suspected exposure

Discussion

This study evaluated the demographic characteristics, exposure details, and post-exposure prophylaxis practices among adult patients presenting to a tertiary ED with suspected rabies contact. The findings were interpreted in the context of current national guidelines and compared with previous studies conducted in Türkiye. The results provide insight into patterns of exposure, prophylactic management, and areas where clinical and public health interventions may be improved.

In the present study, 249 adult patients were evaluated over a one-year period in a tertiary ED. This number is lower than the 10,974 suspected rabies exposures reported by Tekyol et al. (collected between September 2017 and August 2018) across multiple hospitals in Istanbul [9] and the 813 cases recorded by Varışlı et al. (collected in the calendar year 2013) in a regional hospital that included both adults and children [10]. In contrast, Osman et al. conducted a smaller cross-sectional study with 108 participants (March–September 2019), focusing on knowledge and attitudes [11]. These differences reflect variation in rabies-related admissions across Türkiye depending on population structure, urbanization, and study design. While many previous studies have reported a male predominance—such as Guo et al. with 70% male cases in China, Oztoprak et al. with 58.4% male patients in Türkiye, and Frederickson et al. with 55.7% in the United States—our data showed a slightly higher proportion of female patients (53.4%) [12-14]. The mean age in our series was

33.8 years, compared to younger medians reported in similar research. These differences may be related to regional exposure patterns and the adult-only inclusion criteria of our study, which excluded pediatric cases where male dominance is typically more pronounced.

Seasonal patterns in rabies-risk exposures have been consistent across studies. Solmaz et al. reported the highest number of cases in summer (32.4%) and the lowest in winter (18.8%) [15]. Similarly, Can et al. found increased presentations in warmer months, particularly summer and autumn [3]. In our study, the majority of cases also occurred during summer (28.1%), supporting the notion that warmer seasons are associated with higher exposure risk due to increased outdoor activity.

In our study, cats were the most frequently involved animals, particularly in Category II and III exposures. This finding is consistent with urban-focused studies such as Özsemerci et al., who reported 55.2% cat-related and 44.3% dog-related exposures, while Söğüt et al. found dogs to be more common (61.3%) in southeastern Türkiye [16,17]. The predominance of cats in urban areas may be due to their high population, close human interaction, and lower vaccination oversight. A major issue across studies is the unknown or unverified vaccination status of the animals involved. Özsemerci et al. noted that even owned animals often lacked vaccination records [16]. Similarly, most animals in our sample were unvaccinated or undocumented, necessitating full prophylaxis. These findings highlight the need for improved veterinary monitoring and targeted vaccination efforts in urban areas.

Rabies exposures are frequently reported in urban areas, likely due to higher population density and a greater number of stray animals. International studies have highlighted the predominance of pet-related exposures in cities and the role of unvaccinated domestic animals [12,18]. National data similarly show a high rate of contact with stray animals. Yalçın et al. noted that none of the owned animals in pediatric cases were fully vaccinated, while Aydın and Aydın reported that 79% of exposures involved stray dogs or cats [19,20]. In our sample, most exposures occurred in urban settings, particularly within Category II and III, indicating the need for focused preventive efforts in metropolitan areas.

In our study, rabies risk exposures were stratified into four categories; however, since no cases fell under Category IV, the practical distribution resembled a three-tiered model. Prophylactic decisions were based on the Turkish Ministry of Health Rabies Guideline, which recommends no intervention for Category I, vaccination alone for Category II, and both vaccination and immunoglobulin for Category III, depending on the severity of exposure [7].

Nevertheless, all Category I patients received the RV, and immunoglobulin was administered to one patient in this group, although it was not indicated. In Category II, vaccination was appropriately administered in most cases, though a small number of patients also received immunoglobulin unnecessarily.

Among Category III patients, vaccine coverage was high, but immunoglobulin was not provided to all, even though it is recommended in cases involving deep or multiple wounds, mucosal exposure, or immunocompromised status. Similar discrepancies have been documented in previous national studies. Possible reasons for deviations from national prophylaxis guidelines may include variable clinician experience, inconsistent risk perception, and limited access to RIG in some settings. Altın et al. reported vaccine use in patients not meeting prophylaxis criteria, while Deveci et al. noted that immunoglobulin was administered to only 7.9% of cases, despite high rates of Category III-level exposures [21,22]. These findings emphasize the need for reinforced training and systematic application of national guidelines to improve adherence and ensure rational use of post-exposure prophylaxis.

Aydın and Aydın reported that 74.8% of patients with rabies-risk exposure received tetanus prophylaxis, indicating that this component is often considered in clinical settings [20]. However, Altunçekiç Yıldırım et al. found that immunization status was undocumented in 99.2% of cases, despite widespread vaccine use [4]. In the present series, tetanus prophylaxis was frequently administered, but vaccination history was not consistently recorded. According to the Turkish Ministry of Health guideline, tetanus risk must be assessed in all exposure cases, and appropriate action taken. These findings underscore the need for clearer documentation and more structured evaluation in routine practice [7]. Improved record-keeping could be achieved through standardized electronic documentation systems, staff training on risk assessment, and regular audits of vaccination records.

This study has some limitations. Its retrospective design may have resulted in incomplete data, particularly regarding vaccination history, tetanus status, and the rationale for prophylaxis decisions. The single-center, adult-only sample limits generalizability to pediatric populations and other settings. Additionally, the lack of a standardized exposure classification may have introduced inconsistencies in risk assessment. Long-term outcomes, such as clinical follow-up or confirmed protection status, were not evaluated, which limits assessment of the full effectiveness of post-exposure prophylaxis.

Conclusion

This study provides important insights into the clinical management of adult patients presenting with suspected rabies exposure in an ED setting. While vaccination coverage was generally high, notable deviations from national guidelines were observed, particularly regarding the use of RIG and the assessment of tetanus prophylaxis. The unnecessary administration of prophylaxis in low-risk exposures and the underuse of immunoglobulin in high-risk cases underscore the need for clearer risk classification and stricter adherence to established protocols. Furthermore, the frequent lack of documented tetanus immunization status points to a broader issue in the completeness and consistency of post-exposure evaluations. These findings underscore the importance of regular training, standardized

assessment tools, and systematic implementation of national guidelines to ensure effective clinical management and rational resource use in rabies prophylaxis.

Conflict of Interests

The authors declare that there is no conflict of interest in the study.

Financial Disclosure

The authors declare that they have received no financial support for the study.

Ethical Approval

This study was approved by the Non-Interventional Clinical Research Ethics Committee of Kütahya Health Sciences University (Approval No: 2025/05-08, dated 07 April 2025). All procedures adhered to the principles outlined in the Declaration of Helsinki.

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