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Original Research Article

Knowledge on rabies transmission, immunisation and wound management among medical undergraduate students at a medical institute in North India

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ABSTRACT

Background: Medical undergraduates, as future frontline healthcare providers, are instrumental in early detection, risk stratification, and management of rabies exposures. Evaluating their knowledge particularly regarding rabies transmission routes, WHO exposure categories, wound care, and post-exposure prophylaxis is vital for guiding educational interventions and enhancing clinical competencies in rabies prevention and control at both institutional and public health levels.
Methods: A cross-sectional study was conducted among 240 medical undergraduate students from King George's Medical University in Lucknow from May 2025 to July 2025. A pre-tested, semi-structured, self-administered questionnaire was sent as a Google form to all the participants via WhatsApp messaging app. All the participants responded to the questionnaire. Hence, the final analysis comprised of these 240 respondents.
Results: While medical undergraduates have strong knowledge of rabies causation, reservoirs, wound washing, and avoidance of harmful practices, there are misconceptions in understanding of categorizing the exposure, risk-based management, and intradermal vaccination protocols.
Conclusions: The findings suggest the importance of enhancing clinical scenario-based teaching and incorporating updated guidelines into medical curriculum to bridge these knowledge gaps.

Keywords: Immunisation, Medical undergraduates, Post-exposure prophylaxis, Rabies, Wound management

INTRODUCTION

Rabies is a fatal zoonotic viral disease, transmitted through the bites of infected animals predominantly dogs. Globally, rabies remains a neglected disease, approximately 59,000 people lose their lives to the disease every year, more than 95% of the affected people reside in Asia and African continents, and nearly 40% are children under the age of 15.[1-3] The World Health Organization highlights that dog-mediated rabies accounts for up to 99% of human cases across the world and affecting over 3 billion people living in rabies-endemic regions.[1]

India still stands at the epi-centre of the global rabies crisis, accounting for about one-third (35-36%) of all human rabies deaths, with estimates between 18,000 and 20,000 deaths every year.[4,5] low awareness, incomplete vaccination adherence (only 40% complete the full ARV schedule), and inadequate dog immunization under 50% of pet dogs are vaccinated continue to hinder eradication of rabies from the country.[4,5]

Rabies is 100% preventable through immediate wound cleansing, timely post-exposure prophylaxis (PEP).[1,2,6] Yet barriers such as poor surveillance, under-reporting (especially among children), and limited public health

infrastructure persist in many parts of India. In 2015, the WHO, FAO, OIE, and GARC launched the 'Zero by 30' global initiative, aiming to eliminate human deaths from dog-mediated rabies by 2030.[7,8] India's National Action Plan for Dog-Mediated Rabies Elimination (NAPRE) aligns with this vision, promoting a One Health approach encompassing mass dog vaccination, improved human and animal surveillance, and stronger collaboration across all the sectors.[7-9]

Medical undergraduates, as future frontline healthcare providers, are instrumental in early detection, risk stratification, and management of rabies exposures. Evaluating their knowledge particularly regarding rabies transmission routes, WHO exposure categories, wound care, and post-exposure prophylaxis is vital for guiding educational interventions and enhancing clinical competencies in rabies prevention and control at both institutional and public health levels.[10]

METHODS

A cross-sectional study was conducted among 240 medical undergraduate students from King George's Medical University in Lucknow from May 2025 to July 2025.

A pre-tested, semi-structured, self-administered questionnaire was sent as a Google form to all the participants via WhatsApp messaging app. All the participants responded to the questionnaire. Hence, the final analysis comprised of these 240 respondents and it was used to assess knowledge under the following domains, rabies causative organism, reservoir, and transmission routes; WHO-defined exposure categories; appropriate wound management and PEP protocols; knowledge of immunisation (site, route, use of rabies immunoglobulin).

Data were compiled, tabulated, and interpreted in frequencies and percentages. The data collected was entered into an Excel sheet and analysed using SPSS version 24. Sociodemographic data were presented using descriptive statistics wherever applicable. Data was represented in the form of tables and figures wherever necessary. Inferences were drawn to highlight gaps and strengths in students' knowledge.

RESULTS

Professional year

Most respondents were 2nd-year students (52.1%), with slightly fewer in 3rd year (47.9%).

Gender

Majority were male (63.3%) compared to females (36.7%).

The present study assessed the knowledge of medical undergraduate students on rabies transmission, immunisation, and wound management.

Almost all students (98.3%) correctly identified that rabies is caused by a virus, with an equally high proportion recognizing dogs as the primary reservoir in India. Similarly, 96.3% were aware that saliva is the most infectious body fluid of a rabid animal. However, when it came to transmission routes, while 65% associated rabies with animal bites, only a small proportion (13.3%) could identify all possible routes, including lick over broken skin and scratches, indicating that fundamental knowledge was strong, awareness of different transmission routes was limited (Table 1).

Table 1: Knowledge of medical students regarding aetiology of rabies (n=240).

Knowledge	Etiological factor	Response of students, N (%)
Rabies causative organism	Bacteria	4 (1.7)
	Virus	236 (98.3)
Primary reservoir host of rabies in India	Dogs	236 (98.3)
	Pigs	1 (0.4)
	Bats	2 (0.8)
	All of the above	1 (0.4)
Most infectious body fluid of a rabid animal	Saliva	231 (96.3)
	Blood	9 (3.8)
Transmission route of rabies by a host agent	Bite	156 (65.0)
	Lick over broken skin	51 (21.3)
	Bite and scratch	1 (0.4)
	All of the above	32 (13.3)

In case of awareness of WHO exposure categories, the findings revealed mixed results. While a large majority correctly identified Category I exposures such as touch by an animal (93.3%) and licking on intact skin (68.8%), the ability to categorize higher-risk exposures was comparatively weaker. For example, only 65-81.7% correctly identified Category II exposures such as minor abrasions and nibbling, and about 66.3-75% recognized Category III exposures such as licking over broken skin or contamination of mucous membranes. This demonstrates moderate awareness, but also highlights significant knowledge gaps in identifying and classifying high-risk exposures, which could have direct implications for clinical decision-making (Table 2).

When students were asked about appropriate wound management and prophylaxis for different exposure categories, the responses again showed both strengths and weaknesses. For Category I wounds, only 34.2% correctly responded that no intervention was necessary, with the majority unnecessarily recommending vaccination. In contrast, about 74% appropriately

identified wound washing with vaccination for Category II wounds, while 71.7% responded correctly for Category III wounds requiring wound management, vaccination, and rabies immunoglobulin (RIG). Similarly, around 70% of students knew that wild animal bites required complete prophylaxis including RIG. These results indicate a tendency to over-treat minor wounds, while showing better knowledge for higher-risk wounds and wild animal exposures (Table 3).

Table 2: Knowledge of medical students regarding WHO exposure categories (n=240).

Type of exposure	WHO Guideline for exposure category	Category I, N (%)	Category II, N (%)	Category III, N (%)	Don't know, N (%)
Touch by an animal	Category I	224 (93.3)	5 (2.1)	3 (1.3)	8 (3.3)
Lick on intact skin	Category I	165 (68.8)	69 (28.8)	2 (0.8)	4 (1.7)
Nibbling of uncovered skin	Category II	28 (11.7)	156 (65.0)	53 (22.1)	3 (1.3)
Minor abrasion without bleeding	Category II	19 (7.9)	196 (81.7)	22 (9.2)	3 (1.3)
Lick over broken skin	Category III	7 (2.9)	68 (28.3)	159 (66.3)	6 (2.5)
Contamination of mucus membrane with saliva	Category III	7 (2.9)	44 (18.3)	180 (75.0)	9 (3.8)

Table 3: Knowledge regarding guidelines for different wound categories and wild animal bite among medical students as per WHO guidelines (n=240).

Type of wound	WHO guideline for management according to exposure category	Do nothing, N (%)	Wound management, N (%)	(Wound management) + (Anti-rabies vaccination), N (%)	(Wound management) + (Anti-rabies vaccination) + (Rabies immunoglobulins), N (%)
Category I wound	Do nothing	82 (34.2)	145 (60.4)	8 (3.3)	5 (2.1)
Category II wound	(Wound management) + (Anti-rabies vaccination)	3 (1.3)	49 (20.4)	178 (74.2)	10 (4.2)
Category III wound	(Wound management) + (Anti-rabies vaccination) + (Rabies immunoglobulins)	4 (1.7)	2 (0.8%)	62 (25.8%)	172 (71.7%)
Wild animal bite	(Wound management) + (Anti-rabies vaccination) + (Rabies immunoglobulins)	5 (2.1)	14 (5.8)	53 (22.1)	168 (70.0)

Knowledge of wound management practices was good overall. Nearly all students (99.6%) recognized the importance of immediate wound washing, while about two-thirds (66.7%) supported the use of antiseptics. Furthermore, most students were aware that harmful practices such as suturing (82.1%) and cauterization (82.9%) should not be performed. This reflects a sound understanding of fundamental wound care measures, although misconceptions about the universal use of antiseptics remain (Table 4).

Post-exposure prophylaxis knowledge was generally satisfactory. A majority of students (85%) identified the deltoid as the correct site for vaccine administration, and 87.1% selected the intramuscular route. However, awareness of the intradermal route, which is cost-effective and endorsed by WHO in specific contexts, was low, with only 10.4% reporting it correctly. This highlights a need to update students on evolving prophylaxis guidelines (Figure 1 and 2).

Table 4: Knowledge regarding wound management among medical students (n=240).

Question	WHO guidelines	Yes, N (%)	No, N (%)
Wound Should be washed immediately	**Yes**	239 (99.6)	1 (0.4)
Antiseptics should be applied to wound	**Yes**	160 (66.7)	80 (33.3)
Immediately suturing the wound	**No**	197 (82.1)	43 (17.9)
Wound should be cauterized	**No**	199 (82.9)	41 (17.1)

Overall, the interpretation of results indicates that while medical undergraduates have strong knowledge of rabies causation, reservoirs, wound washing, and avoidance of harmful practices, there are misconceptions in understanding of categorising the exposure, risk-based management, and intradermal vaccination protocols.

These findings suggest the importance of enhancing clinical scenario-based teaching and incorporating updated guidelines into medical curriculum to bridge these knowledge gaps.

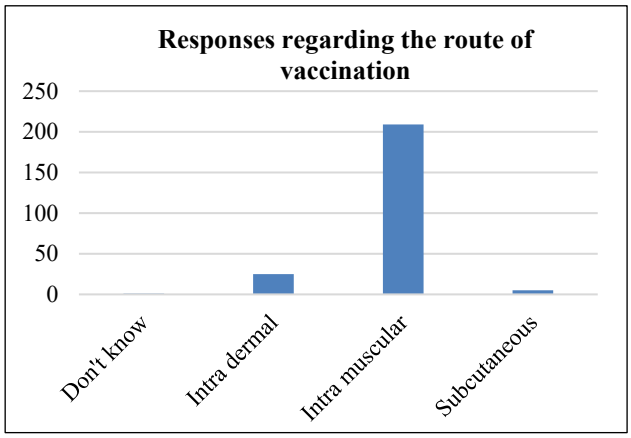

Figure 1: Knowledge regarding post-exposure prophylaxis among medical students and their responses regarding the route of vaccination.

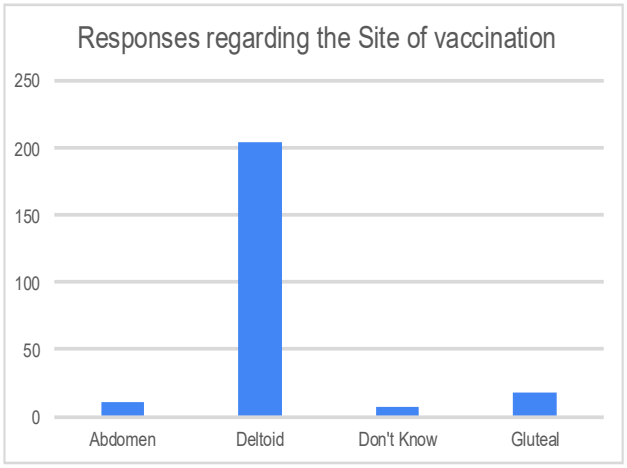

Figure 2: Knowledge regarding post-exposure prophylaxis among medical students and their responses regarding the site of vaccination.

DISCUSSION

The findings of this study highlight that undergraduate medical students have a good understanding of basic rabies epidemiology and causation and microbiology. Almost all students correctly identified rabies as a viral disease with dogs as the primary reservoir, and saliva as the infectious material. However, very less students recognised all routes of transmission, such as lick over broken skin or mucosal contact, which suggests the need for more comprehensive clinical scenario-based teaching. Awareness of WHO exposure categories which plays a crucial role in clinical risk assessment, was suboptimal-particularly for Category II and III exposures where appropriate PEP decisions are crucial. Misclassification of exposures may lead to either over-treatment of minor injuries or under-treatment of serious exposures, both of which have significant public health implications. Similarly, the tendency to recommend vaccination and immunoglobulin even for Category I injuries indicates a lack of confidence in risk categorisation.

Wound management knowledge was good, especially regarding immediate washing and avoiding contraindicated interventions like suturing and cauterization. This suggests that practical aspects of management are better retained. However, the one-third of students who advocated antiseptic use point to residual misconceptions that need to be addressed. Post-exposure prophylaxis knowledge was generally good, with most students correctly identifying the deltoid as the recommended site and intramuscular route for vaccination.

Nonetheless, knowledge of intradermal vaccination, a cost-effective and equally effective alternative recommended by WHO in certain settings, was low and requires inclusion in training. These findings are in line with previous studies from similar settings, which have consistently reported good basic awareness but poor depth of knowledge in clinical risk categorization and management protocols. As future frontline health providers, medical students must be equipped with the ability to accurately assess risk, categorise exposures, and provide appropriate PEP. Integration of more case-based discussions, simulation exercises, and field-based training into the curriculum could help bridge these gaps.

CONCLUSION

In conclusion, medical undergraduates demonstrated strong foundational knowledge of rabies aetiology and basic wound care, but important gaps remain in accurate exposure categorisation and risk-based post-exposure prophylaxis, particularly regarding intradermal vaccination. These deficiencies may lead to inappropriate clinical decisions. Incorporating updated, scenario-based, guideline-oriented teaching into the undergraduate curriculum can strengthen practical competencies and better prepare future physicians to contribute effectively to rabies prevention and control.

Recommendations

Strengthen training on WHO exposure categorization and risk assessment. Emphasize the importance of correct wound management and when PEP is truly indicated. Include teaching on intradermal vaccination protocols and their applicability. Utilize problem-based learning and clinical case discussions to enhance practical understanding.

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