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Compliance To Anti-Rabies Vaccination and its Determinants Among Animal Bite Victims in an Anti Rabies Clinic in Bengaluru

Ramya MP[1], Vinayak H Kashyap[2], Manuja LM[3], Ravish HS[4], Nitu Kumari[5]

[1]*Assistant Professor, Department of Community Medicine, Rajarajeswari medical college and Hospital, Bangalore, India.*

[2]*Assistant Professor, Department of Community Medicine, Varun Arjun Medical College and Hospital, Shahjahanpur, India.*

[3]*Associate Professor, Department of Community Medicine, Sri Chamundeshwari Medical College, Hospital & Research Institute, Channapatna, India.*

[4]*Professor, Department of Community Medicine, Kempegowda Institute of Medical Sciences, Bangalore, India.*

[5]*Assistant Professor, Department of Community Medicine, Maharishi Chyawan Government Medical College, Haryana, India.*

Correspondence:
Dr. Ramya MP

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Abstract

Background: Rabies is a fatal but preventable zoonotic disease, and completion of post-exposure prophylaxis is essential to prevent mortality. Compliance with the full course of anti-rabies vaccination ensures adequate protection; however, incomplete vaccination remains a public health concern. This study assessed compliance to anti-rabies vaccination and its determinants among animal bite victims attending an Anti-Rabies Clinic in Bengaluru. ***Methods:*** A facility-based descriptive study was conducted at the Anti-Rabies Clinic of a tertiary care hospital in Bengaluru from January 2017 to June 2018. Animal bite victims attending the clinic between January and December 2017 and eligible for follow-up were included. Data on socio-demographic characteristics, exposure details, and vaccination status were collected from clinic records. Participants were followed up to assess completion of vaccination. Data were analysed using descriptive statistics and logistic regression to identify determinants of compliance. ***Results:*** Of the 1214 animal bite victims, 1108 were followed up. Compliance was higher with intradermal vaccination (82.7%) compared to intramuscular vaccination (76.5%) (p=0.04). Common reasons for non-compliance included being out of station, loss of wages, forgetfulness, and high cost. Multivariate analysis showed significantly higher compliance among individuals aged 0–18 years (AOR=7.8; 95% CI: 4.2–14.5), literates (AOR=4.1; 95% CI: 2.5–6.6), urban residents (AOR=1.9; 95% CI: 1.3–2.8), dog bite victims (AOR=1.8; 95% CI: 1.1–3.2), and those with severe exposures. ***Conclusion:*** Compliance to anti-rabies vaccination was suboptimal. Strengthening counselling, improving accessibility, and implementing reminder systems may improve compliance and prevent rabies-related mortality.

Keywords: Rabies, Anti-rabies vaccination, Compliance, Post-exposure prophylaxis, Animal bite victims

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INTRODUCTION

Rabies is a fatal zoonotic viral disease that continues to pose a significant public health challenge, particularly in developing countries. It is caused by the rabies virus, a neurotropic virus that affects the central nervous system, resulting in acute encephalitis that is almost invariably fatal once clinical symptoms appear.1 Rabies is transmitted to humans through exposure to saliva of infected animals, most commonly through bites, scratches, or contamination of broken skin and mucous membranes.[2] Although all mammals are susceptible, domestic dogs are responsible for nearly 99% of human rabies cases worldwide, making dog-mediated transmission the primary source of infection in endemic regions.[3]

Rabies remains a significant public health problem, particularly in Asia and Africa, where the majority of global rabies deaths occur.[4] Children are especially vulnerable due to their frequent interaction with animals and increased likelihood of sustaining severe bites.[5]

Rabies is entirely preventable through timely and appropriate post-exposure prophylaxis (PEP), which includes immediate wound cleansing, administration of anti-rabies vaccines, and use of rabies immunoglobulin when indicated.[1] Immediate washing of wounds with soap and water significantly reduces viral load, while anti-rabies vaccines stimulate the production of virus-neutralizing antibodies that prevent viral entry into the nervous system.6 Modern cell culture vaccines are highly safe and effective in preventing rabies when administered according to recommended schedules.7 In severe exposures, rabies immunoglobulin provides

passive immunity until active immunity develops following vaccination.8

India bears a substantial burden of rabies, with millions of animal bite cases reported annually. Dogs account for the majority of exposures, particularly in areas with large populations of stray dogs.9 Although anti-rabies vaccines are available in healthcare facilities under national rabies control initiatives, rabies-related deaths continue to occur, mainly due to delayed initiation or incomplete completion of vaccination.10

Compliance to anti-rabies vaccination refers to the extent to which bite victims complete the recommended vaccination schedule. Completion of the full vaccination course is essential to ensure adequate protection, as incomplete vaccination leaves individuals at risk of developing rabies. Several factors such as lack of awareness, financial constraints, accessibility issues, and inadequate counselling influence compliance. Assessing compliance to anti-rabies vaccination is essential for identifying gaps in service delivery and strengthening rabies prevention strategies.

Therefore, the present study was undertaken to asses compliance to anti-rabies vaccination and its determinants among animal bite victims attending an anti-rabies clinic in Bengaluru.

MATERIALS AND METHODS

A facility-based descriptive study was conducted at the Anti-Rabies Clinic (ARC) of the Preventive Medicine Unit, Kempegowda Institute of Medical Sciences (KIMS) Hospital and Research Centre, Bengaluru. The clinic functions as a tertiary care centre that provides complete post-exposure prophylaxis (PEP) services for animal bite victims, including wound management, administration of anti-rabies vaccine (ARV), and rabies immunoglobulin (RIG) as per standard guidelines. Ethical approval was obtained from the Institutional Ethics Committee prior to the commencement of the study. The study was carried out over a period of eighteen months, from January 2017 to June 2018.

The study population consisted of animal bite victims attending the Anti-Rabies Clinic between January 2017 and December 2017. Participants were selected using purposive sampling. All eligible individuals who provided written informed consent and could be followed up for completion of vaccination were included in the study.

Inclusion criteria:

- Animal bite victims attending the Anti-Rabies Clinic during the study period
- Individuals willing to participate and provide written informed consent
- Individuals available for follow-up

Exclusion criteria:

- Animal bite victims presenting with re-exposure during the study period

Data were collected from structured case record forms routinely maintained at the Anti-Rabies Clinic. Information obtained included socio-demographic characteristics such as age, gender, residence, educational status, and occupation. Clinical details and exposure characteristics were also recorded, including relevant medical history, type and ownership status of the biting animal, category of exposure, site and nature of the wound, and wound washing practices.

Vaccination-related information included the schedule and route of anti-rabies vaccine administration, as well as completion of the recommended course. Details regarding rabies immunoglobulin administration, when indicated, were also documented. In addition, adverse events following vaccination or immunoglobulin administration were noted.

All patients underwent clinical evaluation and detailed history taking at the time of presentation to identify any underlying medical conditions, prior vaccination against rabies, or drug allergies. Post-exposure prophylaxis was administered in accordance with World Health Organization (WHO) guidelines, which included immediate wound cleansing with soap and water, administration of anti-rabies vaccine, and rabies immunoglobulin infiltration for category III exposures.

Data were entered into Microsoft Excel and analysed using Stata version 12.1 statistical software. Descriptive statistics were used to summarise the data in terms of frequencies, proportions, and percentages. The association between vaccination compliance and route of vaccine administration was assessed using the Z test. Univariate and multivariate logistic regression analyses were performed to identify factors associated with compliance.

RESULTS

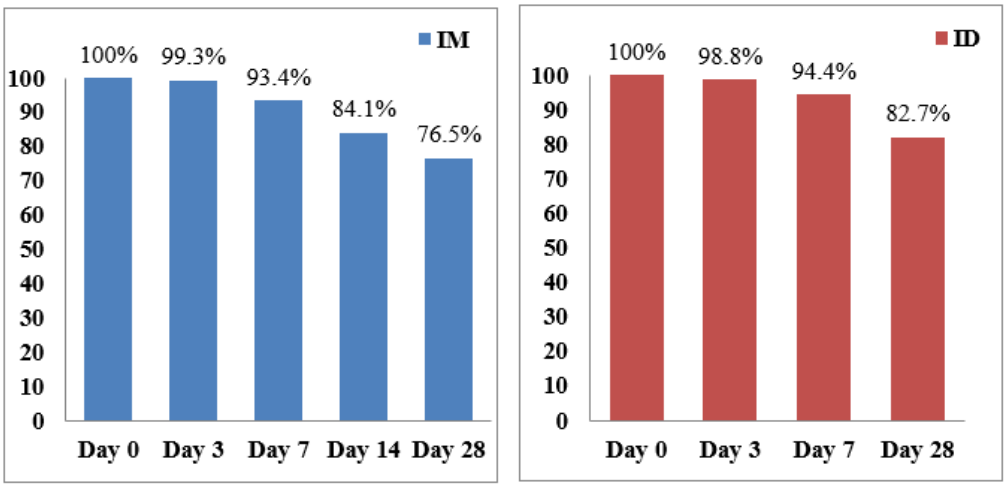
The present study included 1214 animal bite cases who had come to anti rabies clinic for post exposure prophylaxis during the year 2017. All the animal bite victims were followed-up for the complete course of vaccination to assess compliance to post exposure vaccination. Among the 1214 study subjects, 1108 were available for follow-up for the entire course of vaccination.

Table 1: Compliance to post exposure vaccination during the year 2017

Vaccine schedule	Intramuscular vaccination Essen Regimen (n =946)		Intradermal vaccination Updated TRC (n = 162)	
	Number	Percentage	Number	Percentage
Day 0	946	100	162	100
Day 3	939	99.3	160	98.8
Day 7	884	93.4	153	94.4
Day 14	796	84.1	NA*	NA*
Day 28	724	76.5	134	82.7

*NA=not applicable since there is no vaccine scheduled on day 14 for intradermal route

The compliance rate for full course of intramuscular rabies vaccination (IMRV) was 76.5% and for intradermal rabies vaccination (IDRV) it was 82.7%. (table-1)



Graph 1 & 2: Compliance to post exposure vaccination by different routes of administration

The compliance to complete course of vaccination by IDRV was found to be higher as compared to IMRV and it was statistically significant (Z score =1.7, p = 0.04).

The factors influencing the incomplete vaccination course among animal bite victims were out of station, loss of wages, forgotten dates, high cost incurred, long distance for health facility, interferes with school timings, negligence regarding the incidence and fear of adverse drug events. (table-2)

Table 2: Factors contributing to incomplete course of vaccination

Contributing factors for incomplete vaccination	Intramuscular vaccination Essen regimen (n = 222)		Intradermal vaccination Updated TRC (n = 28)	
	Number	Percentage	Number	Percentage
Out of station	57	25.7	8	28.6
Loss of wages	49	22.1	6	21.4
Forgotten dates	29	13.1	5	17.9
High cost incurred	27	12.1	4	14.3
Long distance	22	9.9	2	7.1
Interferes with school timing	18	8.1	2	7.1
Negligence	9	4.1	1	3.6
Fear of adverse reaction	11	4.9	0	0

Determinants of compliance with anti-rabies vaccination were identified using multivariate logistic regression analysis. Variables found to be significant in the univariate analysis were included in the multivariate model to determine independent predictors of vaccine compliance while controlling for potential confounding factors.

Table 3: Association between socio-demographic characteristics and vaccine compliance

Socio-demographic Characteristics (n=1108)		Vaccine Compliance		Odds Ratio (95% CI)	P- Value
		Yes (858)	No (250)		
Age group	0-18	409	38	7.3(4.2-12.8)	**<0.0001**
	19-59	402	180	1.5(0.9-2.5)	0.08
	≥ 60	47	32	-	-
Gender	Male	578	148	1.4(1.1-1.9)	**0.02**
	Female	280	102	-	-
Education	Literate	680	182	1.4(1.1-1.9)	**0.03**
	Illiterate	178	68	-	-
Occupation	Employed	453	145	0.8(0.6-1.1)	0.1
	Unemployed	405	105	-	-
Residence	Urban	710	190	1.5(1.1-2.1)	**0.02**
	Rural	148	60	-	-

The association between socio-demographic characteristics of animal bite victims and compliance to complete course of anti-rabies vaccination was calculated by univariate logistic regression analysis. There was a significant association between some of the socio-demographic characteristics and the compliance to complete course of anti-rabies vaccination. It was found that, compliance to complete course of anti-rabies vaccination was significantly high among the age group 0-18 years (OR= 7.3; 95% CI 4.2-12.8), when compared to other age groups. Similarly, the compliance to complete course of vaccination was high among males (OR= 1.4; 95% CI 1.1-1.9) when compared to females. Likewise, the literates has got a significantly higher compliance when compared to illiterates (OR= 1.4; 95% CI 1.1-1.9); the bite victims from urban area (OR= 1.5; 95% CI 1.1-2.1) had a better compliance when compared to the animal bite victims from the rural areas. But, in the present study, there was no significant difference in the compliance rate while considering the employment status of the animal bite victims.

Table 4: Association between characteristics of animal exposure and vaccine compliance

Characteristics of animal exposure (n=1108)		Vaccine Compliance		Odds Ratio (95% CI)	P- Value
		Yes (858)	No (250)		
Circumstances of Exposure	Provoked	233	69	-	-
	Unprovoked	625	181	1.0(0.7-1.4)	0.9
Place of Exposure	Home	143	53	-	-
	Outside home	715	197	1.3(0.9-1.9)	0.09
Biting Animal	Dog	797	222	1.6(1.0-2.6)	**0.03**
	Other animal	61	28	-	-
Vaccination Status of animal	Vaccinated	95	43	-	-
	Unvaccinated	763	207	1.7(1.1-2.4)	**0.01**
Fate of Biting Animal	Healthy	465	127	-	-
	Sick	80	23	0.9(0.6-1.6)	0.8
	Died /Killed	83	28	0.8(0.5-1.3)	0.3
	Not traceable	230	72	0.8(0.6-1.2)	0.4
Type of Exposure	Abrasion	353	137	-	-
	Laceration	194	42	1.7(1.2-2.6)	**0.003**
	Punctured wound	146	48	1.1(0.8-1.7)	0.4
	Multiple wounds	165	23	2.7(1.7-4.5)	**<0.001**
Site of Exposure	Head & neck	78	4	6.8(2.4-18.8)	**<0.001**
	Upper limb	251	84	1.0(0.7-1.4)	0.8
	Lower limb	426	151	-	-
	Trunk\ Genitals	40	5	1.8(0.8-4.3)	0.1
	Multiple site	63	6	3.7(1.5-8.6)	**0.003**
Category of Exposure	Category I/II	45	13	-	-
	Category III	813	237	0.9(0.5-1.9)	0.9

The association between characteristics of animal bite exposure with compliance to anti-rabies vaccination was calculated by univariate logistic regression analysis. It was found that, compliance to complete course of anti-rabies vaccination was significantly high among dog bite victims (OR=1.6; 95% CI 1.0-2.6) when compared to other animal bite victims. Similarly for unvaccinated animal bites (OR= 1.6; 95% CI 1.0-2.6), lacerated wounds (OR=1.7; 95% CI 1.2-2.6), multiple wounds (OR=2.7; 95% CI 1.7-4.5), bite wounds in the head & neck region (OR= 6.8; 95% CI 2.4-18.8) and multiple exposures in various sites of the body (OR= 3.7; 95% CI 1.5-8.6).

Table 5: Association between individual variable and vaccine compliance

Variables (n=1108)		Adjusted Odds Ratio (95% CI)	Std. Error	Z Value	P- Value
Age group	0-18	7.8(4.2-14.5)	**2.5**	**6.5**	**<0.001**
	19-59	0.9(0.5-1.6)	**0.2**	**0.3**	0.7
	≥ 60	-	-	-	-
Gender	Male	1.1(0.8-1.6)	**0.2**	**0.8**	0.4
	Female	-	-	-	-
Education	Literate	4.1(2.5-6.6)	**0.9**	**5.8**	**<0.001**
	Illiterate	-	-	-	-
Residence	Urban	1.9(1.3-2.8)	0.4	3.3	**0.001**
	Rural	-	-	-	-
Biting Animal	Dog	1.8(1.1-3.2)	0.5	2.3	**0.02**
	Other animal	-	-	-	-
Vaccination Status of animal	Vaccinated	-	-	-	-
	Unvaccinated	2.0(1.3-3.2)	0.5	3.0	**0.002**
Type of Exposure	Abrasion	-	-	-	-
	Laceration	1.9(1.2-2.9)	0.4	2.9	**0.004**
	Punctured wound	1.1(0.8-1.8)	0.3	0.8	0.4
	Multiple wounds	2.4(1.4-3.9)	0.6	3.3	**0.001**
Site of Exposure	Head & neck	5.8(1.9-16.9)	3.2	3.2	**0.001**
	Upper limb	1.1(0.8-1.8)	0.3	0.8	0.4
	Lower limb	-	-	-	-
	Trunk\Genitals	2.2(0.8-5.7)	1.1	1.5	0.1
	Multiple site	2.9(1.1-7.5)	1.4	2.2	**0.03**

The overall effect of different study variables on compliance to complete course anti-rabies vaccination was done using the multiple logistic regression model. The variables that were statistically significant in the univariate logistic regression analysis were included in the multiple logistic regression model. In multivariate analysis, it was found that compliance to complete course of anti-rabies vaccination was significantly high among age groups 0-18 years (OR= 7.8; 95% CI 4.2-14.5), literates (OR= 4.1; 95% CI 2.5-6.6) bite victims from urban area (OR= 1.9; 95% CI 1.3-2.8), dog bite victims (OR= 1.8; 95% CI 1.1-3.2), unvaccinated animal bites (OR= 2.0; 95% CI 1.3-3.2), lacerated wounds (OR= 1.9; 95% CI 1.2-2.9), multiple wounds(OR= 2.4; 95% CI 1.4-3.9) and with bite wounds at head & neck (OR= 5.8; 95% CI 1.9- 16.9) and multiple site exposures (OR= 2.9; 95% CI 1.1-7.5).

DISCUSSION

Timely and complete post-exposure prophylaxis (PEP) is essential to prevent rabies following animal bites, as rabies is almost invariably fatal once clinical symptoms develop. However, the effectiveness of PEP depends not only on initiation but also on completion of the recommended vaccination schedule. Failure to complete the full course leaves bite victims vulnerable to rabies, thereby undermining the purpose of prophylaxis.

In the present study, the compliance rate for completion of the full course of rabies vaccination was 76.5% for the intramuscular (IM) regimen and 82.7% for the intradermal (ID) regimen. These findings indicate relatively better compliance with the intradermal schedule compared to the intramuscular route, possibly due to fewer clinic visits, reduced cost, and improved patient acceptability. Nevertheless, a proportion of patients failed to complete the vaccination schedule. The major reasons for incomplete vaccination in the present study included loss of wages, migration or being out of station, forgetfulness of scheduled dates, high cost incurred, long distance to the health facility, interference with school timings, negligence, and fear of adverse drug reactions. These findings highlight the influence of socioeconomic, logistic, and behavioural factors on treatment adherence.

Similar findings have been reported in other studies conducted across India. A cross-sectional study conducted in an urban slum of Chennai reported a compliance rate of only 55.1%, which is considerably lower than that observed in the present study. The reasons for non-compliance included loss of wages, forgetfulness, and interference with school schedules.11 In contrast, a study conducted in rural Davangere, Karnataka, reported a compliance rate of 82.6%, comparable to the present study, with lack of time identified as the most common reason for incomplete vaccination.12

Studies comparing intramuscular and intradermal regimens have consistently demonstrated higher compliance with the intradermal route. A study conducted in Bangalore reported compliance rates of 60.0% for intramuscular vaccination and 77.0% for intradermal vaccination.13 Similarly, a study conducted at Jamnabai Hospital, Gujarat, reported a compliance rate of 62.8% for intramuscular vaccination.14 Another hospital-based study in Solapur reported higher compliance with intradermal vaccination (62.9%) compared to intramuscular vaccination (48.7%), further supporting the advantages of the intradermal regimen.15 These findings are consistent with the present study, which also demonstrated higher compliance with the intradermal schedule.

A follow-up study conducted at the Medical College Hospital, Jamnagar, Gujarat, reported an overall compliance rate of 66%, which is lower than that observed in the present study.16 Similarly, a retrospective study conducted at a tertiary care hospital in Bengaluru reported a compliance rate of 79.6% for intradermal vaccination.17

Other studies have reported even lower compliance rates, indicating persistent gaps in rabies prevention efforts. A hospital-based longitudinal study conducted in Solapur reported that only 41.6% of patients completed the fourth dose of intradermal vaccination.18 Similarly, a longitudinal study conducted in Mumbai reported a compliance rate of 55.2%, emphasizing the need for improved awareness and counseling.19 In contrast, a study conducted at Sir J.J. Hospital, Mumbai, reported significantly higher compliance with intradermal vaccination (84.2%) compared to intramuscular vaccination (40%).20 Another prospective study comparing the two routes reported compliance rates of 62.8% for intramuscular vaccination and 70% for intradermal vaccination.21 These findings further support the present study's observation of better compliance with the intradermal schedule.

The present study found that compliance was significantly higher among younger age groups (0–18 years), literate individuals, urban residents, dog bite victims, and those with severe exposures such as multiple wounds and bites to the head and neck region. This may be attributed to increased awareness, perceived severity of injury, and better access to healthcare facilities. Similar associations have been reported in other studies. A longitudinal study conducted in Odisha found that treatment completion was significantly associated with age, education, place of residence, and category of bite.22 Another study conducted in Akola, Maharashtra, reported that compliance was significantly associated with category of bite, type of bite, and type of biting animal.23 Similarly, a study conducted in Karnataka found higher compliance among females, older individuals, urban residents, and educated patients.24 These findings highlight the role of sociodemographic and clinical factors in influencing treatment adherence.

Overall, the findings of the present study and previous research indicate that compliance with anti-rabies vaccination remains suboptimal, despite the availability of effective vaccines and national rabies control initiatives. The major barriers identified across studies include socioeconomic constraints, lack of awareness, forgetfulness, distance to healthcare facilities, and occupational commitments.

CONCLUSION

The present study highlights that compliance to anti-rabies vaccination, though relatively better with the intradermal regimen, remains inadequate for achieving optimal protection against rabies. Strengthening patient counselling at the initiation of PEP, improving accessibility of vaccination services, and implementing reminder systems such as phone calls or text messages may enhance compliance.. Improving adherence to the full course of vaccination is crucial for preventing rabies-related mortality and achieving the goal of rabies elimination.

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