ORIGINAL ARTICLE

Economic costs of rabies post exposure prophylaxis

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Abstract

Background: The highest financial expenditure for Rabies in any country is the cost of rabies post-exposure prophylaxis. The type of vaccine and route of administration, as well as type of immunoglobulin used, all significantly influences the cost of treatment. **Aims & Objective**: To analyse the direct and indirect cost of the rabies post exposure prophylaxis. **Material & Methods**: The study was conducted at anti-rabies clinics of Government Hospital, where PEP is provided free of cost and a private medical college hospital, where PEP is provided for a cost. 290 animal bite victims who completed the PEP were included in the study. After obtaining written informed consent from the study subjects, data regarding socio-demographic profile, details of animal bite exposure, cost incurred for PEP i.e, direct and indirect cost were collected. Results were expressed as proportions, median and inter-quartile range (Q1-Q3). **Results**: The total median cost incurred by the bite victims for PEP in Government hospitals was Rs.585 with Q1-Q3 of Rs.444-725 and the cost spent by the government was Rs. 1031; whereas the total cost incurred in private hospital was Rs.5200 with Q1-Q3 of Rs.4900-5701.**Conclusion**: PEP has a significant economic burden to the bite victims, especially for poor people living of the developing World.

Keywords

Rabies; Cost; Post Exposure Prophylaxis; Government Hospital; Private Hospital; Rabies

Introduction

The highest financial expenditure in any country is the cost of rabies Post Exposure Prophylaxis (PEP). Poor people are at a higher risk and the average cost of rabies PEP after contact with a suspected rabid animal is about US$ 45 in Asia, where the average daily income is about US$ 1–2 per person. (1) Most of the expenditure for PEP is borne by those who can least affords it. In developing countries, an estimated 3.87% of the GNP and 31 days wages of an average Asian is spent for full course of PEP. (2)

The type of anti-rabies vaccine (ARV) and route of administration as well as the type of rabies immunoglobulin (RIG) used, all significantly influences the cost of treatment. In addition to the

expense of rabies biological, expenditures for the physician, hospital, loss of income and the emotional & psychological impact of PEP. Post exposure prophylaxis is provided both in government and private health care facilities. Even though PEP is provided free of cost in most of the government hospitals, the animal bite victims will incur expenditure in the form of hospital user fees, purchase of syringes & drugs, loss of wages and travelling cost. (3,4,5)

Aims & Objectives

To know the cost incurred i.e., the direct and indirect cost for rabies PEP at the anti-rabies clinic of the government and private hospital.

Material & Methods

This descriptive study included all the animal bite victims attending anti-rabies clinics of two hospitals.

Study Area: Group 1: Municipal Corporation Hospital, Bangalore, which is a government hospital, where, intradermal rabies vaccination (IDRV) was provided by updated Thai Red Cross regimen (0.1ml of vaccine given on both the deltoids on day 0, 3,7 and 28) and equine rabies immunoglobulin are provided free of cost for all the animal bite victims. (6)

Group 2: Private medical college hospital, where the intramuscular rabies vaccination (IMRV) provided by Essen regimen (1dose of vaccine given on the deltoid on day 0, 3, 7, 14 and 28) and equine/ human rabies immunoglobulin is provided for a cost, which has to be borne by the animal bite victims. (7)

Study Duration: One year from January 2016 to December 2016.

Sample Size: All the 290 new subjects with category II and Category III exposures, who gave informed consent from both the hospitals.

Exclusion criteria: old cases, re-exposures and category I exposures.

Ethical Approval: The study was initiated after obtaining the Institutional Ethical Committee clearance and getting permission from the respective authorities.

Consent: All the study subjects who came to the respective hospitals for PEP were taken written informed consent for participating in the study.

Strategy for data collection: The detailed data was collected from all the study subjects using a predesigned, semi-structured proforma by interview technique; which was pretested by a pilot study and included socio-demographic profile, details of animal bite exposure and the cost incurred for PEP. The details of the cost incurred included direct costs i.e, amount spent on drugs (anti rabies vaccine, rabies immunoglobulin, premedication, antiseptics and antibiotics) and hospital charges; indirect cost like cost of travel to the patient and his accompaniment and loss of wages for both of them was also recorded. Since, PEP was provided free of cost at the government hospitals, the average expenditure incurred by the government for providing PEP per person was also estimated. Likewise, the cost of PEP for Category II bites was estimated by excluding the costs of rabies immunoglobulin.

Data analysis software: Data was coded, entered and analyzed using MS-Excel. Statistical analysis includes proportion, median and inter-quartile range (Q1-Q3).

Results

The present study included all category III exposures, who came for PEP at the respective health facility and completed the full course of vaccination at these centres. Among them, 140 received intradermal rabies vaccination by updated Thai Red Cross regimen in the government hospital and 150 received intramuscular rabies vaccination by Essen Regimen in the private hospital.

The socio-demographic profiles of both the study groups were similar and most of them were adult males. Likewise, the characteristics of the animal bites among the two groups, majority of them were bitten by dogs and over the lower limbs (Table 1).

All the animal bite victims were given post exposure prophylaxis which included wound wash, rabies immunoglobulin and anti-rabies vaccine as recommended by WHO in both the study centres. (8)

The total costs incurred by the bite victims for the post exposure prophylaxis were calculated for both the centres.

Group-1: The total median cost was Rs.585 with inter- quartile range (IQR) of Rs.444-725; which included direct median cost of Rs.300 with IQR Rs.200-350 and indirect median cost of Rs.285 with IQR Rs.179-405. Among the total cost, most was spent on day 0. In this study, majority of the patients who received PEP were daily wage labourers. Hence, major portion of indirect cost incurred was due to loss of productive work of the patients followed by loss of productive work by patient's family members and friends. (Table-2)

As PEP is provided free of cost, the expenditure made by the government was estimated. PEP was provided by Updated TRC regimen and the total amount of vaccine required per person is around 1 ml {(0.2 x 4 doses) + 0.2 ml (wastage)}. The cost of one vial of vaccine is Rs.319. Amount of rabies immunoglobulin required was 1 vial (5 ml) for children less than 15 years and 2 vials (6 – 10 ml) for adults. The cost of equine rabies immunoglobulins is Rs.475/ vial. Hence the government will be spending on an average about Rs.712 per person for RIGs, considering 50 % of the animal bite victims are children. Therefore, the total cost for PEP spent by the government is about Rs.1031, which includes cost of rabies vaccine by intradermal route and rabies immunoglobulin. For category II bites the economic cost will be excluding rabies immunoglobulin.

Group-2: The total median cost was Rs.5200 with IQR of Rs.4900-5701, which included direct median cost of Rs.3865 with IQR Rs. 3662-4120, in which most of the cost incurred was for purchasing ARV & RIG. Majority of the direct cost was incurred on day 0. The indirect median cost spent in this group was 685 with IQR Rs. 500-950 with major portion was incurred due to loss of productive work of bite victims and their care takers (Table-3).

Likewise, the cost incurred for category II bite victims is estimated to be Rs.3950, excluding rabies immunoglobulin.

Discussion

Rabies is a neglected zoonotic disease caused by the rabies virus; occurs in over 100 countries and poses a potential threat to >3.3 billion people worldwide. The neglected disease indicates that, it is insufficiently addressed by Governments and the International community, as they are best defined by the people and communities they affect the most i.e., poor people living in the remote rural areas and urban slums of the developing World. It is however, the disease most amenable to control, as the tools for prevention i.e., post exposure prophylaxis (PEP) are available worldwide. (9) Therefore, it is the first zoonosis on the list of neglected diseases targeted for regional and eventually global elimination.

More than 15 million people worldwide receive PEP and are estimated to prevent hundreds of thousands of rabies deaths annually. The estimated global expenditure for prevention and control of rabies exceeds US$ 1.6 billion. Likewise, WHO estimated that rabies is responsible for 1.74 million DALY lost each year. (10,11)

A combination of large human and dog populations in congested habitable areas combined with widespread poverty will lead to more exposures in World Health Organization (WHO)'s South East Asia Region than in any other part of the World. More than 1.4 billion people in this Region are at risk of rabies infection. Therefore, it continues to be a major public health and economic problem throughout the Region.(12)

Post exposure prophylaxis should be availed as early as possible after exposure in these endemic areas. Proper wound management and simultaneous administration of rabies immunoglobulin (RIG) combined with anti-rabies vaccine (ARV) is almost invariably effective in preventing rabies, even after high-risk exposure. But, the cost of rabies PEP is a major limiting factor, since the rabies immuno-biologicals are highly expensive and increases the burden to the bite victims. Hence compliance to vaccination is also affected. (13,14,15)

The present study showed that, the total median cost incurred for PEP in the government hospital was Rs. 585 with inter quartile range of Rs.444-725 rupees, even though the rabies immune-biologicals were provided free of cost. On the contrary, the total median cost incurred in the private hospital was Rs.5305 with inter quartile range of Rs.4900-5701, where everything is given at a cost which has to be spent by the animal bite victim and definitely becomes a burden for individuals in developing countries.

In the present study government expenditure for providing PEP is Rs.1031(Rs. 319 for Anti rabies vaccine and Rs.712 for rabies immunoglobulin) per person, which is similar to study conducted in tertiary care centre in Kerala, where PEP is provided free of cost shows that total cost of PEP borne by the government for providing PEP to 213 animal bite victims by intradermal route was Rs. 83,400 with an average cost per person for vaccination was Rs. 391.5 and total cost for immunoglobulin was Rs. 1,90,214 with an average per person of Rs. 893.(16,17,18).

Majority of the bite victims from rural areas and from urban slums being poor, invariably go to government hospitals where rabies PEP is provided free of cost. Therefore, considering the large number of animal bite cases in the country and subsequent increase in the demand for modern rabies vaccines, universal

switch over from intramuscular to intradermal route of rabies vaccination may be recommended which reduces both the cost and number of doses needed for PEP.(20) It reduces the volume of vaccine and direct cost required for PEP by 60% when compared with standard intramuscular vaccination and therefore, largely benefits the poor & needy who visits the Government hospitals. Therefore, it is rationale to introduce intra dermal rabies vaccination in rabies endemic country like India.(21) Similarly, the present study showed that, majority of the subjects were males in the age group 15-45 years from lower socio-economic group and daily labourers and most of the bite victims were the only earning members of the family.(22)

Hence the indirect cost spent is definitely a financial burden to these families. In addition to financial burden, bite victims undergo psychological stress and pain in category III bites, which cannot be measured in the monetary terms. The intangible costs because of mental stress could not be included in the present study. Thus, the economic costs for rabies PEP is huge and stupendous.

Conclusion

The cost of post exposure prophylaxis is a significant financial burden in developing countries. The frequency and economic costs of post-exposure prophylaxis are expected to rise dramatically in all rabies endemic countries because of increased population and ineffective dog population control measures. Therefore, the demand for PEP will be ever increasing and the countries should strive to improve the availability for PEP at all the government health facilities by reducing the out of pocket expenses for the poorest communities.

Recommendation

Since the cost for post exposure prophylaxis is huge and especially for a developing country like India, this cost analysis will provide an insight to the policy makers to provide substantial fund to avoid out of pocket expenditure for the poor people who are affected the most.

Relevance of the study

The present study provides the details of both direct and indirect cost of PEP against rabies which will provide an insight to estimate the cost required for supplying the rabies biologicals or to seek the external funding sources like GAVI or WHO.

Authors Contribution

Author 1: Concept, study Protocol, obtaining ethical clearance, implementation, statistical analysis and interpretation & writing research paper. Authors 2,3,4,5,6: Project implementation, data entry, statistical analysis and interpretation.

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Tables

TABLE 1 DETAILS OF EXPOSURES

Characteristics		Government Hospital n = 140	Private Hospital n= 150
Age (in years)	0 – 6	14 (9.69)	12 (8.0)
	7-15	40 (28.57)	34 (22.7)
	16 - 45	62 (44.13)	76 (50.7)
	46 – 60	16 (11.22)	18 (12.0)
	> 60	9 (6.38)	10 (6.7)
Sex	Male	90 (64.03)	101 (67.3)
	Female	50 (35.97)	49 (32.7)
Education	Illiterate	56 (40.31)	28 (18.7)
	Primary school	23 (16.58)	21 (14.0)
	Middle school	14 (9.69)	19 (12.7)
	High school	22 (15.82)	17 (11.3)
	Intermediate	14 (10.00)	22 (14.7)
	Graduate/PG	8 (5.71)	37 (24.66)
	Professional degree	2 (1.53)	6 (4.00)
Socio-economic status (Modified Kuppuswamy classification)	Upper	1 (0.77)	3(2.4)
	Upper middle	9 (6.63)	55 (36.7)
	Lower middle	40 (28.83)	48 (31.7)
	Upper lower	85 (60.97)	40 (26.8)
	Lower	4 (2.81)	4 (2.4)
Biting animal	Dog	135 (96.68)	142 (94.7)
	Cat	5 (3.32)	8 (5.3)
Type of dog	Stray dog	94 (67.09)	83 (58.45)
	Pet dog	46 (32.91)	59 (41.54)
Site of bite	Limb	123 (88.01)	114 (76)
	Trunk	13 (9.18)	24 (16)
	Head & neck	4 (2.81)	22 (14.66)
Type of wounds	Abrasion	66 (47.45)	108 (72.0)
	Puncture wounds	50 (35.46)	21 (14.0)
	Laceration	24 (17.09)	21 (14.0)

TABLE 2 COST INCURRED FOR PEP AT THE GOVERNMENT HOSPITAL

Sl. No.	Direct cost (in INR)	Day 0 Median Q1–Q3	Day 3 Median Q1–Q3	Day 7 Median Q1–Q3	Day 28 Median Q1–Q3	Total Median Q1–Q3
1	Cost of antiseptics, anti-inflammatory & antibiotics	110 50-120	0	0	0	110 50-120
2	User Fee	10 5-10	0	0	0	10 5-10
3	Cost of disposables	20 5-25	5 5-10	5 5-10	5 5-10	20 20-20
4	Cost of transportation of patient	45 30-75	45 30-75	45 30-75	45 30-75	180 120-300
	TOTAL DIRECT COST	170 85-162	50 35-80	50 35-80	50 35-80	300 200-350
	Indirect cost (in INR)					
1	Loss of productive work by patient	300 0-350	0	0	0	500 0-800
2	Cost of transportation of others	130 80-180	0	0	0	140 95-200
3	Loss of productive work by patient's family and friends	175 0-250	0	0	0	175 0-250
	TOTAL INDIRECT COST	290 194-350	0	0	0	300 179-405
	TOTAL COST	450 293-510	52 35-80	52 35-80	52 35-80	585 444-725

TABLE 3 COST INCURRED FOR PEP AT THE PRIVATE HOSPITAL

Sl. No.	Direct cost (in INR)	Day 0 Median Q1–Q3	Day 3 Median Q1–Q3	Day 7 Median Q1–Q3	Day 14 Median Q1–Q3	Day 28 Median Q1–Q3	Total Median Q1–Q3
1	Cost of ARV	319	319	319	319	319	1595
2	Cost of RIG	950 475-950	0	0	0	0	950 475-950
3	RIG administration charges	300	0	0	0	0	300
4	Cost of premedication	95 0-120	0	0	0	0	95 0-120
5	Cost of T.T. Vaccination	50	0	0	0	0	50
6	Cost of antiseptics, anti-inflammatory & antibiotics	110 50-120	0	0	0	0	110 50-120
7	Cost of hospital treatment	100	0	0	0	0	100
8	Cost of disposables	25 0-27.5	0	0	0	0	25 0-27.5
9	Cost of transportation of patient	175 120-200	175 120-200	175 120-200	175 120-200	175 120-200	700 200-1600
	TOTAL DIRECT COST	3340 2978-3460	515 460-540	515 460-540	515 460-540	515 460-540	3865 3662-4120
	Indirect cost (in INR)						
1	Loss of productive work by patient	400 0-500	0	0	0	0	400 0-500
2	Cost of transportation of others	0 0-50	0	0	0	0	0 0-50
3	Loss of productive work by patient's family and friends	325 0-500	0	0	0	0	325 0-500
	TOTAL INDIRECT COST	685 500-950	0	0	0	0	685 500-950
	TOTAL COST	4000 3685-4290	515 460-540	515 460-540	515 460-540	515 460-540	5200 4900-5701