



Research Article

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Determinants of Scrub Typhus: A Case Control Study in Tribal Region of Eastern Maharashtra

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Abstract

Introduction: Scrub typhus is public health problem in South East Asian Region and also it is of rising concern in India. Eastern part of Maharashtra state is highly vulnerable to the disease as it is under forest cover. This region is presently witnessing outbreak of scrub typhus. The present case control study aims to understand determinants of the scrub typhus in this geographical location. **Material & Methods:** Operational definition for scrub typhus cases used in present study was "Individuals who are positive for IgM Elisa of Scrub typhus". Cases of scrub typhus reported to health system that comply with the operational definition were recruited. Individually matched controls were selected from the same village. Matching was done for age, sex, socioeconomic status and residence. Total 16 cases and 32 controls were enrolled and compared for socio-demographic, environmental and behavioral domains. **Results:** Clinical manifestations among cases were Fever, malaise, headache, eschar and rash. The most common sites of eschar was groin 3 (42.8%), followed by suprascapular region 2 (28.6%), axilla 1(14.3%) and elbow 1 (14.3%). The risk factors for scrub typhus were vegetations around household within 3 feet range, length of grass blade more than 2 feet, routine work in shrub, engaging in forest related work and activities around lake with the odds 5.41 (1.13-25.83), 5.6 (1.24-25.49), 3.66 (1.04-12.9) 4.2 (1.02-18.02) and 4.59 (1.25-16.77) respectively. **Conclusion:** Apart from other known risk factors, present study ascertained activities around lake, closeness of vegetations to the household (less than 3 feet) and length of grass blade (more than 2 feet) as new risk factors. These findings may be helpful in developing targeted intervention strategies to control scrub typhus.

Keywords: Scrub typhus, Case control study, Determinants, Risk factors.

INTRODUCTION

Scrub typhus also known as mite-borne typhus or Japanese-river fever is a zoonotic disease. It is caused by the agent *Orientia tsutsugamushi* and transmitted by the bite of infected mite.^[1] Humans are the accidental host of the mite-rodent-mite cycle.^[2] Humans invasion in mite islands make them prone to infection.^[3] Scrub typhus is public health problem in South East Asian Region. The typical geographical location for scrub typhus is described as tsutsugamushi triangle extending from Russian Far East in the north, to Pakistan in the west, Australia in the south, and the Japan in the east.^[4] Scrub typhus has re-emerged in India with recent outbreaks.^[5] Clinical manifestations are diverse ranging from subclinical stage to fatal organ failure and it is grossly under diagnosed.^[6,7] Though exact incidence is not known, globally an estimated 1 billion people are at risk for scrub typhus and an estimated 1 million cases occur annually.^[5] Maharashtra is presently witnessing outbreak of scrub typhus with cases and deaths reported. The study was planned in a tertiary health care centre which caters to the forest area in eastern Maharashtra. This area has naturally more vulnerability to the disease. Recently within period of 3 months from August to October 2018, 19 cases of scrub typhus were reported including 3 deaths. It created panic situation as till date there were no cases reported in this area. In this regard, there was urgent need to understand risk factors that determines scrub typhus in this geography. Present research was conducted with objective to study determinants of the scrub typhus so that health system is better prepared to prevent and control the disease.

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MATERIALS AND METHODS

Before commencement of the study, Ethical approval was sought from Institutional Ethical Committee with registration no. ETC/1033/INST/MH/2018 vide letter no 244/18/EC/Pharmac/GMC/Gondia dated 21.11.2018. Participants were enrolled only after obtaining written informed consent from them.

The present research is a case control study. Reference population for the study is area within jurisdiction of district Gondia, a part of which corresponds to the field practice area under department of Community Medicine, Government Medical College, Gondia. Cases and controls were selected from the same reference population. For recruiting cases, operational definition employed was "Individuals who are positive for IgM Elisa of Scrub typhus". Cases of scrub typhus reported to District health system which comply with the operational definition were selected as cases. Sixteen cases of scrub typhus from 6 different blocks of district Gondia were recruited as cases. Neighborhood controls matched for age, sex, socioeconomic status and residence without any clinical evidence of scrub typhus were selected as controls. To avoid selection bias and ensure controls are representative of the reference population, uniformity was maintained in selecting the controls. House of the cases were identified as starting point. Interviewer moved forward from starting point till 5th household and then from there onward controls were selected from odd numbered household (5,7,9,11 and so on). This continued till individually matched controls were obtained. The controls were individually matched with same gender and age within range of 2 years with residence within 200 meters from the residence of cases. We enrolled controls twice the

number of cases selected. Study was done for the period of 3 months from November 2018 to January 2019. All the participants were subjected to Case Record Form (CRF) which was a standardized questionnaire that captured information on socio-demographic, environmental and behavioral domains. Health education on prevention and control of scrub typhus was the integral part of the study. All those households that an interviewer visited have received health education on prevention and control of scrub typhus after completing interview.

Statistical analysis

Data entry and analysis was done using statistical software SPSS 21.0. Graphical presentation of data is done using Microsoft Office Excel 2010. Socio-demographic profile of the participants is represented as frequency and percentage. Association between study groups was assessed by chi-square test. Also, Odds ratio was calculated to study direction of association between them, if any. P value of statistical tests less than 0.05 was considered to be significant.

RESULTS

Of total 48 study participants 21 (43.75%) were males and 27 (56.25%) were females. Mean age among cases was 43.2 years as compared to 42.7 years in controls. Mean year of schooling was observed to be 8.3 years among cases and 8.1 years among controls. Study participants belonged to class II to class IV of Modified B G Prasad socioeconomic classification in both cases as well as controls. The controls were found comparable to the cases with respect to age, sex, educational qualification and socioeconomic class ($p>0.05$) as depicted in Table 1.

Table 1: Demographic profile of study subjects

Parameters		Cases	Controls	P value
1. Age	20-35years	06 (37.4%)	10 (31.3%)	0.89
	36-50 years	05 (31.3%)	12 (37.4%)	
	>50 years	05 (31.3%)	10 (31.3%)	
2. Sex	Male	07 (43.7%)	14 (43.7%)	0.99
	Female	09 (56.3%)	18 (56.3%)	
3. Education	Illiterate	2 (12.5%)	4 (12.5%)	0.82
	Primary	2 (12.5%)	3 (9.4%)	
	Secondary	9 (56.3%)	15 (46.8%)	
	Higher secondary & above	3(18.7%)	10 (31.3%)	
4. Socio-economic class	Class II	3(18.7%)	5 (15.7%)	0.90
	Class III	8 (50.0%)	15 (46.9%)	
	Class IV	5 (31.3%)	12 (37.4%)	

Fever was the most common feature associated with scrub typhus cases which was observed in all the 16 (100%) cases. It was followed by malaise 13 (81.25%), headache 9 (56.25%), eschar 7 (43.75%) and rash 5 (31.25%) as depicted in Figure 1.

Rash was maculopapular in nature distributed all over the body. Average duration of occurrence of rash from day of fever was 7 days. We noted typical eschars having central tough black necrotic scale with surrounded erythema. Exact duration of occurrence of eschar could not be calculated as most of them were not aware of the eschar owing to its painless nature. It was noted only after inspection by either physician or investigator. The most common sites of eschar was groin 3(42.8%), followed by suprascapular region 2(28.6%), axilla 1(14.3%) and elbow 1(14.3%).

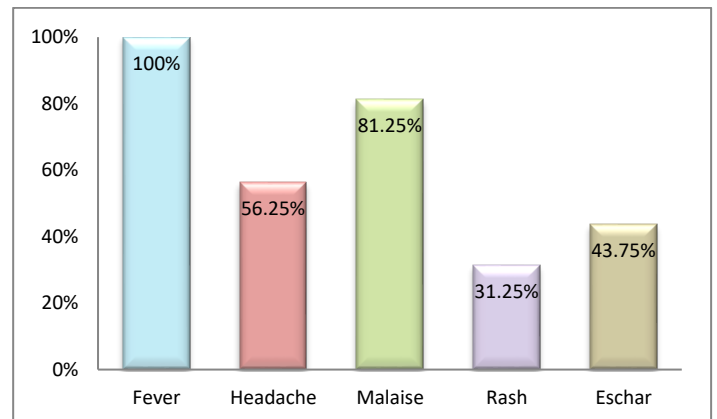


Figure 1: Clinical manifestations of scrub typhus

Present research studied various environmental and behavioral factors that may possibly contribute to occurrence of scrub typhus as depicted in table 2.

Infestation with rodent or presence of pets in the household was not significantly associated ($p>0.05$) with scrub typhus. Also, presence of vegetations around household was not associated with cases, however when distance of vegetations from household was evaluated, it was noted that household that have vegetations within less than three feet range were strongly associate with the cases ($p=0.02$). There were 5.41(1.13-25.83) times more odds of having scrub typhus when household has vegetations close to it. Length of grass blade more than

two feet was significantly associated ($p=0.021$) with 5.6 (1.24-25.49) times more odds of developing scrub typhus than the grass with lesser length. Engaging in forest related work like animal grazing; wood cutting had 4.2 (1.02-18.02) times more odds of having scrub typhus ($p=0.04$). Also, those engaged in close contact with shrub for fodder collection or feeding to animals had 3.66 (1.04-12.9) times more odds of developing scrub typhus ($p=0.03$). Those engaged in activities near lake like washing clothes, cleaning or feeding animals in lake had 4.59(1.25-16.77) times more odds of developing scrub typhus ($p=0.02$). Behavioral factors like open field defecation or practice of drying clothes over shrub were not associate with scrub typhus ($p>0.05$).

Table 2: Risk factors associated with scrub typhus

Parameters	Cases n=16 No. (%)	Controls* n=32 No.(%)	OR [†] (95% C.I.) [‡]	P value	
1. Rodent infestation in the household	14 (87.5%)	29(90.6%)	0.72 (0.10-4.8)	0.73	
2. Pets in the household	11 (68.8%)	20 (62.5%)	1.32 (0.36-4.7)	0.67	
3. Vegetations around household	13 (81.2%)	21 (65.6%)	2.27 (0.53-9.69)	0.26	
4. Distance of vegetations from household	<3 feet	10 (76.9%)	8 (38%)	5.41(1.13-25.83)	0.02
	>3 feet	3 (23.1%)	13 (62%)		
5. Length of grass blade	>2 feet	9 (69.2%)	6 (28.6%)	5.6 (1.24-25.49)	0.021
	<2 feet	4 (30.8%)	15 (71.4%)		
6. Routine work involving contact with shrub	10 (62.5%)	10 (31.2%)	3.66 (1.04-12.9)	0.03	
7. Engaged in forest activities [§]	6 (37.5%)	4 (12.5%)	4.2 (1.02-18.02)	0.04	
8. Open field defecation	9 (56.25%)	15 (46.8%)	1.45 (0.43-4.8)	0.54	
9. Practice of drying clothes over the shrubs	3 (18.7%)	5 (15.6%)	1.24 (0.25-6.03)	0.78	
10. Activities around lakes	9 (56.3%)	7 (21.8%)	4.59(1.25-16.77)	0.02	

*matched for age, sex, socioeconomic status and residence

†OR= Odds ratio, ‡CI= Confidence Interval

§ Forest activities includes visit of individual to forest for reasons like wood cutting, animal grazing, etc

|| Activities around lakes includes washing clothes, bathing/washing animals, feeding animals,etc

DISCUSSION

Gondia district of Eastern Maharashtra has first ever witnessed scrub typhus cases in the August 2018. Geographically this area is different as most of the area is tribal and under forest cover and has plenty of lakes. The present research attempted to study clinical features and identify risk factors associated with scrub typhus in this particular population and geography.

In present research, scrub typhus cases were more in females than in males. Possible explanation could be females in the study area, apart from engaging in agricultural activity, wash clothes in the lakes which have enormously large grass around its bank. Study by Nrushen Peesapati et al and Jacob SM et al observed predilection of scrub typhus towards females.^[8,9] However Md. Jamil et al & Aroma Oberoi et al noted higher predilection towards males.^[10,11] Most common clinical feature among cases was fever which was present in all 16 (100%) cases. This finding is consistent with most of the studies which reported fever or fever with headache as the most common feature.^[8-10,12] Studies have reported wide range in frequency of appearance of eschar ranging from 10% to 86.3 %^[8,10,13,14]. In present study eschar was noted in 43.75% cases. We noted typical maculopapular rash in 31.25% of scrub typhus cases which varies much in different studies from 1.69% to 68.6%.^[10,13,14,15]

A Study from India by Puran Sharma et al suggested rodent infestation or pets in the household are risk factors for scrub typhus which is contrary to our findings^[16]. However study from south Korea and China reported no association of disease with rodents infestation or pets in household.^[17,18] In present study, presence of shrub within 3 feet range

from household was significantly associated with scrub typhus which is consistent with study by George T et al^[19]. Further we found odds of having scrub typhus were 5.6 times higher when grass blade was 2 feet or more in length. Contrary to study by Sun-Seog Kweon et al we did not find open field defecation as a risk factor^[17]. Various studies have reported higher risk of scrub typhus among those engaged in forest related activities which is very similar to our finding with 4.2 times more odds.^[17,18]

Though we could not found related literature, activity around lake was an important risk factor and was more relevant as far as geography of study area is concerned. Odds of having scrub typhus was 4.59 times higher among those having activity around lake.

The present study has certain strengths and limitations. The strengths were-It is a community based study so study participants were representative of the reference population; Neighborhood matching ensured comparability between cases and controls; minimal chances of recall bias as there was very short time lag between reporting of cases and their interviews. The limitations were - Sample size was relatively small; possibility of interviewer's bias could not be ruled out as there was no blinding of interviewers about case control status of the participants.

CONCLUSION

Present study ascertained activities around lake as new risk factor. Our study findings are consistent with established risk factors like forest related activities or routine shrub work. Further it added details about closeness of vegetations to the household (less than 3 feet) and length

of grass blade (more than 2 feet) as risk factors. These findings may be helpful in developing targeted intervention strategies to control scrub typhus.

Conflicts of interest:

The authors declare that there is no conflict of interest

Authors' Contribution:

All the authors fulfilled the authorship criteria

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