Surveillance of Scrub Typhus in the fringe areas around Pune : Potential for Transmission does exist

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Abstract

A field based epidemiological study was undertaken to assess the potential of transmission of scrub typhus in the sylvatic and transitional (fringe) areas at ten different locations around Pune. Parameters studied included rodent trapping and identification, entomological parameters, immunological studies on rodent sera, and rodent organ impression smears. The study revealed that *Rattus r rufescence, Rattus meltada, Suncus murinus* and *Rattus blanfordi* were the predominant sylvatic rodent species. All the species showed mild to moderate infestation with trombiculid mite larvae, with *Rr rufescence* and *S murinus* showing even higher levels of infestation. Pooled rodent sera showed mild rise of OX2 in 13.9%, OX19 in 5.6% and OXK in 9.8% of the pooled sera. The rise in titres was appreciable among rodents from Lonavala, Khadakvasla, Panchet, Singhgadh and Kondhwa areas. Based on the findings of the study, certain recommendations on prevention, surveillance and epidemic investigations of scrub typhus in the Armed Forces have been submitted.

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Introduction

The Indian Army is deployed over a vast stretch of the subcontinent, in diverse terrain. This diversity of terrain and ecological conditions make the soldiers susceptible to an important disease, which often presents with out-breaks, including fatalities - scrub typhus. The importance of this disease was recognized way back in 1933, when the Army Headquarters had directed to employ the Weil-Felix test on sera from all cases of fever. Subsequently, the rapid increase in incidence amongst troops from 1942 onwards, during the Second World War, led to the formation of the Army Headquarters 'Field Typhus Research Teams'. Data compiled by the members of these teams runs into three large volumes [1].

Despite such a high priority allocated to this disease about half a century ago, there seems to be a decline in interest and dwindling in priorities during the past few decades. This may be because the health functionaries may have a feeling that the disease is not common in our country. However, the reality is likely to be quite different. Limited sero-surveys have clearly shown that scrub typhus is quite prevalent in our country [1]. The apparently low frequency of the disease is due to the fact that a number of cases may not be diagnosed given the low level of diagnostic suspicion that health functionaries have in respect of scrub typhus. The price of such complacency is often paid quite dearly. Not too distant memory would take us to 1992 when there was an outbreak among Gentlemen Cadets at the Indian Military Academy. Exposure to mite islands during outdoor exercises were identified as the possible cause [2]. Eight cases occurred including one fatality [3]. Similar episodes of scrub typhus have been described in recent past by Singh et al [4], Chauhan et al [5] and Mehta et al [6].

In the above context, Pune-Khadki-Lonavala-Khadakvasla complex is another large cantonment where a number of major training establishments are located. This provides frequent opportunities for the recruits/trainees/cadets to be exposed to sylvatic/fringe areas, where transmission of scrub typhus may be quite potential. As yet, there is no field study undertaken in defence areas of these locations, for mapping the transmission potential. In view of the same, the present study was undertaken with the aim of mapping the semi-urban and sylvatic fringe areas around Pune, with a view to identify the transmission potential of scrub typhus.

Material and Methods

The present study was a field based, classical "shoe leather" epidemiological study involving a team of specialists in Preventive & Social Medicine, Microbiology and Entomology from the faculty at Armed Forces Medical College (AFMC) Pune. Field work was undertaken in semi-urban and sylvatic/semi-jungle areas covering an area of almost 30 kilometres radius around AFMC, covering ten general locations (Pune Cantt, Ram Tekri, Aundh, Lohegaon, Kondhawa Khurd, Khadki, Singhgadh, Panchet, Khadakvasla and Lonavala). All these locations were covered at least twice a year - once during monsoons and once during late spring so as to cover the areas during maximum and minimum transmission periods. The selected

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areas for laying the rodent traps were thick forested areas as well as the "fringe areas" between the domestic and sylvatic zones. Sherman traps were laid during dusk time. About 100 to 120 traps were placed in one survey, spread over an area of approximately one square kilometer. The traps were collected at first light on the next day.

Rodent identification and ecto-parasite studies were undertaken at Entomology division, Department of Preventive & Social Medicine. Rodent heart blood was drawn, pooled serum was separated and tested for Weil Felix reaction at department of Microbiology. Organ impression smears of rodent heart, lungs, liver and spleen were made, fixed and dispatched to Microbiology department for identification of *Rickettsia* like bodies. These organs were also placed in SPG medium and dispatched to Microbiology Department for isolation of *Rickettsiae*.

Results

1. Details of rodent sampling : A total of 2368 traps were placed in the ten project areas, over the entire duration of the study. 207 rodents were trapped, giving an overall catch rate of 8.74% (95% Confidence limit 7.60% to 9.88%). The catch rate was higher (more than 10%) at Lonavala, Panchet, Singhgadh and Lohegaon. The details of rodent species according to the location are presented in Table 1. It was observed that certain species, viz., *Rattus r rufescence, Rattus meltada* and *Suncus murinus* were the commoner ones encountered at Lonavala, Khadakvasla, Singhgadh and Lohegaon, whereas *Rattus meltada* was most frequent at Panchet and Aundh.

2. Rodent infestation with mite ecto-parasites : (Table 2) It was observed that in most of the species, a moderate level of infestation of 51-100 larvae was the commonest form. However, in case of *S murinus*, a heavier infection of 151-200 larvae per rodent seemed to be the commoner affection. On the other hand, *R blanfordi*, *Mus booduga* and *R wroughtoni* species showed milder levels of infestation (upto 50 per rodent).

3. Distribution of species of mites : Of all the ecto-parasite mites sampled from the rodents, *Leptotrombidium deliense* was the commonest (69.2%) *L longisetosa* (28.3%) was next commonest, while *Herpataacarus* species (2.5%) were quite uncommon.

4. Serology for *Rickettsiae* : A total of 72 pooled rodent sera from the 201 trapped rodents (pooled according to different areas for each round of coverage) were examined for Weil Felix test. The distribution according to levels of titres for antibodies to OX2, OX19 and OXK *Proteus* antigens is presented in Table 3.

Table 1

Distribution of rodents according to their species and area of survey

Location	Species of rodents : No (%)					
	R r rufescens	R meltada	R blandfordi	S murinus	Others (**)	Total
Lonavala	9 (24.3)	10 (27.0)	4 (10.8)	8 (21.6)	6 (16.2)	37 (100)
Khadakvasla	5 (33.3)	2 (13.3)	3 (20.0)	5 (33.3)	Nil	15 (100)
Panchet	3 (13.0)	8 (34.8)	6 (26.1)	2 (8.7)	4 (17.4)	23 (100)
Singhgadh	13 (31.7)	9 (21.9)	9 (21.9)	6 (14.6)	4 (9.8)	41 (100)
Khadki	2 (22.2)	3 (33.3)	1 (11.1)	2 (22.2)	1 (11.1)	9 (100)
Kondhwa	1 (9.0)	1 (9.0)	3 (27.3)	Nil	6 (54.7)	11 (100)
Lohegaon	15 (31.9)	8 (17.0)	9 (19.1)	12 (25.5)	3 (6.4)	47 (100)
Aundh	2 (20.2)	4 (40.0)	1 (10.0)	Nil	3 (30.0)	10 (100)
Pune Cantt	2 (33.3)	1 (16.6)	Nil	1 (16.6)	2 (33.3)	6 (100)
Ram Tekri	3 (37.5)	3 (37.5)	Nil	Nil	2 (25.0)	8 (100)
Total	55 (26.6)	49 (23.7)	36 (17.4)	36 (17.4)	31 (15.1)	207 (100)

Notes : 1. Figures in parenthesis indicate percentages; 2. Statistical analysis was not possible due to very small expected frequencies in a number of cells; 3. **Others included *Rattus wroughtoni* and *Mus booduga.*

Table 2

Mite larval infestation, according to species of rodents

Rodent species	Infestation level with mite larvae					Total
	Upto 50	51 - 100	101 - 150	151 - 200	> 201	
R blandfordi	11 (30.5)	11 (30.5)	5 (13.9)	6 (16.7)	3 (8.3)	36 (100)
M booduga	5 (27.8)	10 (55.6)	3 (16.7)	Nil	Nil	18 (100)
R r rufescens	6 (10.9)	18 (32.7)	18 (32.7)	8 (14.5)	5 (9.1)	55 (100)
R meltada	8 (16.3)	19 (38.8)	12 (24.5)	5 (10.2)	5 (10.2)	49 (100)
S murinus	8 (22.2)	6 (16.7)	4 (11.1)	11 (30.6)	7 (19.4)	36 (100)
R wroughtoni	4 (30.8)	4 (30.8)	2 (15.3)	2 (15.3)	1 (7.7)	13 (100)
Total	42 (20.3)	68 (32.9)	44 (20.7)	32 (16.0)	21 (10.1)	207 (100)

Table 3

Distribution of rodent sera according to results of Weil Felix reaction

Proteus antigen	Titre levels			Total (**)
	< 30	1:30 to 1:60	> 1:60	
OX2	62 (86.1)	10 (13.9)	Nil	72 (100)
OX19	68 (94.4)	4 (5.6)	Nil	72 (100)
OXK	65 (90.2)	7 (9.8)	Nil	72 (100)

** A total of 72 pooled sera were made from the 207 rodents, according to the location and round of trapping

Further distribution of mildly raised Weil Felix results (titres 1:30 to 1:60), according to locations is presented in Table 4. It was observed that, overall, a large majority of the pooled sera did not show rise in titres (86% to 90%) and none of the pool showed titre levels of more than 1:60. However, 13.9% of the pooled sera showed a mild rise (1:30 to 1:60) for OX2, while 5.6% and 9.8% respectively of the pooled sera showed rise in OX19 and OXK. Such mild rise in titres for OX2, OX19 and OXK was, in general, appreciable at Lonavala, Khadakvasla, Panchet, Singhgadh and Kondhwa (Khurd) areas.

Table 4

Distribution of mild rise of titres (titres 1:30 to 1:60) according to locations

Location	Results with mild increase in titre			Total pooled sera examined
	OX2	OX19	OXK	
Lonavala	3 (18.75%)	1 (6.25%)	2 (12.5)	16
Khadakvasla	1 (16.67%)	1 (16.67%)	1 (16.67%)	6
Panchet	1 (12.55%)	1 (12.5%)	1 (12.55%)	8
Singhgadh	3 (25.00%)	1 (8.3%)	2 (16.67%)	12
Khadki	Nil	Nil	Nil	3
Kondhwa (Khurd)	1 (33.3%)	Nil	1 (33.3%)	3
Lohegaon	1 (9.7%)	Nil	Nil	13
Aundh	Nil	Nil	Nil	4
Pune Cantt	Nil	NIl	Nil	3
Ram Tekri	Nil	Nil	Nil	4
Total	10 (13.9%)	4 (5.6%)	7 (9.8%)	72 (100%)

5. Organ impression smears : Out of the organ impression smears of 207 rodents, 3 (1.4%) showed possible *Rickettsia* like bodies. All these smears were from Lonavala area. However, animal inoculation studies from the tisues of rodents could not lead to rickettsial isolation.

Discussion

Way back, during 1930s and 1940s, authorities of the British Indian Army had recommended establishment of a "Typhus Surveillance Team" as well as constitution of a "Typhus Research Team" [1]. Over the years, we seem to have lost track of the importance of these epidemic prone group of diseases, and have obviously paid heavy price in terms of focal outbreaks, morbidity and even mortality.

The findings of the present study indicate that there is a definite evidence of low level transmission of scrub typhus among local sylvatic/peri-urban rodents around Pune. Efficient rodent species have been trapped in the present study. The rodents have also shown mild to moderate infestation with the ectoparasite vector (*L deliense* mite chiggers) as well as serological evidence of low level transmission among these rodent populations. Transmission risk of scrub typhus is therefore potentially high in fringe and sylvatic areas, especially in locations like Panchet, Singhgadh, Lonavala, Khadakvasla and Kondhwa.

Apparently, the tires of antibody against OXK antigen, as shown in the study are on the low side. No cases of scrub typhus have been reported in the area. However, the evidence of low level of transmission among rodents, and the presence of vectors, calls for close epidemiological surveillance, including both zoonotic and clinical parametres, through periodic surveys. It may be useful, as a policy, to carry out such surveys periodically by SHOs located in and around all training establishments, besides in the known endemic areas for scrub typhus.

Based on the findings of this study, it is recommended that :-

(a) Strict preventive measures against scrub typhus be ensured during outdoor camps and exercises in the general areas of Lonavala, Panchet, Singhgadh, Kondhwa and Khadakvasla. This should include meticulous personal protective measures and other laid down procedures for scrub typhus prevention.

(b) Health care providers must keep a high index of suspicion for typhus group of diseases in and around Pune, especially for recruits, cadets and other trainees who are likely to be exposed to the above mentioned areas for outdoor camps, training exercises, route marches, and so on.

(c) A "Central typhus centre" may be raised for imparting training in surveillance and epidemiological investigations of typhus group of fevers. This centre may also provide referral support to the mobile field teams, as are being recommended in subsequent paragraphs. This could be part of the Armed Forces Central Epidemiological Surveillance Centre, functioning at AFMC, Pune.

(d) Mobile typhus surveillance and outbreak investigation teams may be developed, one for each command. It is suggested that these teams should include a specialist in Preventive and Social Medicine (who should have also been trained in surveillance of rodent borne diseases), a medical specialist, a pathologist and an NCO/JCO who has been adequately trained in typhus rodentology and

entomology. One large SHO per command may be developed as a nodal point for these teams. These personnel could be earmarked from the local Military Hospital and large SHO. These teams could maintain the surveillance data for typhus group of diseases within the command zone, and also move to the site of outbreak for rapid investigations and control, within their area of responsibility, on the instructions of respective DDsMS, Commands.

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