International Journal of Community Medicine and Public Health
*Patel BB et al. Int J Community Med Public Health. 2023 May;10(5):1759-1763*
http://www.ijcmph.com
pISSN 2394-6032 | eISSN 2394-6040

DOI: https://dx.doi.org/10.18203/2394-6040.ijcmph20231270

**Original Research Article**

# Outbreak of scrub typhus in western part of India: containment and lessons learnt

**Barun Bhai Patel[1]*, Pranaya Gurmeet[2], Vipul Dutt[1], Harpreet Singh[1], Amit Sharma[3], Vivek Gupta[1], Kapil H. Pandya[1], Ganesh Madne[1], Indrakhi Bhattacharya[1], Paridhi Gupta[3]**

[1]Department of Community Medicine, [2]Department of Obstetrics and Gynaecology, [3]Department of Anaesthetics, AFMS, Pune, Maharashtra, India

**Received:** 21 January 2023
**Revised:** 19 February 2023
**Accepted:** 20 February 2023

***Correspondence:**
Dr. Barun Bhai Patel,
E-mail: barunbhaipatel@gmail.com



## ABSTRACT

**Background:** Scrub typhus is one of the most covert diseases of present era. Diagnosis is often missed, and tools for confirming diagnosis are often not available in resource-poor setups. The aim of the study was to investigate an outbreak investigation and suggests methods of containment.
**Methods:** An epidemiological investigation of Scrub typhus outbreak though active and passive surveillance. Time, Place and person distribution, mean, median stand deviation were used during analysis.
**Results:** Cases presented with high grade fever (100%), bodyache (91%) and headache (81%). Nearly, 22% cases presented with Eschar, 16% of blood samples were positive for OX-19 antigens, 9% blood samples were sent for enzyme linked immunosorbent assay (ELISA) and were positive for IgM antibodies.
**Conclusions:** An outbreak of Scrub Typhus infection was successfully contained without any mortality by effectively using Chemoprophylaxis, judicial use of chemicals and personal protective measures.

**Keywords:** Outbreak, Scrub typhus, Chemoprophylaxis, Personal protection

## INTRODUCTION

Scrub typhus is an acute febrile illness caused by Orientia tsutsugamushi (Rickettsia tsutsugamushi). In India, the presence of scrub typhus and other Rickettsial diseases has been known for several decades. Rickettsial diseases are considered as one of the most covert re-emerging diseases and are being increasingly recognized in India. Rickettsial diseases have been documented in India, since the 1930s, with reports of scrub typhus from Kumaon region, Assam among soldiers during the World War II (WW-II); scrub and murine typhus from Jabalpur area in Madhya Pradesh and murine typhus from Kashmir. During WW-II, scrub typhus produced considerable morbidity and mortality among troops deployed in Southeast Asia. Surveillance in animals and humans in different parts of India has documented significant levels of exposure to infections. Rickettsioses, of which scrub typhus is the commonest and has been clearly reported from several states in India, including Jammu and Kashmir, Himachal Pradesh and Uttaranchal.[1-2] The causative organism, *Orientia tsutsugamushi*, is transmitted to humans by bite of the trombiculid mites (in larval stage), possibly *Leptotrombidium delience.*[3] Since these mites are widely distributed in different types of vegetations e.g., forests, shrubs, paddy fields and plantations, farmers and people who engage in outdoor activities, are at a higher risk of contracting scrub typhus.[4] This disease is grossly under-reported and under-diagnosed owing to the misconception that, scrub typhus is only a concern in heavily forested areas. The clinical presentation often mimics other

common febrile illnesses such as dengue, chikungunya and enteric fever, as clinical presentations are almost similar to these diseases, with only distinguishing feature being presence of black punched out rash i.e., Eschar. This pathognomonic feature i.e., Eschar remains absent in large number of cases that makes diagnosis even more difficult. Associated complications in severe cases include hepatitis, myocarditis, acute respiratory distress syndrome (ARDS), multi organ dysfunction syndrome, disseminated intravascular coagulation and several neurological manifestations. The present outbreak investigation was carried out to address the voids in awareness about the disease profile, benefits of early institution of definitive treatment, highlight the requirement of surveillance system for effective and prompt outbreak response and outlining effective preventive measures which will help in better planning and preparation for outdoor activities in areas likely to be infested with vectors of Rickettsioses.

## METHODS

The present study was carried out as an observational, epidemiological study amongst population residing in a catchment area of healthcare establishment in Punjab near the foothills of Himachal Pradesh and Jammu & Kashmir. The outbreak was suspected on occurrence of index case on 26 Aug 2017 and another case on 28 Aug 2017. Initially, outbreak was investigated on the line of undifferentiated fever outbreak as both cases reported fever and body ache. Rickettsial illness was also considered and development of Eschar amongst one of the case nearly confirmed the causation. An active case search was initiated adopting the case definitions of Indian Council of Medical Research (ICMR).[1] "Suspected case" as one with "acute undifferentiated febrile illness of five days or more with or without eschar should be suspected as a case of Rickettsial infection. (If eschar is present, fever of less than five days duration should be considered as scrub typhus.) Other presenting features may be headache and rash (rash more often seen in fair persons), lymphadenopathy, multi-organ involvement like liver, lung and kidney involvement." "Probable Case" was defined as "A suspected clinical case showing titres of 1:80 or above in OX2, OX19 and OXK antigens by Weil Felix test and an optical density (OD) >0.5 for IgM by ELISA considered positive for typhus and spotted fever groups of Rickettsiae". "Confirmed Case" is one in which "Rickettsial DNA is detected in eschar samples or whole blood by PCR, rising antibody titers on acute and convalescent sera detected by Indirect Immune Fluorescence Assay (IFA) or Indirect Immunoperoxidase Assay (IPA)".

Epidemiological case sheets were developed and data of all cases were collected on epidemiological case sheet. The cases were studied for their distribution in time, place and person; data collated and analyzed. A detailed report of the living conditions was recorded in epidemiological case sheet. Data on prevailing meteorological conditions was collected. A team comprising of one community medicine specialist and health assistant visited the affected area including the housing facilities to carry out investigation. All the exposed personnel were examined and were administered chemoprophylaxis, with weekly Doxycycline 200 mg for seven weeks. A health awareness drive was also organized, highlighting the features of the disease and preventive measures to be taken with an emphasis on personal protection. All persons of the location of concern were examined everyday till maximum incubation period for signs and symptoms by a trained medical officer. Subsequently, other preventive actions to control rodents and infestation of mites, vegetation clearance near the households, spraying of chemicals like Malathion, use of DEPA or DEET for personal protection were implemented. All clothing/beddings were dried in sunlight and ventilation of households was improved by keeping the doors and windows open during the day. All healthcare providers were also given chemoprophylaxis besides adopting standard precautions as applicable in preventing mite bite. The laboratory investigation of the cases included routine blood count, renal function test (RFT), liver function test (LFT), Dengue serology, WIDAL test. Institute ethical committee clearance was sought and obtained retrospectively, on completing the outbreak investigation.

## RESULTS

### *Geographical area*

Cases have occurred in Pathankot district, in northern Punjab which shares boundaries with Jammu and Kashmir and Himachal Pradesh states. It has an average elevation of 332 metres (1,089 ft). It is surrounded by Ravi and Chakki rivers, Shivalik foothills on the south and east and snow-capped Himalayas in the back drop in north. Monsoon in this region is generally between July to September, however, being situated in foothills, mild rain fall can be seen across the year. During the month of August to September the temperature in this region ranges between 24-38$^0$C, with moderate to heavy rainfall. The relative humidity during the monsoons was recorded between (80-95)%. The catchment area is spread over 60 km$^2$ and is mostly covered with trees and shrubs all around. These environmental conditions are ideal habitat for mites as well as for rodents. Population of the area gets exposed to forested vegetations while moving outdoors for daily routine activities. This region of Punjab, Himachal and Jammu and Kashmir are endemic for Scrub Typhus Fever, especially during monsoons and post monsoon periods. Sporadic cases are reported across the year. However, there was no major reported outbreak of the disease in the area in last five years. At the time of outbreak, population of 1186 were living in the area in an approximately equal mix of pucca and kuccha houses. Similarly, floor and beds both were being used for sleeping and per capita floor space was 30-36 sq ft as against recommended 50 -100 sq ft and air space available was 300- 350 cubic ft as against minimum laid down air space 500-1000 cubic ft per capita.

***Time place person distribution of cases***

A total of 32 cases were identified during active and passive case search between 26 Aug to 21 Sep 2017. The mean age of cases was 32±7.07 years. All the have history of outdoor activities in particular area of concern between 05 Aug to 26 Sep 2017. The time distribution of cases revealed initiation of outbreak in a sporadic fashion in last week of Aug 2017, reaching the peak between 11 Sep to 14 Sep and declining thereafter. The time distribution of cases is depicted in (Figure 1).

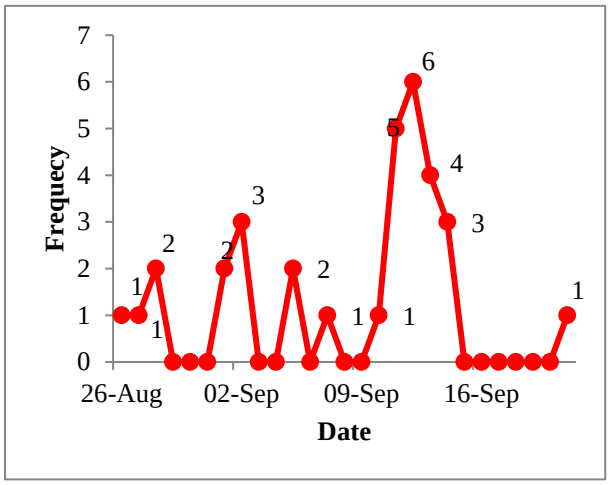


**Figure 1: Epidemic curve of outbreak.**

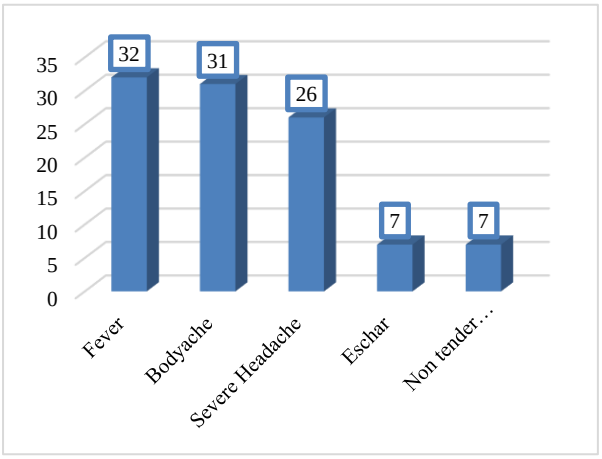


**Figure 2: Distribution of clinical features.**

***Clinical presentation***

Amongst 32 cases, cardinal presenting feature was high grade and continuous fever. Of all the patients admitted, 26 cases (81%) presented with diffuse severe headache, 31 cases (91%) with bodyache and 07 Cases (22%) had Eschar (a painless ulcers upto 1 cm in size, with a black necrotic centre, which is pathognomonic feature of scrub typhus). Distribution of clinical features in cases is described in (Figure 2). Eschar was typical punched out lesion and distributed on abdomen, groin and extremities, while in 01 case eschar was noted on eyelid. The distribution of Eschar is depicted as (Figure 3). Non tender Lymphadenopathy was noted in 4 cases (13%) and 7 (21%) cases required ICU admission, as they developed deranged liver function parameters, acute kidney injury and Central Nervous System (CNS) symptoms, in the form of delirium, and two cases developed pneumonia. After confirmation of diagnosis and treatment on the line of Scrub Typhus, all cases were treated with Doxycycline 100 mg twice daily, and all cases started improving within 48hours of institution of treatment.

**Figure 3: Distribution of Eschars.**

***Lab investigations***

All routine investigations in fever evaluation, consisting of blood counts, peripheral smear examination, LFT and RFT, Dengue serology and WIDAL tests were carried out. Out of 32 cases 4 (12.5%) were positive in Widal test, 8 (25%) patients presented with thrombocytopenia, (<100000/cm3) and deranged LFT parameters. Peripheral smear for Malaria was negative for all patients. During the first week of course of the disease, all the cases were investigated as a case of pyrexia of unknown origin (PUO). Observation of eschar by epidemiological investigating team the investigations were diverted towards Ricketssial diseases. Weil Felix test was performed on all the patients, but only 15 blood samples came positive for OX-19 antigens, 3 blood samples were sent for ELISA for IgM which was positive for all 3 cases.

***Containment of outbreak***

All the cases were treated with Doxycycline 100 mg twice daily. The remaining population was given prophylactic Doxycycline 200 mg weekly for seven weeks. Households were wet mopped with 2% cresol and effective cross ventilation was ensured. All cloths and beddings were dried in sunlight.

**Table 1: Comparison of study findings with similar studies.**

| Signs/ Symptoms | Vivekanandan et al [10] | Subbalaxmi et al [13] | Sivarajan et al [14] | Takhar et al [15] | Pathania et al [16] | This study |
|---|---|---|---|---|---|---|
| **Fever** | 50 (100) | 176 (100) | 75 (83.3) | 66 (100) | 54 (100) | 32 (100 |
| **Headache** | 19 (38) | NA | 56 (62.2) | 20 (30.3) | 20 (30.3) | 26 (81) |
| **Cough** | 20 (40) | 94 (53.4) | 21 (23.3) | 32 (48.5) | 28 (51.85) | 12 (37.5) |
| **GI Symptoms** | 29 (58) | NA | 21 (23.3) | 18 (27.3) | 29 (53.7) | 4 (12.5) |
| **Eschar** | (46) 23 | 23 (13.1) | 10 (11.1) | 10 (11.1) | 7 (12.96) | 7 (22) |
| **Lab investigations** | | | | | | |
| Thrombocytopenia (<100,000/mm3) | 5 (10.8) | 53 (30.1) | 18 (20) | 52 (78.8) | 7 (12.9) | 8 (25) |
| Deranged liver function test | 47 (95.9) | 153 (86.9) | ALT-85 (94) AST-90 (100) | 32 (48.5) | 40 (74.07) | 8 (25) |
| Renal Failure | 6 (12) | 49 (27.8) | 11 (12.2) | 34 (51.5) | 2 (3.70) | Nil |
| Mortality | 1 (2) | 8 (4.5) | 5 (5.15) | 21.2 | 1 (1.87) | Nil |

Diethyl phenyl acetamide (DEPA) 20% was applied, as per procedure, in all clothings, including undergarments and socks. Living area and area adjacent to households were cleared off from vegetation/folliage and sprayed with 50% Malathion. All were educated about source of infection, signs and symptoms and preventive measures of the disease. Detailed advisory was issued in local language for implementing strict preventive measures. All medical officers and paramedics were sensitized for early identification and reporting of cases.

## DISCUSSION

Scrub Typhus is endemic in Southeast Asia, Northern Australia and the Islands of the western Pacific Ocean. Its presence can be seen at different conditions starting from sandy beaches to the Himalayan Mountains. Indigenous rural workers, residents of suburban areas, and westerners visiting endemic areas, on military, business and recreational purposes are most commonly infected.[5] Scrub typhus is transmitted by the bite of an infected trombiculid mite larva called chiggers generally belonging to the sub family Trombiculinae, genus Leptotrombidium of the tribe Trombiculini. O. *tsutsugamushi,* is maintained through transovarian transmission in the trombiculid mites, making them the reservoirs as well as vectors of scrub typhus.[6] In this study the outbreak occurred during the last week of August till September, which is the post monsoon season in study area. This is consistent with the natural history of the disease and corroborates with similar study by Mathai et al.[7] This infection is also known to occur in diverse geographical places like deserts, rice fields, and seashores. In India, the disease was documented for the first time during the World War II among field troops in Assam and West Bengal. Since then, a pan-India presence of scrub typhus has been well documented particularly from south India and the Himalayan region of north India.[8-10] It was only recently that, outbreaks of the disease were reported from many other areas of sub- Himalayan north India and central India.[11-12] In our study also, the disease took place in a place surrounded by dense forested area, making it ideal mite island. Clinical spectrum of Scrub typhus can range from a self-limiting disease to multi organ dysfunction and may even lead to death. Prompt diagnosis and appropriate treatment is therefore very important to reduce morbidity and mortality. presence of pathognomic feature i.e., eschar was noticed among 22% in our study, which was higher than study by Vivekanandan et al and Pathania et al.[10-16] This febrile illness affects, previously healthy active persons and if undiagnosed or diagnosed late may prove life threatening. Unlike the usual viral illnesses, the duration of fever in the majority of cases was usually more than seven days.

In addition to myalgia and headache, nausea, vomiting, cough and breathlessness were seen in a significant number of cases. These findings are consistent with findings of our study also, majority of patients presented with fever, headache, myalgia and features of respiratory and gastrointestinal infection. In the present outbreak, all cases presented with fever, 31 cases (91%) with bodyache. 07 Cases (22%) had Eschar, 22% cases developed multi organ dysfunction. These findings are similar to outbreak investigation findings of M Vivekanandan in Pondicherry and study by Pathania et al.[16] However The mean age of patients in our study was 32±7.07 years which is similar to study by Pathania M et al, where the mean age of the patients was 30.80±12.32 years. Comparative findings of various studies is depicted in (Table1). Identification of areas infested with mites, measures to control mite population, and if possible initiation of chemoprophylaxis with Doxycycline should be undertaken in specific areas during the specific months of monsoon/post monsoon as an effective means to reduce morbidity and mortality due to Rickettsial diseases. Mapping of mites and ticks in different areas of the country needs to be undertaken afresh, so that, information on vector species composition, diversity and abundance can be determined in this area. Efforts should be made to survey likely “mite islands” to yield meaningful information.

***Limitations***

The present study is an outbreak investigation, genearliability of which is limited to affected geographical area.

## CONCLUSION

Early identification of cases of rickettssial diseases by formulation of specific guidelines for diagnosis especially during monsoon and post monsoon, timely initiation of treatment and containment measures can prevent significant morbidity and mortality related to Scrub Typhus.

*Funding: No funding sources*
*Conflict of interest: None declared*
*Ethical approval: The study was approved by the Institutional Ethics Committee*

## REFERENCES

1. DHR-ICMR guidelines for diagnosis and management of Rickettsial diseases in India 2015. Available at: https://www.icmr.nic.in/sites/default/files/guidelines/DHR-ICMR%20Guidelines%20on%20Ricketesial% 20Diseases.pdf. Accessed on 20 November 2022.
2. Bavaro MF, Kelly DJ, Dasch GA. History of US military contribution to the study of Rickettsial diseases. Mil Med. 2005;170(4):49-60.
3. Lerdthusnee K, Khlaimanee N, Monkanna T, Sangjun N, Mungviriya S, Linthicum KJ, et al. Efficiency of Leptotrombidiumchiggers (Acari: Trombiculidae) at transmitting Orientia tsutsugamushi to laboratory mice. J Med Entomol. 2002;39:521-5.
4. Tay ST, Ho TM, Rohani MY, Devi S. Antibodies to Orientia tsutsugamushi, Rickettsia typhi and spotted fever group rickettsiae among febrile patients in rural areas of Malaysia. Trans R Soc Trop Med Hyg. 2000; 94(3):280-4.
5. Woodcart ET. Rickettsial diseases, In: Isselbacher KJ, Braunwald E, eds, Harrison's principles of internal medicine. USA: Mcgraw-Hill Inc; 2000.
6. Tilak R, Kunte ACR. Scrub typhus strikes back: Are we ready?. Med J Armed Forces India. 2019;75:8-17.
7. Mathai E, Rolain JM, Verghese GM. Outbreak of scrub typhus in Southern India during the cooler months. Ann N Y Acad Sci. 2003;990:359e-64.
8. McDonald JC, MacLean JD, McDade JE. Imported rickettsial disease: clinical and epidemiologic features. Am J Med. 1988;85:799-805.
9. Kumar K, Saxena VK, Thomas TG, Lal S. Outbreak investigation of scrub Typhus in Himachal Pradesh (India). J Commun Dis. 2004;36:277-83.
10. Vivekanandan M, Mani A, Priya YS, Singh AP, Jayakumar S, Purty S. Outbreak of scrub typhus in Pondicherry. J Assoc Physicians India. 2010;58:24-8.
11. Sethi S, Prasad A, Biswal M, Hallur VK, Mewara A, Gupta N, et al. Outbreak of scrub typhus in north India: a re-emerging epidemic. Trop Doc. 2014;44:156-9.
12. Rathi NB, Rathi AN, Goodman MH, Aghai ZH. Rickettsial diseases in central India: proposed clinical scoring system for early detection of spotted fever. Indian Pediatr. 2011;48: 867-72.
13. Subbalaxmi MVS, Chandra N, Teja VD, Lakshmi V, Rao MN, Raju YSN. Scrub typhus – Experience from a South Indian tertiary care hospital. BMC Infect Dis. 2012;12:77.
14. Sivarajan S, Shivalli S, Bhuyan D, Mawlong M, Barman R. Clinical and paraclinical profile, and predictors of outcome in 90 cases of scrub typhus, Meghalaya, India. Infect Dis Poverty. 2016;5:91
15. Takhar RP, Bunkar ML, Arya S, Mirdha N, Mohd A. Scrub typhus: A prospective, observational study during an outbreak in Rajasthan, India. Natl Med J India. 2017;30:69-72.
16. Pathania M, Amisha, Malik P, Rathaur VK. Scrub typhus: Overview of demographic variables, clinical profile, and diagnostic issues in the sub-Himalayan region of India and its comparison to other Indian and Asian studies. J Family Med Prim Care. 2019;8:1189-95.

**Cite this article as:** Patel BB, Gurmeet P, Dutt V, Singh H, Sharma A, Gupta V, et al. Outbreak of scrub typhus in western part of India: containment and lessons learnt. Int J Community Med Public Health 2023;10:1759-63.