

Clinical Profile, Outcomes, and Prognostic Factors of Scrub Typhus: A Prospective Observational Study.

Gayathri Chalil¹, Abhipsa Mohapatra², Khetra Mohan Tudur³, Prafulla Kumar Bariha⁴, Manoj Kumar Mohapatra^{5*}

¹Senior Resident, Dept. of Medicine, V.S.S. Institute of Medical sciences and Research (VIMSAR), Burla, Odisha, India, 768017, SUM Hospital, Bhubaneswar

²Asst. Prof. Dept. of Microbiology, SUM Hospital, Bhubaneswar, V.S.S. Institute of Medical sciences and Research (VIMSAR), Burla, Odisha, India. 768017, SUM Hospital, Bhubaneswar

³Asst.Prof. Dept. of Medicine, V.S.S. Institute of Medical sciences and Research (VIMSAR), Burla, Odisha, India, 768017, SUM Hospital, Bhubaneswar

⁴Associate.Prof. Dept. of Medicine, V.S.S. Institute of Medical sciences and Research (VIMSAR), Burla, Odisha, India, 768017, SUM Hospital, Bhubaneswar.

⁵Retd. Prof. Dept. of Medicine, V.S.S. Institute of Medical sciences and Research (VIMSAR), Burla, Odisha, India, 768017, SUM Hospital, Bhubaneswar

Abstract

Background

Scrub typhus is an important cause of acute febrile illness in India and may lead to severe complications, including acute kidney injury and multiple organ dysfunction syndrome. Early identification of patients at risk of severe disease is essential for timely management. This study evaluated the clinical profile, outcomes, and prognostic factors of scrub typhus among adults in Odisha.

Methods

This hospital-based prospective observational study was conducted at Veer Surendra Sai Institute of Medical Sciences and Research (VIMSAR), Burla, Odisha, India, from November 2020 to January 2023. Adults diagnosed with scrub typhus using IgM enzyme-linked immunosorbent assay (ELISA) were included. Demographic characteristics, clinical findings, laboratory parameters, complications, and outcomes were recorded. Data were analysed using SPSS version 22. Continuous variables were summarized using means and standard deviations. Univariate analysis was performed to assess factors associated with severe disease.

Results

Among 985 patients admitted with fever, 110 (11.2%) were diagnosed with scrub typhus. Eschar was identified in 42 patients (38.2%), and complications occurred in 24 (21.8%). Four patients (3.6%) died, all with multiple organ dysfunction syndrome. Factors associated with severe disease included serum albumin below 2.8 g/dL, urine output below 500 mL/24 hours, leukocytosis above 10,000/ μ L, a fever-to-treatment interval exceeding 6 days, and serum creatinine above 3.8 mg/dL.

Conclusion

Scrub typhus was associated with substantial morbidity in this hospital-based cohort. Early diagnosis and recognition of clinical and laboratory indicators of severe disease may support timely management.

Keywords: Scrub typhus, Acute febrile illness, *Orientia tsutsugamushi*, Eschar, Prognostic factors, Doxycycline

Submitted: April 10, 2026

Accepted: May 18, 2026

Published: June 30, 2026

Corresponding Author

Prof. Manoj Kumar Mohapatra

E-mail: mohapatra.manoj@rediffmail.com

Retd. Prof. Dept of Medicine, VIMSAR, Burla, Sambalpur, Odisha, Harshpriya Hyde, Flat No.102, BJB Nagar, Bhubaneswar.

Introduction

Scrub typhus is an important cause of acute febrile illness in endemic regions of Asia and can lead to serious complications, including acute respiratory distress syndrome (ARDS), acute kidney injury (AKI), and multiple organ dysfunction syndrome (MODS). It is a zoonotic infection caused by *Orientia tsutsugamushi* and transmitted to humans by larval mites belonging to the family Trombiculidae. The disease is associated with diverse clinical presentations, ranging from an uncomplicated febrile illness to severe, life-threatening organ dysfunction. Early recognition of severe disease is therefore important for timely management and improved clinical outcomes¹⁻³.

Globally, although over a billion people at risk of ST with an estimated one million cases every year, this disease is peculiarly distributed in the so called tsutsugamushi triangle, now renamed as tsutsugamushi quadrangle, which is bounded on East by Japan, West by Pakistan, North by Russia, South by Australia². It is an important cause of non-malarial febrile illness in SEA, succeeded

by Dengue³. ST is characterized by fever, malaise, suffused conjunctiva like any other febrile illness, however, some patients may develop severe complications that include pneumonitis, acute respiratory distress syndrome (ARDS), acute kidney injury (AKI), myocarditis, multi organ dysfunction syndrome (MODS) with mortality ranged from 1-50%.^{2,3}.

The disease has been reported with increasing frequency from various parts of India with resurgence in North, North East, and South India^{4,5,6,7}. Geographically, Odisha, a state in eastern part of India lies in the Eastern Ghat range with forests and river, which is an ideal habitat for the vector.

However, studies describing the clinical profile, outcomes, and prognostic factors of scrub typhus in western Odisha remain limited. Therefore, this study aimed to evaluate the clinical presentation, complications, outcomes, and factors associated with severe scrub typhus among adult patients admitted to a tertiary care hospital in Odisha^{8,9}.

Materials and Methods

Study Design

This was a prospective observational hospital-based study conducted to evaluate the clinical profile, complications, outcomes, and prognostic factors of scrub typhus among adult patients admitted with acute febrile illness. Patients diagnosed with scrub typhus were evaluated using clinical findings and laboratory investigations, and their clinical course and outcomes were assessed during hospitalization. Clinical and biochemical parameters were analysed to identify factors associated with severe or complicated disease.

Study Setting

The study was conducted at Veer Surendra Sai Institute of Medical Sciences and Research (VIMSAR), Burla, Sambalpur, Odisha, India, from November 2020 to January 2023. The institution is a 2,000-bed tertiary care teaching hospital serving approximately 10 districts in western Odisha and neighbouring districts of Chhattisgarh and Jharkhand. The surrounding region includes forested, agricultural, and riverine environments

in which scrub typhus is an important consideration among patients presenting with acute febrile illness.

Participants

The study population comprised adult patients aged over 18 years who presented with acute febrile illness and were diagnosed with scrub typhus during the study period. Patients were evaluated for clinical features suggestive of scrub typhus, including fever, headache, rash, lymphadenopathy, and the presence or absence of an eschar. Diagnosis was established using an immunoglobulin M enzyme-linked immunosorbent assay (IgM ELISA).

Patients with comorbid conditions, including diabetes mellitus, chronic renal failure, hypertension, coronary artery disease, valvular heart disease, chronic liver disease, or alcoholic liver disease, were excluded. Patients lost to follow-up were also excluded. The exact sampling method and the procedures used to select eligible participants require confirmation from the original study records.

Variables

The principal clinical outcome was the development of severe or complicated scrub typhus during hospitalization. Complications recorded included hematological abnormalities, hepatitis, renal failure, neurological complications, acute respiratory distress syndrome (ARDS), and multiple organ dysfunction syndrome (MODS). In-hospital mortality was also recorded.

Demographic and clinical variables included age, sex, residence, occupational or environmental exposure, duration and severity of fever, associated symptoms, physical examination findings, and the presence and location of an eschar. Laboratory variables included hemoglobin concentration, total leukocyte count, platelet count, blood glucose, blood urea, serum creatinine, serum albumin, serum bilirubin, liver enzymes, and serum electrolytes. Vital signs and urine output were also evaluated.

Potential prognostic factors included elevated body temperature, leukocytosis, thrombocytopenia, hypoalbuminemia, reduced urine output, elevated serum creatinine, and the interval between fever onset and initiation of treatment.

Data Sources and Measurement

After hospitalization and obtaining written informed consent, demographic characteristics, presenting complaints, relevant clinical history, physical examination findings, laboratory investigations, complications, treatment, and outcomes were recorded using a study proforma.

Scrub typhus was diagnosed using IgM ELISA according to the diagnostic protocol adopted for the study. The original protocol also mentioned the Weil–Felix test.

For hematological assessment, 2 mL of venous blood was collected in an ethylenediaminetetraacetic acid (EDTA)-containing tube. Complete blood counts were measured using a Sysmex XS-800i hematology analyser. For biochemical investigations, 4 mL of venous blood was collected and divided between fluoride–oxalate and plain containers. Plasma glucose was measured using the glucose oxidase–peroxidase method. Blood urea was measured using an enzymatic endpoint urease method, serum creatinine using a kinetic method, and total bilirubin using the diazotized sulphanilic acid endpoint

method. Biochemical measurements were performed using an ACCULAB ATT112+ semiautomated analyser. Serum electrolytes were measured using an electrolyte analyser based on the ion-selective electrode method.

Clinical severity was assessed using the Acute Physiology and Chronic Health Evaluation II (APACHE II) scoring system, as described in the original study protocol. Patients received doxycycline and supportive treatment according to their clinical requirements. Clinical progression, complications, and in-hospital outcomes were recorded.

Bias

Potential sources of bias included selection bias associated with the hospital-based study population, information bias related to the recording of clinical findings, and confounding due to differences in disease severity and underlying clinical characteristics. Clinical information and laboratory findings were recorded using a study proforma, and laboratory investigations were performed using the methods and equipment specified in the study protocol. However, the original manuscript did not document specific procedures for minimizing selection bias, ensuring blinded outcome assessment, or controlling confounding. Any additional measures actually undertaken should be specified by the authors.

Sample Size

During the study period, 985 patients with fever were reported to have been admitted and screened, of whom 110 were diagnosed with scrub typhus. The original manuscript did not specify a formal sample-size calculation or an a priori sample-size justification. The authors should clarify whether all eligible patients diagnosed with scrub typhus during the study period were included or whether a predetermined sample size was used.

Quantitative Variables

Quantitative variables included demographic, clinical, physiological, and biochemical measurements. Continuous variables were summarized using means and standard deviations, as reported in the original statistical analysis. Clinical and laboratory parameters were examined in relation to the development of complicated or severe scrub typhus. Clinically relevant thresholds for serum albumin, urine output, leukocyte count, serum creatinine, and the interval between fever onset and

treatment initiation were used in the prognostic analysis, as reported in the study results.

Data Analysis

Data were entered and analysed using SPSS software, version 22. Continuous variables were summarized as means and standard deviations, and categorical variables were expressed as frequencies and percentages. A two-sided p-value of less than 0.05 was considered statistically significant, and 95% confidence intervals were used where applicable. Univariate analysis was performed to evaluate associations between clinical and laboratory parameters and the development of severe or complicated scrub typhus. Odds ratios and their corresponding 95% confidence intervals were reported for prognostic factors, where applicable.

The original Results section describes five independent prognostic factors. If these were identified using multivariable analysis, the specific statistical method and the variables included in the model must be reported here.

Ethical Considerations

The study was conducted after obtaining approval from the Institutional Ethics Committee of Veer Surendra Sai Institute of Medical Sciences and Research, Burla, Odisha, India. Written informed consent was obtained from each participant or the legally authorized representative, as applicable, before enrolment. Patient information was collected and handled for research purposes while maintaining confidentiality.

The ethics approval date and approval or reference number were not provided in the available manuscript and should be added after verification from the institutional approval letter.

Results

Participants

During the study period from November 2020 to January 2023, 985 patients presenting with fever were reported to have been admitted or screened for scrub typhus. Of these, 110 (11.2%) were diagnosed with scrub typhus and included in the study. The available manuscript does not specify the number of patients assessed for eligibility, excluded according to the exclusion criteria, or lost to follow-up. These details require verification from the original study records to complete the participant flow diagram.

During the study period total 985 patients of fever were admitted to the hospital of which 110 (11.2%) patients were diagnosed ST. All the patients were between 20 to 70 years of age. The distribution of patients was almost similar in all age groups i.e. 23.6%, 25.4%, 21.8%, 19.1% in 2nd, 3rd, 4th and 5th decade respectively except 6th decade that had only 10 (9.1%) patients. (Table-1). There were 56 (50.9%) males and 54 (49.1%) females with male to female ratio of 1.1:1. Female patients outnumbered male between 41 to 50 years and almost equal in 31 to 40 years of age group (Table-1)

Table-1 Age and sex distribution

Age Group (Years)	Male	Female	Total
21-30	16	10	26 (23.6%)*
31-40	12	16	28 (25.4%)
41-50	12	12	24(21.8%)
51-60	10	12	22(19.1%)
61-70	6	4	10 (9.1%)
Total	56 (50.9%)*	54 (49.1%)	110

*percentage calculated from total 110.

100 (90.9%) patients from rural area and all were directly or indirectly related to field works like farming (n=75, 75.0%), gardening (n=20, 20.0%), grass cutting (n=10, 10.0%), horticulture activities (n=10,10.0%). From them 25 (25.0%) patients had multiple activities for which total is more than 100 patients. Out of 10 (9.1%) patients from urban area 6 (60.0%) patients had history of working in their gardens attached to house and 4 (4.0%) had history of

visiting to their home at villages with exposure to plants before a week. Fever was present in all cases. High grade continuous fever was found in 75 (68.2%) cases and low-grade fever in 35 (31.8%) cases. Duration of fever at the time of admission was less than 5 days, 5 to 7 days, 7 to 14 days in 30 (27.3%), 55 (50.0%), 20 (18.2%) patients respectively. 5 (4.5%) patients presented with prolonged fever and referred from peripheral hospital as pyrexia of

unknown origin (PUO). Apart from fever, other symptoms like myalgia, headache, vomiting, suffused conjunctiva, and cough were common features. (Table-2)

Table-2. Clinical Features of Scrub Typhus.

Clinical Characteristics	Number (%)
Fever	110 (100.0)
Malaise	85 (77.3)
Headache	60 (54.5)
Vomiting	60 (54.5)
Cough	34 (30.9)
Eschar	42 (38.2)
Lymphadenopathy	34 (30.9)
Hepatomegaly	21 (19.1)
Rash	16 (14.5)
Jaundice	10 (9.1)
MODS	10 (9.1)
Hepato-splenomegaly	8 (7.3)
Oliguria	5 (4.5)
Altered sensorium	3 (2.7)
Seizure	3 (2.7)
Ataxia	1 (0.9)

Eschar was found in 42 (38.2%) cases and females (n=22, 52.4%) outnumbered males (n=20, 47.6%). Majority of patients had eschar on perineal region followed by abdomen and axilla. Eschar behind ear and limbs are uncommon and found in 1 (2.4%) each (Table-3). Lymphadenopathy (30.9%), hepatomegaly (19.1%), and rash 14.5%) were common findings. Complications were encountered in 24 (21.8%) cases (Table-4). A single patient had multiple complications therefore, the total patients in Table-2 outnumbered total patients with complications (n=24). Hematological complications like

leukocytosis, thrombocytopenia, anemia, and pancytopenia was found in 20 (18.1%), 10 (9.1%), 8 (7.3%), and 6 (5.5%) cases respectively. MODS was found in 10 (9.1%) cases. Neurological complications were found in 7 (6.4%) cases and ataxia which is a very rare complication was found in 1 (0.9%) case. ARDS found in 2 (1.8%) cases were part of patients with MODS. The hematological and biochemical findings among patients with uncomplicated and complicated ST were given in Table-5.

Table-3 Distribution of Eschars

Region of Body	Number (%) (n=42)
Inguinal region (Pubic+Perineal)	15 (35.7)
Abdomen	12 (28.6)
Back	7 (16.7)
Axillary	5 (11.9)
Upper limb	1 (2.4)
Lower limb	1 (2.4)
Behind Ear	1 (2.4)



Fig-1: Eschar behind ear.



Fig-2: Eschar in abdomen.

Table-4. Complications in Scrub Typhus

Complications	Number (Percentage)*
Anemia	8 (7.3)
Thrombocytopenia	10 (9.1)
Leukocytosis	20(18.1)
Pancytopenia	6 (5.5)
Hepatitis	12 (10.9)
Renal Failure	11 (10.0)
MODS	10 (9.1)
Neurological	7 (6.4)
i.Meningoencephalitis	3 (2.7)
ii.Convulsion	3 (2.7)
iii.Ataxia	1(0.9)
ARDS	2 (1.8)

*Percentage calculated from total patient (n=110).

Patients with multi organ dysfunction syndrome (MODS) had high bilirubin, urea, and creatinine as per the dysfunction. Patients without organ dysfunction had normal

biochemical values (Table-5). Patients with MODS were admitted to ICU. Out of 110 patients there were 4 (3.6%) deaths and all patients who died had MODS.

Table 5: Comparison between Uncomplicated and Complicated ST

Variables	ST (Uncomplicated) N=86 (78.2%)	ST (Complicated) N=24 (21.8%)	P value
Male/ Female	42/44	14/10	
Age (Years)	36.5±14.0	37.7±16.2	<0.1
Temperature (°F)	101.7±1.8	103.1±2.8	<0.002
Respiration rate (No./ minute)	23.2±7.1	35.3±5.6	<0.001
Heart rate (No. of beats/ minute)	97.9±10.6	111.4±10.4	<0.001
Mean blood pressure (mmHg)	104.2±5.2	85.1±15.1	<0.001
Urine output (ml/24 hour)	1020.0±353.2	846.1±388.0	<0.001
Hemoglobin (gm/dL)	8.8±2.4	6.8±2.2	<0.001
Hematocrit (%)	31.5±5.3	33.0±7.1	<0.002
Total leukocyte count (/ µL)	8732.5±3561.5	13765.3±3328.6	<0.001
Platelet count (/ µL)	126900.8±18454.6	94385.7±6547.8	<0.001
Blood glucose (mg/dL)	74.2±16.1	72.4±64.5	>0.5
Blood Urea (mg/dL)	54.6±37.6	141.3±50.3	<0.001
S. Creatinine (mg/dL)	4.3±1.2	8.7±1.4	<0.001
S.protein (gm/dl)	5.1±0.7	4.3±1.1	<0.01
S. albumin (gm/dL)	3.4±0.4	2.4±0.3	<0.01
S. bilirubin (mg/dL)	1.6±4.3	7.9±9.2	<0.001
SGOT	64.6±14.3	148.6±44.3	<0.001
SGPT	54.6±14.3	98.6±34.3	<0.001
Alkaline Phosphatase	142.6±34.3	248.6±74.3	<0.001
S.sodium (mEq/L)	132.6±5.2	129.1±25.4	<0.001
S.potassium (mEq/L)	3.5±0.7	3.3±1.1	<0.01
APCHE-II Score	9.6±2.1	16.7±4.6	

Univariate analysis showed that high temperature, leukocytosis, thrombocytopenia, hypoalbuminemia, low urine output, high creatinine were bad prognostic factors of ST (Table-6).

Table-6: Wilk's lambda (U-statistics) and Univariate 'F' ratio

Variable	Wilk's Lambda	F	Significance
Sex	0.99	0.24	0.61
Age	0.98	0.78	0.39
Heart Rate (beat/min.)	0.97	1.74	0.002
Mean B.P. (mmHg)	0.96	1.58	0.214
Temperature (°F)	0.96	2.62	0.001
Resp. Rate (No/minute)	0.99	0.001	0.972
Urine output (ml/24 hr)	0.91	7.01	0.019
Blood Glucose (mg/dL)	0.96	2.37	0.127
S. bilirubin (gm/dL)	0.99	0.34	0.557
S. albumin (gm/dL)	0.97	1.48	0.006
B. urea (mg/dL)	0.97	2.36	0.128
S. Creatinine (mg/dL)	0.97	2.36	0.002
S. Sodium (mEq/Lt.)	0.97	2.06	0.154
Hemoglobin (gm/dL)	0.97	1.74	0.191
Total Leukocyte count (thousands/µL)	0.99	0.24	0.001
Platelet Count (1x10 ⁵ /µL)	0.95	3.22	0.001

There were 5 independent risk factors for development of SST. They were 1) Low albumin <2.8 gm/dl (OR=1.9[95%CI 1.2-3.1], p=0.002), 2) low urine output < 500 ml/24 hours (OR=1.8 [95%CI=1.1-2.8],p=0.01), 3) leukocytosis > 10000/ul (OR=4.4[95%CI=1.4-14.3],p=0.02), 4) Fever to treatment interval >6.0 days OR=3.2 [95%CI=2.4-7.3],p=0.002), 5) High creatinine >3.8 OR=3.6 [95%CI=2.4-7.3],p=0.002).

Out of 24 complicated ST, single risk factor was present in 8 (33.3%) cases and multiple risk factors were present in rest 16 (66.7%) cases. Two, 3, and 4 risk factors were present in 5 (20.8%), 4 (16.6%), and 7 (29.1%) cases respectively. We did not find age and presence of eschar as risk factors for adverse outcome.

Month wise variation of incidence of ST showed that out of 110 patients 63 (57.3%) patients were admitted during July to September i.e. in rainy season.

All uncompacted patients were treated with oral Doxycycline 100 mg twice daily for 7 days along with Omeprazole, Domperidone and oral or Injectable paracetamol. Patients with complicated ST were treated with Inj. Doxycycline 100 mg IV in 100 ml normal saline slowly over 1 hour to avoid thrombophlebitis. Other measures like IV fluids, sodium replacement were done. Out of 110 patients 35 patients did not tolerate doxycycline and patients were given azithromycin or Chloramphenicol.

Discussion

This study evaluated the clinical presentation, complications, outcomes, and prognostic factors of scrub typhus among adults admitted to a tertiary care hospital in western Odisha. Among 985 patients admitted with fever, 110 (11.2%) were diagnosed with scrub typhus. Complications occurred in 24 (21.8%) patients, and four patients (3.6%) died. The principal findings were the frequent occurrence of eschar and systemic complications, the association of several clinical and biochemical abnormalities with severe disease, and the importance of recognizing potential indicators of deterioration early in the clinical course.

Prevalence of Scrub Typhus Among Patients With Acute Febrile Illness

Scrub typhus accounted for 11.2% of febrile admissions in the present study, indicating that it represented a clinically

important cause of acute febrile illness in this hospital population. This finding supports the consideration of scrub typhus in the differential diagnosis of fever in endemic regions, particularly where environmental exposure to mite-infested vegetation is common. However, the proportion observed represents the hospital-based frequency among patients evaluated and should not be interpreted as the population prevalence of scrub typhus in Odisha.

Previous Indian studies have reported considerable variation in the frequency of scrub typhus among patients with acute febrile illness. Reported proportions have ranged from approximately 3.5% to 18.5% among adult populations, while higher proportions have been observed in selected paediatric populations.^{8,9} Differences in geography, season, patient selection, referral patterns, diagnostic methods, and clinical suspicion may contribute to this variation. The present finding is consistent with the importance of scrub typhus as a cause of fever in eastern India.

Demographic Characteristics and Environmental Exposure

The study included 56 males (50.9%) and 54 females (49.1%), indicating a nearly equal distribution between sexes. Most patients were from rural areas, with 100 (90.9%) reporting a rural residence. Agricultural activities were common, including farming, gardening, grass cutting, and horticultural work. These observations suggest that exposure to agricultural and vegetated environments may be relevant to the clinical epidemiology of scrub typhus in this population.

These occupational and environmental patterns are biologically plausible because scrub typhus is transmitted through the bites of infected larval mites found in suitable vegetation. Similar observations have been reported in previous Indian studies, in which agricultural work and exposure to rural environments were common among affected patients.^{12,13} Nevertheless, because the study did not include a control group without scrub typhus or a formal analysis of exposure-associated risk, these findings describe the characteristics of affected patients and do not establish that a particular occupation or residence independently increases the risk of infection.

Clinical Presentation and the Presence of Eschar

Fever was present in all 110 patients, while malaise was reported in 85 (77.3%), headache and vomiting in 60

(54.5%) each, and cough in 34 (30.9%). These findings demonstrate that scrub typhus can present with nonspecific symptoms that overlap with other causes of acute febrile illness. Such overlap may complicate clinical recognition, especially in endemic settings where several infectious diseases circulate concurrently.

Eschar was identified in 42 patients (38.2%). Although an eschar can provide an important diagnostic clue, its absence in the remaining patients indicates that the diagnosis cannot depend on this finding alone. The frequency of eschar reported in the present study falls within the wide variation described in previous studies from India and other Asian countries.^{14,15} Differences in patient characteristics, examination practices, skin pigmentation, and the anatomical location of lesions may contribute to variation in reported detection rates.

The most frequent locations of eschar in this study were the inguinal or perineal region (15/42, 35.7%) and abdomen (12/42, 28.6%), followed by the back and axilla. This distribution emphasizes the importance of a systematic physical examination, including less readily visible body regions. Previous research has also highlighted the diagnostic value of examining the entire body surface for eschars.^{14–16} However, the proposed relationship between lesion location, clothing, and working posture remains speculative because these factors were not formally evaluated in the present study.

Complications and Organ Involvement

Complications were recorded in 24 patients (21.8%), demonstrating that a clinically important proportion of affected adults developed systemic involvement. The reported complications included hematological abnormalities, hepatitis, renal failure, neurological complications, acute respiratory distress syndrome (ARDS), and multiple organ dysfunction syndrome (MODS). Leukocytosis occurred in 20 patients (18.1%), hepatitis in 12 (10.9%), renal failure in 11 (10.0%), and MODS in 10 (9.1%). These findings indicate that scrub typhus may extend beyond an uncomplicated febrile illness and involve multiple organ systems.

The observed pattern is consistent with the established clinical spectrum of scrub typhus, in which systemic inflammation and vascular involvement may contribute to hepatic, renal, pulmonary, neurological, and hematological abnormalities.¹⁷ Previous Indian and international studies have likewise described organ dysfunction among patients with severe disease.^{18,19} Differences in reported

complication rates may reflect variation in referral populations, definitions of severity, diagnostic criteria, access to treatment, and the timing of hospital presentation.

The presence of multiple complications in some patients is important when interpreting the results. Individual complication counts may exceed the number of patients with complicated disease because a single patient could develop more than one complication. Therefore, complication-specific percentages should not be interpreted as mutually exclusive categories.

Laboratory Abnormalities and Disease Severity

Patients with complicated scrub typhus had higher mean temperatures, respiratory rates, and heart rates, as well as lower mean blood pressure and urine output, than patients without complications. These findings suggest that physiological instability was associated with complicated disease in this cohort. Reduced urine output may indicate impaired renal perfusion or evolving kidney injury, whereas abnormalities in vital signs may reflect systemic illness and physiological stress. Nevertheless, these observations should be interpreted as associations rather than proof of causation.

Hematological differences were also observed. The complicated group had a higher mean total leukocyte count and a lower mean platelet count than the uncomplicated group. These findings suggest that inflammatory responses and hematological abnormalities may accompany more severe clinical presentations. Previous studies have similarly reported leukocytosis and thrombocytopenia among variables associated with severe scrub typhus.^{18,19} However, these parameters should be interpreted alongside the overall clinical presentation and other laboratory results rather than used in isolation.

Biochemical abnormalities were prominent among patients with complicated disease. The complicated group had higher mean blood urea, serum creatinine, bilirubin, liver enzyme levels, and alkaline phosphatase, together with lower serum protein and albumin levels. These findings are consistent with renal and hepatic involvement in severe scrub typhus. Elevated creatinine and urea may indicate impaired renal function, while elevated bilirubin and liver enzymes suggest hepatic involvement. Hypoalbuminemia may reflect systemic inflammation, altered vascular permeability, reduced protein synthesis, or other concurrent clinical factors; the present study cannot determine the relative contribution of these mechanisms.

Serum sodium and potassium values were also reported to differ between the uncomplicated and complicated groups. These findings indicate that electrolyte abnormalities may accompany more severe illness, although their independent prognostic significance cannot be established from the descriptive comparisons alone.

The interpretation of these laboratory findings requires caution. The study was conducted in a hospital population, and several biochemical abnormalities may reflect established organ dysfunction rather than early predictors of subsequent deterioration. Their value for prospective prediction would require evaluation at a clearly defined time point, followed by appropriate statistical modelling and validation.

Prognostic Factors Associated With Severe Disease

The study reported five factors associated with severe scrub typhus: serum albumin below 2.8 g/dL, urine output below 500 mL/24 hours, leukocyte count above 10,000/ μ L, a fever-to-treatment interval exceeding six days, and serum creatinine above 3.8 mg/dL. These findings suggest that biochemical evidence of systemic illness, reduced urine output, an elevated leukocyte count, and delayed treatment may identify patients who warrant careful clinical assessment.

Low serum albumin may be associated with systemic inflammation and increased disease severity. Reduced urine output and elevated serum creatinine may reflect renal impairment, while leukocytosis may accompany a substantial inflammatory response. A longer interval between fever onset and treatment may indicate delayed recognition or presentation. However, the study design does not establish that treatment delay independently caused severe disease, and the possibility of confounding by initial disease severity must be considered.

The original manuscript reports odds ratios and confidence intervals for these factors. It also describes them as independent risk factors. This interpretation is appropriate only if a suitable multivariable analysis was performed to account for relevant confounding variables. Because the original Methods section primarily describes univariate analysis, the statistical approach used to identify independent factors must be clarified before definitive conclusions can be drawn.

Previous studies have also investigated clinical and laboratory predictors of severe scrub typhus. Research from

South Korea and India has reported associations involving leukocytosis, hypoalbuminemia, and other clinical characteristics.^{18,19} The agreement between these reports and the present findings supports further investigation of these variables as potential markers of severe disease. Nevertheless, thresholds identified in a single-centre study should not be assumed to have the same predictive accuracy in other populations without external validation.

Mortality and Clinical Implications

Four of the 110 patients died, corresponding to an in-hospital mortality of 3.6%. All four deaths occurred among patients with MODS. This observation indicates that multiple organ dysfunction was associated with fatal outcomes in this cohort. However, because there were only four deaths, the study provides limited statistical precision for identifying mortality-specific predictors.

The original analysis also found no statistically significant association between eschar status and death. Given the small number of deaths, this result should not be interpreted as evidence that eschar status has no prognostic relevance. Similarly, the absence of an association between age and adverse outcome in this cohort does not exclude an association in other populations.

These findings support careful assessment for organ dysfunction in patients with suspected or confirmed scrub typhus. Monitoring vital signs, urine output, renal function, blood counts, serum albumin, and other clinically indicated laboratory parameters may help clinicians recognize deterioration. The findings do not establish a validated prediction rule, and prospective studies are needed to assess the predictive performance of individual variables and combinations of variables.

Generalizability

The findings of this study may be relevant to other tertiary care hospitals in scrub typhus-endemic regions of India, particularly areas with similar agricultural, forested, and rural environments. The clinical presentation, frequency of eschar, and laboratory abnormalities described in this study may help clinicians recognize scrub typhus and assess patients for potential complications. However, the results may not be directly generalizable to community populations, primary healthcare settings, or hospitals serving populations with different demographic characteristics, environmental exposures, referral patterns, and access to diagnostic services. Furthermore, the exclusion of patients with several chronic comorbidities

may limit applicability to patients with more complex clinical profiles. Multicentre studies involving diverse populations are needed to determine whether the observed clinical associations and prognostic factors are consistent across different settings.

Page | 11 **Limitations**

This study has several limitations. First, it was conducted at a single tertiary care hospital, which may limit the generalizability of the findings to other healthcare settings and community populations. Second, patients with several comorbid conditions were excluded, potentially limiting the applicability of the results to patients with complex underlying illnesses. Third, the relatively small number of patients with complications and the four recorded deaths limit the precision of estimates relating to severe disease and mortality.

The study also did not report a formal a priori sample-size calculation in the available manuscript. In addition, the sampling procedure, participant flow, and handling of patients lost to follow-up require further clarification. The statistical methods used to identify the reported independent prognostic factors also need to be specified clearly. Finally, the study did not report external validation of the identified prognostic factors. Consequently, the findings should be interpreted as observations from a hospital-based cohort rather than as a validated prediction model for severe scrub typhus.

Conclusion

The most common clinical symptoms were fever, myalgia, headache, vomiting, and eschar; a significant percentage of patients experienced sequelae such as hepatitis, acute kidney injury, haematological abnormalities, neurological involvement, and multiple organ failure syndrome. Severe disease was found to be independently predicted by low serum albumin, leukocytosis, high serum creatinine, decreased urine output, and delayed medication initiation. Early identification, prompt doxycycline therapy, and close observation of high-risk patients produced positive clinical results with a comparatively low death rate. Scrub typhus patients will be more likely to receive an early diagnosis, experience fewer complications, and have a higher chance of survival if medical staff are better informed and peripheral healthcare facilities are strengthened.

Recommendation

Scrub typhus should be considered an important differential diagnosis in all patients presenting with acute undifferentiated febrile illness, particularly during the monsoon and post-monsoon seasons in endemic regions. To avoid serious consequences, early clinical suspicion, thorough eschar inspection, and timely laboratory confirmation using IgM ELISA or other approved diagnostic techniques are crucial. Since leukocytosis, thrombocytopenia, hypoalbuminemia, oliguria, elevated serum creatinine, and delayed therapy initiation have been found to be predictive of severe disease, clinicians should keep a careful eye on these individuals. In clinically suspected instances, empirical doxycycline therapy should be started right away while awaiting test confirmation. It is advised that public health initiatives concentrate on vector control, early referral of high-risk patients, community awareness, and personal protective measures during agricultural operations. For scrub typhus in endemic regions, further multicenter research with bigger sample sizes should assess long-term results, validate prognostic models, and investigate novel diagnostic biomarkers and treatment approaches.

Acknowledgements

The authors thank the clinical, laboratory, and nursing staff of Veer Surendra Sai Institute of Medical Sciences and Research (VIMSAR), Burla, Odisha, for their assistance with patient care and laboratory investigations during the study period.

The authors also acknowledge all study participants for their cooperation.

Source of Funding

This study did not receive any specific financial support from public, commercial, or not-for-profit funding agencies.

Data Availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request, subject to institutional policies, ethical approval requirements, and applicable patient confidentiality protections.

List of abbreviations

ST	Scrub Typhus
SST	Severe Scrub Typhus
IgM	Immunoglobulin M
ELISA	Enzyme-Linked Immunosorbent Assay
ARDS	Acute Respiratory Distress Syndrome
AKI	Acute Kidney Injury
MODS	Multiple Organ Dysfunction Syndrome
ICU	Intensive Care Unit
PUO	Pyrexia of Unknown Origin
APACHE II	Acute Physiology and Chronic Health Evaluation II
CBC	Complete Blood Count
IEC	Institutional Ethics Committee
ICMR	Indian Council of Medical Research
OR	Odds Ratio
CI	Confidence Interval
SPSS	Statistical Package for the Social Sciences
EDTA	Ethylenediaminetetraacetic Acid
IV	Intravenous

Source of funding

There no funding for this study

Conflict of interest

The authors declare that there are no conflicts of interest regarding the publication of this manuscript.

Author biography

Dr. Gayathri Chalil is a Senior Resident in the Department of Medicine with a special interest in infectious diseases, tropical medicine, and clinical epidemiology. Her research focuses on acute febrile illnesses, rickettsial infections, and evidence-based management of infectious diseases.

Dr. Abhipsa Mohapatra is an Assistant Professor in the Department of Microbiology at SUM Hospital, Bhubaneswar. Her research interests include clinical microbiology, emerging infectious diseases, diagnostic microbiology, and antimicrobial resistance.

Dr. Khetra Mohan Tudu is an Assistant Professor in the Department of Medicine with expertise in internal medicine and infectious diseases. His academic interests include tropical infections, critical care medicine, and clinical research.

Dr. Prafulla Kumar Bariha is an Associate Professor in the Department of Medicine with extensive experience in medical education and the management of communicable diseases. His research focuses on tropical medicine, metabolic disorders, and evidence-based clinical practice.

Prof. Manoj Kumar Mohapatra is a retired Professor of Medicine with over three decades of experience in clinical medicine, infectious diseases, and medical research. He has authored numerous peer-reviewed publications and has made significant contributions to the understanding and management of tropical infectious diseases, particularly scrub typhus and other acute febrile illnesses.

References

- Kelly DJ, Fuerst PA, Ching WM, Richards AL. Scrub typhus: the geographic distribution of phenotypic and genotypic variants of *Orientia tsutsugamushi*. Clin Infect Dis, 2009;48 (suppl-3): s203-30.
<https://doi.org/10.1086/596576>
- Watt G, Parola P. Scrub typhus and tropical rickettsioses. Curr Opin Infect Dis, 2003;16:429-36.
<https://doi.org/10.1097/00001432-200310000-00009>
- Susilawati TN, McBride WJ. Acute undifferentiated fever in Asia: a review of the literature. Southeast Asian J Trop Med Pub Health, 2014;45:719-26.
- Khan SA, Khamo V, Uriah HJ, Bora T, Dutta P. Scrub typhus in hilly region of north east India. Ind J Med Res, 2016;144:38-40.
<https://doi.org/10.4103/0971-5916.193302>
- Sinha p, Gupta s, Dawra r, Rijhawan P. recent outbreak of scrub typhus in North Western part of India. Ind J Med Microbiol, 2014;32:247-50.
<https://doi.org/10.4103/0255-0857.136552>
- Jamil M, Bhattacharya P, Mishra J, Akhtar H, Roy A. Eschar in Scrub typhus: a study from North East India. J Assoc Phys Ind, 2019;67:32-34.
- Mathai E, Lloyd G, Cherian T, Abraham OC, Cherian AM. Serological evidence for the continued presence of human rickettsioses in Southern India. Ann Trop Med Parasitol, 2001;95:395-98
<https://doi.org/10.1080/00034983.2001.11813652>
<https://doi.org/10.1080/00034980120065804>

8. Bal M, Mohanta MP, Sahu S, Dwibedi B, Pati S, Ranjit M. Profile of pediatric scrub typhus in Odisha, India. *Ind Pediatrics*, 2019;56:304-306.

<https://doi.org/10.1007/s13312-019-1519-1>

9. Rao N, van Eijk AM, Choubey S, Ali SZ, Dash A, Barla P, et al. Dengue, chikungunya, and scrub typhus are important etiologies of non-malarial febrile illness in Rourkela, Odisha, India. *BMC Infect Dis*, 2019;19:572. Doi: [org/10.1186/s12879-019-4161-6](https://doi.org/10.1186/s12879-019-4161-6).

<https://doi.org/10.1186/s12879-019-4161-6>

10. Guidelines for diagnosis and management of rickettsial diseases in India. DHR-ICMR, 2015; 1-19.

11. Knaus WA, Draper EA, Wagner DP, Zimmerman JE. APACHE II: a severity of disease classification system. *Crit Care Med*, 1985;13:818-29.

<https://doi.org/10.1097/00003246-198510000-00009>

12. Mahajan SK, Raina R, Singh B, Singh DV, Kanga A, Sharma A, et al. Pattern of clinical presentation, laboratory findings, and mortality risk among patients of scrub typhus in Western Himalayas. *J Assoc Phys Ind*, 2016;64:26-30.

13. Sharma PK, Ramakrishnan R, Hutin JF, Barui AK, Manickam P, Kakkar M. Scrub typhus in Darjeeling, India: opportunities for simple, practical prevention measures. *Trans Royal Soc Trop Med Hyg*, 2009;7:1016-8.

<https://doi.org/10.1016/j.trstmh.2009.02.006>

14. Kim DM, Won KJ, Park CY, Yu KD, Kim HS, Yang TY, et al. Distribution of eschars on the body of scrub typhus patients: a prospective study. *Am J Trop med Hyg*, 2007;76:806-9.

<https://doi.org/10.4269/ajtmh.2007.76.806>

15. Jeong YJ, Kim S, Wook YD, Lee JW, Kim K, Lee SH. Scrub typhus: clinical, pathologic, and imaging findings. *Radiographics*, 2007;27:161-72.)

<https://doi.org/10.1148/rg.271065074>

16. Kundavaram AP, Jonathan AJ, Nathaniel SD, Varghese GM. Eschar in scrub typhus: a valuable clue to the diagnosis. *J Postgrad Med*, 2013;59:177.)

<https://doi.org/10.4103/0022-3859.118033>

17. Moron CG, Popov VL, Feng HM, Wear D, Walker DH. Identification of the target cells of *Orientia tsutsugamushi* in human cases of scrub typhus. *Mod Pathol*, 2001;14:752-9.)

<https://doi.org/10.1038/modpathol.3880385>

18. Kim DM, Kim SW, Choi SH, Yun NR. Clinical and laboratory findings associated with severe scrub typhus. *BMC Infect Dis*, 2010;10:108.

<https://doi.org/10.1186/1471-2334-10-108>

19. Sharma R, Mahajan SK, Singh B, Raina R, Kanga A. Predictors of severity in Scrub typhus. *J Assoc Phys Ind*, 2019;67:35-38.

PUBLISHER DETAILS



Student's Journal of Health Research Africa

e-ISSN: 2709-9997, p-ISSN: 3006-1059

Vol. 7 No. 2 (2026): June 2026 issue

<https://doi.org/10.51168/rhxs3656>

Original Article

Student's Journal of Health Research (SJHR)

(ISSN 2709-9997) Online

(ISSN 3006-1059) Print

Category: Non-Governmental & Non-profit Organization

Email: studentsjournal2020@gmail.com

WhatsApp: +256 775 434 261

**Location: Scholar's Summit Nakigalala, P. O. Box 701432,
Entebbe Uganda, East Africa**

