

Clinico-Hematological and Biochemical Profile of Scrub Typhus in Children

Naz Yasmeen¹, Ghazala Naushaba², Md. Athar Ansari³¹Senior Resident, Department of Paediatrics, Nalanda Medical College and Hospital, Patna, Bihar, India²Senior Resident, Department of Paediatrics, Nalanda Medical College and Hospital, Patna, Bihar, India.³Professor, Department of Paediatrics, Nalanda Medical College and Hospital, Patna, Bihar, India.

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Corresponding Author: Dr. Ghazala Naushaba

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Abstract:**Background:** Scrub typhus is a re-emerging zoonotic infection in India and an important cause of acute febrile illness in children. Due to its nonspecific clinical presentation and resemblance to other endemic infections, it is frequently underdiagnosed, leading to increased morbidity.**Aim:** To study the clinical features along with hematological and biochemical profiles of scrub typhus in the pediatric age group admitted to a tertiary care center.**Methodology:** This prospective observational study was conducted over 12 months from November 2023 to October 2024 in Department of Paediatrics, Nalanda Medical College and Hospital, Patna, Bihar, India. Eighty-five children aged 1 month to 18 years with serologically confirmed scrub typhus were enrolled. Clinical manifestations, laboratory parameters, complications, and outcomes were recorded and analyzed.**Result:** Fever was present in all cases. Common findings included hepatosplenomegaly, anemia, leukocytosis, thrombocytopenia, elevated liver enzymes, and raised C-reactive protein levels. Pneumonitis and meningoencephalitis were the most frequent complications. Majority of patients recovered with timely treatment.**Conclusion:** Scrub typhus should be considered in children presenting with acute undifferentiated fever. Early diagnosis and prompt treatment result in favorable outcomes.**Keywords:** Scrub typhus, Pediatric, Acute febrile illness, Hematological profile, Biochemical abnormalities.**DOI:** 10.25258/ijpqa.17.1.80

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Introduction

Orientia tsutsugamushi is the causative organism of scrub typhus, the most common rickettsial illness in India [1]. Due to a variety of symptoms, a lack of awareness of the illness, a low level of suspicion among doctors, and the lack of community-based diagnostic facilities, scrub typhus is typically underdiagnosed in our nation [2]. Mild to severe clinical symptoms are possible. It can be lethal and impact on nearly every organ system. Timely identification and treatment are crucial because of the high risk of serious consequences and the quick response to doxycycline. The majority of research on rickettsial illnesses in India and throughout the world focuses on adult populations [3].

Scrub typhus, also called bush typhus, is an infectious disease caused by a bacterium called *Orientia tsutsugamushi*, which belongs to the order Rickettsiales, family Rickettsiaceae (phylum Proteobacteria, class Alpha Proteobacteria). The Japanese name of the species, *tsutsugamushi*, combines the words *tsutsuga*, which means illness, and *mushi*, which means insect. In mites belonging to the

Trombiculidae family, it is a naturally occurring obligatory intracellular gram-negative bacterial parasite [4]. The most common rickettsial infection in the Indian subcontinent is *Orientia tsutsugamushi*. Untreated epidemics can have fatality rates between 30% and 60%. According to an article, the death rate in untreated instances might reach 70%. According to current estimates, illness affects 1 billion people worldwide and claims 1 million lives [5].

Hepatitis, shock, pneumonia, acute renal damage, and meningoencephalitis may aggravate this illness and necessitate critical care hospital stays [6]. If treatment is not received, ST can become fatal, with a mortality incidence of 6% and up to 24% in cases of multi-organ failure. Humans get the zoonotic illness scrub typhus by the bite of a larval trombiculid mite, commonly referred to as a chigger. These days, especially in the monsoon season.

All ages are affected, and if left untreated, it can lead to major consequences such as pneumonitis, acute respiratory distress syndrome, meningoencephalitis, septic shock, multi-organ failure, and even death.

The low index of suspicion and the prevalence of terrible illnesses like dengue and malaria during the monsoon were the major reasons why the condition was difficult to identify until recently. Furthermore, there were few reports and higher rates of morbidity and death in India because to vague clinical signs and symptoms and restricted availability to more sensitive and precise tests to identify scrub [7]. Scrub typhus, which frequently necessitates hospitalization, is one of the most underdiagnosed and underreported illnesses in the world, according to the World Health Organization. Scrub typhus is currently making a major comeback in India.

There is little clinical difference between this illness and other causes of acute undifferentiated fever, such as malaria, dengue fever, various rickettsioses, leptospirosis, and enteric fever [8]. When a patient is suspected of having scrub typhus, prompt diagnosis can help the practitioner treat them appropriately and perhaps lower the disease's morbidity and mortality. Scrub typhus is underdiagnosed in India, particularly in Rajasthan, due to a lack of knowledge, a low index of suspicion among doctors, a lack of confirming testing equipment, and clinical signs that mirror other more common illnesses such as dengue, malaria, and leptospirosis [9].

The majority of the data from the outbreak seasons were analyzed retrospectively in earlier investigations. Therefore, we made the decision to conduct a prospective survey to look at the common clinical and laboratory characteristics of scrub typhus as well as seasonal changes in children hospitalized to our tertiary care medical college hospital.

Methodology

Study Design: This study was a prospective observational hospital-based study conducted to assess the clinico-hematological and biochemical abnormalities in children diagnosed with scrub typhus.

Study Duration: The study was conducted over a period of 12 months from November 2023 to October 2024

Study Area: The study was carried out in the Department of Pediatrics, Nalanda Medical College and Hospital, Patna, Bihar, India

Sample Size: A total of 85 children meeting the inclusion criteria were enrolled in the study.

Sampling Technique: All eligible pediatric patients admitted during the study period with a confirmed diagnosis of scrub typhus were consecutively enrolled until the required sample size was achieved.

Inclusion Criteria

- Children aged 1 month to 18 years
- Presented with acute febrile illness suggestive of scrub typhus

- Laboratory confirmation of scrub typhus by IgM ELISA for *Orientia tsutsugamushi*
- Children whose parents or guardians provided informed consent

Exclusion Criteria

- Children with co-existing confirmed infections such as malaria, dengue, enteric fever, or leptospirosis.
- Children with pre-existing chronic liver disease, hematological disorders, chronic kidney disease, or immunodeficiency.
- Children who left against medical advice (LAMA) or had incomplete diagnostic records
- Neonates (<1 month of age).

Data Collection: Data were collected prospectively using a predesigned and pretested structured proforma. Information regarding demographic details, presenting symptoms, clinical signs, and duration of illness was recorded at the time of admission. Laboratory parameters including complete blood count, liver function tests, renal function tests, serum electrolytes, and C-reactive protein were documented from hospital investigation reports. The diagnosis of scrub typhus was confirmed using IgM ELISA for *Orientia tsutsugamushi*. Additional investigations such as chest X-ray, cerebrospinal fluid analysis, or other relevant tests were performed when clinically indicated, and findings were systematically recorded.

Procedure: All eligible children admitted with suspected scrub typhus were evaluated clinically and investigated as per departmental protocol. After confirmation of diagnosis, detailed clinical examination and relevant laboratory investigations were carried out. Patients were managed according to standard treatment guidelines, and their clinical course was monitored throughout the hospital stay. Any complications developing during treatment were noted. Data were recorded daily until discharge or outcome and were later compiled for analysis.

Statistical Analysis: The data collected were entered into Microsoft Excel and analyzed using Statistical Package for Social Sciences (SPSS) software. Continuous variables were expressed as mean and standard deviation, while categorical variables were presented as frequencies and percentages. Results were summarized in tables and figures wherever appropriate for clear representation of findings.”

Result

Table 1 illustrates the gender and age distribution of minors who have been diagnosed with scrub typhus. The age range of 1–<5 years old accounted for 42.4% of all cases, suggesting that younger children are more susceptible to the illness. Male children were more likely to be impacted (62.4%) than

female children (37.6%), which may indicate that boys are more likely to be exposed to the outdoors.

The results show that young male children in the pediatric population are most affected by scrub typhus.

Table 1: Age and Gender Distribution of Study Participants (n = 85)

Age Group	Male n (%)	Female n (%)	Total n (%)
1 month – <1 year	6 (7.1)	4 (4.7)	10 (11.8)
1 – <5 years	22 (25.9)	14 (16.5)	36 (42.4)
5 – <10 years	15 (17.6)	8 (9.4)	23 (27.1)
10 – 18 years	10 (11.8)	6 (7.1)	16 (18.8)
Total	53 (62.4)	32 (37.6)	85 (100)

Table 2 shows how the people in the group who had scrub typhus showed it in the clinic. The most consistent presenting symptom was fever, which was present in all instances (100%). Additional frequently reported symptoms were headache (21.2%), cough (28.2%), vomiting (32.9%), and stomach

discomfort (23.5%). In many youngsters, neurological symptoms such as seizures (11.8%) and impaired sensorium (10.6%) point to central nervous system involvement. These results demonstrate how scrub typhus is generic and multisystemic.

Table 2: Clinical Presentation of Children with Scrub Typhus (n = 85)

Clinical Feature	Frequency (n)	Percentage (%)
Fever	85	100
Vomiting	28	32.9
Cough	24	28.2
Abdominal pain	20	23.5
Headache	18	21.2
Seizures	10	11.8
Altered sensorium	9	10.6
Edema	8	9.4
Lymphadenopathy	7	8.2
Oliguria	5	5.9

In Table 3, you can see the clinical signs that were seen during the physical test. The most common results were hepatomegaly (56.5%) and splenomegaly (38.8%), indicating that scrub typhus frequently involves the liver. Even though eschar is thought to be

pathognomonic, it was only found in 25.9% of cases, suggesting that its absence does not rule out the diagnosis. Overt jaundice appears to be a rare symptom of paediatric scrub typhus, based on the low prevalence of icterus (4.7%).

Table 3: Clinical Signs Observed on Examination (n = 85)

Clinical Sign	Frequency (n)	Percentage (%)
Hepatomegaly	48	56.5
Splenomegaly	33	38.8
Hepatosplenomegaly	26	30.6
Eschar	22	25.9
Pallor	20	23.5
Icterus	4	4.7

Table 4 presents the hematological abnormalities observed in children with scrub typhus. The most common abnormality was leukocytosis (44.7%), which was followed by thrombocytopenia (22.4%) and anemia (25.9%). These results indicate an initial

inflammatory response and may indicate peripheral blood cell death or bone marrow involvement. The necessity to distinguish scrub typhus from other feverish infections like dengue is highlighted by the presence of thrombocytopenia.

Table 4: Hematological Parameters in Study Participants (n = 85)

Parameter	Abnormality	Frequency (n)	Percentage (%)
Hemoglobin	Anemia	22	25.9
Total leukocyte count	Leukocytosis	38	44.7
Platelet count	Thrombocytopenia	19	22.4

Table 5 shows a summary of the chemistry problems that the study subjects had. Hepatic involvement with a preponderance of AST increase was indicated by the higher frequency of elevated AST values (60.0%) compared to ALT elevation (32.9%).

Significant systemic inflammation was indicated by elevated CRP values in 89.4% of patients. Another common observation was hyponatraemia (35.3%). These metabolic anomalies are crucial laboratory indicators for scrub typhus early diagnosis.

Parameter	Abnormality	Frequency (n)	Percentage (%)
AST	Elevated (>80 U/L)	51	60
ALT	Elevated (>80 U/L)	28	32.9
Serum bilirubin	>1 mg/dL	6	7.1
Serum albumin	<3 g/dL	11	12.9
CRP	>10 mg/L	76	89.4
Serum creatinine	Elevated	8	9.4
Hyponatremia	<135 mEq/L	30	35.3

In Table 6, you can see the different problems that can happen because of scrub typhus. The most frequent consequence was pneumonitis (20.0%), which was followed by septic shock (8.2%) and meningoencephalitis (12.9%). In severe instances, the

incidence of myocarditis (4.7%) and acute renal damage (7.1%) indicates multisystem involvement. These results highlight how scrub typhus can be fatal if it is not identified and treated right away.

Complication	Frequency (n)	Percentage (%)
Pneumonitis	17	20
Meningoencephalitis	11	12.9
Septic shock	7	8.2
Acute respiratory distress syndrome	5	5.9
Acute kidney injury	6	7.1
Myocarditis	4	4.7

Table 7 shows what happened to the kids who were studying. While 2.4% of patients died, most patients (97.6%) made a full recovery. The remarkable

recovery rate indicates that pediatric scrub typhus may be successfully treated with early detection, prompt diagnosis, and adequate antibiotic therapy.

Outcome	Frequency (n)	Percentage (%)
Recovered	83	97.6
Mortality	2	2.4

Discussion

One of the most frequent causes of acute undifferentiated fever in all age groups, but especially in children, is scrub typhus, also called Tsutsugamushi fever. Numerous outbreaks have recently been recorded from all throughout India, particularly during the winter season (September to January) in north India and the monsoon season (June to December) in south India [10]. Most individuals had non-specific signs and symptoms of acute undifferentiated fever along with a protracted temperature. However, severe side effects as hemophagocytic lymphohistiocytosis, aortic valve endocarditis, pneumonia, acute respiratory distress syndrome (ARDS), acute encephalitis syndrome, and multiorgan dysfunction syndrome (MODS) were not unusual. Even though eschar is a pathognomonic characteristic, it was only seen in a limited percentage of patients, which makes clinical diagnosis difficult [11]. The main

risk factor for higher morbidity and death was delayed diagnosis.”

The incidence of scrub typhus in infants under one year old who spend most of their time indoors is an unexpected result that is likely connected to the altered habitat of chiggers during the monsoon season. The social behavior that permits male youngsters to go outside during playtime may be the cause of the higher frequency of scrub typhus among boys in this research as well as in other investigations. Given the chiggers' habitat, the absolute rise in the rural population makes sense. Open defecation, which is strongly associated with the potential for trombiculid mite exposure, was reported by 77% of the study sample [12].

There were no notable differences in the other characteristics. For instance, in much research, gender propensity favored either men or females, but in our

analysis, the difference was not statistically significant. Unlike this prospective study, ours was retrospective, thus we concentrated on comparator validation rather than incidence confirmation. This pathogen-induced EC activation, leucocyte infiltration, and inflammatory cytokine production result in endothelial damage. Microvascular leakage and vascular impairment can occasionally result from an unchecked influx of neutrophils and monocytes brought on by the over activation of EC. Severe ST results from such deterioration in end organs such the heart, brain, kidneys, and lungs [13].

This discovery may be explained by the bacterium's unregulated growth, spread throughout the host, the host's rapid inflammatory response, and sustained cytokine activation. These hematological indicators have been demonstrated to predict severe ST, especially in children with central nervous system involvement. The incidence of severe ST increases with the duration of fever. Our analysis found no correlation with thrombocytopenia, a hematological marker of severe ST and delayed fever defervescence that has been reported in a small number of pediatric investigations [14]. Therefore, in contexts with limited resources, anemia and neutrophilic leukocytosis can be used as hematological markers to initiate empirical treatment in febrile infants without eschar, especially those from endemic areas with end-organ damage.

In conclusion, the goal of this study was to assess the clinical manifestation of scrub typhus in children hospitalized to a tertiary care hospital, as well as any hematological or biochemical abnormalities. The results show that scrub typhus frequently manifests as an acute febrile disease with a variety of nonspecific symptoms, frequently accompanied by serious laboratory abnormalities and multisystem involvement. For prompt diagnosis and suitable treatment, early identification based on a high index of suspicion, bolstered by distinctive clinical characteristics and test results, is essential. To lower morbidity and avoid potentially fatal consequences by early treatment, this study highlights the significance of taking scrub typhus into account as a differential diagnosis in children presenting with undifferentiated fever, particularly in endemic locations.

Conclusion

This study shows that scrub typhus, which has a variety of clinical symptoms and notable hematological and biochemical abnormalities, is a prominent and sometimes overlooked cause of acute febrile illness in the pediatric population. Transaminase elevation, hepatosplenomegaly, increased inflammatory markers, and sequelae including meningoencephalitis and pneumonitis were often noted. Early diagnosis requires a high index of suspicion along with supporting test results since the clinical presentation frequently overlaps with other endemic

illnesses. Early beginning of adequate antibiotic medication improves results and lowers mortality and morbidity. Increasing doctors' knowledge of scrub typhus' clinico-hematological and biochemical characteristics can help with prompt diagnosis and efficient treatment, particularly in endemic areas.

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