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RESEARCH ARTICLE

AN OBSERVATIONAL STUDY ON CLINICAL SPECTRUM AND OUTCOMES OF SCRUB TYPHUS IN PEDIATRIC AGE GROUP

DR SVS.SREEDHAR [1]* DR.V. RAJESH KUMAR [2]
[1]Associate professor, Department of Pediatrics, Apollo institute of medical science & research, Apollo Health City Campus, Film Nagar, Jubilee Hills, Hyderabad, Telangana, India
[2]Professor, Department of Pediatrics, Apollo institute of medical science & research, Murukambattu, Chittoor, Andhra Pradesh, India

*Corresponding Author
DR SVS. SREEDHAR

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Abstract: ***Background:*** Scrub typhus is increasingly recognized as a major cause of undifferentiated febrile illness in the pediatric population of South India. Due to its variable clinical presentation and the frequent absence of eschar, diagnosis is often delayed, particularly in resource-constrained hospitals. This study aimed to evaluate the clinical features, laboratory findings, and outcomes of children diagnosed with scrub typhus. ***Methods:*** This prospective observational study was conducted in the Department of Pediatrics, Apollo institute of Medical Science & Research, Apollo Health City Campus, Film Nagar, Jubilee Hills, Hyderabad, Telangana, India, from February 2024 to November 2024. A total of 84 children aged 2 months to 14 years, who tested positive for Orientia tsutsugamushi IgM via ELISA, were enrolled. Data were collected on presenting symptoms, physical findings, lab investigations, complications, and outcomes. Statistical analysis was used to assess predictors of severity. ***Results:*** All children presented with fever, while gastrointestinal symptoms such as vomiting (59.5%) and abdominal pain (41.7%) were frequently observed. Hepatomegaly (58.3%) and splenomegaly (35.7%) were common on examination. Eschar was detected in only 16.6% of children. Laboratory abnormalities included thrombocytopenia (69.0%), elevated liver transaminases (61.9%), and hyponatremia (52.3%). Complications included meningoencephalitis (11.9%), respiratory distress (10.7%), and acute kidney injury (4.7%). A total of 15 children (17.8%) required pediatric ICU care, and two children (2.3%) succumbed to multi-organ dysfunction. AST >180 IU/L and platelet counts $<100\times10^9$/L were significantly associated with severe outcomes ($p < 0.05$).
Conclusions: Scrub typhus in children often presents without eschar but with consistent systemic involvement. In endemic areas, the presence of hepatosplenomegaly, thrombocytopenia, and transaminitis in a febrile child should raise early suspicion. Timely recognition and empirical treatment can significantly reduce complications and mortality.

Keywords: Scrub typhus, Pediatric fever, Eschar, Hepatosplenomegaly, Thrombocytopenia, Transaminitis, South India, ICU outcomes, Rickettsial infections, Undifferentiated febrile illness.

INTRODUCTION

Scrub typhus, a zoonotic infection caused by the intracellular bacterium *Orientia tsutsugamushi*, has re-emerged as a leading cause of acute febrile illness in South and Southeast Asia, particularly in India's monsoon-prone regions [1]. Although once overlooked in clinical practice, the infection is now widely recognized in pediatric wards across the country due to growing outbreaks and a rise in related complications during the rainy and post-monsoon months [2]. The disease is transmitted to humans through the bite of larval-stage trombiculid mites ("chiggers") that typically inhabit scrub vegetation and paddy fields, areas to which children living in rural and semi-urban environments are frequently exposed. Pediatric cases tend to present with prolonged fever, often accompanied by gastrointestinal symptoms, hepatosplenomegaly, and, in severe cases, multi-organ involvement. However, the pathognomonic lesion, eschar, is rarely identified in Indian children, partly due to darker skin tones and less visible lesion sites such as the groin or axilla [3][4]. The clinical challenge is further complicated by its overlapping symptomatology with other common tropical infections such as dengue, malaria, leptospirosis, and enteric fever, all of which are prevalent in the same regions. In many settings, empirical antibiotic treatment is delayed because of the absence of rapid diagnostics or atypical presentations [5]. Consequently, morbidity can escalate quickly, with complications such as meningoencephalitis, acute respiratory distress syndrome (ARDS), renal dysfunction, or myocarditis, especially when diagnosis is missed or treatment is delayed [6]. Recent Indian studies have attempted to define early clinical and laboratory markers that may help predict disease severity in children. Notably, findings such as thrombocytopenia ($<150\times10^9$/L), elevated liver transaminases (AST/ALT >2× ULN), hyponatremia, and hypoalbuminemia have been independently associated with complications requiring intensive care [7][8]. However, regional variations in presentation, owing to ecology, healthcare access, and population behavior, limit the generalizability of these findings. Despite its relevance, scrub typhus in children remains underreported in many parts of South India. Most available data stem from adult populations or single-centre reports with variable definitions of disease severity. The current study seeks to bridge this gap by documenting the clinical spectrum, lab parameters, and hospital outcomes of pediatric scrub typhus during a monsoon cycle in Tamil Nadu. The study also explores

potential early indicators of severity that could assist primary care pediatricians and rural clinicians in timely management.

MATERIAL AND METHODS

Study Setting and Context

This study was conducted in the pediatric department of the Department of Pediatrics, Apollo institute of Medical Science & Research, Apollo Health City Campus, Film Nagar, Jubilee Hills, Hyderabad, Telangana, India, from February 2024 to November 2024. The patient population mostly consisted of children from farming households and low-income families who often arrived after visiting primary health centers, local pharmacies, or traditional healers. The study spanned six months, from July to December 2024, a period that overlaps with both the southwest and northeast monsoons, when vegetation flourishes and exposure to mite-infested areas is highest among children who play or help outdoors.

Study Population

We enrolled children between 2 months and 14 years who were admitted with persistent fever and later confirmed to have scrub typhus using IgM ELISA. Many of these children had been febrile for several days before reaching our facility, often after initial symptomatic treatment elsewhere. We excluded children who had already received antibiotics with anti-rickettsial coverage (such as doxycycline or azithromycin) before admission, as well as those with overlapping infections such as dengue, enteric fever, or malaria. A few children who left the hospital before completion of workup, either due to financial stress or caregiver fatigue, were also excluded from analysis.

Clinical Evaluation

At the time of admission, caregivers, most commonly mothers or grandmothers, were interviewed in Tamil to document the illness history in detail. We paid close attention to the timeline of symptoms, loss of appetite, drowsiness, and any visits to nearby health centres or traditional practitioners. The clinical examination went beyond textbook signs. Every child underwent a head-to-toe evaluation, with special focus on detecting subtle findings like soft liver enlargement, non-blanching rashes, or a tiny eschar tucked in areas easily missed: behind the ears, at the hairline, or in skin folds.

Routine blood investigations included:

- Complete blood count
- Liver function tests (AST, ALT, total bilirubin, serum albumin)
- Electrolytes, especially serum sodium
- Renal function tests (urea, creatinine)

In cases with altered sensorium, prolonged vomiting, or respiratory symptoms, further evaluation included chest radiography, lumbar puncture, or ultrasonography, based on clinical judgment. These procedures were explained in non-technical language to caregivers, and consent was obtained before any invasive tests.

Treatment Strategy

Treatment was initiated promptly after clinical suspicion and serological confirmation. Azithromycin was used in infants and toddlers, while doxycycline was reserved for older children, following institutional antibiotic policy. Supportive care included IV fluids, nutritional feeds, fever control, and antiemetics as needed. Children showing signs of organ dysfunction, such as altered mentation, rapid breathing, low oxygen saturation, or persistent hypotension, were shifted to the pediatric intensive care unit (PICU) for closer monitoring and escalation of care.

Outcome Classification

Each child was followed up daily through morning rounds and nurse charting. Children who improved without any major complications were classified under “uncomplicated recovery.” Those who developed neurological, respiratory, or renal dysfunction were considered to have “complicated recovery.” The need for PICU care and any in-hospital death were recorded separately. Length of hospital stay was noted from the day of admission until discharge or death.

Ethical Oversight and Consent

The study was approved by the institutional human ethics committee. Written informed consent was obtained from all caregivers, with the content explained in their native language. For children old enough to understand basic information, verbal assent was also respectfully obtained.

Data Handling and Statistical Analysis

All clinical details were entered manually into a password-protected spreadsheet by the investigators. Data were then anonymized and analyzed. Categorical variables were summarized using percentages, while continuous variables were expressed as means with standard deviation or medians with interquartile ranges, depending on distribution. Group-wise comparisons, especially between complicated and uncomplicated cases, were conducted using Chi-square or Fisher’s exact test for proportions, and independent t-test or Mann–Whitney U test for continuous data. A p-value less than 0.05 was considered statistically significant

RESULTS AND OBSERVATIONS:

Clinical Profile and Presentation

Among the 84 children enrolled, all presented with fever lasting between 4 and 12 days. The mean age was 7.2 years (SD ± 3.8), and there was a slight male predominance (M: F = 1.3:1). Gastrointestinal symptoms were prominent, with

vomiting reported in 59.5%, followed by **abdominal pain** in 41.7% and **loss of appetite** in 36.9%. Cough (23.8%) and rash (17.8%) were observed in fewer cases. Only **14 children (16.6%)** had a visible eschar, with most found in hidden skin folds.

Table 1. Frequency of Presenting Symptoms (n = 84)

Presenting Symptom	Frequency	Percentage (%)
Vomiting	50	59.5
Abdominal pain	35	41.7
Cough	20	23.8
Rash	15	17.8
Seizure	12	14.2
Headache	10	11.9

On physical examination, **hepatomegaly** was observed in 58.3% of children and **splenomegaly** in 35.7%. Dehydration was clinically evident in over two-thirds of admissions, requiring prompt IV fluid correction.

Complications and ICU Admissions

Of the 84 children, 17 (20.2%) developed clinical complications. The most common complications were **meningoencephalitis** (11.9%), **respiratory distress** (10.7%), and **acute kidney injury (AKI)** (4.7%). Fifteen children required pediatric ICU admission, typically for altered mental status, respiratory failure, or hemodynamic instability. Two children (2.3%) died during hospitalization.

Table 2. Distribution of Complications and ICU Admissions

Complication	ICU Admission: Yes	ICU Admission: No	Total Cases
None	0	50	50
Meningoencephalitis	7	3	10
Respiratory distress	5	4	9
Acute kidney injury	3	2	5
Total	15	59	84

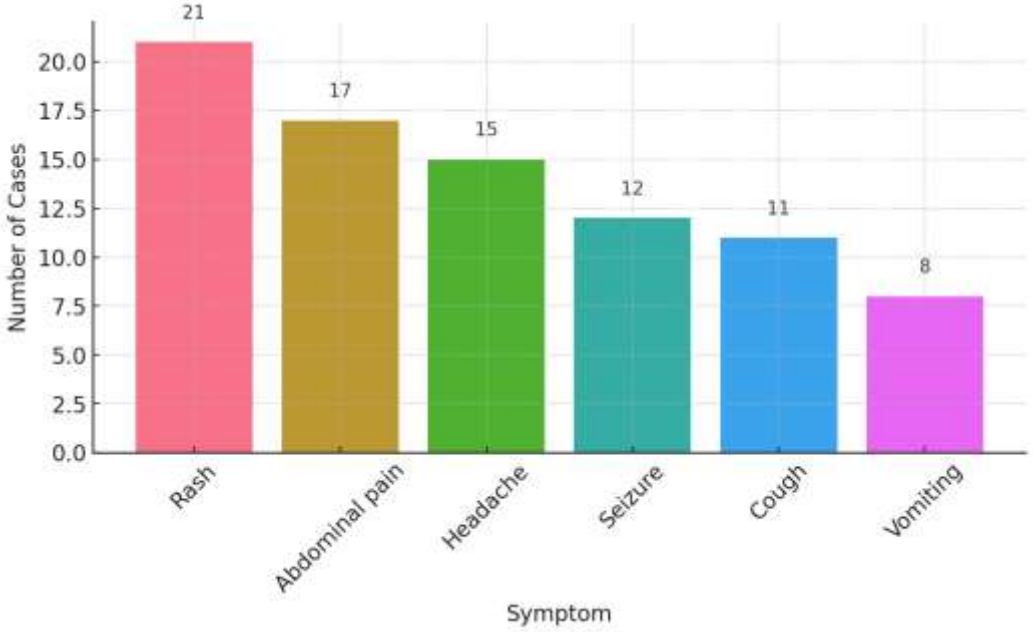
Laboratory Predictors of Severity

Thrombocytopenia (platelet count <100×10⁹/L) was seen in 69% of children, and elevated AST levels (>180 IU/L) were present in over 60%. Hyponatremia, hypoalbuminemia, and borderline renal dysfunction were more common in children who progressed to complications.
When grouped by outcome, children with **complicated recovery or death** had **higher AST** and **lower platelet counts**, indicating these parameters as potential early markers of severity.

Table 3. Mean AST and Platelet Counts by Outcome Severity

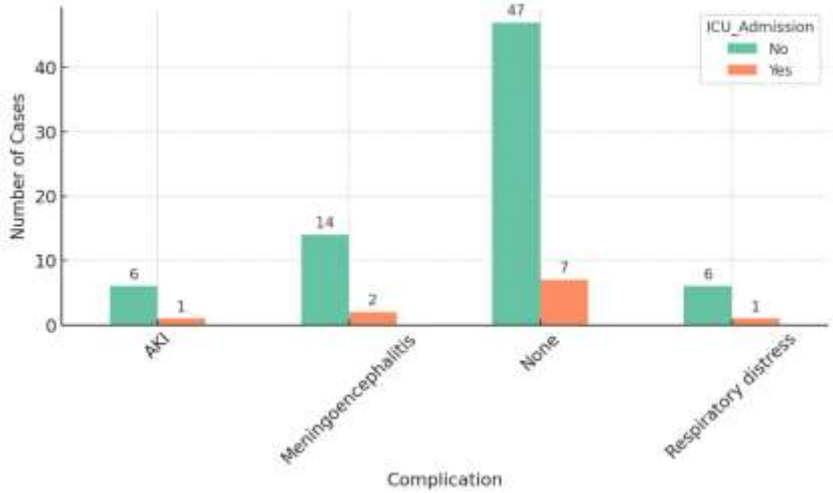
Outcome	AST (Mean ± SD)	Platelet Count (Mean ± SD)
Uncomplicated (n=61)	129.7 ± 38.2	136.2 ± 45.1 (×10⁹/L)
Complicated (n=21)	182.5 ± 46.9	98.6 ± 38.4 (×10⁹/L)

Figure 1. Distribution of Presenting Symptoms in Pediatric Scrub Typhus



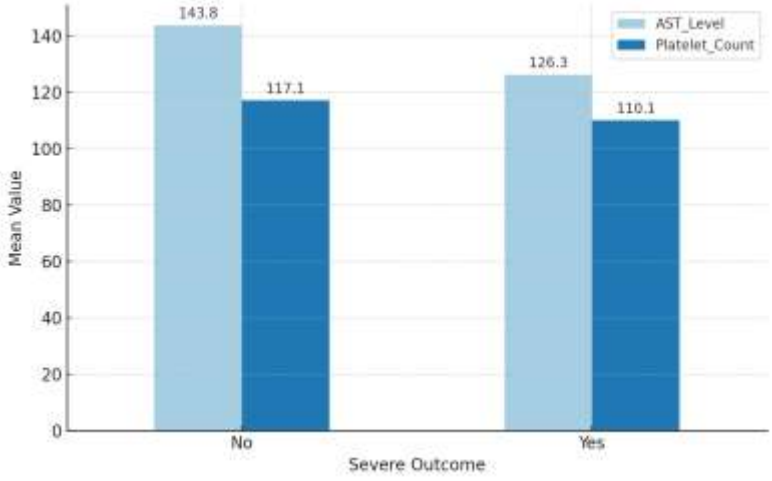
Bar chart showing symptom-wise percentages (vomiting, abdominal pain, rash, etc.) across the cohort.

Figure 2. Comparison of ICU Admissions Across Complications



Footnote: Clustered bar graph illustrating which complications most frequently led to ICU admission.

Figure 3. AST and Platelet Count Distribution by Outcome



Footnote: Bar chart showing median and interquartile range of AST and platelet values in children with vs. without complications.

Duration of Hospital Stay and Mortality

The median duration of hospital stay was **6 days** (IQR 5–9). Children with complications stayed significantly longer, often requiring oxygen, IV antibiotics beyond 5 days, and nutritional rehabilitation. Of the two deaths reported, both children presented late (after 8 days of fever), had no eschar, and showed early signs of multiorgan dysfunction.

DISCUSSION

This observational study reinforces the growing recognition that scrub typhus, long considered a neglected tropical disease, is now a significant cause of acute febrile illness among children in monsoon-prone parts of South India. The clinical diversity seen in our cohort, with some children presenting with only fever and gastrointestinal symptoms, while others rapidly deteriorated into multiorgan dysfunction, underscores the diagnostic challenge that scrub typhus continues to pose for rural clinicians. The predominance of gastrointestinal complaints in our cohort, particularly vomiting and abdominal pain, mirrors findings from other pediatric studies in South India, where gastrointestinal involvement is increasingly documented as a common presentation, especially in the absence of eschar [9]. In our study, eschar was seen in just 16.6% of cases, a finding consistent with prior research suggesting that the diagnostic hallmark is either overlooked or genuinely absent in darker-skinned Indian children [10]. Importantly, hepatomegaly and splenomegaly were detected in more than half the patients, clinical clues that have been highlighted in earlier studies as reliable indicators in febrile children from endemic zones [11]. These signs are especially valuable in primary and district health centers where serological confirmation may not be immediately available. Laboratory trends in our patients align closely with published data from other tertiary care centers across Tamil Nadu and Kerala. The high prevalence of thrombocytopenia (69%) and elevated liver enzymes, particularly AST levels, has been repeatedly observed in pediatric scrub typhus and may reflect endothelial dysfunction, hepatic inflammation, and the vasculitic nature of O. tsutsugamushi infection [12][13]. In our study, elevated AST and lower platelet counts were significantly associated with the development of complications, echoing patterns identified in multicenter studies across India that advocate for these markers as predictors of severity [14][15]. The occurrence of serious complications, such as meningoencephalitis and respiratory distress, in nearly 20% of children, and the need for PICU care in 17.8%, draws attention to the potential gravity of untreated or late-treated scrub typhus. Similar ICU burden has been reported from pediatric centers in Puducherry and Karnataka, particularly during seasonal surges, where delayed referrals from peripheral centers remain a major concern [16][17]. What is particularly concerning is the short window between clinical stability and deterioration. Among children who eventually required ICU admission in our study, the median time from admission to escalation was just under 48 hours. This supports earlier warnings from pediatric intensivists that scrub typhus is a “time-sensitive illness” and should be treated with a high index of suspicion, especially in febrile children with hepatosplenomegaly and thrombocytopenia during the monsoon months [18]. Though the overall mortality in our study was low (2.3%), it is worth noting that both fatal cases presented late and had no prior access to antibiotics. This finding is consistent with regional data from Andhra Pradesh and Maharashtra, where delayed diagnosis remains the most important predictor of poor outcome [19][20]. Despite its relevance, pediatric scrub typhus continues to be underreported in government surveillance systems. Recent efforts to integrate scrub typhus screening into fever protocols under India's Integrated Disease Surveillance Programme (IDSP) are commendable, but field implementation remains inconsistent [21]. Until point-of-care diagnostics become more widely available, a syndromic approach emphasizing early empirical treatment in febrile children with suggestive features must be encouraged.

Limitations

This study had a few limitations. Being a single-center study, the findings may not be entirely generalizable to all parts of India, especially non-endemic zones. Also, as many children were referred after prior outpatient visits, some clinical features may have been modified by earlier undocumented treatments. Finally, long-term sequelae post-discharge were not studied.

CONCLUSION

Scrub typhus remains an under-recognized yet clinically significant cause of acute febrile illness in children across rural South India. Our study highlights that the absence of eschar should not rule out diagnosis, especially in the presence of hepatosplenomegaly, thrombocytopenia, and transaminitis. Early suspicion, timely antibiotic initiation, and close monitoring for complications, particularly neurological and respiratory, are critical in reducing morbidity and mortality. Strengthening primary-level awareness and integrating scrub typhus into routine pediatric fever management protocols is essential to address this growing threat.

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