ARTICLE

Clinical and Diagnostic Utility of Eschar and IgM ELISA in Pediatric Scrub Typhus: A Prospective Observational Study from a Tertiary Care Centre in Puducherry

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ABSTRACT

Background: Scrub typhus, caused by Orientia tsutsugamushi, is a significant etiological agent of acute febrile illness (AFI) in the pediatric population in endemic regions. The diagnosis is challenging due to the non-specific clinical presentation and limited availability of reference standard tests such as Indirect Immunofluorescence Assay (IFA). This study evaluated the utility of the eschar and immunoglobulin M (IgM) Enzyme-Linked Immunosorbent Assay (ELISA) in children presenting with acute febrile illness. Methods: A cross-sectional observational study was carried out in the Pediatric Department and Pediatric Intensive Care Unit (PICU) of a tertiary care hospital in Puducherry. Sixty-four pediatric subjects presenting with <15-days fever and fulfilling inclusion criteria (presence of an eschar, IgM ELISA positivity or both) were enrolled in the study. Clinical profiles, diagnostic laboratory parameters, Eschar distribution and treatment were evaluated using Statistical Package for Social Sciences (SPSS) version 23. Results: Of the 64 patients included in the analysis, school-age children (6–12 years) formed the largest group (54.7%, n=35). The male to female ratio was 1.06:1. Majority of the cases presented with 6–10 days fever (51.5%, n=33). The eschar was found in 45.5% (n=29) patients, with the most common sites being the inguinal region (24.0%, n=7) and axilla (20.5%, n=6). Scrub typhus IgM ELISA was positive in 89.1% (n=57) of children. Hepatomegaly was seen in 59.0% (n=38) of patients while splenomegaly occurred in 37.5% (n=24). Thrombocytopenia (<150,000/mm³) was observed in 67.2% (n=43) of patients and elevation in C-reactive protein (CRP) was seen in 61.0% (n=39). Co-infections with Dengue IgM and Widal positivity were present in 9.4% (n=6) and 6.25% (n=4) of cases, respectively. Doxycycline was administered to 73.4% (n=47) of patients, and azithromycin to 26.6% (n=17). Average hospital stay was 6–10 days in 57.8% (n=37) of cases, with no reported fatalities. Conclusion: The scrub typhus IgM ELISA in conjunction with a detailed clinical examination for the eschar, especially in intertriginous folds, can be an effective diagnostic tool for the management of this disease in the pediatric population in a resource-limited endemic setting.

Keywords: Scrub typhus, Orientia tsutsugamushi, Eschar, IgM ELISA, Pediatric Acute Febrile Illness, Puducherry

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INTRODUCTION

Orientia tsutsugamushi is an obligate intracellular bacterium transmitted by a vector of larval trombiculid mites (chiggers) and is a primary causative agent of acute febrile illness (AFI) in tropical and subtropical Asia-Pacific regions also known as the 'tsutsugamushi triangle'. Incubation period of acute infection can range from 5 to 15 days and presents with varied clinical manifestations ranging from self-limiting febrile illness to multi-organ dysfunction syndrome (1,2).

One of the hallmark signs of scrub typhus is the presence of a pathognomonic eschar at the chigger bite site. The diagnosis of scrub typhus can be challenging when eschar is absent or undiscovered in a patient, differentiating between scrub typhus and other infections endemic to the region like dengue, malaria, typhoid and leptospirosis (3,4).

Although an Indirect Immunofluorescence Assay (IFA) for scrub typhus is considered the reference standard, it has limited application in day-to-day practice due to inter-observer variability, limited availability of reagents and lack of consensus on diagnostic cut off titers that are suitable for Indian endemic population. On the contrary, Scrub Typhus IgM ELISA offers higher sensitivity, objective cut off value and easy applicability (5,6).

This study evaluated the clinical spectrum, anatomic distribution of eschars and diagnostic value of IgM ELISA and eschar detection in children managed in a tertiary setup in Puducherry, South India.

MATERIALS AND METHODS

A prospective cross-sectional observational study was done in the Department of Pediatrics (Inpatient Ward and PICU) in a tertiary care centre at Puducherry over a period of 18 months following Institutional Ethics Committee (IEC) clearance (Ref no:35/SVMCH/IEC-Cert/February24). A total sample size of 64 pediatric patients was estimated based on statistical power of 80%, confidence level of 95% and allowable error of 5%.

Paediatric patients presenting with <15-days fever satisfying Indian Academy of Pediatrics (IAP) case definition guidelines, presence of classic eschar or Scrub Typhus IgM ELISA positivity

or both were the inclusion criteria. Informed written consent provided by parents or legal guardians. Neonates (age <28 days), infants with major congenital anomalies and cases in which consent was denied were excluded.

DATA COLLECTION

All participants were asked to provide detailed demographic details and history along with detailed clinical examination. Venous blood sample (5 mL) was taken in appropriate vials upon admission for complete blood counts, C-reactive protein (CRP), Dengue IgM, Widal and Scrub Typhus IgM ELISA.

STATISTICAL ANALYSIS

The data was entered into Microsoft Excel 2010 and analyzed using SPSS Version 23. Categorical variables were expressed as frequencies and percentages. Continuous variables were expressed as mean ± standard deviation (SD).

RESULTS

The results of the study were presented in table 1-4. A total of 64 paediatric patients were enrolled in the study. School-aged children (6–12 years) constituted the majority of cases (54.7%, n=35), followed by children aged 3–5 years (21.9%, n=14). Infants (<1 year) and adolescents (>12 years) accounted for 3.1% (n=2) and 4.7% (n=3), respectively. Males comprised 51.5% (n=33) and females 48.5% (n=31), yielding a male-to-female ratio of 1.06:1. Most patients belonged to rural and semi-urban surrounding regions of Puducherry and Tamil Nadu.

Table 1: Demographic Characteristics of Study Participants (N = 64)

Parameter	Subgroup	Number of Patients (n)	Percentage (%)
Age Group	<1 year	2	3.1%
	1 – <3 years	10	15.6%
	3 – 5 years	14	21.9%
	6 – 12 years	35	54.7%
	>12 years	3	4.7%
Gender	Male	33	51.5%
	Female	31	48.5%
Duration of Fever at Admission	1 – 5 days	23	36.0%
	6 – 10 days	33	51.5%
	>10 days	8	12.5%

Table 2: Clinical Manifestations and Diagnostic Test Results (N = 64)

Clinical / Laboratory Parameter	Category	Number of Patients (n)	Percentage (%)
Eschar Status	Present	29	45.5%
	Absent	35	54.5%
Scrub Typhus IgM ELISA	Positive	57	89.1%
	Negative	7	10.9%
Hepatomegaly	Present	38	59.0%
	Absent	26	41.0%
Splenomegaly	Present	24	37.5%
	Absent	40	62.5%
C-Reactive Protein (CRP)	Positive	39	61.0%
	Negative	25	39.0%
Dengue IgM Co-positivity	Positive	6	9.4%
	Negative	58	90.6%
Widal Positivity	Positive	4	6.25%
	Negative	60	93.75%

Eschar Anatomical Distribution

An eschar was identified in 29 patients (45.5%). Intertriginous and moist skin areas were the most common sites of eschar formation, led by the inguinal/groin region (24.0%, n=7) and axilla (20.5%, n=6).

Table 3: Anatomical Distribution of Eschar (n = 29)

Anatomical Site	Number of Patients (n)	Eschars Percentage (%)
Inguinal Region	7	24.0%
Axilla	6	20.5%
Limbs	5	17.0%
Ear / Head	4	14.0%
Neck	4	14.0%
Chest	3	10.5%

Table 4: Key Hematological Findings and Treatment Outcomes (N = 64)

Parameters	Subgroup	Number of Patients (n)	Percentage (%)
Total Leucocyte Count (TLC)	<4,000 /mm³ (Leukopenia)	12	18.75%
	4,000 – 11,000 /mm³ (Normal)	38	59.37%
	>11,000 /mm³ (Leukocytosis)	14	21.88%
Platelet Count	<150,000 /mm³ (Thrombocytopenia)	43	67.2%
	≥150,000 /mm³ (Normal)	21	32.8%
Hemoglobin Status	<11 g/dL (Anemia)	39	60.9%
	≥11 g/dL	25	39.1%
Antibiotic Administered	Doxycycline	47	73.4%
	Azithromycin	17	26.6%
Hospital Stay Duration	1 – 5 days	19	29.7%
	6 – 10 days	37	57.8%
	>10 days	8	12.5%

DISCUSSION

Paediatric scrub typhus can be an important cause of acute febrile illness in the Southern part of India (7, 8). In our study, the highest incidence of scrub typhus was seen in school-age group (6–12 years, 54.7%) in concordance with an increased likelihood of outdoor exercise and exposure to mite-infested vegetation (9,10).

The clinical presentation of scrub typhus can overlap significantly with other tropical infections such as dengue and enteric fever. In our series, we observed hepatomegaly (59.0%) and splenomegaly (37.5%) as common physical examination findings, reflecting the generalized reticuloendothelial involvement. Inflammation markers such as increased CRP (61.0%) and thrombocytopenia (67.2%) were also significant in supporting the diagnosis of scrub typhus (11,12).

Presence of a pathognomonic eschar was found in 45.5% of patients in our study. Literature shows a wide variability of eschar occurrence ranging from 7% to 80% depending on geographical region, observer experience and skin pigmentation. The high proportion of eschar occurrence in the groin (24.0%) and axilla (20.5%) emphasizes the need to keep a high index of suspicion and perform a detailed physical examination of the intertriginous fold areas (13).

Scrub typhus IgM ELISA showed a positive yield of greater than 90%, which highlights its applicability as an easily accessible and rapid diagnostic test in a hospital setup, where reference IFA is not always available. Prompt initiation of appropriate enteral therapy with doxycycline or azithromycin resulted in rapid response and defervescence of patients within 24 to 48-hours without mortality (5, 14, 15).

CONCLUSION

A meticulous physical examination to look for an eschar, especially in intertriginous flexural folds and timely use of a scrub typhus IgM ELISA can be an effective strategy for diagnosing this tropical infection in the paediatric population. The early diagnosis ensures prompt initiation of targeted antibiotics to prevent organ dysfunction and improve clinical outcomes.

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