Section: Microbiology

Original Research Article

PREVALENCE AND CLINICO-EPIDEMIOLOGICAL PROFILE OF SCRUB TYPHUS IN PAEDIATRIC PATIENTS PRESENTING WITH ACUTE UNDIFFERENTIATED FEBRILE ILLNESS IN A TERTIARY CARE CENTRE

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Received : 20/01/2024
Received in revised form : 22/02/2024
Accepted : 02/03/2024

Keywords:
Scrub typhus, paediatric patients, prevalence, clinico-epidemiological profile, IgM ELISA, geographic clustering.

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DOI: 10.47009/jamp.2024.6.2.74

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2024; 6 (2); 356-360

Abstract

Background: Scrub typhus, a vector-borne zoonotic infection transmitted by Leptotrombidium mites, has evolved into a global health threat. We conducted a hospital-based cross-sectional study over two years (January 2022–December 2023) to investigate the prevalence and clinico-epidemiological profile of Scrub typhus in paediatric patients presenting with acute undifferentiated febrile illness. **Materials and Methods:** A total of 963 paediatric patients (1 month to 14 years) were enrolled. Demographic, clinical, and laboratory data were collected. Serum samples were screened for Scrub typhus using IgM ELISA. Seasonal and geographical clustering was analyzed. **Result:** The study revealed a prevalence of 22.84%, with a higher incidence in the 4-10 age group (56%). Fever was the predominant symptom (99%), and 28% presented with eschars. Cases peaked in cooler months, emphasizing the role of trombiculid mites. Geographical clustering was notable in Thiruvallur district, with a concentration in Thiruvallur block (45.85%).**Conclusion:** Scrub typhus presents a significant burden in paediatric populations, particularly during cooler months and in specific geographic regions. Understanding its epidemiology and clinical manifestations is crucial for timely diagnosis and intervention, emphasizing the need for heightened clinical awareness and targeted interventions in endemic areas.

INTRODUCTION

Scrub typhus, a vector-borne zoonotic infection transmitted by Leptotrombidium mites, is a growing concern globally. Caused by the bacterium Orientia tsutsugamushi, it accounts for 35–50% of Acute Undifferentiated Febrile Illnesses (AUFI) with significant morbidity and mortality.[1] Originating in the 'tsutsugamushi triangle,' the endemic region spans from Japan to Australia and Pakistan, but its incidence has expanded to Africa, Chile, Peru, and various parts of India, particularly in the northeastern and southern regions.[1,2]

Chiggerosis, transmitted by the larval stage of the mite, is synonymous with Scrub typhus. The term "scrub" denotes a type of vegetation, and "typhus" refers to "fever with stupor" in Greek. The ecological niches, termed "Typhus islands," are where mites live, and transmission occurs. The Trombiculid mite transmits the disease during its blood meal, with an incubation period of 6-21 days. [3, 4]

Scrub typhus manifests with fever, headache, myalgia, and gastrointestinal symptoms. A pathognomonic finding in endemic settings is the presence of a necrotic eschar at the mite bite site. Eschar starts as small papules, enlarge, undergo central necrosis, and become a blackened crust resembling a skin burn. The detection of eschar is challenging, particularly in dark-skinned individuals and certain locations such as groins and axilla.[5] Severe complications include encephalitis, interstitial pneumonia, ARDS and circulatory collapse with hemorrhagic manifestations. It can

ISSN (O): 2687-5365; ISSN (P): 2753-6556

mimic the clinical presentation of other illnesses like chikungunya and dengue, posing challenges to physicians. Mortality can reach 35-60%, with a variable case fatality rate in India ranging from 1.3% to 33.5%, depending on organ involvement and complications. Timely diagnosis and appropriate therapy are crucial for preventing fatalities. [2, 6]

A dramatic clinical response is observed in patients treated with doxycycline within 48 hours. In children, a recommended treatment involves azithromycin for 3 days.[6]

Despite its potential fatality, Scrub typhus is considered a neglected tropical disease in terms of research and healthcare policy formulation. This underscores the need for an in-depth investigation into its prevalence, clinical diversity, seasonal and geographical profile. On this background the current research was undertaken to contribute significantly to our understanding of Scrub typhus.

MATERIALSANDMETHODS

This hospital-based cross-sectional study was conducted in the Department of Microbiology at Government Medical College Hospital, Thiruvallur, spanning a 2-year period from January 2022 to December 2023. Institutional Ethics Committee approval was obtained prior to the commencement of the study.

Participant Selection: Children aged one month to 14 years presenting with symptoms of acute undifferentiated febrile illness were enrolled after obtaining written informed consent from parents. Patients with a definitive infective etiology were excluded from the study.

Data Collection: Demographic, relevant clinical, and laboratory details of eligible patients were documented using a specific proforma. The collected data were subjected to analysis.

Sample Collection: Phlebotomy was performed under aseptic conditions and 3ml of blood was collected following standard laboratory investigation protocols.

Laboratory Procedures: Blood samples after receiving in the Microbiology department, were subjected to serum separation through centrifugation. The screening for IgM antibodies against Scrub typhus was carried out using an ELISA kit (In Bios International Inc, WA, USA), adhering to the manufacturer's instructions. The ELISA kit utilized Karp, Kato, Gilliam, and TA716 recombinant proteins of the 56-kD, the major immunodominant protein located on the outer membrane of the bacteria. Sensitivity and specificity of the IgM ELISA were 84% and 98%, respectively. Pre-determined region-specific cut-offs were applied, considering samples with an OD value above 0.8 as reactive for Scrub typhus.

RESULTS

During the study period from January 2022 to December 2023, a total of 963 serum samples were collected from children with acute febrile illness, comprising 919 inpatients and 44 outpatients from the pediatric department.

Demographic features of study participants are presented in [Table 1].The age distribution ranged from 0 to 14 years, with the majority (28.6%) falling in the age group of 7-10 years, followed by 27.7% in the 4-6 years age group. The male-to-female ratio was 1.26:1.

Regarding the clinical symptoms and signs, fever was the most common presenting complaint, observed in 99% of participants. Gastrointestinal symptoms such as nausea and vomiting were reported in 52% of cases. Rashes were observed in 35% of participants and the pathognomonic feature an eschar was noted in 28 % of patients [Figure 1].

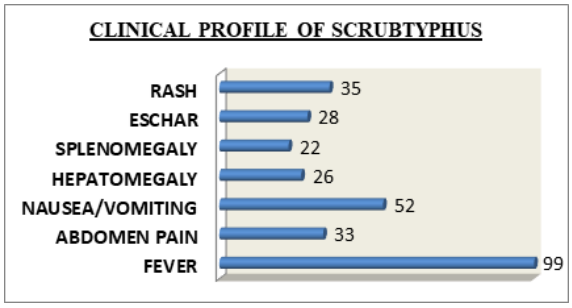

Figure 1: Clinical profile of Scrub typhus. Represented by bar chart – clinical presentation of laboratory confirmed scrub typhus by IgM ELISA, had fever as presenting complaint in 99% of cases. 52% presented with gastrointestinal symptoms. 35% presented with rashes and pathognomonic sign an eschar was present in 28% of the participants.

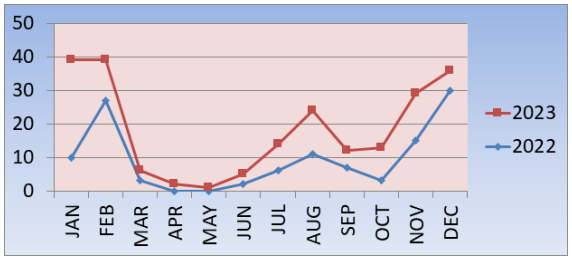

Figure 2: Seasonal variation of Scrub typhus among the study participants. Seasonal distribution among 220 positive scrub typhus cases studied during the year 2022(blue line) and 2023 (brown line) had maximum number of cases in the cooler months of the year starting from November (29), December (36), January & February (39 each). With a peak in August (24)

Scrub Typhus Positivity: Among the 963 participants, 22.8% (220) tested positive for Scrub typhus using IgM ELISA. The annual distribution of positive cases showed 117 and 103 individuals tested positive for Scrub typhus in the years 2022 and 2023 respectively.

ISSN (O): 2687-5365; ISSN (P): 2753-6556

[Figure 2], depicts the seasonal variation of Scrub typhus among the study participants. Scrub typhus cases peaked during the cooler months, particularly between December (36 cases) and February (39 cases), with another peak observed in August (24 cases).

Geographical Clustering of Scrub typhus in and around Thiruvallur district is discussed in [Table 2]. Geographical clustering of Scrub typhus cases in and around Thiruvallur district revealed a higher concentration in Thiruvallur block (83 cases) among the 14 health unit blocks. Arokkonam in Ranipet district recorded the highest number of cases among the areas bordering Thiruvallur district.

These findings provide a comprehensive overview of the demographic distribution, clinical presentation, seasonal and geographical clustering of Scrub typhus in the study population during the specified period.

Table 1: Demographic features of the study participants positive for Scrub typhus.

Age distribution	No. of participants (%)	Male (%)	Female (%)
0-3 years	59(26.8)	20(9.09)	29(13.18)
4-6 years	61(27.7)	38 (17.27)	23 (10.45)
7-10 years	63 (28.6)	38 (17.27)	26 (11.81)
11-14 years	37(16.8)	17 (7.72)	19(8.63)
Total	220(22.8)	123(55.90)	97(44.09)

Table 2: Geographical Clustering of Scrub typhus in and around Thiruvallur district.

Distribution of Scrub typhus within the health unit blocks of Thiruvallur district n=181	
Name of health unit block	**No. of positive (%)**
Thiruvallur	83(45.85)
Kadambatur	28(15.46)
Poondi	23(12.7)
Thiruvalangadu	14(7.73)
Ellapuram	7(3.86)
Pallipattu	6(3.31)
Poonamalle	6(3.31)
Sholavaram	5(2.76)
Tiruthani	4(2.20)
Others(RK pet, Villivakkam Gummidipoondi, Minjur & Puzhal)	5(2.75)
Total	181
Distribution of Scrub typhus in the bordering districts in and around Thiruvallur n=39	
Name of the area	No. of positive (%)
Arakkonam	20(51.2)
Chittoor & Thirupathi (Andhra Pradesh)	8(20.5)
Kanchipuram	8(20.5)
Vellore	2(5.10)
Chengalpattu	1(2.56)
Total	39

DISCUSSION

Scrub typhus, one of the neglected infectious diseases without licensed vaccines, has re-emerged in India, especially burdening children with a high rate of complications. This study involved 963 paediatric patients presenting with acute undifferentiated febrile illness from January 2022 to December 2023.

Key demographic characteristics revealed a higher incidence (56%) of Scrub typhus in the age group of 4 to 10 years which is similar to a study on burden of paediatric Scrub typhus at a tertiary care hospital, in which most common age group reported was between 5-10 years.[7] In gender distribution male children out numbered females with the ratio of 1.26:1.This is consistent with the study done by Kumar Jana et al on Scrub typhus in paediatric population in which male to female ratio of 1.22:1was reported.[8]

Fever was the predominant symptom (99%), aligning with existing literature, [8-10] and other common clinical features included vomiting, nausea, hepatomegaly, and splenomegaly. Rash was observed in 35% of patients. Notably, gastrointestinal signs and symptoms were observed, emphasizing the varied clinical presentation of Scrub typhus in paediatric patients. [8, 11]

In the classical presentation of Scrub typhus, the initial sign is the appearance of vesicular lesion at the site of chigger bite which further develops into an eschar or an ulcer with regional lymphadenopathy. However in this study the presence of eschar, a pathognomonic sign, was noted in 28% of cases, comparable to other studies, however, it's crucial to acknowledge that eschar absence does not rule out Scrub typhus.[9-15]

Laboratory diagnosis, relying on serological tests such as WF test, ELISA and IFA play a vital role due to the nonspecific nature of symptoms. In this study, IgM ELISA for Scrub typhus diagnosis was used. The pre-determined region specific cut-off OD value was fixed to 0.8 which is closer to a study by Blacksell SD et al.[12] The prevalence of Scrub typhus in paediatric population was found to be 22.84% consistent with a study by Devasagayam et

ISSN (O): 2687-5365; ISSN (P): 2753-6556

al [1]and Kumar v et al in which the prevalence of 25.3% & 24% has been reported respectively.

Patients pick up an infective larval mite accidentally while lying, sitting or walking on the infested ground most commonly during the monsoon period.[4] While analysing the seasonal variation of burden of Scrub typhus during the study period revealed a steep rise in the cases during the cooler months, particularly between December to February, with an another peak observed in August. Other studies also observed the transmission to be maximum in cooler months from November to December which is directly linked to the secondary vegetation after monsoon period, vector activity and habitat. [2, 10-15] The seasonal distribution of cases, with peaks during cooler months, correlates with the increased activity of trombiculid mites after the monsoon period.

Devasagayam et al observed more prevalence of Scrub typhus in South India (55.5%) followed by North India (31.5%). [2] Scrub typhus has been reported extensively in Tamilnadu especially in and around Vellore due to denser vegetation, favouring exposure to trombiculid mites. [12] Regarding geographical mapping of Scrub typhus in this study, out of 220 positive patients, 181 patients were distributed in various health unit blocks of Thiruvallur district and 39 of them were from adjoining areas. Among the bordering districts Arakkonam has reported 20 (51.2%) paediatric Scrub typhus patients, as these two districts are in close proximity to Vellore district with heavy vegetation. [14]

Geographical mapping in Thiruvallur district highlighted Thiruvallur health unit (45.85%) as a hotspot for Scrub typhus. This corresponds to areas with dense vegetation, increased marshy and agricultural land, creating favourable conditions for mite exposure. Next to Thiruvallur block, high number of scrub typhus were reported in Kadambattur block (15.46%) followed by Poondi (12.7%) [Table 2]. Also Thiruvallur district is a place with large water bodies, increased grassy lands and agriculture field that provides optimal conditions for the infected mites to thrive. These geographic regions with forest clearings, river banks and grassy fields are high-risk areas to acquire the mite.

The study underlines the importance of clinical suspicion especially in patients unresponsive to conventional antibiotics during the monsoon period and originating from endemic areas. This research contributes valuable insights into the current epidemiological landscape of Scrub typhus in the paediatric population, emphasizing the need for heightened clinical awareness, early laboratory investigations, and treatment and regional-specific interventions for effective management.

CONCLUSION

This study underscores the critical importance of comprehending the epidemiology and clinical manifestations of Scrub typhus to facilitate timely diagnosis and intervention. In our investigation, the prevalence of Scrub typhus was determined to be 22.84%. Given its endemic nature, Scrub typhus should be recognized as a significant aetiological agent in the paediatric population presenting with acute undifferentiated febrile illness.

By shedding light on the prevalence and clinical implications of Scrub typhus, this study aims to contribute to the improvement of diagnostic strategies and the implementation of effective interventions in paediatric populations. This understanding is pivotal for healthcare practitioners in regions endemic for Scrub typhus to ensure prompt recognition and management of this potentially fatal disease.

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ISSN (O): 2687-5365; ISSN (P): 2753-6556