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Original Article

Rickettsial Infections in Febrile Paediatric Patients: Observations from a Tertiary Care Hospital in Cumilla, Bangladesh

Muhammed Mizanur Rahman Bhuyan[1], Abu Sufian[2], Abir Hossain[3], Sharmin Sultana[4], Momtaz Begum[5]

Abstract

Background: *Rickettsial infections are emerging tropical diseases caused by obligate intracellular, pleomorphic gram-negative coccobacilli. Early diagnosis is difficult because serological tests vary greatly in sensitivity and specificity. Although the Indirect Immunofluorescence Antibody (IFA) test is the gold standard, its high cost and limited availability restrict its use. Therefore, the Weil-Felix test is still widely used in rural areas for presumptive diagnosis.* ***Materials and Methods:*** *This prospective cross-sectional study was conducted in the Paediatric Department of Eastern Medical College Hospital (EMCH), Cumilla, from January to December 2025, after obtaining ethical approval from the IERB of EMC, to evaluate the clinico-demographic patterns and frequency of suspected rickettsial infections among febrile children. A total of 110 children (≤12 years) were enrolled by convenient sampling. Children over 12 years, those with confirmed other causes of fever, lack of guardian consent, or critical ill cases were excluded. Data was collected using a pre-tested structured questionnaire containing sociodemographic details, history, and clinical findings. Laboratory tests, including CBC and the Weil-Felix test, were performed. Written informed consent was obtained from each child's legal guardian. Collected data were analyzed in SPSS version 25. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize the findings.* ***Results:*** *In total, 110 children were enrolled, with a slight male predominance (53% vs. 47%). The mean duration of fever was 6.9 ± 1.3 days. Most children belonged to the 4-6 year age group (40;36.4%), followed by those aged 7-9 years (31;28.2%). The mean age of the study participants was 6.1±2.7 years. The overall percentage of rickettsial infection was 35.5%. Among the positive cases, OX-19 was the most frequent antigen (22; 20.0%), followed by OX-K (19; 17.3%) and OX-2 (18; 16.4%). The most frequently reported clinical features were altered bowel habits (26; 23.6%) and both headache and vomiting (21; 19.1% each). Abdominal pain was noted in 8 cases (7.3%), while rash was present in 7 cases (6.4%). Leukocytosis was observed in 12 cases (10.9%).* ***Conclusion:*** *Rickettsial infections in children are underdiagnosed but potentially severe. Early recognition, High clinical suspicion, early recognition and prompt appropriate therapy are essential to reduce morbidity and mortality. The Weil-Felix test can be useful for presumptive diagnosis in rural settings.*

Keywords: Febrile illness, Rickettsial infection, Paediatric patients, Clinical profile, Laboratory findings, Weil-Felix test.
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Introduction

Systemic bacterial infections account for a significant proportion of febrile illnesses, with blood cultures commonly identifying pathogens such as *Salmonella enterica*, *Streptococcus pneumoniae*, *Staphylococcus aureus*, and *Escherichia coli*[1]. However, bacteria that require more specialized diagnostic methods such as *Rickettsia* remain undetected despite their public health importance[2]. Rickettsial diseases are recognized as important contributors to Pyrexia of Unknown Origin (PUO), highlighting the need to distinguish them from other frequent causes of fever[3]. These infections represent emerging tropical illnesses caused by obligate intracellular, pleomorphic, gram-negative coccobacilli[4]. Transmission typically occurs through arthropod vectors like ticks, fleas, mites, and lice, or through direct contact with reservoir animals such as rodents, dogs, cattle, and mice[4]. The organisms primarily infect vascular endothelial, reticuloendothelial, and blood cells. Human-to-human transmission is uncommon and occurs only through blood transfusion or organ transplantation[5].

Rickettsial infections in children are an often-unrecognized cause of acute febrile illness, frequently presenting diagnostic challenges due to

[1]Assistant Professor, Department of Paediatrics, Eastern Medical College & Hospital, Cumilla, Bangladesh.
[2]Associate Professor, Department of Paediatrics, Eastern Medical College & Hospital, Cumilla, Bangladesh.
[3]Assistant Professor, Department of Paediatrics, Eastern Medical College & Hospital, Cumilla, Bangladesh.
[4]Assistant Professor, Department of Paediatrics, Eastern Medical College & Hospital, Cumilla, Bangladesh.
[5]Assistant Professor, Department of Paediatrics, Eastern Medical College & Hospital, Cumilla, Bangladesh.

Address of Correspondence: Dr. Muhammed Mizanur Rahman Bhuyan, Assistant Professor, Department of Paediatrics, Eastern Medical College & Hospital, Cumilla, Bangladesh. Email: drmizancmc47@gmail.com

their varied and nonspecific symptoms. Common clinical features include fever, rash, headache, and gastrointestinal complaints, while laboratory and neurological findings may involve thrombocytopenia, elevated C-reactive protein (CRP) with convulsions, altered sensorium, and meningeal signs[6]. In India, studies have reported that up to 27.3% of acute febrile illness cases are attributed to rickettsial infections[7]. Diagnosis is complicated by the distinct clinical manifestations associated with different rickettsial strains[8]. Immunofluorescence assay (IFA) is regarded as the gold standard, though it is costly and requires specialized expertise[4]. Molecular tests are increasingly used for detecting rickettsial infections because of their high sensitivity and specificity[9], whereas the Weil-Felix test, despite its lower accuracy, remains the most used method for initial diagnosis[10].

The Weil-Felix test detects antibodies against various *Proteus* species that share cross-reacting antigens with *Rickettsia*[11]. It is recommended to perform the test 5-7 days after fever onset[12]. Diagnosis is typically based on either a fourfold rise in agglutinin titres in paired sera (preferred) or a single titre above 1:80, though baseline titres should be region-specific[13]. Despite its limitations, the Weil-Felix test remains a cost-effective tool for laboratory diagnosis and can be used as a screening method, detecting more true cases than misdiagnoses[14,15]. Delayed diagnosis and treatment may lead to severe complications, including acute respiratory distress syndrome (ARDS), septic shock, and multi-organ failure that resulting mortality[16]. Mortality from rickettsial infections has been reported in 1-30% of untreated cases[4,17].

Rapid and accurate diagnosis of rickettsial infections is crucial for timely antibiotic treatment, reducing disease duration, and lowering morbidity and mortality. Physicians and healthcare workers in this region must be familiar with the clinical features, diagnostic methods, and appropriate management of these infections. To address this need, the present study aims to provide a presumptive diagnosis of clinically suspected rickettsial fever using the Weil-Felix test and to estimate the frequency of the disease in this region.

Materials and Methods

Study Design: This was a prospective cross-sectional study conducted at paediatric department of Eastern Medical College Hospital, Cumilla, to determine the clinico-demographic patterns and estimate the frequency of clinically suspected rickettsial infections among febrile pediatric patients. The study period was from January 2025 to June 2025. A total of 110 febrile children were selected by convenient sampling.

Sample size: The sample size was calculated using the formula $n = Z^2pq/d^2$, taking a prevalence of 38.33%[18] with a 10% allowable error, and a Z-value of 1.96, yielding a sample size of 91. 20% non-respondent participants were 18.2. So, total sample size was 91+19= 110.

Data Collection Procedure: Data was collected through a pre-tested structured questionnaire. The questionnaire included sections on sociodemographic details, history and clinical examination findings of the child. Laboratory investigations like CBC and Weil-Felix test were done. Written informed consent was obtained from the legal guardians of all children prior to participation. All records were stored securely providing the unique study ID of each participant. The Weil-Felix test was done using standard protocol. Weil-Felix seropositivity was defined as a titer of ≥1:80 against any of the OX antigens (OX-2, OX-19 or OX-K), or a fourfold rise in paired sera when available[13].

Inclusion Criteria: Children aged ≤12 years with fever for at least 3 days without an established diagnosis, whose legal guardians provide informed consent.

Exclusion Criteria: Children older than 12 years; those with a confirmed alternative cause of fever (e.g., dengue, malaria, typhoid, pneumonia, or sepsis); children without guardian consent; and critically ill children or those unable to complete the interview at the time of data collection were excluded.

Statistical Analysis: Collected data were entered into Microsoft Excel and analyzed using SPSS version 25.0. Descriptive statistics such as frequencies, percentages, means, and standard deviations were used to summarize the data and a p-value of <0.05 was considered statistically significant. The results were presented using tables, figures, and narrative descriptions.

Ethical Consideration: Ethical permission for the study was taken from the IERB of Eastern Medical College, Cumilla. Informed written consent was received from all legal guardians of participants. Participant information was kept strictly confidential and anonymous. Participation was voluntary and had the right to withdraw at any stage without any consequences.

Results

This study shows a slightly higher representation of males (53%) than females (47%) among the participants. The mean duration of fever was 6.9 ± 1.3 days. Regarding age distribution, most children belonged to the 4-6 year age group (40; 36.4%),

followed by those aged 7-9 years (31; 28.2%) (Figure-1, Table-I). The mean age of the study participants was 6.1±2.7 years (Table-I).

Figure-2 demonstrates that the overall percentage of rickettsial infection was 35.5% (39 cases). Among the positive cases, the distribution of Weil-Felix antigens showed that OX-19 was the most frequent antigen (22; 20.0%), followed by OX-K (19; 17.3%) and OX-2 (18; 16.4%). Additionally, leukocytosis was observed in 12 cases (10.9%) (Table-II).

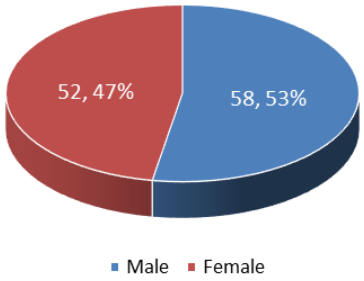

Figure-1: Gender distribution of study participants (n=110)

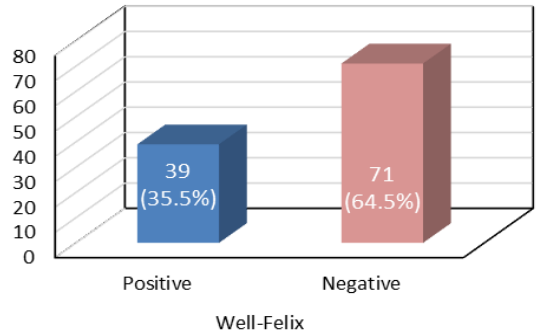

Figure-2: Percentage distribution of positive Well-Felix tests among study participants (n=110)

Table-I: Age distribution of the study cases (n=110)

Age distribution	Frequency	Percentage (%)
1-3	23	20.9
4-6	40	36.4
7-9	31	28.2
10-12	16	14.5
Mean±SD	**6.1±2.7 years**	

Table-II: Percentage distribution of Weil-Felix antigens and leukocytosis among positive Weil-Felix cases (n=39)

Weil-Felix Antigens	Frequency	Percentage (%)
OX 2	18	16.4
OX 19	22	20.0
OX K	19	17.3
Leukocytosis	12	10.9

Table-III: Clinical features among positive Weil-Felix Cases (n = 39)

Clinical features	Frequency	Percentage (%)
Headache	21	19.1
Rash	7	6.4
Abdominal pain	8	7.3
Vomiting	21	19.1
Altered bowel habit	26	23.6

Table-IV: Socio-demographic distribution of the study cases (n=110)

Variables	Category	Frequency	Percentage (%)
Residence	Rural	69	62.8
	Urban	41	37.2
Economic condition	Good	26	23.6
	Middle	69	62.8
	Poor	15	13.6

Among the 39 positive Weil-Felix cases, the most frequently reported clinical features were altered bowel habits (26; 23.6%) and both headache and vomiting (21; 19.1% each). Abdominal pain was noted in 8 cases (7.3%), while rash was present in 7 cases (6.4%) (Table-III). Of the 110 study participants, the majority resided in rural areas (69; 62.8%), while 41 (37.2%) were from urban areas. Regarding economic status, most children belonged to middle-income families (69; 62.8%), followed by those from good economic conditions (26; 23.6%) and poor economic backgrounds (15; 13.6%) (Table-IV).

Discussion

Rickettsial infections are a significant global health concern, caused by various bacterial strains of the genus Rickettsia, and have a tendency to emerge and re-emerge[19]. The study showed a slightly higher representation of males (53%) than females (47%) among the participants. Similar gender distribution was also observed in other studies[20-22]. Boys participate in outdoor activities more frequently than girls, making them more prone to the disease. The mean duration of fever in our study was 6.9 ± 1.3 days, which is comparable to the findings of Smriti et al.[23], who reported a mean duration of 6.4 ± 1.8 days. Regarding age distribution, the majority of children in this study were in the 4-6 year age group (36.4%), followed by those aged 7-9 years (28.2%). The mean age of participants was 6.1 ± 2.7 years. This pattern is slightly younger compared to the findings of Smriti et al., who reported that children aged 6-10 years were most affected (50%), followed by the 1-5 year age group (20%), with a higher mean age of 8.5 ± 3.2 years. These differences may reflect variations in study populations, regional epidemiology, or referral patterns.

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Rickettsial diseases contribute substantially to the burden of tropical febrile illnesses. In most cases, patients are initially present with fever along with non-specific symptoms such as vomiting, muscle pain, headache, and redness of the eyes, which often complicates the diagnostic process[24]. Among the rickettsial cases, the most frequently reported clinical features were altered bowel habits (26; 23.6%), followed by headache and vomiting (21; 19.1% each). Abdominal pain was observed in 8 cases (7.3%), and rash was documented in 7 cases (6.4%) (Table III). Kumar et al.[25] similarly reported notable frequencies of headache (31.5%), vomiting (46.8%), abdominal pain (22.6%), and rash (18.5%).

In the present study, rickettsial infection was detected in 35.5% of cases (39 children). Among these positive cases, OX-19 was the most commonly identified antigen (20.0%), followed by OX-K (17.3%) and OX-2 (16.4%). This distribution of Weil-Felix antigens is in line with findings from other studies, which reported similar prevalence patterns[26,27]. Additionally, leukocytosis was observed in 10.9% of cases in this study, which is notably lower than the 41.9% reported in another study. This difference may reflect variations in patient populations, disease severity, or timing of laboratory evaluation[25]. In contrast, Smriti et al.[23] found that rickettsial infections were higher in children, with a prevalence of 78%. This discrepancy may be due to differences in study population, diagnostic methods, or regional epidemiology.

In our study, the majority of children came from middle-income families (62.8%) and resided in rural areas (62.8%). These findings align with previous studies, which suggest that rural populations are more vulnerable to rickettsial infections[28,29]. The seasonal occurrence of rickettsial infections is influenced by regional climate, temperature, and rainfall patterns[30]. Rickettsial infections typically respond rapidly to antimicrobial therapy. Doxycycline is the preferred antibiotic, although chloramphenicol is occasionally used in certain endemic regions[31]. Treatment should be continued until the patient has been afebrile for at least 24 hours or for a minimum of seven days[32].

Conclusion

Rickettsial infections in children are underdiagnosed but potentially severe. Early recognition, High clinical suspicion, early recognition and prompt appropriate therapy are essential to reduce morbidity and mortality. Awareness of the diverse clinical presentations, including neurological and ocular involvement, is key to improving diagnosis and management in paediatric populations. The Weil-Felix test can be effectively utilized for the presumptive diagnosis of rickettsial infections, especially in rural and resource-limited settings.

Recommendation

Further large-scale studies using molecular methods, such as PCR, are recommended to better understand the epidemiology of paediatric rickettsial infections and to optimize diagnostic and treatment strategies.

Conflict of interest

The authors declared that they have no conflict of interest and the study did not receive any funding.

References

1. Reddy EA, Shaw AV, Crump JA. Community-acquired bloodstream infections in Africa: a systematic review and meta-analysis. Lancet Infect Dis. 2010; 10 (6): 417-32. doi: 10.1016/S1473-3099(10)70072-4.
2. Prasad N, Murdoch DR, Reyburn H, Crump JA. Etiology of Severe Febrile Illness in Low- and Middle-Income Countries: A Systematic Review. PLoS One. 2015; 10 (6): e0127962. doi: 10.1371/journal.pone.0127962.
3. Mittal V, Gupta N, Bhattacharya D, Kumar K, Ichhpujani RL, Singh S, et al. Serological evidence of rickettsial infections in Delhi. Indian J Med Res. 2012; 135 (4): 538-41.
4. Rathi N, Rathi A. Rickettsial infections: Indian perspective. Indian Pediatr. 2010; 47 (2): 157-64. doi: 10.1007/s13312-010- 0024-3.
5. Bernabeu-Wittel M, Segura-Porta F. Enfermedades producidas por Rickettsia [Rickettsioses]. Enferm Infecc Microbiol Clin. 2005; 23 (3): 163-72. Spanish. doi: 10.1157/13072167.
6. Lendner I, Shmueli M, Elamour S, Ling G, Ben-Shimol S. Comparison of Brucellosis and Rickettsiosis in Children: A Retrospective Cohort Study. J Clin Med. 2025; 14 (5): 1465. doi: 10.3390/jcm14051465.
7. D'Cruz S, Perumalla SK, Yuvaraj J, Prakash JAJ. Geography and prevalence of rickettsial infections in Northern Tamil Nadu, India: a cross-sectional study. Sci Rep. 2022; 12 (1): 20798. doi: 10.1038/s41598-022-21191-7.
8. Mahajan SK, Rolain JM, Kashyap R, Bakshi D, Sharma V, Prasher BS, et al. Scrub typhus in Himalayas. Emerg Infect Dis. 2006; 12 (10): 1590-2. doi: 10.3201/eid1210.051697.
9. Khrouf F, Sellami H, Elleuch E, Hattab Z, Ammari L, Khalfaoui M, et al. Molecular diagnosis of Rickettsia infection in patients from Tunisia. Ticks Tick Borne Dis. 2016; 7 (5): 653-6. doi: 10.1016/j.ttbdis.2016.02.010.
10. 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. doi: 10.1086/596576.
11. Isaac R, Varghese GM, Mathai E, J M, Joseph I. Scrub typhus: prevalence and diagnostic issues in

rural Southern India. Clin Infect Dis. 2004; 39 (9): 1395-6. doi: 10.1086/424748.
12. Mahajan SK, Kashyap R, Kanga A, Sharma V, Prasher BS, Pal LS. Relevance of Weil-Felix test in diagnosis of scrub typhus in India. J Assoc Physicians India. 2006; 54: 619-21.
13. Rathi N, Kulkarni A, Yewale V. For Indian Academy of Pediatrics Guidelines on Rickettsial Diseases in Children Committee. IAP Guidelines on Rickettsial Diseases in Children. Indian Pediatr. 2017; 54 (3): 223-9. doi: 10.1007/s13312-017-1035-0.
14. Stephen S, Ambroise S, Gunasekaran D, Hanifah M, Sangeetha B, Pradeep J, et al. Serological evidence of spotted fever group rickettsiosis in and around Puducherry, south India-A three-year study. J Vector Borne Dis. 2018; 55 (2): 144-50. doi: 10.4103/0972-9062.242562.
15. Kato CY, Chung IH, Robinson LK, Austin AL, Dasch GA, Massung RF. Assessment of real-time PCR assay for detection of Rickettsia spp. and Rickettsia rickettsii in banked clinical samples. J Clin Microbiol. 2013; 51 (1): 314-7. doi: 10.1128/JCM.01723-12.
16. Narvencar KP, Rodrigues S, Nevrekar RP, Dias L, Dias A, Vaz M, et al. Scrub typhus in patients reporting with acute febrile illness at a tertiary health care institution in Goa. Indian J Med Res. 2012; 136 (6): 1020-4.
17. Prabhakaran A, Lal S, Biswas S, Vinoth S, Asraf AS, Mittal V. Serological study of rickettsial diseases in human and rodent population in Chittoor dist. (A.P.). J Commun Dis. 2010; 42 (3): 209-13. Erratum in: J Commun Dis. 2010; 42 (3): 2 p preceding 171.
18. Chunchanur SK, Shwetha JV, Ambica R. Rickettsial Infection in Patients with Acute Febrile Illness at a Tertiary Care Hospital in Bengaluru, India - Serological, Demographic and Clinical Profile. Int J Trop Disease Health. 2018; 32 (4): 1-6.
19. Parola P, Paddock CD, Raoult D. Tick-borne rickettsioses around the world: emerging diseases challenging old concepts. Clin Microbiol Rev. 2005; 18 (4): 719-56. doi: 10.1128/cmr.18.4.719-756.2005.
20. Shashidhara HJ, Augustin L. Rickettsial infection in children: clinical profile and response to treatment. MedPulse Int J Pediatr. 2021; 18 (1): 1-5.
21. Kumar M, Murthy SK, Delhikumar CG, Narayanan P. Scrub typhus in children at a tertiary hospital in Southern India: clinical profile and complications. J Infect Public Health. 2012; 5 (1): 82-8.
22. Kulkarni T, Benakatti G, Bidari L. Prospective study with rapid and low cost serodiagnostic assay for rickettsial infections in children of Vijayapura district, Northern Karnataka, India. Int J Contemp Pediatr. 2018; 5 (4): 1244-8. doi: 10.18203/2349-3291.ijcp20182059.
23. Smriti A, Kumari N, Singh A, Narain B. Rickettsial fever in pediatric patients: an analysis of clinical presentation and laboratory findings. Int J Curr Pharm Rev Res. 2024; 16 (12): 266-70.
24. Dass R, Deka NM, Duwarah SG, Barman H, Hoque R, Mili D, et al. Characteristics of pediatric scrub typhus during an outbreak in the Northeastern region of India: peculiarities in clinical presentation, laboratory findings and complications. Indian J Pediatr. 2011; 78 (11): 1365-70. doi: 10.1007/s12098-011-0470-5.
25. Kumar S, Aroor S, Kini PG, Mundkur S, Gadiparthi M. Clinical and laboratory features of rickettsial diseases in children in South India. Pediatr Oncall. 2019; 16 (1): 9-16. doi: 10.7199/ped.oncall.2019.11.
26. Akshatha P. Vijayalakshmi J. Prevalence of Rickettsial infections in a tertiary care centre. Indian J Microbiol Res. 2020; 7 (1): 6-9.
27. Hullatti C, GSL, BV. Hyponatremia: a diagnostic marker for the diagnosis of rickettsial diseases. Int J Contemp Pediatr. 2017; 4 (3): 696-9. doi: 10.18203/2349-3291.ijcp20170993.
28. Wang YC, Chen PC, Lee KF, Wu YC, Chiu CH. Scrub typhus cases in a teaching hospital in Penghu, Taiwan, 2006-2010. Vector Borne Zoonotic Dis. 2013; 13 (3): 154-9. doi: 10.1089/vbz.2012.1059.
29. Liu JR, Xu BP, Li SG, Liu J, Tian BL, Zhao SY. [Clinical features of four atypical pediatric cases of endemic typhus with pneumonia]. Zhonghua Er Ke Za Zhi. 2013; 51 (10): 775-8.
30. Li T, Yang Z, Dong Z, Wang M. Meteorological factors and risk of scrub typhus in Guangzhou, southern China, 2006-2012. BMC Infect Dis. 2014; 14: 139. doi: 10.1186/1471-2334-14-139.
31. Mathai E, Rolain JM, Verghese GM, Abraham OC, Mathai D, Mathai M, et al. Outbreak of scrub typhus in southern India during the cooler months. Ann N Y Acad Sci. 2003; 990: 359-64. doi: 10.1111/j.1749-6632.2003.tb07391.x.
32. Murali N, Pillai S, Cherian T, Raghupathy P, Padmini V, Mathai E. Rickettsial infections in South India - how to spot the spotted fever. Indian Pediatr. 2001; 38 (12): 1393-6.

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