

The Study of Clinical and Laboratory Profile of Paediatric Enteric Fever in a Tertiary Care Hospital of the Kashmir Valley

Mohmad Rayees Khanday¹, Ruhbhana Qadri², Mohd Suhail Lone³

¹Department of Paediatrics, Government Medical College, Srinagar, Jammu & Kashmir, India

²Assistant Professor, Department of Pediatrics Microbiology, Children Hospital, Bemina

³Associate Professor, Department of Microbiology, Government Medical College, Srinagar, Jammu & Kashmir, India

Received: 01-03-2024 / Revised: 15-03-2024 / Accepted: 22-04-2024

Corresponding author: Dr. Mohmad Rayees Khanday

Conflict of interest: Nil

Abstract

Background: Enteric fever remains an important cause of hospitalisation among children in the Kashmir Valley, while antimicrobial resistance continues to complicate treatment across South Asia.

Objective: To describe the clinical, laboratory and microbiological profile, complications, treatment response and outcome of children with enteric fever admitted to a tertiary care hospital in Srinagar.

Methods: We reviewed the case records of children aged 1–14 years admitted to the Department of Paediatrics, Government Medical College, Srinagar, between January 2022 and February 2024 with a discharge diagnosis of enteric fever. Children were included if they had clinical features suggestive of enteric fever together with a positive blood culture, a positive Typhidot IgM, or a significant Widal titre (TO or TH $\geq$ 1:160). Data on demography, clinical features, laboratory parameters, antimicrobial susceptibility, treatment and outcome were extracted and analysed with SPSS version 26.

Results: Of 156 children included, the mean age was 7.4 ± 3.5 years and 74.4% were aged 5–14 years; boys outnumbered girls in a ratio of 1.5:1. Most families belonged to the lower or middle socio-economic strata, and only 7.7% of children had a documented history of typhoid vaccination. Fever was universal, and the other common presenting features were anorexia and weakness (48.7%), vomiting (41.0%), abdominal pain (37.2%) and diarrhoea (21.8%). Splenomegaly was the commonest sign (45.5%). Anaemia was present in 44.9%, eosinopenia in 57.7% and raised C-reactive protein in 71.2%; the total leucocyte count was normal in about 70% of children. Blood culture was positive in 28.8%, and all 45 culture-confirmed isolates demonstrated nalidixic acid resistance while remaining susceptible to ceftriaxone. Complications occurred in 19.9% of children, hepatitis being the commonest. The mean time to defervescence was 3.6 ± 2.1 days and the mean hospital stay was 6.8 ± 2.3 days. All children recovered; there were no deaths. Ceftriaxone retained activity against all culture-confirmed isolates in this cohort, supporting its continued use in accordance with local susceptibility patterns and prevailing treatment guidelines.

Keywords: Enteric Fever; Typhoid; Children; Kashmir; Salmonella Typhi; Antimicrobial Resistance.

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

The remains an important public health problem in South Asia. Treatment has become more challenging because of evolving antimicrobial resistance.

However, an updated clinical and antimicrobial susceptibility profile from the valley is lacking. We therefore undertook this study to describe the socio-demographic characteristics, clinical spectrum, laboratory profile, complications, antimicrobial susceptibility, treatment response and outcome of children with enteric fever admitted to the Department of Paediatrics, Government

Medical College, Srinagar, over a 26-month period from January 2022 to February 2024.

Materials and Methods

Study Design and Setting: This was a retrospective, record-based study conducted in the Department of Paediatrics, Government Medical College, Srinagar — the apex tertiary care and referral hospital of the Kashmir valley, drawing patients from all ten districts of the valley — between January 2022 and February 2024.

Study Population: Children aged 1–14 years admitted with a discharge diagnosis of enteric fever

were eligible for inclusion. We included a child if fever of at least three days' duration was accompanied by one or more suggestive features (abdominal pain, vomiting, diarrhoea, constipation, headache, or hepatosplenomegaly) and at least one of the following: blood culture positive for *Salmonella enterica*; a positive Typhidot IgM rapid test; or a Widal agglutination titre of TO and/or TH $\geq 1:160$, in line with the IAP Task Force criteria [9].

Children with an alternative confirmed diagnosis (malaria, dengue, tuberculosis, urinary tract infection and the like) or with incomplete records were excluded.

Data Collection: Data were extracted from admission registers, inpatient case sheets and the hospital information system onto a pre-designed proforma. The variables recorded were age, sex, residence (rural/urban), socio-economic status (modified Kuppaswamy scale), season of admission, duration of fever, presenting symptoms and signs, haemoglobin, total and differential leucocyte counts, platelet count, liver enzymes, serum electrolytes, C-reactive protein, Widal titre, Typhidot, blood culture result, antimicrobial susceptibility of isolates, antibiotics received, time to defervescence, complications, duration of hospital stay and outcome.

Microbiological Methods: Blood samples were collected before initiation of antibiotics at the study hospital, with approximately 1 mL of blood collected per child. Blood cultures were processed in the Department of Paediatric Microbiology, Children's Hospital, Bemina, using the BacT/ALERT automated system, with identification and antibiotic susceptibility testing performed on the VITEK 2 platform. Cultures were repeated when contamination was suspected. Susceptibility was interpreted according to the CLSI guidelines used by the laboratory during the study period.

Operational Definitions: Leucopenia was taken as a total leucocyte count below $4,000/\text{mm}^3$ and leucocytosis as above $11,000/\text{mm}^3$; anaemia as haemoglobin below the age-adjusted WHO cut-off; eosinopenia as the absence of eosinophils on the peripheral smear; thrombocytopenia as a platelet

count below $150,000/\text{mm}^3$; transaminitis as transaminases above twice the upper limit of normal; and hyponatraemia as serum sodium below 135 mEq/L . Relapse was defined as recurrence of fever within two weeks of completing antibiotics.

Statistical Analysis: Data were analysed using SPSS version 26 (IBM Corp., Armonk, NY, USA). Continuous variables are presented as mean $\pm$ standard deviation, and categorical variables as frequencies and percentages.

Results

During the study period, 156 children aged 1–14 years met the inclusion criteria.

Socio-demographic Profile and Seasonality: The mean age was 7.4 ± 3.5 years. Nearly three-quarters of the children (74.4%) were aged between 5 and 14 years, 19.2% were aged 2 to under 5 years, and only 6.4% were under two years of age. Boys accounted for 60.3% of the cohort, giving a male-to-female ratio of 1.5:1. Most families belonged to the lower (34.6%) or middle (58.3%) socio-economic strata, and close to two-thirds (62.8%) lived in rural areas. A documented history of typhoid vaccination was present in a mere 7.7% of children. Cases were seen throughout the year, but nearly half (46.8%) presented between March and June, coinciding with the warmer months in the valley.

Clinical Features: Every child in the study had fever, and in 97.4% it had lasted five days or more by the time of admission. Beyond fever, the children were brought in with a fairly uniform picture of constitutional and gastrointestinal upset: anorexia and weakness in 48.7%, vomiting in 41.0%, abdominal pain in 37.2%, diarrhoea in 21.8% and constipation in 4.5%. Cough (17.9%) and headache (17.3%) were less frequent. On examination, splenomegaly was the commonest finding (45.5%), followed by pallor (31.4%), coated tongue (29.5%) and hepatomegaly (26.3%). Icterus was seen in 8.3% and lymphadenopathy in 15.4%. Younger children tended to present with abdominal distension, diarrhoea and cough, whereas abdominal pain and headache dominated in the older age group, much as Sarswat et al. described [10].

Table 1: Clinical profile of children with enteric fever (n = 156)

Symptom / sign	n (%)
Fever	156 (100)
Anorexia / weakness	76 (48.7)
Vomiting	64 (41.0)
Abdominal pain	58 (37.2)
Pallor	49 (31.4)
Coated tongue	46 (29.5)
Splenomegaly	71 (45.5)
Hepatomegaly	41 (26.3)

Diarrhoea	34 (21.8)
Cough	28 (17.9)
Headache	27 (17.3)
Lymphadenopathy	24 (15.4)
Icterus	13 (8.3)
Constipation	7 (4.5)
Seizures	5 (3.2)

Laboratory Profile: The haemogram was unremarkable in a striking proportion of these children: the total leucocyte count was within normal limits in 69.9%, which accords with the IAP observation that a normal TLC is the rule rather than the exception in enteric fever [9]. Anaemia was the single commonest abnormality (44.9%), reflecting both the illness and the high background prevalence of nutritional anaemia in the region. Eosinopenia was present in 57.7%, raised C-reactive protein in 71.2%, and transaminases were elevated beyond twice the upper limit of normal in 33.3%. Thrombocytopenia occurred in 15.4%, leucocytosis in 18.6%, leucopenia in 11.5%, hyponatraemia in 13.5%, hypokalaemia in 8.3% and pancytopenia in 5.8%.

Table 2: Laboratory findings (n = 156)

Investigation	n (%)
Anaemia	70 (44.9)
Raised CRP (>6 mg/L)	111 (71.2)
Eosinopenia	90 (57.7)
Transaminitis (>2× ULN)	52 (33.3)
Leucocytosis	29 (18.6)
Thrombocytopenia	24 (15.4)
Hyponatraemia	21 (13.5)
Leucopenia	18 (11.5)
Hypokalaemia	13 (8.3)
Pancytopenia	9 (5.8)

Microbiological profile and antimicrobial susceptibility: Blood culture grew *Salmonella enterica* in 28.8% (45/156) of children. Of these culture-confirmed isolates, 40 (88.9%) were *Salmonella Typhi* and 5 (11.1%) *Salmonella Paratyphi A*. All 45 cultured isolates demonstrated nalidixic acid resistance; none was classified as XDR.

Table 3: Antimicrobial susceptibility of blood culture isolates (n = 45)

Antibiotic	Sensitive n (%)	Resistant n (%)
Ceftriaxone	45 (100)	0
Meropenem	45 (100)	0
Piperacillin-tazobactam	45 (100)	0
Azithromycin	43 (95.6)	2 (4.4)
Cefixime	43 (95.6)	2 (4.4)
Ciprofloxacin	7 (15.6)	38 (84.4)
Co-trimoxazole	29 (64.4)	16 (35.6)
Nalidixic acid	0	45 (100)

Treatment, complications and outcome: By the time they reached us, 92.3% of the children had already received antibiotics — usually a fluoroquinolone or an oral cephalosporin — from a peripheral centre. All children were started on parenteral ceftriaxone as per our institutional protocol and IAP recommendations [11]; azithromycin was added in 17.9% for persistent fever, and four children (2.6%) were switched to meropenem.

Fever settled over a mean of 3.6 ± 2.1 days, and the mean hospital stay was 6.8 ± 2.3 days. Complications were seen in 19.9% of children (Table 4). No child developed intestinal perforation, haemorrhage or shock, and there were no deaths or relapses during follow-up.

Table 4: Complications (n = 156)

Complication	n (%)
Hepatitis	14 (9.0)
Bronchopneumonia / lower respiratory involvement	6 (3.8)
Febrile seizures	5 (3.2)
Encephalopathy	4 (2.6)
Acute kidney injury	2 (1.3)
Any complication	31 (19.9)

Discussion

the reason for this difference cannot be determined from the present study the high prevalence of nalidixic acid and ciprofloxacin resistance in culture-confirmed isolates argues against empirical use of fluoroquinolones which may reflect differences in referral patterns, case mix, or illness severity.

Our study has the usual limitations of a retrospective, single-centre, hospital-based design. Serological tests of imperfect specificity contributed to the diagnosis in a subset of patients; prior antibiotics reduced culture yield; and milder cases managed as outpatients never entered the dataset. A prospective community-based study with blood cultures before any antibiotics would give a truer picture of the valley's burden.

Conclusions

Enteric fever remains an important, largely vaccine-preventable cause of hospitalisation among school-aged children in the Kashmir Valley, with a spring-early summer peak and a predominance of children from rural and lower-to-middle socioeconomic backgrounds.

With nalidixic acid resistance observed in all 45 culture-confirmed isolates and ceftriaxone susceptibility preserved, ceftriaxone retained activity in this cohort. These findings support its continued use in accordance with local susceptibility patterns and prevailing treatment guidelines, while continuous local surveillance remains important. In the longer run, safe drinking water, sanitation and typhoid conjugate vaccination are important preventive strategies.

What this study adds: a contemporary clinical, laboratory and antibiogram profile of paediatric enteric fever from the Kashmir valley, and a local benchmark against the pre-2020 data from the same region.

References

1. Mogasale V, Maskery B, Ochiai RL, Lee JS, Mogasale VV, Ramani E, et al. Burden of typhoid fever in low- and middle-income countries: a systematic literature-based update with risk-factor adjustment. *Lancet Glob Health*. 2014;2(6):e570-e580.
2. Ochiai RL, Acosta CJ, Danovaro-Holliday MC, Baiqing D, Bhattacharya SK, Agtini MD, et al. A study of typhoid fever in five Asian countries: disease burden and implications for controls. *Bull World Health Organ*. 2008;86(4):260-268.
3. Sinha A, Sazawal S, Kumar R, Sood S, Reddaiah VP, Singh B, et al. Typhoid fever in children aged less than 5 years. *Lancet*. 1999;354(9180):734-737.
4. Saha SK, Baqui AH, Hanif M, Darmstadt GL, Ruhulamin M, Nagatake T, et al. Typhoid fever in Bangladesh: implications for vaccination policy. *Pediatr Infect Dis J*. 2001;20(5):521-524.
5. Wijedoru L, Mallett S, Parry CM. Rapid diagnostic tests for typhoid and paratyphoid (enteric) fever. *Cochrane Database Syst Rev*. 2017;5(5):CD008892.
6. Klemm EJ, Shakoor S, Page AJ, Qamar FN, Judge K, Saeed DK, et al. Emergence of an extensively drug-resistant *Salmonella enterica* serovar Typhi clone harboring a promiscuous plasmid encoding resistance to fluoroquinolones and third-generation cephalosporins. *mBio*. 2018;9(1):e00105-18.
7. Hooda Y, Tanmoy AM, Nath SD, Barman Jui A, Al Amin, Rahman H, et al. Outbreak of ceftriaxone-resistant *Salmonella enterica* serovar Typhi, Bangladesh, 2024. *Emerg Infect Dis*. 2025;31(7):1460-1465. doi:10.3201/eid3107.241987.
8. Mushtaq S, Bhat AA, Rather GN, Akhter R, Bhat I, Wani T. Clinical profile of enteric fever in tertiary care hospital of Kashmir. *Int J Contemp Pediatr*. 2017;4(5):1754-1757.
9. IAP Task Force. IAP Task Force report: diagnosis of enteric fever in children. *Indian Pediatr*. 2006;43(10):875-883.
10. Sarswat S, Kumar M, Gupta R. Paediatric nature of enteric fever with emerging antibiogram: a cross-sectional study. *Int J Pediatr Res*. 2018;4(1):1-4.
11. IAP Task Force. IAP Task Force report: management of enteric fever in children. *Indian Pediatr*. 2006;43(10):884-887.
12. Behera JR, Rup AR, Dash AK, Sahu SK, Gaurav A, Gupta A. Clinical and laboratory profile of enteric fever in children from a tertiary care centre in Odisha, Eastern India. *Cureus*. 2021;13(1):e12826.
13. Haque N, Akhter S, et al. Clinical and laboratory features of enteric fever in children and antibiotic sensitivity pattern in a tertiary care hospital of a low- and middle-income country (Dhaka, Bangladesh). *Cureus*. 2022;14(10):e30512.
14. Siddiqui FJ, Rabbani F, Hasan R, Nizami SQ, Bhutta ZA. Typhoid fever in children: some epidemiological considerations from Karachi, Pakistan. *Int J Infect Dis*. 2006;10(3):215-222.
15. Ganesh R, Janakiraman L, Vasanthi T, Sathiyasekaran M. Profile of typhoid fever in children from a tertiary care hospital in Chennai, South India. *Indian J Pediatr*. 2010;77(10):1089-1092.
16. Walia M, Gaiind R, Mehta R, Paul P, Aggarwal P, Kalaivani M. Current perspectives of enteric fever: a hospital-based study from India. *Ann Trop Paediatr*. 2005;25(3):161-174.

17. Qureshi K, et al. Emerging trends of multidrug-resistant and extensively drug-resistant *Salmonella* Typhi in a tertiary care hospital of Lahore, Pakistan. *Microorganisms*. 2021;9(12):2484.
18. Chitkara AJ, Chitkara S, Narang PS, Sundharam M, Goyal M. Clinico-bacteriological profile of typhoid fever in a private sector hospital in New Delhi. *Indian Pediatr*. 2019;56(12):1033-1036.
19. Vinh H, Parry CM, Hanh VTN, Bay PVB, Campbell JI, Diep TS, et al. Risk factors for the development of severe typhoid fever in Vietnam. *BMC Infect Dis*. 2014;14:73.
20. Wijedoru LPM, Mallett S, Parry CM. Typhoid fever among hospitalized febrile children in Siem Reap, Cambodia. *Trans R Soc Trop Med Hyg*. 2012;106(11):711-713.
21. Punjabi NH, Agtini MD, Ochiai RL, Sudarmono P, Pulungsih SP, Subekti D, et al. Enteric fever burden in North Jakarta, Indonesia: a prospective, community-based study. *J Infect Dev Ctries*. 2013;7(10):781-787.
22. Priyadharshini D, Clinton M, Sethuraman N, et al. Clinical profile and prescription patterns in culture-proven enteric fever in children. *Pediatr Infect Dis J*. 2024;6(1):6-9.