

A study of the clinical spectrum of enteric fever among pediatric patientsAnjali Sharma¹, Akriti Gupta²¹MD, DNB Pediatrics, Consultant, Devraj hospital, Gwalior, India²Assistant professor, Department of Pediatrics, RD gardi medical College, Ujjain, India

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Corresponding Author: Dr. Akriti Gupta

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Abstract:

Background: Enteric fever remains a major public health problem in developing countries, particularly affecting children due to poor sanitation, unsafe drinking water, and immature immunity. Pediatric patients often present with atypical and non-specific symptoms; in many cases, abdominal pain is the predominant presenting complaint, which may delay diagnosis and increase the risk of complications.

Objectives: To evaluate the clinical spectrum, laboratory abnormalities, and complications of enteric fever among pediatric patients.

Methods: This hospital-based observational cross-sectional study included 240 children aged 6 months to 16 years with enteric fever admitted to a tertiary care hospital. The majority of cases belonged to the 5–15-year age group. Diagnosis was based on clinical features and laboratory confirmation using complete blood count, Typhi-dot test, and blood or stool culture. Clinical, demographic, laboratory, and outcome data were analyzed using SPSS version 20, and statistical significance was assessed using the chi-square test.

Results: Fever was present in all patients (100%). Abdominal pain was the predominant presenting symptom, followed by malaise (62.5%). The most affected age group was 5–15 years (37.5%), with a slight male predominance (56.3%). Laboratory abnormalities included anemia (37.5%), leukopenia (33.3%), thrombocytopenia (25%), and elevated liver enzymes (41.6%). Most patients presented between 7 and 14 days of illness. Complications were observed in 37.5% of cases, with hepatitis being the most frequent. Hematological abnormalities showed a significant association with the occurrence of complications.

Conclusion: Enteric fever in children presents with a wide clinical spectrum and significant laboratory abnormalities. Early diagnosis, prompt treatment, and careful monitoring of hematological parameters are essential to reduce complications and improve outcomes.

Keywords: Children; Clinical spectrum; Enteric fever; Pediatric population; Salmonella Typhi.

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Introduction

The bacteria *Salmonella enterica* serotype Typhi (S. Typhi) and, to a lesser extent, *Salmonella enterica* serotype Paratyphi (S. Paratyphi A, B, and C) are the main causes of enteric fever, also referred to as typhoid fever, a systemic infectious disease [1]. The disease continues to be a significant global public health concern, particularly in underdeveloped nations where poor hygiene habits, contaminated drinking water, and inadequate sanitation are the primary causes of its spread. The illness typically manifests as a protracted fever, which is frequently followed by additional symptoms such as gastrointestinal issues, splenic and liver enlargement, and blood count fluctuations [2].

The pediatric population is particularly at risk for enteric fever, the reason being the undeveloped immune system and the higher probability of exposure to such diseases through, among others, contaminated food and water. Children may exhibit a full spectrum of symptoms from mild to severe,

which makes the diagnosis difficult [3]. On the other hand, adults could easily be diagnosed as they often show classical signs like step-ladder fever, abdominal ache, and even rose spots. Children, however, display unusual or less pronounced signs such as continuous low-grade fever, diarrhea, loss of appetite, and lethargy in younger age groups and may even not grow normally [4]. Serious consequences such as intestinal perforation, haemorrhage, brain injury, and sepsis disproportionately affect newborns and infants, leading to a higher mortality and sickness incidence in this age group [5].

The enteric fever symptoms in children depend on their age, nutritional status, and existing health conditions. Older children and adolescents are more likely to show typical symptoms, whereas toddlers and infants frequently show non-specific symptoms that can be mistaken for other febrile illnesses like malaria, dengue, or viral gastroenteritis [6].

Laboratory results usually show low wbc numbers count or slight increase in white blood cells, anemia, and very high inflammatory factors. Blood culture is still the most reliable method for diagnosis but there are factors including low sensitivity, long waiting time for results, and previous antibiotic therapy that often hinder prompt confirmation [7].

Research undertaken recently have pointed out the developments in pediatric enteric fever, especially among the ones caused by multidrug-resistant (MDR) and extensively drug-resistant (XDR) strains of *S. Typhi*, which are in fact very hard to be treated [8]. Thus, the clinical picture is formed not only by host determinants but also by factors like the virulence of the microbe and the resistance of the microbe to antimicrobials. Early detection, correct antimicrobial treatment, and patient care are of great importance in keeping severe complications from occurring and decreasing the death rate. Besides, measures to prevent the disease such as improved sanitary conditions, immunization, and raising awareness among residents continue to be very effective in controlling the disease especially in areas where it is widespread [9].

In terms of the pediatric population, getting to know the different clinical features of enteric fever is a must for quick diagnosis, good treatment and target-oriented health interventions. Continuous monitoring and researching are crucial to detecting sickness patterns and resistance trends, hence, the best treatment methods can be adopted, and the worldwide burden of this preventable but still common disease can be minimized [10].

Methodology

Study Design: This hospital-based observational cross-sectional study was conducted to prospectively evaluate the clinical spectrum, laboratory abnormalities, and complications of enteric fever in children. Both clinical and laboratory parameters were assessed in children diagnosed with enteric fever.

Study Area: The study is conducted in the Department of Paediatrics, Devraj Hospital in Gwalior, India.

Study Duration: The study was conducted over a period of one year.

Sample Size: A total of 240 children aged 6 months to 16 years diagnosed with enteric fever were enrolled using a non-probability convenience sampling method. All eligible pediatric patients admitted during the study period and fulfilling the inclusion criteria were included. The majority of cases belonged to the 5–15-year age group.

Selection Criteria

Inclusion Criteria: Children between 6 months to 16 years in either sex.

- Enteric fever was diagnosed in him on the basis of clinical features—exhibiting fever, vomiting, abdominal pain, diarrhea, and malaise.
- Laboratory confirmation is made by a positive Complete Blood Count, a positive Typhi-dot test, or growth of *S. Typhi* from blood/stool culture.
- Obtained written informed consent from parents or guardians.

Exclusion Criteria:

- Obtained written informed consent from parents or guardians.
- Individuals suffering from comorbidities that were already present, such as nerve system diseases, liver diseases that are chronic, kidney failure that is chronic, and disorders of connective tissue.
- History of successful pulmonary consumptive treatment is also recommended.

Data Collection: Data on demographic characteristics, presenting symptoms, duration of illness, and clinical outcomes were collected using a structured questionnaire. A detailed medical history and thorough clinical examination were performed for each child to identify complications related to enteric fever. Baseline investigations included complete blood count, liver function tests, renal function tests, and abdominal ultrasonography. Additional investigations such as prothrombin time, activated partial thromboplastin time, electrocardiography, chest X-ray, echocardiography, cerebrospinal fluid analysis, and computed tomography of the brain were carried out when clinically indicated.

Procedure: After obtaining written informed consent from parents or legal guardians, all eligible children were enrolled in the study. A comprehensive clinical history was obtained, including demographic details, duration of illness, presenting symptoms, and past medical history. In many cases, abdominal pain was the predominant and occasionally the sole presenting complaint, with or without associated symptoms such as fever, vomiting, diarrhea, or malaise. A complete physical examination was performed to assess the general condition, record vital parameters, and detect complications such as hepatosplenomegaly, gastrointestinal bleeding, and neurological involvement. Most enrolled children belonged to the 5–15-year age group. Baseline investigations for all patients included complete blood count, liver and renal function tests, and abdominal ultrasonography. Additional investigations such as prothrombin time, activated partial thromboplastin time, electrocardiography, chest X-ray, echocardiography, cerebrospinal fluid analysis, and computed tomography of the brain performed when clinically indicated to identify and document complications

Statistical Analysis: All the data gathered were recorded and processed through SPSS version 20. To depict the demographic and clinical characteristics, descriptive statistics were used, and the results were presented as mean values and percentages. The chi-square test was applied to bring out the relationship between complications and factors like age group, duration of illness, and presence of anemia, leukopenia, and thrombocytopenia, with a p-value <0.05 regarded as statistically significant.

Results

This study included 240 children diagnosed with enteric fever, aged between 6 months and 16 years.

There was a slight male predominance (56.3%). A wide spectrum of clinical manifestations was observed. Abdominal pain emerged as the predominant presenting symptom, and in several cases, it was the only complaint, while fever remained the most consistent finding. Laboratory investigations and imaging were performed to identify disease-related abnormalities. Complications observed during hospitalization were analyzed in relation to demographic and laboratory parameters. Tables 1–6 summarize the demographic characteristics, clinical features, laboratory findings, duration of illness, and complications.

Table 1: Age and Gender Distribution of Patients (Regrouped)

Age Group (years)	Male (n)	Female (n)	Total (n)	Percentage (%)
≤5 years	60	48	108	45
5–15 years	75	57	132	55
Total	135	105	240	100

The majority of enteric fever cases (55%) occurred in children aged 5–15 years, indicating that school-aged children represent the most affected group. This may be attributed to increased outdoor

exposure, school attendance, and consumption of contaminated food and water. Children below 5 years accounted for 45% of cases, while infants constituted a small proportion.

Table 2: Presenting Symptoms of Enteric Fever

Symptom	Number of Patients (n)	Percentage (%)
Fever	240	100
Abdominal pain	180	75
Malaise/Fatigue	150	62.5
Vomiting	120	50
Anorexia	110	45.8
Diarrhea	95	39.6

Fever was present in all patients (100%). Abdominal pain was the most prominent symptom (75%) and was the predominant presenting complaint in many cases, occasionally occurring without other significant symptoms. Malaise or fatigue was reported in 62.5% of patients. Gastrointestinal

symptoms such as vomiting (50%) and diarrhea (39.6%) were less frequent, while anorexia was observed in 45.8% of cases. These findings highlight the variable and often atypical clinical presentation of pediatric enteric fever.

Table 3: Laboratory Findings

Parameter	Normal (n)	Abnormal (n)	Percentage Abnormal (%)
Hemoglobin (Anemia)	150	90	37.5
Leukocyte count (Leukopenia)	160	80	33.3
Platelet count (Thrombocytopenia)	180	60	25
Liver enzymes (ALT/AST)	140	100	41.6
Renal function (RFT abnormal)	200	40	16.7

Hematological abnormalities were common. Anemia (37.5%) and leukopenia (33.3%) were the most frequent findings, followed by thrombocytopenia (25%). Elevated liver enzymes were observed in 41.6% of patients, indicating

hepatic involvement, while renal function abnormalities were comparatively uncommon (16.7%). These results suggest that enteric fever commonly affects hematological and hepatic parameters in children.

Duration (days)	Number of Patients (n)	Percentage (%)
<7 days	60	25
7–14 days	140	58.3
>14 days	40	16.7

Most of the pediatric population (58.3%) came to the doctor after 7-14 days of sickness and this could mean either the parents had hesitated to take the child to the doctor or the doctor had missed the diagnosis. Only a quarter turned up early (<7 days),

while a prolonged disease (>14 days) was seen in 16.7% cases, which may have put these patients at a higher risk for complications and underlined the need for early diagnosis and treatment more than ever.

Complication	Number of Patients (n)	Percentage (%)
Hepatitis	40	16.7
Gastrointestinal bleeding	15	6.3
Intestinal perforation	5	2.1
Encephalopathy	10	4.2
Other (pneumonia, myocarditis)	20	8.3

In 37.5% of patient's complications were seen, the most frequent of them being hepatitis (16.7%). Severe complications like intestinal perforation were infrequent (2.1%), yet they might be life-

threatening. Encephalopathy and other systemic manifestations have also been reported, which highlight the importance of careful monitoring and timely intervention to avoid death and suffering.

Hematological Abnormality	Complications Present (n)	Complications Absent (n)	Percentage with Complications (%)
Anemia	45	45	50
Leukopenia	30	50	37.5
Thrombocytopenia	25	35	41.7

Anemia in children was associated with the greatest incidence of complications (50%), thrombocytopenia was second (41.7%) and leukopenia was third (37.5%). This implies that the presence of hematological abnormalities is a factor that may help to predict the severity of the disease and complications in pediatric enteric fever, thus it is necessary to monitor these parameters closely.

Discussion

One of the biggest health risks to children in the developing world is still enteric fever, particularly in places with inadequate sanitation and little access to potable water. To assess the clinical range, laboratory results, and consequences of enteric fever in children, the current prospective hospital-based study was conducted. Similar results were also found by Crump et al. (2010), suggesting that delayed identification and treatment of enteric fever remain a significant public health issue in endemic areas [11].

The study included 240 children aged 6 months to 16 years, with a slight male predominance, a finding consistent with observations by Sinha et al. (1999), who attributed this trend to greater outdoor exposure among boys and differences in healthcare-seeking behavior between genders [12]. Most cases were

observed in children aged 5–15 years, indicating that school-aged children constitute the most vulnerable group in this setting. This finding differs from earlier reports emphasizing younger children and may reflect increased environmental exposure, school attendance, and consumption of contaminated food and water in this age group. Similar age-related vulnerability has also been noted in endemic regions by Bhutta (2000) and Bhan et al. (2005) [13,14],

Fever was the most consistent clinical feature, present in all patients. Abdominal pain emerged as the predominant presenting symptom and, in several cases, was the sole complaint, underscoring the atypical and often non-specific presentation of enteric fever in children. Other symptoms such as malaise, vomiting, and diarrhea reflected both systemic and gastrointestinal involvement. Parry et al. (2002) described intestinal lymphoid tissue involvement as a key factor contributing to gastrointestinal manifestations in enteric fever [15]. The variability in clinical presentation observed in the present study aligns with findings by Thaver and Zaidi (2009), who emphasized that non-specific symptoms frequently delay early clinical diagnosis in pediatric enteric fever [16].

Laboratory findings revealed that anemia and leukopenia were the most common hematological abnormalities, followed by thrombocytopenia. These findings are consistent with the observations of Wain et al. (2015), who suggested that bone marrow suppression and immune-mediated mechanisms play a central role in hematological alterations seen in enteric fever [17]. Elevated liver enzymes were observed in a substantial proportion of patients, indicating hepatic involvement, which corroborates findings reported by Kliegman et al., (2020) [18]. Although renal impairment was less common, its presence highlights the potential for multisystem involvement in severe diseases.

In this research, most of the children displayed signs of illness after a period of 7 to 14 days, indicating that there might be a delay in seeking healthcare or an incorrect diagnosis at first. According to the study by Ochiai et al. (2008), a later visit to the doctor means more complications and a longer hospital stay [19]. Complications were observed in more than 33% of the study participants; among these, hepatitis was the most frequent. The other complications like gastrointestinal bleeding, encephalopathy, and intestinal perforation, although rare, are still very important clinically. Shah et al. (2014) established that quick start-up of the right antibiotic therapy reduces the severity of complications significantly, and this might be the reason why the current study had a lower incidence of life-threatening outcomes compared to others [20].

Conclusion:

Enteric fever remains a significant cause of morbidity among children in endemic regions and continues to pose serious public health concern. The disease exhibits a variable clinical presentation, with fever as a consistent finding and abdominal pain emerging as the predominant, and in some cases the sole, presenting symptom, often accompanied by gastrointestinal and systemic manifestations. The highest burden was observed among children aged 5–15 years, highlighting the vulnerability of school-aged children in endemic settings.

Hematological abnormalities and hepatic involvement were common, and a substantial proportion of patients developed complications, with hepatitis being the most frequent. Delayed presentation and abnormal hematological parameters were associated with an increased risk of complications, emphasizing the importance of early recognition, timely diagnosis, and close clinical and laboratory monitoring. Integrated strategies including appropriate antimicrobial therapy, improved sanitation and hygiene practices, and vaccination are essential to reduce morbidity and improve outcomes in pediatric enteric fever

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