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Incidence of Typhoid Bacterimia in Infants and Young Children in a Tertiary Care Hospital

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ABSTRACT

Background: *Typhoid fever is a severe bacterial infection triggered by Salmonella Typhi, primarily spread via contaminated food and water. It frequently occurs in developing nations and primarily impacts young kids. Blood culture confirms the diagnosis, while prevention relies on hygiene, sanitation, and vaccination. This study evaluates the occurrence and clinical characteristics of typhoid in young children.* ***Methods & Materials:*** *This cross-sectional study, conducted in a hospital setting in Dhaka, Bangladesh (Jan 2024–Jun 2025), involved 150 children aged ≤5 years who had suspected enteric fever. Blood samples were obtained prior to antibiotic administration for culture and sensitivity testing following standard procedures and the Kirby–Bauer method (CLSI). Data analysis was conducted with SPSS v25, and the chi-square test was utilized ($p < 0.05$). Approval for ethical considerations and informed consent was secured.* ***Results:*** *Among 150 children, 28.0% (42/150) tested positive for typhoid, primarily S. Typhi (81.0%, 34/42). Age had a significant correlation with infection ($p = 0.048$), whereas sex did not ($p = 0.46$). Fever was widespread, accompanied by typical gastrointestinal symptoms. Ceftriaxone (95.2%) and azithromycin (90.5%) exhibited the greatest sensitivity. The majority recovered without issues (85.7%), however, complications were associated with prolonged hospital stay (>7 days) ($p = 0.032$).* ***Conclusion:*** *Enteric fever primarily impacted preschoolers, with S. Typhi being the most frequent isolate. Infection was significantly linked to age, whereas sex showed no association. Ceftriaxone and azithromycin proved to be the most effective, with the majority of cases recovering without complications.*

Keywords: *Typhoid Bacterimia, Incidence, Infants, Young Children*

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INTRODUCTION

Typhoid fevers are severe, possibly lethal febrile diseases and major contributors to illness in developing countries [1]. This fever, caused by Salmonella Typhi, impacting as much as 1% each year in endemic areas [2]. It mainly impacts children than older people [3]. Worldwide typhoid fever cases have fluctuated historically, with estimates varying from 12 to 27 million in 2000–2010, 14 million in 2010, 17.8 million in 2015, and 11 million in 2017[4-6]. The illness transmits through the fecal-oral pathway via direct contact—contaminated food or water due to insufficient hygiene—or indirect contact, where sewage pollutes water, crops, or inadequately treated piped water [7].

Typhoid fever frequently results in mild symptoms like fever or fatigue, yet can result in serious, potentially life-threatening complications, such as intestinal perforation, if not treated. The range of the disease varies from a nonspecific febrile condition to a severe typhoidal syndrome, marked by high fever, toxicity, hepatomegaly, and splenomegaly [8-10]. The incubation period decreases and the risk of infection increases with larger doses. Gastric acid restricts Salmonella Typhi entry, whereas both natural and vaccine-induced immunity provide some level of defense [11].

The diagnosis of typhoid fever mainly relies on blood culture, which is the gold standard for identifying Salmonella Typhi. Serological assays such as the Widal test are not as dependable, while PCR provides a quick, sensitive option [12]. Successful prevention depends on enhanced safe water, sanitation, hygiene (WASH), community health education, and immunization [13]. Vi polysaccharide (Vi-PS) and live oral Ty21a vaccines are approved for typhoid, with age restrictions of ≥2 and ≥6 years, respectively, and immunity decreases after 2 years, limiting their application in endemic regions. Typhoid conjugate vaccines (TCVs) overcome these challenges, demonstrating safety, immunogenicity, and efficacy in infants and young children [14-16].

A significant research project in southern coastal Pakistan tracked children under five to assess the incidence of typhoid bacteremia and discovered that infants and toddlers face a considerable burden as well. These results underscore that severe typhoid affects not only older children but also highlights the susceptibility of very young children in endemic regions [10]. A worldwide analysis of incidence studies showed that typhoid fever is still prevalent in numerous endemic areas, particularly in Asia and Africa, with continued transmission posing a considerable threat to young children, notably those under five years old [17].

Clinical research in Bangladesh indicates that children between 1–5 years with S. Typhi bacteremia demonstrate clinical and immune responses akin to older children and adults, reinforcing the notion that younger age does not lead to milder illness and highlighting that young child are a critical group for disease monitoring and intervention [18]. Active monitoring in a Dhaka slum revealed that young children are at significantly greater risk of bacteremic typhoid compared to older individuals, emphasizing their considerable disease burden in urban areas where the disease is prevalent [2].

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Information regarding blood culture–confirmed typhoid bacteremia in young children within Bangladeshi tertiary hospitals is scarce. This research seeks to evaluate its occurrence and clinical characteristics to guide focused prevention and treatment.

METHODS & MATERIALS

Study Design and Setting

This was a hospital-based cross-sectional observational study conducted in the Department of Pediatrics at Ashiyan Medical College, Dhaka, Bangladesh. The study was carried out over a period of 12 months, from January 2024 to June 2025, to assess the incidence, clinical profile, and antimicrobial sensitivity patterns of typhoid bacteremia among infants and young children.

Study Population

The study population comprised infants and children aged up to 5 years who were clinically suspected of having enteric fever and were admitted to the pediatric department during the study period.

Sample Size and Sampling Technique

A total of 150 participants were included in the study. The sample size was determined based on feasibility and previous similar studies conducted in comparable settings. A purposive sampling technique was used to recruit eligible participants consecutively until the required sample size was achieved.

Inclusion Criteria

- Children aged ≤5 years
- Clinically suspected cases of enteric fever (presence of fever ≥3 days with suggestive clinical features such as diarrhea, vomiting, abdominal pain, or coated tongue)
- Patients whose guardians provided informed written consent

Exclusion Criteria

- Children who had received antibiotics for more than 48 hours prior to hospital admission
- Patients with confirmed alternative diagnoses (e.g., malaria, dengue, urinary tract infection)
- Critically ill patients where blood culture could not be obtained prior to antibiotic administration

Data Collection Procedure

After obtaining informed consent, detailed sociodemographic and clinical information was collected using a structured and pretested questionnaire. A thorough physical examination was performed for each patient. Under strict aseptic conditions, 2–5 mL of venous blood was collected prior to initiation of antibiotic therapy and sent for blood culture and sensitivity testing. Standard microbiological techniques were followed for isolation and identification of organisms. Antimicrobial susceptibility testing was performed using the Kirby–Bauer disc diffusion method, and results were interpreted according to the guidelines of the Clinical and Laboratory Standards Institute.

Laboratory Methods

Blood samples were inoculated into appropriate culture media and incubated under standard conditions. Positive cultures were subcultured, and organisms were identified based on colony morphology, Gram staining, and biochemical tests. Antibiotic susceptibility testing was carried out against commonly used antibiotics, including ceftriaxone, azithromycin, ciprofloxacin, ampicillin, and chloramphenicol.

Data Analysis

All collected data were entered and analyzed using IBM SPSS Statistics (version 25 or higher). Descriptive statistics were expressed as mean ± standard deviation for continuous variables and frequencies with percentages for categorical variables. Chi-square (χ^2) test was used to assess the association between categorical variables (e.g., age, sex, complications). A p-value <0.05 was considered statistically significant.

Ethical Considerations

Ethical approval was obtained from the Institutional Review Board (IRB) of the respective institution prior to commencement of the study. Written informed consent was obtained from the parents or legal guardians of all participants. Confidentiality of patient information was strictly maintained, and all procedures were conducted in accordance with the ethical principles of the Declaration of Helsinki.

RESULTS

A total of 150 infants and young children clinically suspected of enteric fever were included in this study.

Socio-demographic Characteristics

Table I shows the mean age of the study population was 3.2 ± 1.8 years (range: 2 months to 5 years). The majority of children belonged to the 3–5 years age group (40.0%), followed by 1–3 years (38.7%) and <1 year (21.3%). There was a slight male predominance, with 82 (54.7%) males and 68 (45.3%) females.

Table I: Socio-demographic Characteristics of the Study Population (*n*=150)

Variable	Frequency (n)	Percentage (%)
Age group		
<1 year	32	21.3
1–3 years	58	38.7
3–5 years	60	40.0
Sex		
Male	82	54.7
Female	68	45.3

Incidence and Etiology of Typhoid Bacteremia

Table II presents, out of the 150 children, 42 were confirmed to have typhoid bacteremia by blood culture, yielding an overall incidence of 28.0%. Among the isolates, 34 (81.0%) were *Salmonella Typhi* and 8 (19.0%) were *Salmonella Paratyphi A*.

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Table II: Incidence and Etiological Distribution of Typhoid Bacteremia (*n*=150)

Variable	Frequency (n)	Percentage (%)
Blood culture positive	42	28.0
Blood culture negative	108	72.0
Organism isolated (n=42)		
Salmonella Typhi	34	81.0
Salmonella Paratyphi A	8	19.0

Association of Age and Sex with Typhoid Bacteremia

Table III shows the proportion of typhoid bacteremia increased with age, with the highest occurrence in the 3–5 years age group (36.7%). Typhoid bacteremia was slightly higher among males (30.5%) compared to females (25.0%). Statistical analysis using the Chi-square test showed a significant association between age group and typhoid bacteremia (p = 0.048), whereas the association with sex was not statistically significant (p = 0.46).

Table III: Association of Age and Sex with Typhoid Bacteremia (*n*=150)

Variable	Positive n (%)	Negative n (%)	Total	p-value
Age group				0.048*
<1 year	6 (18.8)	26 (81.2)	32	
1–3 years	14 (24.1)	44 (75.9)	58	
3–5 years	22 (36.7)	38 (63.3)	60	
Sex				
Male	25 (30.5)	57 (69.5)	82	0.46
Female	17 (25.0)	51 (75.0)	68	

Clinical Presentation of Confirmed Cases

Figure 1 show among the 42 culture-confirmed cases, fever was present in all patients (100%), followed by diarrhea (47.6%), vomiting (42.9%), and abdominal pain (38.1%). Other clinical findings included coated tongue, hepatomegaly, and splenomegaly.

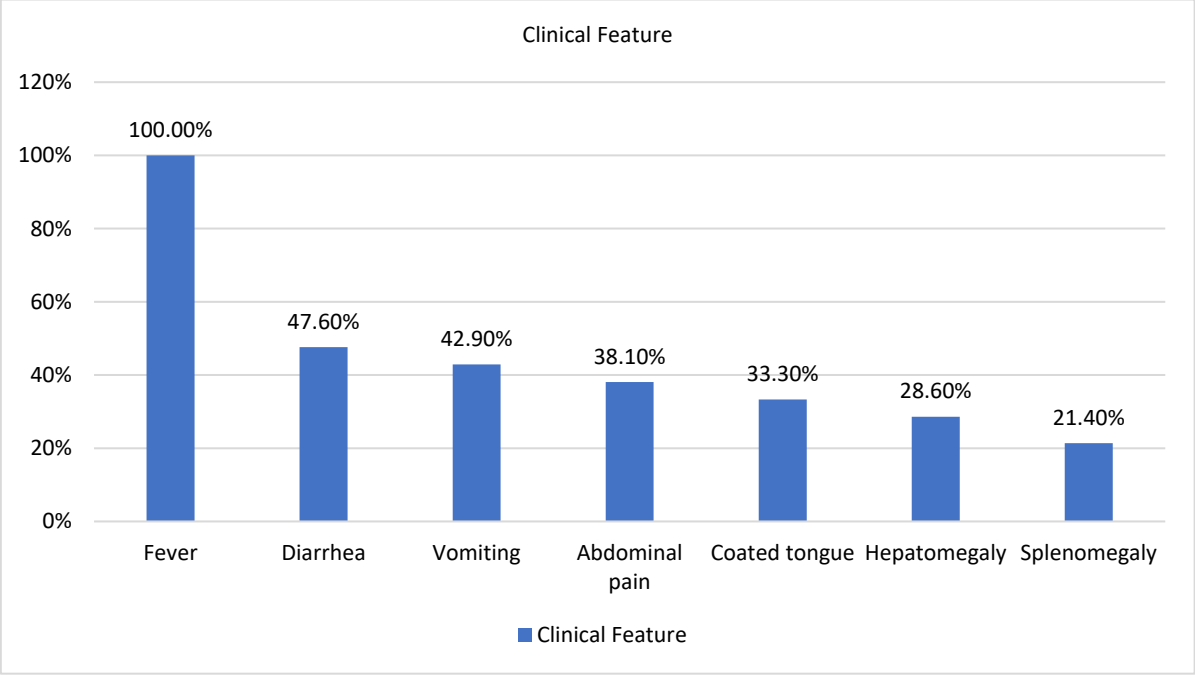

Figure 1: Clinical Features of Typhoid Bacteremia Cases (*n*=42)

Laboratory Findings and Antimicrobial Sensitivity Pattern

Table IV presents hematological analysis revealed that leukopenia was present in 35.7% of cases, while 23.8% had leukocytosis and 31.0% had thrombocytopenia. In terms of antimicrobial sensitivity, ceftriaxone (95.2%) and azithromycin (90.5%) were highly effective, whereas reduced sensitivity was observed for ciprofloxacin (52.4%), ampicillin (35.7%), and chloramphenicol (42.9%).

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Table IV: Laboratory Profile and Antimicrobial Sensitivity Pattern (*n*=42)

Parameter	Frequency (n)	Percentage (%)
Hematological findings		
Leukopenia	15	35.7
Leukocytosis	10	23.8
Normal WBC	17	40.5
Thrombocytopenia	13	31.0
Antibiotic sensitivity		
Ceftriaxone	40	95.2
Azithromycin	38	90.5
Ciprofloxacin	22	52.4
Ampicillin	15	35.7
Chloramphenicol	18	42.9

Outcome and Complications

Table V shows most patients recovered without complications (85.7%), while 14.3% developed complications. A statistically significant association was observed between presence of complications and prolonged hospital stay (>7 days) (p = 0.032).

Table V: Association Between Complications and Duration of Hospital Stay (*n*=42)

Complication Status	≤7 days n (%)	>7 days n (%)	Total	p-value
No complication (n=36)	27 (75.0)	9 (25.0)	36	
Complication present (n=6)	1 (16.7)	5 (83.3)	6	0.032*
Total	28	14	42	

DISCUSSION

In our study, the majority of suspected enteric fever instances were found in children aged 3–5 years, followed by those aged 1–3 years, with a minimal dominance of males. Saha et al. additionally noted that enteric fever is most prevalent among Bangladeshi children under 5 years, especially those aged 2–5 years, with a slight predominance in males. This resemblance implies that preschool-aged children, particularly boys, are more impacted in endemic areas due to greater exposure to contaminated sources and behavioral influences [19.20].

In this study, 28.0% of the suspected cases tested positive for typhoid bacteremia through blood culture. Salmonella Typhi was the most common isolate, followed by S. Paratyphi A. This pattern aligns with the findings of Buckle et al., who indicated that S. Typhi is responsible for most global typhoid cases, whereas S. Paratyphi A plays a minor role in the worldwide disease burden [21].

Typhoid bacteremia rose with increasing age, peaking at 36.7% in the 3–5 years age group, and exhibited a notable correlation with age. Despite males exhibiting a marginally greater positivity rate compared to females, the link with sex was not statistically significant. Similar findings were reported by Keddy et al., who observed that typhoid fever is more common in older children within pediatric age groups, reflecting increased exposure to contaminated food and water with age, while sex differences were minimal and not statistically significant [22].

In this study, every culture-confirmed case exhibited fever, accompanied by diarrhea, vomiting, and abdominal pain, alongside coated tongue and hepatosplenomegaly. Another study indicated that fever was present in all patients, along with diarrhea (28.5%), abdominal pain (15.4%), cough (44.4%), and constipation (18.1%). The study also revealed that extended fever, stomach pain, and skin rashes were notably linked to culture-confirmed typhoid fever, emphasizing fever accompanied by gastrointestinal symptoms as the main clinical pattern [23].

In this study, leukopenia and thrombocytopenia were frequently observed results. Ceftriaxone and azithromycin demonstrated considerable sensitivity. Kumar et al. indicated leukopenia and thrombocytopenia, showing elevated sensitivity to ceftriaxone and diminished efficacy of older antibiotics such as ampicillin and chloramphenicol, akin to this study [24].

In this research, 85.7% of patients healed without issues, whereas 14.3% experienced complications. Complications were notably linked to an extended hospital stay (>7 days). Comparable results were observed by Bhutta, who pointed out that the complications of typhoid fever are linked to higher disease severity and extended hospitalization periods in contrast to uncomplicated cases [25].

The study indicates that typhoid fever primarily impacts preschool-aged children, is predominantly caused by S. Typhi, showcases typical clinical and hematological characteristics, responds effectively to ceftriaxone and azithromycin, and generally has positive outcomes, although complications are associated with extended hospitalizations.

CONCLUSION

Enteric fever primarily impacted children between 3 and 5 years old, with a culture positivity rate of 28.0% and S. Typhi being the most common isolate. Infection was significantly linked to age, but not to sex. The primary presentation was fever accompanied by gastrointestinal symptoms. Ceftriaxone and azithromycin demonstrated significant effectiveness, with the majority of patients recovering without issues; however, complications were associated with extended hospital stays

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