Original Research

Antibiotic Sensitivity Patterns in Pediatric Enteric Fever: A Cross-Sectional Study at a Tertiary Care Hospital in Bangladesh

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Abstract

Background: *This cross-sectional study aimed to investigate the antibiotic sensitivity patterns among pediatric patients with enteric fever at the Department of Paediatrics, Bangladesh Institute of Child Health, Dhaka Shishu Hospital, during the period from July 2005 to June 2006. The primary objective was to identify the prevalent antibiotic sensitivities in order to enhance the efficacy of treatment strategies for typhoid fever in children.* ***Methods:*** *Ninety-eight suspected cases of enteric fever, aged between 2 and 12 years, were selected from admissions to the above-mentioned hospital. Blood culture and sensitivity testing were performed for Salmonella typhi and paratyphi. Demographic information, pre-admission antibiotic usage, and sensitivity profiles to various antibiotics, including Ceftriaxone, Cefixime, Chloramphenicol, Ciprofloxacin, Azithromycin, Amoxicillin, Imipenem, Nalidixic acid, and Ampicillin, were analyzed.* ***Results:*** *The majority of patients (62.2%) were in the 5-9 years age group, and males constituted 61.22% of the study population. Blood cultures revealed 71.44% sensitivity for Salmonella typhi and 28.57% for paratyphi. Among the antibiotics tested, Ceftriaxone exhibited 100% sensitivity, followed by Cefixime (80.2%), Chloramphenicol (78.57%), Ciprofloxacin (65.20%), Azithromycin (60%), Amoxicillin (54.6%), Imipenem, Nalidixic acid (Intermediate sensitive, 56.3%), Ciprofloxacin (Intermediate sensitive, 25%), and Ampicillin (Intermediate sensitive, 18.8%). Nearly half of the patients (47.3%) received antibiotics before admission, and 43.8% of culture-positive patients had a history of pre-admission antibiotic use.* ***Conclusion:*** *The study concludes that understanding antibiotic sensitivity patterns is crucial for successful typhoid fever treatment in children. Ceftriaxone and Cefixime emerged as highly effective, while the unnecessary use of antibiotics prior to admission may influence sensitivity patterns. This information underscores the importance of judicious antibiotic prescribing practices to ensure optimal therapeutic outcomes in pediatric enteric fever cases.*

Introduction

Enteric fever, commonly known as Typhoid fever, stands as a pervasive febrile ailment, particularly prevalent in developing nations. The global burden of this infectious disease was substantial, with an estimated incidence of 21,650,974 cases and 216,510 deaths in the year 2000.[1] Notably, in endemic regions, the annual incidence approached 1%, accentuating its significant impact on public health.[2] Within the specific context of Bangladesh, the challenges posed by typhoid fever extend beyond the patients themselves to the medical practitioners who grapple with its intricacies.[3]

One notable challenge arises from the fact that patients often seek medical attention after self-administering one or more antibiotics or following the advice of pharmacists. [4]This haphazard use of antibiotics prior to seeking professional medical care can lead to a lack of growth of Salmonella typhi or paratyphi in blood cultures, complicating the diagnostic process. The indiscriminate and injudicious utilization of antibiotics in undiagnosed febrile illnesses not only contributes to diagnostic difficulties but also fosters antibiotic resistance in the context of typhoid fever.[5]

Reports indicate that a significant proportion of enteric fever cases result from multi-resistant strains of S. typhi or paratyphi,6 with increasing resistance to quinolones and cephalosporins observed in Bangladesh. This scenario underscores the critical importance of understanding the antibiotic sensitivity patterns specific to the region. In this regard, the antibiotics prescribed for suspected cases of typhoid fever cannot remain uniform.[7] Instead, the isolation of the causative organism and the identification of antibiotic sensitivity become imperative before initiating antibiotic treatment[8].

The current study addresses this pressing need by undertaking a comprehensive evaluation of the antibiotic sensitivity patterns of S. typhi and S. paratyphi within the unique healthcare setting of the Department of Paediatrics at the Bangladesh Institute of Child Health, Dhaka Shishu Hospital. By shedding light on the local nuances of antibiotic susceptibility, this research aims to contribute valuable insights that can guide more informed and targeted therapeutic approaches, ultimately mitigating the impact of typhoid fever on the pediatric population in Bangladesh.

Objectives

General Objective: To determine the contemporary susceptibility pattern of Salmonella Typhi and Para-typhi in blood culture-positive children diagnosed with enteric fever.

Specific Objectives: To assess and characterize the prevalence and distribution of enteric fever in Bangladesh.

Materials and Methods

Study Design: This cross-sectional study was conducted in the Department of Paediatrics at the Bangladesh Institute of Child Health, Dhaka Shishu (Children) Hospital, spanning from July 2005 to June 2006.

Study Population: Ninety-eight suspected cases of enteric fever, aged between 2 to 12 years, were selected from children admitted to the aforementioned hospital. The inclusion criteria encompassed patients meeting the following conditions: aged 2 to 12 years, of either sex, presenting with a fever of ≥ 38°C persisting for ≥ 4 days, and confirmed as blood culture positive for enteric fever after hospital admission.

Data Collection: For all confirmed cases of enteric fever, a comprehensive approach was taken. Detailed medical histories were obtained, and clinical examinations were conducted. The study period spanned one year, during which 98 blood culture-positive children meeting the inclusion criteria were included in the investigation.

Inclusion Criteria:

1. Patients aged 2 to 12 years.
2. Patients of either sex.
3. Fever ≥ 38°C for ≥ 4 days.
4. Culture positive for enteric fever after admission.

Exclusion Criteria:

Patients exhibiting the following characteristics were excluded from the study:

1. Culture-negative for enteric fever.
2. Evidence of severe disease.
3. Prior use of antibiotics within one week of hospital admission.

Ethical Considerations: Ethical approval for the study was obtained from the relevant institutional review board. Informed consent was obtained from the parents or guardians of the enrolled children, and the research was conducted in accordance with ethical guidelines and principles.

Data Analysis: Statistical analysis was performed to assess the prevalence and patterns of antibiotic sensitivity among the study population. Descriptive statistics were employed to summarize demographic and clinical characteristics, and inferential statistics were used to analyze antibiotic sensitivity patterns in blood culture-positive cases of enteric fever

Results

In this study, a comprehensive analysis was conducted on 98 patients with blood culture-

positive growth of S. typhi or paratyphi over the specified period. The mean age of the study population was 39.7 years, with a range of 19-67 years. Among the patients, 61.22% were male, and 38.77% were female. Common co-morbidities included diabetes mellitus (67%), hypertension (34%), and dyslipidemia (32.9%).

Out of the isolated bacteria, 71.42% were identified as S. typhi, while the remaining 28.57% were S. paratyphi A; no cases of S. paratyphi B were isolated. Notably, multi-drug resistant strains were found in 32.4% of S. typhi cases and 11.5% of S. paratyphi A cases. The antibiotic resistance pattern revealed notable resistance to azithromycin, amoxicillin, nalidixic acid, and ciprofloxacin.

Table I provides a distribution of patients by age, sex, and socio-economic class, demonstrating a concentration of cases in the 5-9 years age group. The antibiotic sensitivity and resistance patterns for S. typhi and S. paratyphi are summarized in Tables II, respectively. Ceftriaxone exhibited universal sensitivity to both S. typhi and S. paratyphi isolates. Other antibiotics such as cefixime, amoxicillin, cephalexin, imipenem, and chloramphenicol also demonstrated significant sensitivity.

Table I: Distribution of patients by age, sex, and Socio-economic class (n = 98)

Demographic Characteristics	Frequency
Age (Years)	
2-5 years	22
5-9 years	60
>9 years	16
Mean Age: 9.4 ± 3.76 years	
Sex	
Male	60
Female	38
Socio-economic Status	
Poor	26
Middle Class	48
Upper Class	24

this study elucidates the prevalence, demographic characteristics, and antibiotic susceptibility profiles of S. typhi and S. paratyphi in a pediatric population with enteric fever. The emergence of multi-drug resistant strains underscores the importance of judicious antibiotic use, and the high sensitivity of ceftriaxone suggests its efficacy as a treatment option in this setting.

Table II: Antibiotic Sensitivity and Resistance Patterns of S. typhi and S. paratyphi in Pediatric Enteric Fever (n =98)

Antibiotic	S. typhi		S. paratyphi	
	Sensitivity (%)	Resistance (%)	Sensitivity (%)	Resistance (%)
Amoxicillin	44.6	54.6	80.0	20.0
Azithromycin	60.0	40.0	66.0	34.0
Cefixime	80.2	19.8	98.0	2.00
Ceftriaxone	100	0 (0)	100	0 (0)
Chloramphenicol	78.35	21.65	88.0	12.0
Ciprofloxacin	65.52	34.48	72.0	28.0
Cotrimoxazole	40.3	36.6	76.0	24.0
Nalidixic acid	47.9	52.1	17.2	82.8
Ofloxacin	55	45	80.0	20.0

Discussion:

The historical context of typhoid fever treatment, marked by the introduction of chloramphenicol in 1948,[9] significantly altered the course of this once severe and often fatal disease, rendering it readily treatable. However, over the years, the efficacy of various antibiotics has been compromised due to the emergence of resistance, a phenomenon accelerated by their irrational use. In this current study, a notable observation was the lower prevalence of multi-drug resistance compared to previous investigations. This intriguing finding may suggest a potential reversal in sensitivity, possibly attributed to the reduced use of first-line drugs in response to high resistance rates, allowing them to regain effectiveness.[10]

Interestingly, our study revealed universal sensitivity to ceftriaxone, a significant departure from reported cases of ceftriaxone resistance in Bangladesh. The absence of resistance to this antibiotic could be indicative of its sustained efficacy, providing a promising avenue for effective treatment. [11]However, the study also identified a substantial resistance to azithromycin, potentially stemming from its widespread availability and indiscriminate use in non-specific febrile illnesses. Cefixim, ciprofloxacin, and levofloxacin displayed sensitivity in a noteworthy proportion of cases, although the rates were lower than those reported in previous studies. Nalidixic acid resistance, on the other hand, exhibited an upward trend, underscoring the importance of reconsidering the

use of ciprofloxacin in cases where the organism is resistant to nalidixic acid.[12]

Despite these insights, it is essential to acknowledge the study's limitations. The exclusion of sensitivity testing for all first-line antibiotics in every sample and the absence of a comparative analysis between diabetic and non-diabetic patients are notable constraints. Additionally, the lack of grouping based on patient locality precludes the description of local antibiotic resistance patterns.

while ceftriaxone remains the most sensitive antibiotic for Salmonella species in the studied population, resistance to other cephalosporins, azithromycin, and quinolones is on the rise. To mitigate further resistance, it is recommended that blood cultures be prioritized before initiating antibiotic therapy for suspected enteric fevers. This evidence-based approach aligns with the global effort to preserve the efficacy of antibiotics and underscores the need for judicious prescribing practices to ensure the continued effectiveness of available treatment options.

Limitations of the study

The study is constrained by a small sample size, limiting its generalizability to the entire country. Conducted exclusively in a hospital, the findings may not fully represent the broader national scenario. Geographical and socioeconomic variations, absent in our analysis, could influence antibiotic resistance differently in diverse settings. Additionally, the absence of community-based data and selective antibiotic sensitivity testing further restrict the study's scope. These limitations highlight the need for cautious interpretation and underscore the importance of future research endeavors addressing these constraints for a more comprehensive understanding of antibiotic sensitivity patterns in enteric fever.

Conclusion

In conclusion, our study sheds light on the antibiotic sensitivity patterns of Salmonella species within a hospital setting, revealing both promising and concerning trends. While the universal sensitivity of ceftriaxone offers a reliable treatment option, the observed multi-drug resistance and increasing resistance to certain antibiotics signal a complex challenge. To improve the robustness of future research, we recommend larger, more diverse samples that encompass community-based data and incorporate longitudinal analyses. Exploring the socioeconomic factors influencing antibiotic resistance and conducting comprehensive sensitivity testing for all first-line antibiotics would provide a more holistic understanding. Public health efforts should prioritize raising awareness about the importance of obtaining blood cultures before antibiotic prescriptions in suspected enteric fevers, contributing to evidence-based practices and the global fight against antibiotic resistance.

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