

ORIGINAL ARTICLE

Current Antimicrobial Susceptibility Pattern of *Salmonella typhi* and *paratyphi* in Children Suffering from Enteric Fever Admitted in a Tertiary Care Hospital

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Abstract

Background: Enteric fever, specially Typhoid fever is endemic in Bangladesh. Due to lack of clean water, sanitation, and proper awareness it is more common in urban area and slum area of cities. Its diagnosis poses several problems, after diagnosis, it is important to treat with the right antibiotic before any complications can occur.

Objective: Aim of the study was to assess the current susceptibility pattern of typhoidal salmonellae to antimicrobial using for treatment of typhoid fever.

Methods: A prospective observational study was carried out for blood culture positive Typhoid fever admitted in Dhaka Shishu Hospital, during the period of May 2017 to April 2018. Children from 1 year to 15 years with blood culture positive for *S. Typhi* and *S. Para Typhi* were included in this study.

Results: One hundred ten strain of *Salmonella typhi* and *paratyphi* were isolated from June 2017 to July 2018. Out of 110 isolated, 97 (88%) were *Salmonella typhi* and 13 (12%) were *paratyphi*. Among them sensitivity to Ceftriaxone was 90% (99) and cefixime 80% (88). Sensitivity to other drugs was Ampicillin or Amoxicillin 54%, Chloramphenicol 48%, Ciprofloxacin 42%, Azithromycin 38%, Co-trimoxazole 20% respectively.

Conclusion: In this study antimicrobial sensitivity testing showed that *Salmonellae Typhi* as well as *para typhi* were not 100% sensitive to any drug. Besides this, study showed sensitivity reduce to 60% to 20 to previously used first line drugs and fluoroquinolone groups for treatment of typhoid fever. So judicious use of appropriate antibiotics for treatment of typhoid fever needed.

Key words: Typhoid fever, *Salmonellae typhi*, culture sensitivity.

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Introduction

Enteric fever includes typhoid fever caused by *Salmonella typhi* and para typhoid fever by *Salmonella paratyphi* A B C. Typhoid fever affects roughly 21.6 million people annually, resulting 216,500 death.¹ More than 90% of this morbidity and mortality occurred in Asia.²

Enteric fever continues to be a major health problem despite the use of antibiotics and the development of newer antibacterial drugs.³ If not treated properly, enteric fever carries a mortality rate of 30%, whilst appropriate antimicrobial treatment reduces the mortality rate to as low as 0.5%.⁴ In case of enteric fever, it is often necessary to commence treatment before the results of laboratory sensitivity testing.⁵ *Salmonella typhi* has rapidly gained resistance to antibiotics like ampicillin, chloramphenicol and cotrimoxazole and also to previously efficacious drug like ciprofloxacin.⁶ The incidence of multidrug resistant (MDR) *Salmonella typhi* was reported to be as high as 60 per cent.⁷

Due to the variation in the susceptibility patterns of *Salmonella typhi*, it is important to constantly monitor the susceptibility patterns of *Salmonella typhi* to commonly prescribed antibiotics and to prevent the emergence of multi drug resistance.

Material and Methods

A prospective study was conducted at Dhaka Shishu Hospital. A total of 110 case of culture positive *Salmonella typhi* and *paratyphi* were considered for study. The study period was from May 2017 to April 2018 and data were collected from inpatient

department. Inclusion criteria were fever of at least 101° F, minimum duration of 3 days, age were 1 years to 15 years. Blood was collected from patients at the day of enrolment.

Blood culture was done using a BacT/Alert automated system, and positive cultures were characterized using standard bacteriological procedures.⁸ Antimicrobial susceptibility profiles were assessed by the disc diffusion method and resistance was determined per Clinical and Laboratory Standards Institute (CLSI) guideline as Needed.⁹

Data were entered and analyzed using SPSS version 23. Data has been summarized using percentage, and table.

Results

The majority of the patients were in the age group 6-15 years (57.77%) as shown in the table I. Out of 110 culture positive case 97(88.18%) were *Salmonella typhi* and 13(11.82%) were *paratyphi*. There were 56.36 % (62) male and 43.64% (48) female children.

Table I
Age specific group of enteric fever (n=110)

| Age group (Years) | Frequency | Percent |
|-------------------|-----------|---------|
| 1-5 | 47 | 42.23 |
| 6-15 | 63 | 57.77 |
| Total | 110 | 100 |

Table II
Laboratory findings in enteric fever (n=110)

| Parameter | Bacteria isolated | | | |
|--------------------|-------------------------|-----------------------------|-------------|-------------|
| | <i>Salmonella typhi</i> | <i>Salmonella paratyphi</i> | Total | |
| Leucocytes/cumm | <4000 | 19 | 3 | 22 (20.1%) |
| | 4000-11000 | 72 | 9 | 81 (73.63%) |
| | >11000 | 5 | 2 | 7 (6.36%) |
| Hb (gm/dl) Mean±SD | (9.7±1.78) | | | |
| Widal test | 1:160-1:320 | 59 (53.63%) | 28 (25.45%) | 87 (79.09%) |
| | >1:320 | 18 (16.36%) | 5 (4.54%) | 23 (20.91%) |

In this study most of the patients 73.63% (81) had leucocytes count between 4000-11000/cumm, with the median WBC count of 8000/cumm. Leucopenia (WBC<4000/cumm) was 20.1% (22). Widal test 1:160-1:320 was 79.09% (87), >1:320 was 20.91% (23).

Antimicrobial susceptibility pattern of 110 of *S. typhi* and paratyphi were as sensitivity to ceftriaxone 90% (99), cefixime 80% (88) besides these sensitivity to other antimicrobial were as follows amoxicillin 54% (59), chloramphenicol 48%(52), ciprofloxacin 42% (46), azithromycin 38% (42), cotrimoxazole 32% (35), as shown in Table III.

Table III
Susceptibility pattern of salmonella species
(n=110)

| Antibiotics | Sensitive n(%) | Intermediate n(%) | Resistant n(%) |
|-----------------|-------------------|----------------------|-------------------|
| Ceftriaxone | 99(90) | 11(10) | 0(0) |
| Cefixime | 88(80) | 17(16) | 5(4) |
| Amoxicillin | 59(54) | 27(24) | 24(22) |
| Chloramphenicol | 52(48) | 40(36) | 18(16) |
| Ciprofloxacin | 46(42) | 43(38) | 11(10) |
| Azithromycin | 42(38) | 46(42) | 22(20) |
| Co-trimoxazole | 35(32) | 32(29) | 43(39) |

Discussion

Enteric fever is still a significant public health problem in many developing countries. It is a dread disease because of its long course and associated complications if not detected and treated early. There are reports of changing clinical features in typhoid fever caused by drug resistant *S. typhi* leading to difficult in clinical diagnosis.^{10, 11}

Typhoid fever is endemic in Bangladesh, where there is a high incidence in children.¹²

In this study we found 42.23% of children were less than five years, which is also in agreement with an earlier report of 43.9% prevalence rate in Cebu city, Phillipine¹³. The reason is that children are the most vulnerable group in environments where inadequate water supply and poor environmental hygiene are problems because of their high level of ignorance. They are usually quick to satisfy their thirst irrespective of the water source especially if the water is apparently clean and without color.

In this study 73.63% (n=81) had leucocytes count between 4000-11000/cumm, with the median WBC count of 8000/cumm. which was similar finding with the study done in children by Sudharsan et al.¹⁴ that showed WBC count between 5000-10000/cumm in 70.9% cases.

Similarly, in our study leucocyte count below 4000/cumm was seen in 20.1%. which is similar to study done by Joshi et al.¹⁵ where they showed WBC count <4000/cumm in 16% cases. In the present study, among 110 patients, antimicrobial susceptibility to ceftriaxone was 90% sensitive, 10% intermediate and cefixime was 80% sensitive to *S. typhi*. Whereas amoxicillin, chloramphenicol, ciprofloxacin, azithromycin, co-trimoxazole were sensitive in 54%, 48%, 42%, 38% and 32% respectively. Our study defer with Joshi et al.¹⁵ where they showed *S. typhi* 100% sensitive to co-trimoxazole, chloramphenicol, cefotaxime, ceftriaxone, cefixime and ofloxacin.

At the end of 1980s and 1990s salmonella developed resistance to first line antibiotics, namely amoxicillin, co-trimoxazole and chloramphenicol simultaneously.¹⁶

Our study showed that ciprofloxacin and azithromycin is sensitive 42% and 38% to *S. typhi*, this study differ with Misra et al.¹⁷ More than 99% of *S. typhi* and 86.3% of paratyphi isolated in their study were susceptible to azithromycin. In 2003, the world Health Organization published guidelines that recommended azithromycin, ceftriaxone or cefixime for quinolone-resistant *Salmonella typhi* and paratyphi A infection.¹⁸ But by the fifteen years *S. typhi* change its sensitivity to azithromycin and in our study we found only 38% sensitive and 42% intermediately sensitive to azithromycin.

Conclusion

The emergence of MDR strains has reduced the choice of antibiotics in many areas. There are two categories of drug resistance, resistance to antibiotics such as chloramphenicol, ampicillin and trimethoprim-sulphamethoxazole and resistance to the fluoroquinolone drugs. There are disturbing a recent report of the emergence of fluoroquinolone resistant isolates in various parts of Asia & there have been a few reports of resistance to third generation cephalosporin in the same region. In This study antimicrobial sensitivity test showed that *Salmonella typhi* as well as paratyphi have not 100% sensitivity

to any antibiotics. Ceftriaxone and cefixime is the drug that show 90% and 80% sensitivity respectively.

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