

Sensitivity pattern of *Salmonella* isolates from blood culture in children in a tertiary care hospital in Western Tamil Nadu

Jagannathan Krishnasamy¹, Abinaya Srinivasan²

From, ¹Consultant Paediatrician, ²Post-graduate Student, Department of Paediatrics, G. Kuppaswamy Naidu Memorial Hospital, Coimbatore, Tamil Nadu, India.

Correspondence to: Jagannathan Krishnasamy, Department of Paediatrics, G. Kuppaswamy Naidu Memorial Hospital, Coimbatore, Tamil Nadu, India. E-mail: jagannathkrish@yahoo.co.uk

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ABSTRACT

Background: Antibiotic resistance to *Salmonella* differs in each region. Limited studies are available on antibiotic sensitivity pattern to *Salmonella* in western part of Tamil Nadu. **Objective:** The objective of the study was to study the antibiotic sensitivity pattern of *Salmonella* isolates in children in western part of Tamil Nadu and to analyze subspecies variation in antibiotic sensitivity. **Materials and Methods:** A retrospective analysis of blood culture sensitivity reports of 89 patients with enteric fever between the ages of 1 and 18 years old who were admitted over a period of 5 years in a tertiary care center in western part of Tamil Nadu was performed. Variables such as age, gender, subtypes of *Salmonella* infection, and sensitivity pattern to antibiotics were analyzed. **Results:** All *Salmonella* isolates were highly sensitive to co-trimoxazole, chloramphenicol, ampicillin, and third-generation cephalosporins (nearly 100%). The highest resistance was to nalidixic acid followed by quinolones. Resistance to azithromycin was close to 15%. Overall, *Salmonella* paratyphi A strains showed higher resistance and *Salmonella typhimurium* infection was higher in infants. **Conclusion:** Although multidrug-resistant *Salmonella* is documented worldwide, the first-line drugs were highly sensitive. Azithromycin is an easy and feasible alternative, but resistance should be kept in mind. *Salmonella* paratyphi A infections must also to be considered in multidrug-resistant conditions.

Key words: Antibiotic sensitivity, Children, Typhoid

Enteric fever is still a major public health problem in developing countries like India. Resistance to *Salmonella* has been emerging since 1990 and this is the era of multidrug-resistant typhoid to antibiotics such as amoxicillin, co-trimoxazole, chloramphenicol, and fluoroquinolones worldwide [1]. Knowledge about antibiotic sensitivity pattern in a particular region is essential as it varies with demography. In western part of Tamil Nadu, data are lacking about the antibiotic sensitivity pattern of *Salmonella* in the pediatric age group. It is also helpful in initiating empirical antibiotic therapy, reducing multidrug resistance, and thus minimizing complications. Hence, the present study was undertaken with an objective to study the antibiotic sensitivity pattern of *Salmonella* isolates in children in western part of Tamil Nadu and to analyze subspecies variation in antibiotic sensitivity.

MATERIALS AND METHODS

A retrospective observational study was undertaken at G. Kuppaswamy Naidu Memorial Hospital, Coimbatore – a tertiary care center in western part of Tamil Nadu, to study the sensitivity patterns of *Salmonella* isolates in children for over a period of 5 years from January 2013 to December 2017. After

obtaining the approval of ethical committee, blood culture sensitivity reports of 89 patients within the age group of 1 month–18 years suffering from enteric fever were included in the study. Blood culture was done in BD BACTEC™ Peds plus™ medium and was incubated with BD BACTEC™ system. Cultures were incubated and reports were interpreted within 5 days. Variables such as age, gender, subtypes of *Salmonella* infection, and sensitivity pattern to antibiotics were analyzed.

RESULTS

A total of 89 children between the age group of 1 month and 18 years of age who were positive for *Salmonella* infection were included in the study. The study included 46 males and 43 females with the ratio of 1.06. The mean age of children was 7.2 years. The youngest patient was 3 months old infant with *Salmonella typhimurium* infection. The age-wise distribution and the different species are mentioned in Table 1.

The most common species isolated was of *Salmonella typhi* in 63 patients followed by *Salmonella* paratyphi A in 21 patients and *Salmonella* paratyphi B in 2 patients. *S. typhimurium* was isolated from three patients and all of them were infants. *Salmonella* sensitivity pattern was checked against nine antibiotics – ampicillin,

cefixime, cefotaxime, ceftriaxone, co-trimoxazole, chloramphenicol, nalidixic acid, azithromycin, and ciprofloxacin. Susceptibility was classified as resistant – R, moderately sensitive – MS, or sensitive – S. All *Salmonella* isolates were sensitive to co-trimoxazole and chloramphenicol (100%). Ampicillin was sensitive to 98.9% of isolates. Similar pattern of sensitivity was seen with the third-generation cephalosporins (cefotaxime and ceftriaxone) and showed only 1.1% resistance (Fig. 1).

Resistance to quinolones was significant in our study. Ofloxacin, ciprofloxacin, and levofloxacin were analyzed separately. Sensitivity to ciprofloxacin was tested in all the samples. Out of them, *Salmonella* paratyphi B and *S. typhimurium* were 100% sensitive. About a quarter, 16 (25.4%) samples of *S. typhi* strains were resistant and 34 (54%) samples were moderately sensitive. Only 13 samples (20.6%) were sensitive to ciprofloxacin. Among *Salmonella* paratyphi A strains, 5 (23.8%) samples were sensitive, 14 (66.7%) samples showed moderate sensitivity, while 2 (9.5%) were resistant to ciprofloxacin. Most of the strains of *S. typhi* (85.7%) and all strains of *Salmonella* paratyphi A were resistant to nalidixic acid. Strains resistant to quinolones were also resistant to nalidixic acid. Sensitivity to azithromycin was tested only in the past few years. Out of 20 samples (15 of *S. typhi*) tested, 3 (15%) were resistant.

DISCUSSION

Resistance of *Salmonella* infections has been increasing considerably overtime and literature shows varying sensitivity pattern within the country. Resistance to fluoroquinolones has increased in recent years [2-4], and therefore, ciprofloxacin is not being used as the first choice of empirical treatment in enteric fever [5-7]. Multidrug resistance has been reported up to

39%–44% in India [5]. Knowledge of the pattern of antibiotic sensitivity in each region will aid in early and appropriate management of *Salmonella* infections and avoid drug resistance. Few studies have shown the resurgence of sensitivity to chloramphenicol [8-10]. Our study showed 100% sensitivity to the co-trimoxazole and chloramphenicol. Similarly, studies conducted by Dahiya *et al.* [11] and Behl *et al.* [12] in North India showed resurge of increasing sensitivity to co-trimoxazole and chloramphenicol.

Although studies from western part of India showed ceftriaxone resistance close to 9% [5], the third-generation cephalosporins still remain the drug of choice for complicated typhoid [1] showing resistance of only 1.1% in our study. There is increased minimum inhibitory concentration to ceftriaxone [13]. Azithromycin, the current alternative treatment option, requires more clinical and laboratory data to support its use in the treatment of uncomplicated enteric fever [14,15]. Emerging resistance of *S. typhi* to fluoroquinolones and nalidixic acid has been reported in different centers in India [7]. Furthermore, resistance to nalidixic acid resistance is directly proportional to increased MICs of ciprofloxacin. Hence, treatment with fluoroquinolones should be avoided in nalidixic acid-resistant isolates of *S. typhi* [4]. Oral azithromycin is an easy choice because of its once-daily dosing as outpatient [14] and efficacy was almost equal to cephalosporins [15]. However, our study showed resistance to cephalosporins in up to 15% and *Salmonella* paratyphi A had higher resistance to it. Sensitivity pattern to drugs like azithromycin was included only in the past 3 years, which is a limitation of our study. Although this is the first study of its kind in this region, multicentric study is recommended in the same region to confirm and generalize the findings.

CONCLUSION

Of the subtypes in *Salmonella*, 70.7% were *S. typhi* followed by 23.5% *Salmonella* paratyphi A. In spite of emerging multidrug resistance to *Salmonella*, our study showed 100% sensitivity to co-trimoxazole and chloramphenicol. Judicious use of these drugs may be helpful. The third-generation cephalosporins still remain the drug of choice for hospitalized patients and in complicated typhoid infections. Resistance to fluoroquinolones is high and is at par with nalidixic acid. Oral azithromycin can be used as an alternative in children presenting with uncomplicated infection in the outpatient setting.

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Table 1: Age-wise distribution of *Salmonella* subspecies

Subspecies/age	<2 years	2–5 years	>5 years	Total
<i>Salmonella typhi</i>	12	17	34	63
<i>Salmonella typhimurium</i>	2	1	0	3
<i>Salmonella</i> paratyphi A	1	7	13	21
<i>Salmonella</i> paratyphi B	1	1	0	2
Total	16	26	47	89

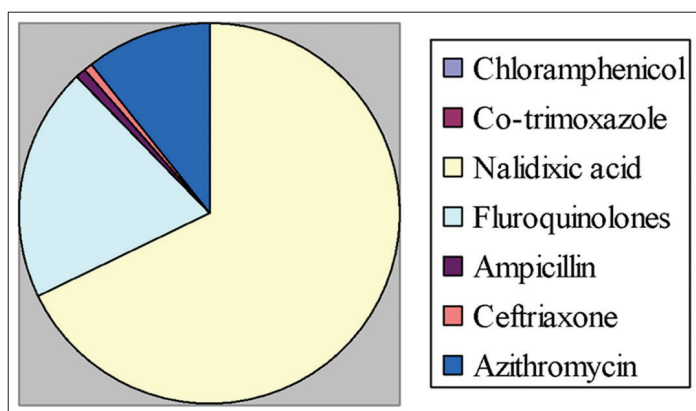


Figure 1: Resistance of *Salmonella typhi* to various antibiotics

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