Original article:

Prevalence and Antibiogram of Salmonella typhi and paratyphi A Isolates from a Tertiary Care Hospital

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Abstract

Introduction: Enteric fever affects millions of individual every year globally. It is a major public health problem in developing country like India. Drug resistance is the major issue for infections like Salmonella, and it is of paramount importance to limit the unnecessary use of vital drug so that efficacy of the drugs used for the infection should not be further jeopardized.

Aims and Objectives: To study the prevalence of Salmonella infection in IPD (In patient department) patients from tertiary care hospital and antimicrobial susceptibility pattern of Salmonella infection for prompt and effective use of antimicrobial agents against the infection.

Materials and Methods: A total of 6981 blood samples with the suspected enteric fever and pyrexia of unknown origin were included in the study from the Jan 2015 to May 2018. Salmonella typhi and Salmonella paratyphi A were isolated using standard biochemical tests. Isolated strains were subjected to antimicrobial susceptibility pattern by Kirby Bauer's disc diffusion method.

Results and Conclusion: 33 salmonella species were isolated. 27 isolate were identified as Salmonella enteric serovar typhi and 6 isolates were identified as Salmonella enteric serovar paratyphi A. All the isolates were sensitive to chloramphenicol. The isolates showed increasing trend of resistance to ciprofloxacin. The re-emergence of sensitivity to chloramphenicol, emphasize the need to review the empirical treatment of enteric fever.

Keywords: Salmonella typhi, Salmonella paratyphi A, antimicrobial susceptibility.

Introduction

Enteric fever is most commonly caused by Salmonella typhi followed by Salmonella paratyphi A particularly during summers and is predominantly associated with systemic infections in developing countries, one of the major etiological factors for travellers associated diarrhoea.[1] Five F's (food, fingers, flies, fomites, faeces) plays a vital role in transmission of disease.[2]

Since 1960 drug resistance to salmonella infection has been reported.[6] At the end of 1980 and 1990 'Multidrug resistant (MDR) strains' (resistant to ampicillin, chloramphenicol and co-trimoxazole) came into picture.[5] Later in years Nalidixic acid resistant (NAR) salmonella was observed. Nalidixic acid resistant (NAR) salmonella showed increase non-responsiveness to Fluoroquinolones (FQ's) by the patients.[1] Nalidixic acid is a reliable indicator for such FQ's. These NARS isolates were found to have higher MIC to ciprofloxacin.[5] After resistant to FQ's, 3rd and 4th generation cephalosporins were used for treatment, but due to emergence of resistant for these antibiotics, treatment options are getting limited.[1] All these resistant reflect overuse or irrational use of antibiotics as an empirical therapy for typhoidal

disease. Now it has become topic of concern for both clinicians and clinical microbiologists as it poses threat to public health.[6]

In case of enteric fever it is advisable to start antibiotic treatment before the antimicrobial sensitivity pattern so as to decrease the mortality rate of 30% to as low as 0.5%.[3] Hence antibiogram of Salmonella infection for a particular area is considered useful to avoid future drug resistant to current drug of choice.

Aims and Objectives

1. To study the prevalence of Salmonella typhi and paratyphi infection in tertiary care hospital.
2. Antimicrobial susceptibility pattern of Salmonella species for prompt and effective use of antimicrobial agents against the infection.

Materials and Methods

This study was conducted at the department of microbiology from January 2015 and May 2018.The total of 6981 patients admitted in wards of paediatric and medicine departments with provisional diagnosis of enteric fever or pyrexia of unknown origin (PUO) were included in this study.

Samples: A total of 6981 venous blood samples were included in this study. Blood was collected with proper aseptic precaution in brain heart infusion broth and incubated at 37ºC for 48hrs. Subcultures were done on blood agar, MacConkey agar and incubated aerobically at 37ºC for 18 to 24hrs. In negative cases subcultures were done for one week.

S.typhi and S.paratyphi A were isolated by conventional biochemical reactions and were confirmed by serotyping with factor sera. Antibiotic susceptibility testing was carried out by Kirby-Bauer's disk diffusion methods under CLSI guidelines. Escherichia coli ATCC 25922 was used as a quality control strain. Each isolate was tested for a set of antimicrobial drugs. These include: -

Ampicillin (10µg), Nalidixic acid (30µg), Co-trimoxazole (1.25/23.75µg), Ciprofloxacin (5µg), Chloramphenicol (30µg), Ceftriaxone (30µg)

Results

Out of total no. of patient studied 5602(80.24%) were children and 1379(19.75%) were adults (Figure 1). The prevalence of enteric fever was higher in children (69.69%) compared to adults (30.30%) {Table1, Figure2}. Sex wise distribution of salmonella isolates was not significant.

Salmonella isolates were found throughout the year more during summers (Table 2, Figure 3). A total of 33 isolates of Salmonella typhi 27 (81.8%) and paratyphi A 6 (18.1%) were obtained in blood culture giving the overall percentage positivity of 0.47% [Table 3, Figure 4]. Antibiogram of these isolates revealed that all the isolated of Salmonella were (100 %) sensitive to Chloramphenicol, Co-trimoxazole. There was no Multidrug resistant (MDR) strains (resistant to ampicillin, chloramphenicol and co-trimoxazole) found in this study. Highest resistance was observed against Nalidixic acid (90.90%) followed by Ciprofloxacin and Ampicillin with (48.48%) and (27.27%) respectively [Table 4, Figure 5].

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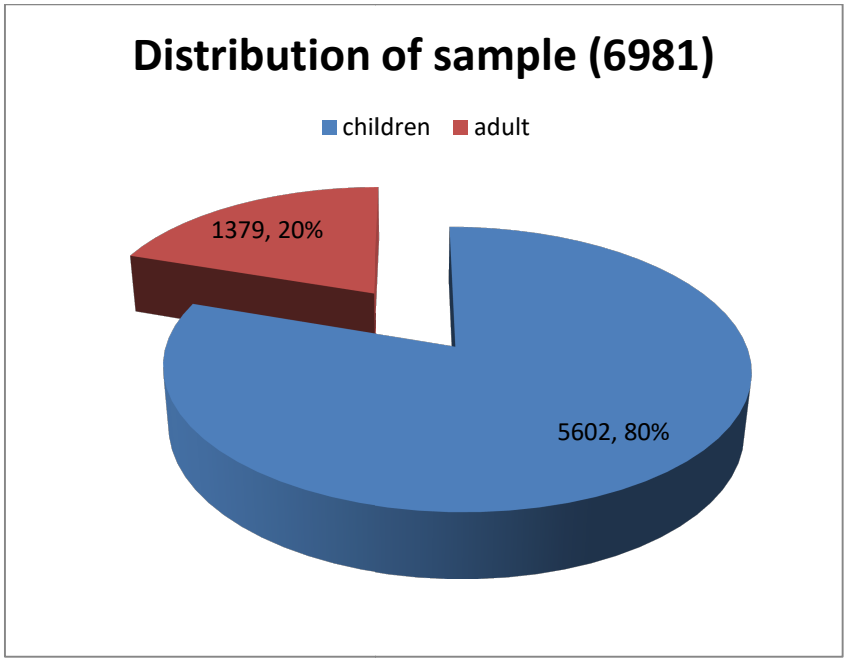

Figure 2

Table 1: Total no. of Isolate.

Isolates	Number	Percentage (%)
Children	23	69.69
Adult	10	30.30
Total	33	100

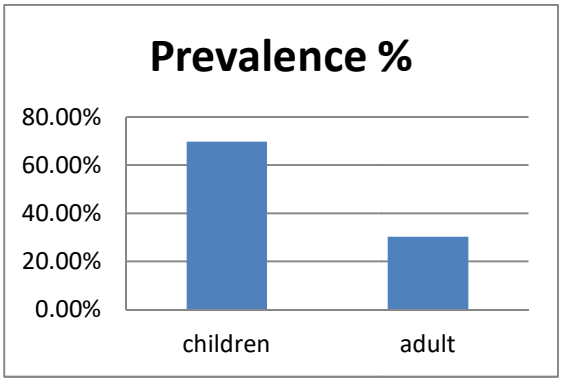

Figure 2

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Table2: Distribution of salmonella positive cases by month.

Month	Number of isolates.
January	3
February	2
March	4
April	8
May	3
June	5
July	1
August	1
September	1
October	0
November	1
December	4
Total	33

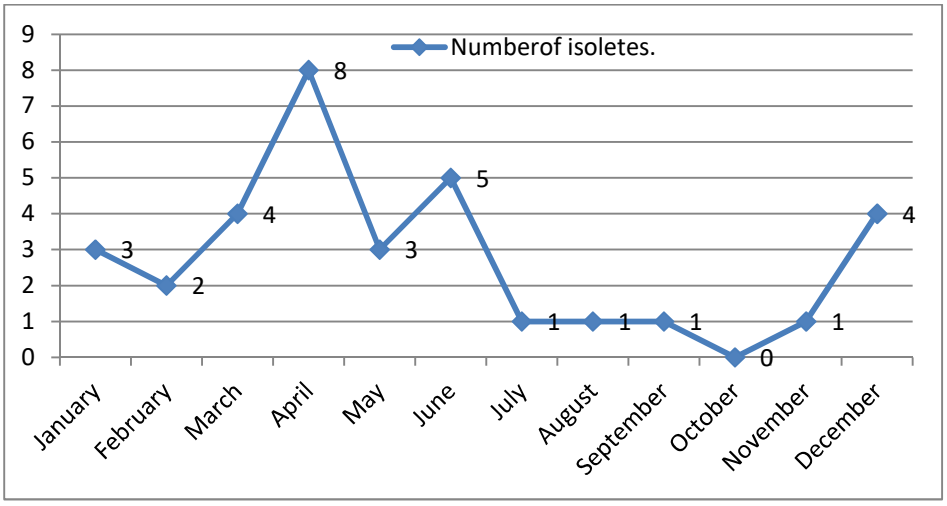

Figure 3: Month wise distribution of salmonella.

Table 3: Salmonella enteric serovar typhi and paratyphi A

Serovar	Total No.	Percentage
Salmonella typhi	27	81.80%
Salmonella paratyphi A	6	18.18%

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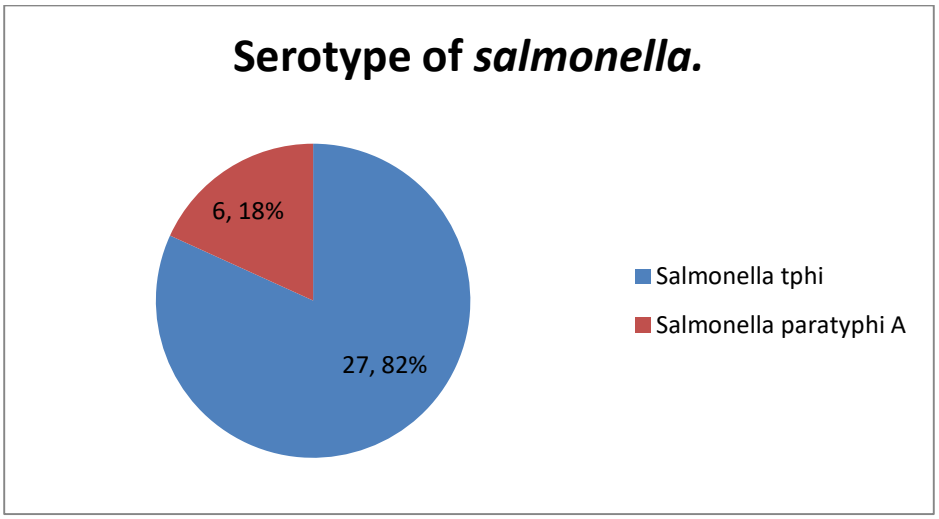

Figure 4

Table 4: Antibiogram of Salmonella isolates.

Antibiotics	**Sensitive no. (%)**	**Resistance no. (%)**	**Intermediate sensitive no. (%)**
Ampicillin (10µg)	22 (66.6%)	9 (27.27%)	2 (6.06%)
Nalidixic acid (30µg)	3 (9.09%)	30 (90.90%)	-
Ciprofloxacin (5µg)	7 (21.21%)	16 (48.48%)	10 (30.30%)
Co-trimoxazole (1.25/23.75µg)	33(100%)	-	-
Chloramphenicol (30µg)	33(100%)	-	-
Ceftriaxone (30µg)	30 (90.90%)	2 (6.06%)	1 (3.03%)

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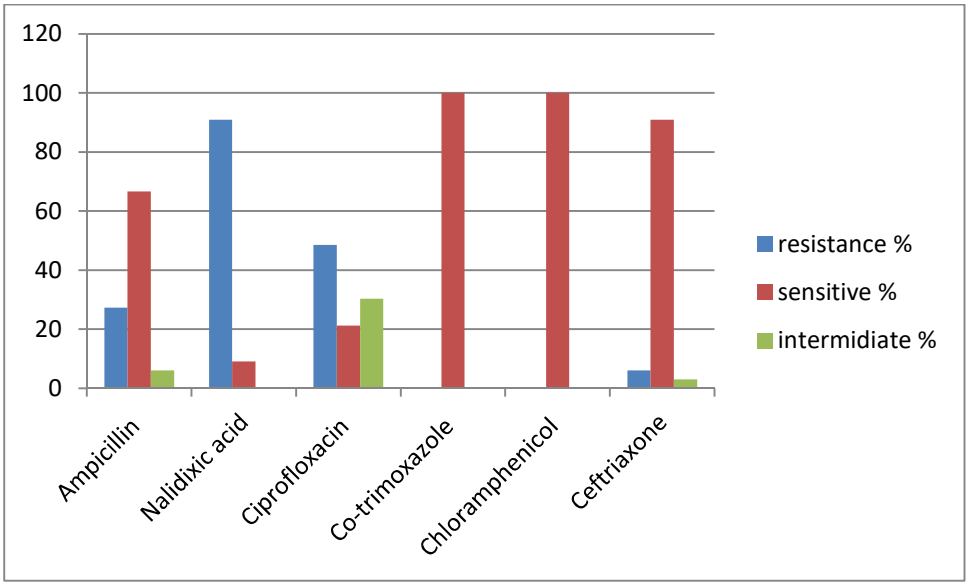
Figure 5: Antibiotic susceptibility pattern of salmonella.



Discussion

Various factors including poor sanitation, bad food hygiene, inappropriate cooking of meats and eggs cause enteric fever particularly in developing country like India. Ideal antimicrobial treatment of patients with enteric fever should correspond with local pattern of antimicrobial susceptibility testing.[5] In this study no isolates showed Multidrug resistant (MDR) strains. Similar finding was observed in Puducherry by Bhat K.S et al.[11] Multidrug resistant (MDR) strains was observed in Delhi (14.9%) by R Raveendran et al[5] and in Karnataka which was even lower (10%) by Kavita Nagshetty et al[7] while 3.7% was reported in a study by S Rai et al.[1] This pattern showed decrease in Multidrug resistant (MDR) strains for the isolates of salmonella. First line drug (ampicillin, chloramphenicol and co-trimoxazole) can be prescribed in susceptible cases and it will justify the concept of antimicrobial recycling. In this study there was 100% sensitivity to Chloramphenicol and Co-trimoxazole. 93% was reported by B prajapati et al[2] from Nepal in 2008. The resistance pattern of Co-trimoxazole has shown decreasing trends from 1995.[2] Although Chloramphenicol administration needs continuous monitoring of patient due to high relapse, bone marrow toxicity and chronic continued carriage.

Various epidemiological studies conducted in different parts of India have shown decrease sensitivity pattern of ciprofloxacin. [4,8,9] Fluoroquinolone resistance has increased over recent years.[13] 48.8% resistance to ciprofloxacin is observed in this study. 68% was observed in a study by García-Fernández A et al[12] in 2015, 25.8% by Bhat K.S et al[11] in 2017, 22% by Revathy G et al[14] in 2013. <2% by S S Bhattacharya et al[10] and 4.21% in Karnataka[7] was reported, finding were less because the no of isolates in these studies were more. Increases in resistance to ciprofloxacin have emerged in recent years[3,7] because of which ciprofloxacin should not be considered as drug of choice for enteric infection.[5]

Third generation cephalosporin is the treatment for Fluoroquinolone resistant cases.[5] 2% resistance for Ceftriaxone was observed in this study. Resistance of 3% to 6.25% was reported from Orrisa by

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Bhattacharya S S et al.[10] Drawbacks with the use of Ceftriaxone are high cost, route of administration, relief from symptoms and even treatment failure in few cases.[3,6]

Conclusion

To sum up the study, hospital antibiotic policy of empirical treatment in case of enteric fever needs to be rationalized. There should be continuous evaluation of antimicrobial susceptibility pattern. First line drugs might be considered as an effective component in the treatment of enteric fever and thus can prevent the spread of resistance in future.[3,4] Prevention is better than cure which includes proper hand washing, sanitary disposal of faeces, safe public water supply, controlling flies and pasteurisation of milk and other dairy products. Immunity can be conferred by vaccination or after infection. Vaccination is must for people travelling in endemic regions.

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