

Antimicrobial Susceptibility Patterns of *Salmonella typhi* and *Salmonella paratyphi A* in a Tertiary Care Hospital

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ABSTRACT

Background: Enteric fever is still an important public health problem in developing countries including Nepal. A changing antibiotic susceptibility pattern of *Salmonella typhi* and *Salmonella paratyphi A* and emergence of multi drug resistance has increased to a great concern. Aim of the study was to investigate the antibiotic susceptibility pattern of *Salmonella typhi* and *Salmonella paratyphi A*.

Methods: Study was carried out at the department of microbiology in Kathmandu Medical College. Blood culture samples were collected from suspected enteric fever patient and tested microbiologically by standard procedure. Antibiotic susceptibility test was performed by Kirby-Bauer disc diffusion method and results were interpreted by National Committee for Clinical Laboratory (NCCLS) guideline.

Results: Of total 78 (2.0%) *Salmonella* serotype isolated from 3,980 blood culture samples, in which 47 (60.3%) were *S. typhi* and 31 (39.7%) were *S. paratyphi A*. Isolates were from all age group median age being the 25 years. Among the tested antibiotics *S. typhi* was susceptible towards Ciprofloxacin (100%) followed by Gentamicin (97.9%), Ofloxacin (95.7%), Ceftriaxone (95.7%) and Chloramphenicol (93.6%). In case of *S. paratyphi A* most of the tested antibiotics showed high percentage of susceptibility and least susceptible antibiotic for *S. paratyphi A* was Ampicillin (25.8%). Three isolates of *S. typhi* showed multidrug resistance.

Conclusions: A considerable variation was observed in the antimicrobial susceptibility pattern of *S. typhi* and *S. paratyphi A*. Hence antibiotic susceptibility test must be sought before instituting appropriate therapy to prevent from further emergence of drug resistance.

Keywords: antimicrobial sensitivity test; ciprofloxacin; enteric fever; multi-drug resistance; *salmonella*.

INTRODUCTION

Enteric fever includes Typhoid fever caused by *Salmonella typhi* and paratyphoid fever caused by various strains of *Salmonella paratyphi*. Enteric fever is an important public health problem in many developing countries including Nepal. According to recently revised global estimate, it causes 21.6 million illness every year, resulting in 216,500 death.¹ *Salmonella enterica* serovar typhi is now known to be markedly resistance to commonly prescribed antibiotics^{2,3} and there has been increasing concern about the prevalence of multi-drug

resistance *Salmonella typhi* and *Salmonella paratyphi A* strains in developing countries.^{4,5} There have been several reports of multi-drug resistance *Salmonella typhi* with plasmid-mediated resistance to conventional antibiotics such as Chloramphenicol, Co-trimoxazole and Ampicillin in different parts of the world.^{5,6} Multi-drug resistance *Salmonella typhi* to antibiotic such as Chloramphenicol, Amoxicillin, Co-trimoxazole, and Fluoroquinolone have emerged as new challenges to the treatment of typhoid fever.^{6,7}

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Hence, there is a need for the study of incidence and susceptibility patterns of *Salmonella species* to commonly prescribed antibiotics in an attempt to understand antibiotics susceptibility profile of the isolates and to prevent from the emergence of multi drug resistance.

METHODS

A cross-sectional study was carried out at the department of microbiology in Kathmandu Medical College (KMC) from October 2010 to November 2011. The blood samples were collected for culture in aseptic condition from patients attending KMC Teaching hospital, with a history of fever of variable duration. Ethical approval was taken from IRC-KMC. Patient who had taken antibiotic were excluded from the study. Brain-heart infusion (BHI) broth was used as culture media which support the growth of all common pathogens causing bacteraemia/septicemia. Collection of blood, incubation, and subcultures onto blood agar and Mac-Conkey agar were done as per the standard methods.⁸ Suspected non-lactose-fermenting colonies were further processed and identified by biochemical reactions and confirmed by group and type specific *Salmonella* antisera (Denka Seiken, Japan). Antimicrobial susceptibility was determined by the Kirby-Bauer disc-diffusion method performed on Muller-Hinton agar plates. Antibiotics disc used in this study were Ampicillin (10 µg), Ceftriaxone (30µg), Chloramphenicol (30 µg), Ciprofloxacin (5 µg), Co-trimoxazole (25 µg), Ofloxacin (30 µg) and Gentamicin (10 µg) (Hi Media Laboratory Ltd, Mumbai, India).¹³ the disk strength and zone-size interpretation was in accordance with the National Committee for Clinical Laboratory Standards (NCCLS).⁹ Data were entered in Microsoft Excel and analyzed by SPSS version 16.0.

RESULTS

Of the total 3,980 blood culture samples submitted to the Department Microbiology of Katmandu Medical College, from the suspected patient of enteric fever, 78 (2.0%) sample showed positive growth for *Salmonella species*. Out of total positive cases 47 (60.3%) were *S. typhi* and 31 (39.7%) were *S. Paratyphi A*. Isolates were from all age group, the median age being 25 years. The male to female ratio was 1.5:1.

S. typhi was most susceptible towards Ciprofloxacin 47 (100%), followed by Gentamicin 46 (97.9%), Ofloxacin 45 (95.7%), Ceftriaxone 45 (95.7%) and Chloramphenicol 44 (93.6%). In case of *S. paratyphi A* most of the tested antibiotics showed high percentage of susceptibility and the least susceptible antibiotic was Ampicillin 8 (25.8%).

Out of the 47 *S. typhi* isolates; three isolates were multi

drug resistance, showing resistance simultaneous to Ampicillin, Chloramphenicol, and Co-trimoxazole which are first line anti typhoidal drugs (Table 1). Most of the positive cases lie in the age group 21-40 years. Median age being the 25 years (Table 2).

Table 1. Antibiotics Susceptibility patterns of isolated *Salmonella species* against tested antibiotics at 37 °C for 24 hr

Antibiotic	Susceptibility	
	S.typhi n=47 (%)	S.paratyphi A n =31 (%)
Ampicillin	33 (70.2)	8 (25.80)
Chloramphenicol	44 (93.6)	31 (100)
Co-trimoxazole	43 (91.5)	31 (100)
Ciprofloxacin	47 (100)	31 (100)
Ceftriaxone	45 (95.7)	31 (100)
Gentamicin	46 (97.9)	30 (96.8)
Ofloxacin	45 (95.7)	31 (100)
Multi-drug resistance (Ampicillin+Co- trimoxazole +Chloramphenicol)	3 (6.38)	-

Table 2. Distribution of Age and Sex ratio for culture positive cases

Age	Sex		
	Male n (%)	Female n (%)	Total n (%)
<5 years	-	1 (100)	1 (1.3)
5-20	17 (68)	8 (32)	25 (32.1)
21-40	25 (59.6)	17 (40.5)	42 (53.8)
41-60	3 (50)	3 (50)	6 (7.7)
>60	3 (75)	1 (25)	4 (5.1)
Total	48 (61.5)	30 (38.5)	75 (100.0)

DISCUSSION

Enteric fever is a major health problem in developing countries including Nepal.¹ Isolation of *Salmonella species* occurs throughout the year. This means that drinking water conditions and sanitation have not improved or a large number of carriers are present in the society. However there is a slight trend towards increased isolation in the summer months.¹⁰

In this study, out of 78 isolates 47 (60.3%) were *S. typhi* and 31 (39.7%) were *S. paratyphi A*. This result was harmony with the result of Guha et al, who found that out of 114 isolates, 76 (66.6%) were *S. typhi* and 38 (33.3%) were *S. paratyphi A*.¹¹

Enteric fever is mainly caused by *S. enterica* serotype typhi while that due to *S. paratyphi A* has been reported

less frequently. But the incidence of *S. paratyphi A* is on the rise.¹² In the present study incidence of *S. paratyphi A* was 31 (39.7%) which is similar to the study conducted by Tankhiwala et al.¹³

Prompt institution of appropriate antimicrobial therapy can reduce morbidity and mortality associated with this illness. Since 1948, chloramphenicol had been the mainstay of treatment of enteric fever until 1972 when chloramphenicol-resistance typhoid fever became a major problem. In this study re-emergence of chloramphenicol susceptibility was observed,¹⁴ 93.6% *S. typhi* were susceptibility of chloramphenicol and 6.38% were resistance. This finding was similar to the finding of Sharma et al,¹⁵ who showed that 92.7% isolates were susceptible to chloramphenicol and 3.6% were resistance. In case of *S. paratyphi A* all isolates were susceptible to chloramphenicol. No multidrug *S. paratyphi A* was isolated.

Co-trimoxazole is the second cost effective drug used to treat typhi and paratyphi infection. Present study showed that 43 (91.5%) *S. typhi* were susceptible to Co-trimoxazole and 4 (8.5%) were resistance. similar results were shown by Murdoch et al.¹⁶ As 5% of the isolates were resistance to Co-trimoxazole. Similarly in case of *S. paratyphi A* all the isolates were susceptible to Co-trimoxazole which is also shown by Murdoch et al.¹⁶ Among multidrug resistance *S. typhi* all the isolates were resistance to Co-trimoxazole, this finding was in agreement with the finding of Nagesha et al¹⁷ who showed that among multidrug resistance *S. typhi*, 97% isolates were resistance to Co-trimoxazole.

In this study Ceftriaxone was 100% susceptible to *S. paratyphi A* which was supported by Bhatia et al,¹⁸ who also showed 100% susceptibility to this drug. In case of *S. typhi 2* (4.3%) showed resistance to Ceftriaxone this finding was similar to the finding reported from Pakistan and Bangladesh.^{19,20} Fluoroquinolone particularly ciprofloxacin was the most frequently used antibiotics in typhi and paratyphi case but none of the isolates were resistance to this antibiotic this finding is similar to the finding of Khanal B et al.²¹

Plasmid mediated multi drug resistance is known to be increasing in salmonella serotype. However in the present study three out of the 47 isolates of *S. typhi* were multi drug resistance, showing resistance to Ampicillin, Co-trimoxazole and Chloramphenicol simultaneously. Though multi drug resistance among *S. paratyphi A* was not observed, its emergence in other part of the world warrants judicious use of antibiotics, where various percentage of multi drug resistance *S. paratyphi A* was observed.¹²

CONCLUSIONS

In the Present study *Salmonella paratyphi A* was observed as a rapidly emerging pathogen of enteric fever. Similarly considerable variation in the antibiotic susceptibility pattern of *S. typhi* and *S. paratyphi A* was observed as suggested by the re-emergence of Chloramphenicol sensitivity. Thus, susceptibility pattern of causative organism must be sought before instituting appropriate therapy to prevent from further emergence of drug resistance.

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