

Study of enteric fever and antibiogram of *Salmonella* isolates at a Teaching Hospital in Kathmandu Valley

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ABSTRACT

Enteric fever is one of the common public health problems in Nepal. This study was carried out at Nepal Medical College Teaching Hospital located at peri-urban area in Kathmandu Valley to find out the prevalence of enteric fever and the sensitivity pattern of the *Salmonella* isolates. A total of 479 patients with fever were included in the study. Venous blood samples collected aseptically were subjected to culture and were studied following the standard bacteriological procedure. The overall prevalence of enteric fever was 5.4 % (26/479). Of them more than half (65.4 %) were caused by *S. paratyphi* A whereas remaining (34.6 %) by *S. typhi*. The positive rate was higher in children aged 1-15 years (8.9 %) followed by 15-30 years of age (4.3 %) and others (1.9 %). Gender wise, females to male ratio was 1.4:1. The occurrence of infections was higher in Dalit (7.1 %), Khas (Brahmin and Chhetri) (5.9 %) and Madeshi (5.9 %) whereas lowest was in Adibasi Janajati (4.8 %). Prevalence rate of enteric fever among different sex, age and ethnic group was not significant ($p > 0.05$). Isolates were highly sensitive to Amikacin (100.0 %) and Ciprofloxacin (96.1 %) whereas least sensitive to Gentamycin (68.7 %).

Keywords: Enteric fever, prevalence, antibiogram, Nepal.

INTRODUCTION

Enteric fever (typhoid fever) caused by *Salmonella typhi* and *S. paratyphi* is one of the major public health problem particularly in developing countries. The disease may be acute non-complicated (characterized by prolonged fever, disturbances in bowel functions, headache, malaise and anorexia) and complicated (intestinal bleeding, melena, intestinal perforation and peritonitis).¹ According to WHO, 16.6 million cases of enteric fever occurs each year accounting for 600,000 deaths² primarily in developing countries.³ Of the infected individuals, 1.0-5.0% becomes carries.¹ Typhoid fever has very high socio-economic impact because of hospitalization and associated reasons. The disease is highly prevalent in south-central and south-east Asia² attributed mainly to poor sanitary and hygienic condition particularly due to contamination of drinking water supplies.¹ Importance of enteric fever has increased once again due to the emergence of drug resistant strains.

Enteric fever (locally known as *Bisham Jwor* or *Myade Jwor*) is endemic in Nepal and constitutes a major cause of morbidity and mortality^{4,5} primarily affecting the children and young adults.^{4,6} The disease occurs sporadically throughout the year with a peak incidence / outbreaks during summer (monsoon) season⁷⁻¹⁰ and is attributed to contamination of foods and drinking water. Fecal contamination of drinking water source / supply system is common in Nepal.¹¹⁻¹³

Antimicrobial susceptibility testing is crucial for clinical management. During recent years, multi-drug resistant organisms has been reported from different parts of world¹ including from Nepal.^{5,8,14} A largest single-point source outbreak of multidrug-resistant (plasmid encoded single-point mutation) typhoid fever associated with contamination of water supply has also been reported.¹⁰ In this paper, we report the prevalence of typhoid fever recorded at a teaching hospital located in a periurban area of Kathmandu Valley and the drug resistance pattern of isolates.

MATERIALS AND METHODS

This study was carried out at Nepal Medical College Teaching Hospital located in per-urban area in north-east part of Kathmandu Valley. A total of 479 feverish patients attending Out Patient Departments during August 2008 to January 2009 (six months) were included. The blood samples collected by venipuncture under aseptic condition were subjected to culture for *Salmonella* (5 ml blood in 45 ml of brain heart infusion broth) at 37°C and sub-cultured on solid medium (MacConkey agar, MA) after every 24 hours of

Table-1: Growth positive rate among two different sexes

Sex	Total n	Positive n	(%)	P-value
Male	439	23	5.2	>0.05
Female	40	3	7.5	
Total	479	26	5.4	

Table-2: Growth positive rate among different ethnic groups

Ethnic group	Total n	Positive n	(%)	P-value
Dalit	14	1	7.1	>0.05
Brahmin-Chhetri	221	13	5.9	
Madeshi*	34	2	5.9	
Adibasi Janajati	210	10	4.8	
Total	479	26	5.4	

*Includes Tarai Brahmin-Chhetri and middle caste people

incubation. Tiny non-lactose fermenting colonies on MA were subjected to identification following standard bacteriological procedure (microscopic examination, biochemical studies and serotyping). Growth negative on sub-culture till 120 hrs (five days) were regarded as culture negative.

The isolates were then subjected to drug sensitivity testing by Kirby-Bauer Method employing commonly used drugs. The drug used included Amikacin (30 mcg), Ciprofloxacin (30 mcg), Ofloxacin (5 mcg), Tobramycin (30 mcg), Ampicillin (10 mcg) and Gentamycin (10 mcg). This work was approved by Institutional Research Committee of the college.

RESULTS

Out of 479 blood samples cultured, 26 (5.4%) were positive for *S. typhi* and *S. paratyphi*. Of the total 26 isolates, 17 (65.4%) were *S. paratyphi* A and 9 (34.6%) were *S. typhi*. *S. paratyphi* B was not isolated. Slightly higher growth positive rate was seen in females (7.5%) compared to males (5.2%) ($p>0.05$). The growth positive rate was seen higher in children (9.0%) (aged 15 and less than 15 years) followed by 4.3% in the age group of 16-30 years and 2.0% in more than 30 years ($p>0.05$). Ethnicwise, *Dalits* showed relatively higher growth positive rate (7.1%). Both *Brahmin-Chhetri* and *Madeshi* showed same growth positive rate (5.9%) whereas *Adibasi Janajati* (indigenous nationalities) showed lowest growth positive rate of 4.8% ($P>0.05$).

S. paratyphi A was highly sensitive to Amikacin (100.0%) and Ofloxacin (100.0%) followed by Ciprofloxacin (94.1%) whereas, moderately sensitive to Gentamycin (70.6%). *S. typhi* was found to be highly sensitive to Amikacin (100.0%) and Ciprofloxacin (100.0%) however, least sensitive to Tobramycin (55.6%).

DISCUSSION

Enteric fever is a major health problem in developing countries attributed to poor sanitary and hygienic conditions including lack of potable water. In Nepal, drinking water sources (piped, natural taps/spouts and wells) is heavily contaminated.¹¹⁻¹³ In the cities, contamination of water is resulted due to cross-contamination with sewerage.¹⁵ Still, in many communities, most of households do not have latrines.¹⁶ Therefore, the disease has remained endemic with outbreaks occurring time and again.⁷⁻¹⁰

Table-3: Growth positive rate in three different age groups

Age-group	Total	Positive n	(%)	P-value
0-15	167	15	9.0	>0.05
16-30	211	9	4.3	
>30	101	2	2.0	
Total	479	26	5.4	

The overall growth positive rate for *Salmonella* spp. in this study was the relatively low (5.4%). However, similar positive rate has been reported also by other workers from Nepal. Sharma *et al*,¹⁷ reported the positive rate of 6.9% while Khanal *et al*,⁵ from a teaching hospital eastern Nepal reported 5.1%. Positive rate even lower than present findings (2.3%) among children in Kathmandu has also been reported.⁹ Gupta *et al*,¹⁸ from India (2.7%) have also reported low positive rate in general population. Low positive rate might be due to the use of antibiotics prior to sample collection. However, this was not looked into in this study. In contrast, higher positive rates have been reported from hospitals located in city center of Kathmandu and Lalitpur Districts in the valley.^{14,19} Amatya *et al*,¹⁹ from Kathmandu reported positive rate of 23.1% whereas Maskey *et al*,¹⁴ from Lalitpur reported 18.8%.

In contrast to previous reports^{8,9,14,17,20} in this study, *S. paratyphi* A was more commonly isolated than *S. typhi*. The higher isolation rate of *S. paratyphi* A observed in this study correlates with an increasing trend of this organism observed by Maskey *et al*.¹⁴ In their observation, *S. paratyphi* A as a proportion of all *Salmonella* isolates rose significantly from 23.0% during 1993-1998 to 34.0% in 1999-2003. An increase in enteric fever cases due to *S. paratyphi* A has also been reported from neighboring country India.¹⁸

Previous reports from Nepal including recent one have shown higher prevalence of salmonellosis in males than in females.^{4,6,9,17} More outdoor exposure of males has been given the possible reason for higher positive rate among them. However, in this study, prevalence of salmonellosis in females was slightly higher compared to males. Higher growth positive rate among males has also been reported among children attending a children hospital in Kathmandu.²⁰ The reason for such discrepancy demands further investigation. Slightly higher prevalence among females, mostly pregnant women, is reported from Pakistan and has been explained on the basis of increased susceptibility to infection during pregnancy.²¹

Table-4: Drug sensitivity pattern of *S. paratyphi* A (n=17)

Antibiotic	Sensitive		Resistant	
	Frequency	(%)	Frequency	(%)
Amikacin	17	100.0	0	0.0
Ofloxacin	17	100.0	0	0.0
Ciprofloxacin	16	94.1	1	5.9
Ampicillin	15	88.2	2	11.8
Tobramycin	14	82.4	3	17.6
Gentamycin	12	70.6	5	29.4

Table-5: Drug sensitivity pattern of *S. typhi* (n=9)

Antibiotic	Sensitive		Resistant	
	Frequency	(%)	Frequency	(%)
Amikacin	17	100.0	0	0.0
Amikacin	9	100.0	0	0.0
Ciprofloxacin	9	100.0	0	0.0
Ofloxacin	7	77.8	2	22.2
Ampicillin	7	77.8	2	22.2
Gentamycin	6	66.7	3	33.3
Tobramycin	5	55.6	4	44.4

Among the ethnic population, marginally higher growth positive rate was observed among *Dalits* compared with *Brahmin-Chhetri*, *Madhesi* and *Adibasi-Janajati*. This finding may be associated with relatively low human development index of *Dalit* population in Nepal.²² *Salmonella* growth positive rate was higher in children (15 and less than 15 years old) and decreasing positive rate with increasing age. This appeared to be due to the immune deficiency during childhood and their behaviors. Of the growth positive cases nearly three-fifth was children.

S. paratyphi was most sensitive towards Amikacin and Ofloxacin followed by Ciprofloxacin. In previous studies, Ciprofloxacin was reported to be most effective.^{7,18,23} Sensitivity towards Ciprofloxacin observed in this study was similar with one of the previous report⁴ whereas, lower sensitivity to Ciprofloxacin has also been reported in earlier studies from Nepal.^{6,9} However, the previous studies have reported varying degree of effectiveness towards Ofloxacin.^{6,9,20}

S. typhi was most sensitive to Amikacin and Ciprofloxacin followed by others. This finding was closer to previous findings from Nepal.^{4,7} Sensitivity towards Ciprofloxacin observed in this study was in agreement with the findings from India.¹⁸ However, a recent study from Nepal have shown lower sensitivity rate.⁹ In this study, less sensitivity towards Gentamycin and Tobramycin was observed.

Findings of present study indicated the endemicity of salmonellosis in the peri-urban area of Kathmandu Valley. Keeping in view of fecal contamination of drinking water, poor hygienic conditions and drug resistant pattern of the isolates, appropriate measures to combat this disease is advocated.

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