

MULTIDRUG RESISTANCE IN *SALMONELLA TYPHI* ISOLATED FROM DRINKING WATER IN AMRAVATI

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ABSTRACT

Waterborne infections are most common cause of mortality in underdeveloped and developing countries, and 80% of the infectious diseases are waterborne in India. There is problem of multiple drug resistant in *Salmonella typhi* in drinking water due to improper and indiscriminate use of antibiotics in the treatment. Therefore, attempt was made to isolate *Salmonella typhi* from different sources of drinking water and to find out its antibiotic sensitivity to prescribe correct treatment to the typhoid patients in Amravati. A total of 1000 water samples from various sources such as tube wells (340), open wells (340) and hotels and restaurants (320) were analyzed for the coliform water contamination and 96 strains of *Salmonella typhi* were isolated and observed. Most of the strains of *Salmonella* species were sensitive to norfloxacin; ciprofloxacin, levofloxacin, kanamycin, streptomycin, ceflazidime and chloramphenicol, and resistant to linezolid, gatifloxacin, amoxycylav, cefepime, ampicillin, nalidixic acid and co-trimoxazole.

INTRODUCTION

Waterborne infections are most common cause of mortality in underdeveloped and developing countries, and according to World Health Organization (WHO), 80% of the infectious diseases are waterborne in India. *Salmonella typhi*, an etiological agent of typhoid fever continues to be a public health problem in many parts and annually estimated 600000 deaths from enteric fever occur throughout the world (Gautam et al. 2002). Due to indiscriminate and sub-clinical use of antibiotics, there is a development of resistance among the human bacterial pathogens. In India there has been an increase in the degree of chloramphenicol resistance during the years 1960 and 1961 among the 678 *Salmonella typhi* strains tested.

Multiple drug resistance patterns of *Salmonella typhi*, isolated from drinking water in salinity affected villages of Vidarbha, showed highest sensitivity against cephalexin, gentamicin, nalidixic acid, nitrofurantoin, norfloxacin and P-floxacin, and resistance to commonly used amoxicillin, cefuroxime, cephalexin, ciprofloxacin and lincomycin (Tambekar & Kalbande 2004). More than 70% *Salmonella typhi* were resistant to most of the antibiotics commonly used to treat typhoid patients (Mandal et al. 2003, Sangavi et al. 1999, Nadgir et al. 1998). All strains of *Salmonella typhi* isolated in a Hospital at Nagpur, were sensitive to ciprofloxacin and cephalexin and resistant to ampicillin, chloramphenicol and co-trimoxazole (Tankiwale et al. 2003).

Thus, contaminated drinking water is the common cause of multidrug resistance typhoid infection hence, attempt was made to isolate *Salmonella typhi* from different sources of drinking water and to find out its antibiotic sensitivity to prescribe correct treatment to the typhoid patients in Amravati.

MATERIALS AND METHODS

A total of 1000 water samples were collected from various sources such as open wells, tube wells, and hotels and restaurants in sterile bottles from different localities of Amravati city. All water samples

were analyzed by Manja's H₂S test (Manja et al. 2001) and used as a presumptive test for the detection of *Salmonella*. The coliform contamination in water was detected in the H₂S test as blackening of medium within 24 to 48 h. The H₂S positive test was further processed for the presence of *Salmonella* spp. by subculturing on *Salmonella*, *Shigella* agar medium (SAA) and xylose lysine deoxycolate (XLD) agar. Identification of *Salmonella typhi* was made on the basis of standard test.

Antibiotic susceptibility of isolated and identified *Salmonella typhi* were made by disc diffusion technique. The 16 antibiotics discs (Hi-media Laboratories, Mumbai) were used in the study (Table 1).

RESULTS AND DISCUSSION

In this study, total 1000 water samples from various sources such as tube wells (340), open wells (340), and hotels and restaurants (320) were analyzed for the coliform water contamination, and coliforms were found in 150 tube well, 150 open well and 125 hotels and restaurants. A total of 96 strains of *Salmonella typhi* were isolated and identifies from these contaminated drinking waters, 43 from OW, 30 from TW, and 23 from hotels and restaurants (Table 2).

After determining Multiple Antibiotic Resistance (MAR) profile, it was observed that all 96 *Salmonella* species were sensitive to norfloxacin, ciprofloxacin and levofloxacin, 95 isolates to kanamycin and streptomycin, 94 to ceftazidime, 93 to chloramphenicol, 88 to ticarcillin, and 77 to ampicillin, nalidixic acid and co-trimoxazole. On the other hand 87 isolates were resistant to linezolid, 80 to gatifloxacin, 28 to amoxyclav, 21 to cefepine, 23 to tetracycline, and 19 to ampicillin, nalidixic acid and co-trimoxazole (Fig. 1).

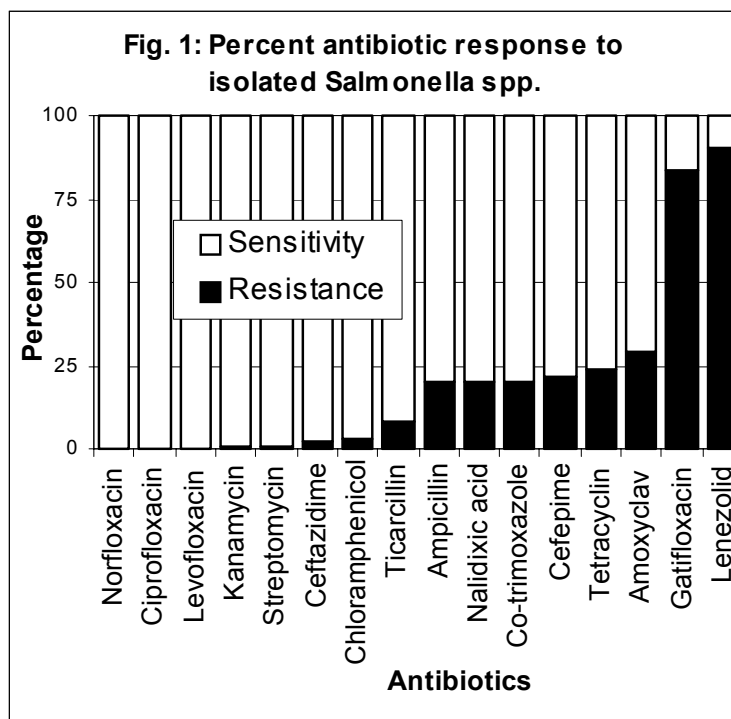
In northern India, 19% chloramphenicol sensitivity was seen in *Salmonella typhi*, while 63% strains were sensitive to ciprofloxacin. *Salmonella* strains were found to be sensitive to gentamycin,

Table 1: Antibiotics used in the study.

Antibiotic Disc	Quantity (mcg/disc)	Antibiotic Disc	Quantity (mcg/disc)
Amoxyclav	30	Kanamycin	30
Ampicillin	10	Levofloxacin	5
Cefepine	30	Linezolid	30
Ceftazidime	30	Nalidixic acid	30
Chloramphenical	30	Norfloxacin	10
Ciprofloxacin	5	Streptomycin	10
Co-trimoxazole	25	Tetracyclin	30
Gatifloxacin	5	Ticarcillin	75

Table 2: Contamination as per the source of drinking water and antibiotic susceptibility pattern of isolated *salmonella* spp.

Source	Sample Number	Contaminated water samples	<i>Salmonella</i> spp. isolated	Score		Total
				Resistance	Sensitive	
Open well	340	150	43	145 (21%)	543 (79%)	688
Tube well	340	150	30	94 (20%)	386 (80%)	480
Hotels and Restaurants	320	125	23	72 (20%)	296 (80%)	368
Total	1000	425	96	311	1225	1536



amikacin, cefotaxime, ceftizoxime and ceftriaxozone (Gautam et al. 2002). *Salmonella* isolates were sensitive to ciprofloxacin and cephotaxime in most parts of India (Tankhiwale et al. 2003).

The maximum antibiotic resistance was recorded to linezolid (90.6%) and gatifloxacin (83.33%), the moderate antibiotic sensitivity to amoxycylav (70.8%), tetracycline (76%), cefepime (78%), co-trimoxazole (80%), and 100% sensitivity to norfloxacin, ciprofloxacin, levofloxacin by isolated *Salmonella typhi*. Out of the total 96 strains of *Salmonella* species isolated in Amravati, 80% were sensitive and 20% resistant to tested antibiotics (Fig. 1).

The variation occurred in antibiotic sensitivity pattern of *Salmonella* species confirmed the emergence of antibiotic resistance. The resistance in bacterial pathogens to antibiotics increased the chances of severe infection in human beings. The data indicated that the norfloxacin, ciprofloxacin, levofloxacin, kanamycin and streptomycin should be the drugs of choice to combat typhoid infection avoiding the treatment with gatifloxacin in Amravati. For proper antityphoid treatment, physician should perform the antibiotic sensitivity test before actual antibiotic treatment.

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