

ANTIBIOTIC SUSCEPTIBILITIES OF SALMONELLA SEROGROUPS ISOLATED FROM TURKISH CHILDREN*

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SUMMARY: Akan Ö, Kanra G, Seçmeer G, Ceyhan M, Ecevit Z, Berkman E. (Infectious Disease Unit, Department of Pediatrics, Hacettepe University Faculty of Medicine, Ankara, Turkey). Antibiotic susceptibilities of *Salmonella* serogroups isolated from Turkish children. Turk J Pediatr 1997; 39: 7-11.

This study is performed to show the serogroup distribution and in-vitro antibiotic susceptibilities of *Salmonella* species that cause either gastroenteritis with/without bacteremia or enteric fever at Hacettepe University İhsan Doğramacı Children's Hospital. Of the 309 *Salmonella* strains evaluated, serogroup B was the most common isolate (56%) followed by serogroup D (33%). Antibiotic susceptibility tests using the disk diffusion technique revealed resistance rates of 43 percent for ampicillin, 41 percent for chloramphenicol, 29 percent for trimethoprim-sulfamethoxazole (SXT) and 32 percent for ceftriaxone among *Salmonella* serogroup B. The same rates were 10, eight, seven and zero percent for *Salmonella* serogroup D, and seven, 14, and zero percent for serogroup C, respectively. *S.typhi* strains susceptible to all antibiotics studied except tetracycline (33% resistant). No resistance was detected against the quinolones. The antibiotic resistance of *Salmonella* species isolated from children seems to be important, especially in serogroup B. Susceptibility tests should be considered in the antimicrobial therapy of *Salmonella* infections where indicated. *Key words:* *Salmonella* species, antibiotic susceptibility.

Salmonella infections continue to be one of the important health problems among adults and children in Turkey, especially in the warm seasons^{1,2}. Use of antibiotics mainly depends on the type of infection. Chloramphenicol, ampicillin and trimethoprim-sulfamethoxazole have been considered to be the standard agents for therapy in view of their efficacy and low cost. However, since resistance to each of these standard antibiotics has become common in many parts of the world, the antibiotic susceptibility pattern of the involved pathogen should be considered during the therapy^{3,4}. This study was performed to show the serotype distribution and in-vitro antibiotic susceptibilities of *Salmonella* species that cause either gastroenteritis with/without bacteremia or enteric fever at Hacettepe Children's Hospital.

Material and Methods

Strains: *Salmonella* strains isolated from stools or blood cultures of children admitted to Hacettepe University İhsan Doğramacı Children's Hospital between January 1994 and June 1995 with complaints of diarrhea and/or fever, were

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included in the study. All strains were acquired outside the hospital, and special attention was given not to include more than one isolate from the same child. Identification of the strains were done first by using biochemical and then serological tests. Serogroups were determined by slide agglutination technique using standard polyvalent and group specific antisera (Difco)^{5,6}.

Antibiotic Susceptibility Tests: The antibiotic susceptibility to eight antibiotics using the disk diffusion technique was determined according to the recommendations of the National Committee for Laboratory Standards⁷. The antibiotic disks were as follows: ampicillin (10 µg/ml), chloramphenicol (30 µg/ml), tetracycline (30 µg/ml), trimethoprim-sulfamethoxazole (1.25,23.75 µg/ml), sulbactam-ampicillin (10/10 µg/ml), ceftriaxone (30 µg/ml), ofloxacin (5 µg/ml), and ciprofloxacin (5 µg/ml) (Oxoid, BBL).

Results

A total of 309 *Salmonella* strains were included in the study. The types of specimens and the serogroups of *Salmonella* species are shown in Table I.

Table I: The Types of Specimens and the Serogroups of the *Salmonella* species

<i>Salmonella</i> Serogroup	Blood	Stool	Total
B	9	154	173
C	0	14	14
D	1	101	102
S.typhi	4	16	20
Total	14	285	309

One hundred and seventythree (56%) of the strains belonged to *Salmonella* serogroup B, followed by serogroup D (102 strains, 33%). The isolates of serogroup B were more resistant to the antibiotics studied. The quinolones and ceftriaxone were the most effective antibiotics with the lowest resistance rates. The antibiotic resistance rates of *Salmonella* isolates according to their serogroup is shown in Table II. S.typhi isolates were more sensitive than non-typhoid *Salmonella* to the antibiotics studied (Table III).

Table II: Antibiotic Resistance Rates of *Salmonella* Species

<i>Salmonella</i> Serogroup	AMP R%	CHL R%	SXT R%	SAM R%	Tet R%	CRO R%	OF R%	CIP R%
B	43	41	29	39	53	32	0	0
C	7	14	14	7	14	0	0	0
D	10	8	7	7	33	0	0	0
S.typhi	0	0	0	0	21	0	0	0

Table III: Antibiotic Resistance Rates of S.typhi and nontyphoid Salmonella

	n	AMP R%	CHL R%	SXT R%	SAM R%	TET R%	CRO R%	OF R%	CIP R%
nontyphoid Salm.**	289	30	28	20	26	46	20	0	0
S.typhi	20	0	0	0	0	21	0	0	0

* R% includes both resistant and intermediately resistant strains. AMP: ampicillin, CHL: chloramphenicol, SXT: trimethoprim-sulfamethoxazole, SAM: sulbactam-ampicillin, TET: tetracycline, CRO: ceftriaxone, OF: ofloxacin, CIP: ciprofloxacin.

** nontyphoid salmonella.

Discussion

Antimicrobial therapy in Salmonella infections is only indicated in patients with bacteremia or enteric fever. The use of antibiotics in non-typhoid Salmonella gastroenteritis remains controversial⁸. Studies have shown no clinical improvement with antimicrobial therapy, and both clinical and/or bacteriological failure or relapse has been demonstrated in Salmonella gastroenteritis. There is also the risk of emergence of drug-resistant strains, so antibiotic therapy in the gastroenteritis form should be limited to neonates, young infants and immunosuppressed patients^{3, 9}.

The choice of antibiotics has been complicated by the emergence of Salmonella strains resistant to the commonly used antimicrobials such as chloramphenicol, ampicillin and trimethoprim-sulfamethoxazole (SXT). Increasing multiple-resistant strains have been a problem in many parts of the world¹⁰. In Turkey several studies about the antibiotic susceptibility of Salmonella spp. show antibiotic resistance rates of 27 to 95.8 percent for ampicillin, 27 to 94.3 percent for chloramphenicol, and 18 to 88.8 percent for SXT¹¹⁻¹⁵. The wide range among the rates reported from different parts of Turkey may be due to lack of differentiation of hospital and non-hospital isolates. Hospital-acquired Salmonella spp. tend to be more resistant to the antibiotics studied¹⁵. In general S.typhi has remained susceptible to antimicrobial agents, especially compared to non-typhoid Salmonella¹⁶. Though multiple resistant S.typhi isolates have been reported in some parts of the world, it is not yet a problem for Turkish isolates^{13, 17, 18}. Our isolates of S.typhi also showed no resistance to the antibiotics studied except tetracycline.

The difference in resistance rates among non-typhoid Solmonella and S.typhi may be because of the distinct sources of the species. The only reservoir for S.typhi is man, whereas animals constitute the principal source of non-typhoid Salmonella strains that infect man¹⁹. Multiple resistant Salmonella strains are generally transmitted on plasmids, an the widespread use of antimicrobials in animals directly affects the resistance rates of Salmonella spp. present in the environment^{3, 20}. Resistance of the Salmonella spp. to commonly used antibiotics

has brought about the search for new effective antibiotics. Third-generation cephalosporins have been used successfully in enteric fever of children²¹; but the resistance rate of 32 percent for ceftriaxone in our *Salmonella* serogroup B strains should be taken into account in the decision of empirical use. Our high rate of cephalosporin resistance may be due to extended spectrum beta-lactamases seen in such isolates²². The quinolones have been found to be effective against enteric pathogens. Their spectrum of activity, high fecal levels, good intracellular and bowel penetration properties, and high lymph node and systemic drug concentrations have made them the drug of choice in enteric fever of adults²³. However, their usage in children is controversial. In some pediatric trials, good to excellent efficacy has been reported with mild and reversible adverse effects. They may be promising in enteric infections in childhood if they are approved for children²⁴.

Antibiotic resistance of *Salmonella* species isolated from children seems to be important, especially in isolates belonging to serogroup B. In addition to antibiotic susceptibility results, the clinical efficacy of the antimicrobials, duration of excretion of the pathogen, relapse rates and the development of *Salmonella* carrier state are important factors that must be considered in the selection of the antibiotic. Further studies regarding clinical and laboratory findings should be performed to construct a protocol about rational antibiotic usage in *Salmonella* infections among children.

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