

Short Communication

Antibiotic Susceptibility Pattern of *Salmonella* *worthington* Isolated from Neonates - a Retrospective Study

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SUMMARY: *Salmonella* *worthington* is an emerging pathogen and has been implicated in a number of outbreaks of neonatal meningitis and septicemia. Over a period of 5 years, a total of 30 strains of this pathogen were isolated from blood and cerebrospinal fluid of neonates suffering from septicemia with or without meningitis. Most of these strains were resistant to the penicillin group of antibiotics, and many were resistant to cefotaxime. Sixty percent of the isolates were resistant to amikacin; 86% were resistant to chloramphenicol, and none were resistant to ciprofloxacin or norfloxacin. Parenteral fluoroquinolone should be included as part of antibiotic therapy in suspected cases of neonatal meningitis due to *S. worthington*.

Salmonella enterica serovar *Worthington* (*Salmonella worthington*) is an emerging pathogen and has been responsible for hospital associated outbreaks in nursery units (1,2). Such infections are characterized by a high mortality rate due to the neonatal immune system, which is not fully developed and to the emergence of multidrug resistance among strains of nontyphoidal *Salmonellae*. We conducted a retrospective study to determine the antibiotic sensitivity pattern of *S. worthington* strains isolated from neonates from 1995 to 2000. Knowledge of the antibiotic sensitivity pattern will be useful to the formulation of guidelines regarding empirical therapy before drug sensitivity reports are available, and will thus contribute to better patient management.

Samples from a total of 752 cases of suspected neonatal septicemia were subjected to bacteriological examination over the 5-year period. Strains of *S. worthington* were isolated from 30 (3.9%) cases of neonatal septicemia with or without meningitis. This included strains isolated from sporadic cases and from two outbreaks. Blood and/or cerebrospinal fluid (CSF) samples were subjected to standard bacteriological methods for isolation and identification of pathogens (3). Antibiotic sensitivity was determined using the Kirby-Bauer disc diffusion method according to the guidelines set by the National Center for Clinical Laboratory Standards (NCCLS), using standard American Type Culture Collection (ATCC) strains with every batch of tests as described (4). Based on the

zone diameter, the isolates were characterized as sensitive, intermediate, or resistant. The antibiotic discs (Hi-Media Laboratories, Pune, India) used included ampicillin, amoxicillin, cefotaxime, chloramphenicol, amikacin, ciprofloxacin, and norfloxacin in all 30 cases, and ofloxacin in 14 cases.

S. worthington was isolated from blood samples in 19 cases, from CSF samples in five cases and from both blood and CSF in six cases. The results of the antibiotic sensitivity patterns are summarized in Table 1.

Neonatal infection due to *S. worthington* can clinically present as diarrhea, septicemia, jaundice, or meningitis (1,2,5). The source of infection is essentially environmental, and the organism has been isolated from baby cots, warmer mattresses and the rubber tubing of the suction apparatus stationed in neonatal intensive care units (2,5). In earlier reports from India, strains were found to be resistant to multiple antibiotics, and were associated with a high mortality rate (6). Microbiological assessment of in vitro sensitivity often takes 48 h from the time of collection of samples, and empirical therapy needs to be instituted before the sensitivity reports are obtained. Prior knowledge of the sensitivity pattern of pathogenic bacteria will facilitate early institution of therapy to which the organisms are likely to be sensitive.

Our results showed that most isolates of *S. worthington* were resistant to ampicillin and amoxicillin. Nineteen out of 30 (63%) isolates were resistant to cefotaxime; six (20%) of the

Table 1. The antibiotic resistance (%) of isolates of *S. worthington*

Sample	Number	A	Am	Ce	C	Ak	Cp	N	O ¹
Blood	19	79	89	58	89	49	0	0	0
CSF	5	100	100	60	100	60	0	0	0
Blood and CSF	6	100	100	83	66	100	0	0	NT
Total	30	86	93	63	86	60	0	0	0

A, Ampicillin; Am, Amoxicillin; Ce, Cefotaxime; C, Chloramphenicol; Ak, Amikacin; Cp, Ciprofloxacin; N, Norfloxacin; O, Ofloxacin; NT, Not Tested.

¹Ofloxacin was tested in 12 out of 19 isolates from blood and 2 out of 5 isolates from cerebrospinal fluid (CSF).

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remaining 11 were sensitive, and five (17%) had zone diameters in the intermediate range. The appearance of cephalosporin-resistant nontyphoidal *Salmonellae* is a matter of concern. In addition, a novel cefotaximase, CTX-2, has recently been demonstrated in *S. mbandaka* (7). Resistance to cefotaxime also indicates resistance to ceftriaxone and ceftizoxime, further limiting the therapeutic choice (4). In our study, 18 out of 30 (60%) strains were resistant to amikacin, and most strains were also resistant to broad-spectrum antibiotics such as chloramphenicol. In the first reported nursery outbreak due to *S. worthington*, all strains were sensitive to chloramphenicol and to aminoglycosides including kanamycin and gentamicin (1), whereas only four out of six strains of this pathogen isolated from cases of infantile gastroenteritis in Iraq were sensitive to chloramphenicol and kanamycin (8). Chloramphenicol and aminoglycoside resistance was documented in a report of a nursery outbreak from Pakistan (2). In contrast, none of the isolates in the present report were resistant to the fluoroquinolone group of antibiotics, although one isolate had intermediate sensitivity to ciprofloxacin and norfloxacin. Because of the limited number of antibiotics to which this serotype is susceptible, it is important to test strains for susceptibility to more than one fluoroquinolone, given that resistance to one agent of this group cannot always be extrapolated to others (4). Although side effects of fluoroquinolones on joints are known to occur in pediatric age patients, many authorities now recommend their use for treating *Salmonella* meningitis in infants (9).

On the basis of our findings, we suggest that in suspected outbreaks and sporadic cases of *S. worthington* septicemia and meningitis in neonates, a parenteral fluoroquinolone should be included in the therapeutic regimen pending the antibiotic susceptibility report. In combination with other antibiotics such as amikacin or cefotaxime, such therapy would also cover the spectrum of other Gram-negative pathogens that are frequent causes of neonatal septicemia. Because strains may vary in their susceptibility to antibiotics in various geographical areas, it is important to carry out such studies in hospitals and referral centers so that proper therapeutic guidelines can be established. There is also an urgent need to devise an antibiotic policy in all hospitals relative to various clinical situations, so that antibiotic therapy that is likely to be beneficial can be started before the in vitro sensitivity reports are available.

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