

Antibiotic sensitivity of enteropathogenic bacteria isolated from patients in a Sharjah hospital

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(Received 9 September 1983; accepted 8 November 1983)

SUMMARY

In recent years widespread circulation of salmonella and shigella strains resistant to multiple antibiotics has become an international problem. Accordingly the bacterial sensitivity to a range of antibiotics has been assessed *in vitro* and recorded for the period 1979-83 for patients from the Al Qassimi Hospital. A total of 229 enteric pathogens from 148 children and 59 adult patients were isolated and studied. Most of the enterobacteria were sensitive to colistin, gentamicin, trimethoprim and chloramphenicol (*Salmonella typhi* approached 100% sensitivity). High rates of sensitivity were also found to ampicillin in *S. typhi* (96%) and other salmonella serotypes (85%), whilst only 57% of *Shigella* species and 14% of *Escherichia coli* were sensitive to this antibiotic. Low rates of sensitivity to sulphamethoxazole, streptomycin and tetracycline were found in shigella and *E. coli* (ranging from 7 to 14%). Approximately 50% of *S. typhi* and other salmonella serotypes were sensitive to sulphamethoxazole and streptomycin and 80% to tetracycline. Resistance to three or more antibiotics was very common in shigella and enteropathogenic strains of *E. coli* (74-85%), less common in non-typhoid salmonella (29%) and exceptional in *S. typhi* strains. In general, shigella and *E. coli* isolates showed a high rate of resistance to several antibiotics, whilst *S. typhi* and other salmonella serotypes retained their original sensitivity to most of the antibiotics used in clinical practice.

INTRODUCTION

Antibiotic sensitivity of the organisms causing infection of the alimentary tract varies with time and geographical location. In recent years a major concern has been the development of chloramphenicol resistance among strains of *Salmonella typhi* isolated in various parts of the world (Bryan, 1982). Further, widespread circulation of multiply resistant strains of non-typhoid salmonella (Krugman & Katz, 1981) and shigella (Frost & Rowe, 1983) has also become an international problem. The purpose of this study was to determine the sensitivity pattern of enteric pathogens isolated from patients who were treated in Al Qassimi Hospital during the period 1979-83. This, in turn, may reflect the sensitivity pattern of the United Arab Emirates; this is the first report from the area.

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PATIENTS AND METHODS

Enteric pathogens were isolated from 148 children and 59 adults. The patients were predominantly Arabs (38 % from the United Arab Emirates, 10 % from other Arab countries), followed by Pakistanis (21 %), Indians (19 %) and other nationalities (Europeans, Africans, other Asians 11 %). Most patients were treated in out-patient clinics (63 %), but those needing isolation and continuous medical care (37 %) were admitted to the hospital. With a few exceptions the organisms were isolated from stools. However, 15 strains of *S. typhi* were isolated from blood and one from urine. Also one strain of salmonella group B (non *S. paratyphi* B) was isolated from the blood of an Indian child with a history of fever for several weeks.

With the exception of campylobacter strains, enteropathogenic organisms were isolated and identified by standard methods (Cowan, 1974). Antibiotic sensitivities were determined by the Kirby-Bauer disk diffusion method (Waterworth, 1981) using Mastring-S disks (Mast Laboratories Ltd, Bootle, Merseyside, U.K.) on Difco Diagnostic Sensitivity Test Agar (Difco Laboratories, Detroit, Michigan, U.S.A.). For the isolation and sensitivity testing of campylobacter strains a special selective technique was used (Butzler & Skirrow, 1979).

RESULTS

Two hundred and thirty-two isolates were identified and their sensitivities determined. Sensitivities of *S. typhi* (26 strains), non-typhoid salmonella (122 strains), shigella (46 strains), enteropathogenic *Escherichia coli* (21 strains) and campylobacter (17 strains) are presented. *S. typhi* proved highly sensitive to the majority of antimicrobial agents used, including chloramphenicol (Table 1). However, nine strains (34 %) were resistant to one antibiotic (sulphamethoxazole), two (8 %) to two antibiotics (streptomycin + sulphamethoxazole or streptomycin + ampicillin) and only one strain (4 %) to three antibiotics (sulphamethoxazole, colistin and tetracycline).

Non-typhoid salmonella (belonging chiefly to groups B, C and E) showed high rates of sensitivity (82–100 %) to the whole spectrum of antibiotics commonly used against Gram-negative bacteria. Nevertheless, a fair proportion of salmonella were resistant to sulphamethoxazole (60 %), streptomycin (35 %) and tetracycline (27 %). Most commonly, salmonella isolates were only resistant to sulphamethoxazole (29 %) or to three or more antibacterial agents (29 %). Among the latter, triple resistance to sulphamethoxazole, streptomycin and tetracycline was very common. Double resistance to any combination of the above agents was less common (16 %).

Sensitivity of *Shigella* species (more than 60 % were *S. flexneri* types) was extremely varied. Eighty-six to 100 % isolates were sensitive to cephalixin, chloramphenicol and several aminoglycosides, whilst only 7–12 % of isolated strains were sensitive to sulphamethoxazole, streptomycin and tetracycline. On the other hand, sensitivity to trimethoprim and ampicillin was in the range of 50–60 %. No single resistance to any antimicrobial agent was found; multiple resistance, however, was very common (74 %). Here, triple resistance to sulphamethoxazole, streptomycin and tetracycline was more common than quadruple or quintuple resistance, where additional resistance to ampicillin and/or trimethoprim was also found. Resistance to only two drugs was much less common (21 %).

Table 1. Percentage of strains sensitive to antibiotics

| | <i>Salmonella typhi</i> | <i>Salmonella non-typhi</i> | <i>Shigella</i> | <i>E. coli</i> | <i>Campylobacter</i> |
|-------------------|-------------------------|-----------------------------|-----------------|----------------|----------------------|
| Ampicillin | 96 (26)* | 85 (120) | 52 (42) | 14 (21) | 69 (13) |
| Cephalexin | 100 (26) | 84 (107) | 86 (35) | 48 (21) | 13 (16) |
| Sulphamethoxazole | 64 (25) | 41 (116) | 7 (44) | 14 (21) | 25 (16) |
| Trimethoprim | 100 (23) | 92 (102) | 51 (43) | 71 (21) | 14 (14) |
| Chloramphenicol | 100 (25) | 93 (109) | 91 (23) | 55 (11) | NT — |
| Tetracycline | 90 (10) | 73 (64) | 12 (25) | 14 (7) | 80 (10) |
| Colistin | 95 (21) | 83 (86) | 85 (34) | 100 (19) | 73 (11) |
| Streptomycin | 50 (6) | 65 (72) | 10 (30) | 10 (10) | 92 (12) |
| Gentamicin | 100 (24) | 98 (117) | 100 (42) | 95 (21) | 93 (15) |
| Amikacin | 100 (12) | 100 (29) | 100 (12) | 100 (9) | 100 (4) |
| Neomycin | NT† — | 85 (73) | 100 (15) | 67 (6) | NT — |
| Erythromycin | NT — | NT — | NT — | NT — | 100 (17) |

* Number of strains tested in parentheses.

† NT, not tested.

Enteropathogenic *E. coli* strains (various serotypes) were mostly sensitive to gentamicin, colistin and amikacin (95–100%), moderately sensitive to chloramphenicol, neomycin and trimethoprim (55–71%) and resistant to streptomycin, sulphamethoxazole, tetracycline and ampicillin (10–14% sensitive). Eighty-five per cent of isolates showed multiple resistance to several commonly used antibiotics, and this was the main characteristic of this group.

Campylobacter strains were highly sensitive to erythromycin (100%) and aminoglycosides (92–100%) and frequently sensitive to ampicillin, colistin and tetracycline (70–80%). Low sensitivity rates were found to sulphamethoxazole (25%), and even lower to cephalexin and trimethoprim (12–14%). Most of the resistant strains (87%) showed multiple resistance to the latter group of antibiotics, where extra resistance to ampicillin was also noted.

DISCUSSION

Chloramphenicol resistance has been reported in individual strains of *S. typhi* since 1950 (Anderson & Smith, 1972). However, there was no major concern until 1972 when chloramphenicol-resistant strains were responsible for a large number of cases in Mexico and subsequently also in India, Vietnam, Thailand and Spain (Bryan, 1982). The present study demonstrates that *S. typhi* strains isolated from patients in Sharjah retained their sensitivity to the whole spectrum of antimicrobial agents, including chloramphenicol. Although resistance to various microbiological agents among enterobacteria is transferable by R-factors, the situation is very complex as far as the origin of chloramphenicol resistance in *S. typhi* strains is concerned (Bryan, 1982). It has been suggested that as long as *S. typhi* is not frequently present in the human intestine and as long as chloramphenicol is not used indiscriminately, the conditions for appearance of chloramphenicol-resistant strains will not be satisfied (Anderson & Smith, 1972). However, the transmission of drug-resistant typhoid organisms from one area to another is quite possible (Overturf, Marton & Mathies, 1973). Nevertheless, our data suggest that chlor-

amphenicol-resistant strains of *S. typhi* are very uncommon or non-existent in this part of the world.

High rates of resistance among strains of non-typhoid salmonella, shigella and *E. coli* are in accordance with widespread circulation of multiply resistant strains of these bacteria in various parts of the world (Krugman & Katz, 1981; Bryan, 1982). As in other parts of the world (Scragg, Appelbaum & Govender, 1978) this pattern of resistance may result from widespread use of antibiotics in this area, or less specifically, may be related to the large circulation of a working force coming regularly to the United Arab Emirates from the Indian subcontinent. Whatever the reason may be for the above pattern of antibiotic resistance, it would be prudent that the antibiotic sensitivity of each patient's isolate be determined.

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