Original Article

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Prevalence of *Shigella* Species and Their Antimicrobial Resistance Patterns at Amirkola Children's Hospital, North of Iran

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Abstract

Objective: In the few cases of acute childhood diarrhea that require antimicrobial therapy, the correct choice of the drug depends on detailed previous knowledge of local strains and pattern of antimicrobial resistance. Shigellosis is one of the most important examples in this group of intestinal infections. In order to establish such parameters in our city this study was carried out to determine the prevalence and pattern of antimicrobial resistance of *Shigella* species among patients with acute diarrhea admitted to the Amirkola children's hospital, North of Iran.

Material & Methods: The study included all patients with acute diarrhea, 6 months to 12 years of age, who were admitted to the Amirkola children's hospital during March 2001 to March 2004. Incidence, phenotypic characteristics and antimicrobial resistance patterns of *Shigella* strains, isolated from hospitalized children with acute diarrhea, were studied

Findings: We received 260 positive cultures for *Shigella* out of 1850 stool samples during 3 years (14.05%). Shigella specimens presented a high resistance rate to trimethoprim-sulfamethoxazole (73.84%) and ampicillin (73.84%), and low resistance rate to Ciprofluxacine (2.69%) and cefotaxim (2.69%). *S. flexneri* (70%) was most frequently isolated, followed by *S. Sonnei* (30 %). No cases of *S. boydii* and *S. dysenteriae* were found.

Conclusion: Our results provide data on antimicrobial resistance to choose a proper antibiotic for Shigellosis in our community. According to our findings cefotaxime for pediatric patients and quinolone derivatives for adult patients are the proper drug choices. Systematic monitoring is needed to identify changes in prevalence and antimicrobial resistance pattern.

Key Words: Shigella, Prevalence, Antimicrobial resistance, Children, Diarrhea

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Introduction

Knowledge of local patterns of resistance is essential to optimize guidelines for empirical antimicrobial treatment. Awareness of susceptibility patterns in other parts of the world may be important for determining empirical antimicrobial therapy for diarrhea patients[1].

Shigella is one of the most important causes of gastroenteritis and death of 3-5 millions of children under the age of 5 years in developing countries[2,3,4]. Ingestion of even 100 microorganisms leads after 4-7 days to an acute diarrhea. Because of delay in humoral responses, complication and mortality rate due to shigellosis in children is higher than in other age groups[5,6]. Early diagnosis and drug therapy in children is imperative because of high tendency for occurrence of complications[2]. According to WHO report, antimicrobial resistance pattern for *shigella* varies in different parts of the world and with the time[6]. This microorganism may also be able to show antibacterial resistance during the course of the drug therapy[7].

The predominant *shigella* strains isolated in Karaj, Iran, was *shigella flexeneri* and the least common antimicrobial resistance belonged to Nalidixic acid[8]. In Kashan, Iran, the most sensitive antibacterial agent for *shigella* was ciprofloxacin[9]. *Shigella* strains isolated from stool samples of children in Mofid hospital in Tehran were resistant to co-trimoxazol (98.5%) and ampicillin (84.6%). Only 10% were resistant to Nalidixic acid[10].

The most prevalent *shigella* strain in a Turkish study was *shigella sonnei*. Seventy nine percent of isolated strains were resistant to streptomycin, 56% to tetracyclin and 55.7% to trimethoprim-sulfamethaxazol. None of the isolateds was resistant to ciprofloxacin, nalidixic acid, cephazolin or ceftriaxon[11].

Of 4688 stool samples cultured in Karachi, Pakistan, 193 (4.1%) were positive for *shigella* species. *Shigella flexeneri* was the predominant serogroup followed by *shigella sonnei*. All isolateds were susceptible to ofloxacin and ceftriaxon. High rates of resistance were observed for co-trimoxazol and ampicillin [12].

Material & Methods

This is a cross- sectional study, carried out on diarrhea patients admitted to Amirkola children's hospital affiliated to Babol University of Medical Sciences, North of Iran, from 2001-2004.

The study included all children older than six months with an acute diarrhea who were admitted to the hospital. Children with a history of chronic diarrhea, immunedificiency, malnutrition and chronic illness were excluded. Fresh stool was taken from all patients, and cultured on SS agar media (Kooshanfar Azar Giti KFG. Company, Iran).

Antibiotic sensitivity of isolated strains was identified with disk diffusion method using 15 different antibiotic disks. Capability to growth in the presence of bactricidal level of an antibiotic in media was considered being resistant. Resistance or sensitivity is defined according to the size of the inhibition made around the disks and it correlates with standard minimal inhibitory concentration (MIC) which is the lowest concentration that visibly inhibits bacterial growth to permit extrapolation from this simple test to the more complicated agar or broth dilution MIC test. For recognition of Shigella spices one drop of antisera of Shigella added to bacterial colony, which make agglutination after 2 minutes. We estimated a sample size of 1800 patients, if we consider d= 0.02, p= 0.1 and $\alpha = 0.05$.

Demographic data like age, sex, and place of residence (rural or urban) and the season of year were collected by a questionnaire. These data are analyzed by SPSS-I0 and the results expressed as relative frequencies.

Findings

From March 21, 2001 to March 21, 2004, 1850 pediatric patients (6 month - 12 years) were admitted because of diarrhea with moderate to sever dehydration. *Shigella* was grown on 260 out of 1850 stool cultures (14.5%).

One-hundred forty six patients (56.15%) were male and 114 (43.85%) female. One-

hundred eight (41.54%) came from rural area and 152 were urban. Most of the cases of shigellosis (57%) were admitted to the hospital in summer. Only 35 (13.46%) of the patients were infants.

The most common affected age group was 1-5 years and the least common affected age group was that of infants aged 2-11 months. *Shigella* species typing revealed 70% *S. flexeneri* and 30% *S. Sonnei*. Antimicrobial resistance pattern to the commonly used antibiotics for shigellosis is showed on table 1.

Discussion

The prevalence of Shigellosis among diarrhea patients in our hospital was 14.05%, which is higher than the rate reported for Karachi, Pakistan[12]. In another study the prevalence of shigellosis was increased from 5.8% to 16.8% for a period of 10 years in Karaj and Tehran, Iran[13]. Some studies from other parts of the world report similar findings. For example in Malaysia the prevalence of shigellosis was increased from 8.5% in 1992 to 13% in 2003[14].

The predominant species of Shigella in our study was *S. flexeneri*, followed by *S. sonnei*, which is the same predominant species in Pakistan[12]. The predominant species in other parts of Iran differ from our study for example in Shiraz the predominant specious was *S. Sonnei* followed by *S. flexeneri*[15]; in Tehran the predominant species reported was *S. Boiedi* followed by *S.Sonnei*[16]. The predominant species in most parts of the world is *S. Sonnei* followed by *S. flexeneri*[17,18]; in Nepal it was reported to be *S. Dysentriae* followed by *S. flexeneri*[19].

Most of our patients came from rural area and the prevalence of antibacterial resistance in these patients was higher than the in the urban areas. In rural patients, recurrent disease may be related to low hygienic behavior, cultural and economical reason and also the unavailability of clean water.

In our study, like in other studies, the seasonal tendency of shigellosis was summer[17,19]. The prevalence of antimicrobial

Table 1: Bacterial resistance pattern of Shigella for commonly used antibiotics- Amirkola children's hospital

Antibiotics	*Bacterial resistance (%)*
Co-trimoxazol	192 (73.8)
Tetracycline	192 (73.8)
Ampicillin	78 (30.0)
Kanamycin	54 (20.8)
Ceftriaxone	47 (18.1)
Cefazoline	38 (14.6)
Nalidixic acid	32 (12.3)
Chloramphenicol	32 (12.3)
Cephalotin	23 (8.8)
Toberomycine	23 (8.8)
Ceftizoxime	7 (2.7)
Ceftazidime	7 (2.7)
Gentamycin	7 (2.7)
Ciprofluxacine	7 (2.7)
Cefotaxime	7 (2.7)

resistance according to the season of occurrence for summer; autumn and spring were 87%, 73% and 22% respectively. The increase in the prevalence of disease and also the antimicrobial resistance in summer may be due to increase in the entrance of travelers and the emergence of new resistant species in our area[19,20]. The susceptible age group in our study, like in other studies, was age 1-5 years; 6-11 month-old infants were the least common affected age group. This may be due to the breast-feeding which plays the crucial role for protection against gastrointestinal infections[21,22].

The pattern of antimicrobial resistance in our study was mostly a multidrug resistance. This is similar to other studies[7,23].The most common antibacterial resistance was observed for trimetoprim-sulfamethaxazol, tetracycline and ampicillin. Similar patterns of resistance were reported from Chile, Pakistan, Turkey, India and Nepal[11,18,19,24].

Some of these studies used tube dilution method for determining bacterial resistance whereas we have used disk diffusion method. Ceftizoxime, ceftazidime, gentamicin, ciprofloxacine and cefotaxime were the least common antimicrobial resistant agents. In a recent study Alici and colleagues did not report any resistance to ciprofloxacine for *Shigella*[19]. Fulla and colleagues also reported no resistance to ciprofloxacine, Cefotaxime and Nalidixic acid[24]. This drug was recommended as a drug of choice for treatment of shigellosis in France[5].

Conclusion

According to our finding Cefotaxim for pediatric patients and quinolones derivatives for adult patient are the proper choices.

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