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ORIGINAL ARTICLE

Prevalence of urinary tract pathogens and antimicrobial susceptibility patterns in children at hospitals in Iran

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ABSTRACT

Background: Urinary tract infections (UTIs) are one of the most frequent bacterial infections in children. Most commonly, members of Enterobacteriacea, particularly uropathogenic strains of E. coli and Enterobacter spp. are the primary causative organisms of UTIs in different parts of the world.

Patients and methods: A total of 55 hospitals from 12 provinces in Iran participated in this study. 1696 children with UTI aged 0 to 5 years referred to these hospitals were included in this study. Urine cultures were carried out and the isolates were identified by gram staining and conventional biochemical methods. Antimicrobial susceptibility testing was performed by disk diffusion method according to the current National Committee for Clinical Laboratory Standards (NCCLS) guidelines.

Results: In general 438 urine isolates were obtained. E. coli was the most frequently occurring pathogen (54.80%), followed by Klebsiella pneumoniae (16.0%), coagulase negative Staphylococci (11.2%), Enterobacter spp. (9.6%), Proteus spp. 1.4% and P. aeruginosa (1.4%). Resistance rates of E. coli isolates were 85.9% to co-trimoxazole, 80.0% to penicillin, 77.0% to ampicillin, 68.0% to chloramphenicol, 12.9% to ciprofloxacin, 12.9% to ceftriaxone, 12.9% to cephalotin, and 14.0% to amikacin. K. pneumoniae isolates were 18.5%, 20.0%, 24.0% and 29.0% resistant to cephalothin, ceftriaxone, amikacin and gentamicin respectively; however, penicillin (88.5%), co-trimoxazole (74.2%), and ampicillin (68.5%) were the least effective drugs.

Conclusion: High prevalence of drug-resistant urinary tract pathogens, particularly to ampicillin and co-trimoxazole among Iranian children suggests cautious use of antibiotic therapy for the treatment. Finally, we suggest that empirical antibiotic selection should be based on knowledge of the local prevalence of bacterial organisms and antibiotic sensitivities rather than on universal guidelines.

Keywords: *Urinary tract infection, Antimicrobial susceptibility pattern*
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INTRODUCTION

Urinary tract infections (UTIs) are one of the most frequent infections in children. At least 8% of girls and 2% of boys will have a urinary tract infection (UTI) in childhood, and between 30% and 40% will have another episode within two years (1,2).

Several studies has demonstrated that the geographical variability of pathogen occurrence in

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cases of UTI among inpatients and outpatients populations is limited by the predominance of gram-negative species usually Enterobactericeae and particularly E. coli and Enterobacter spp. in various regions of the world (3,4).

However, Pseudomonas aeruginosa and Enterococcous spp. are usually ranked among the top five pathogens and the resistance patterns of these pathogens can vary significantly between hospitals, countries and continents (4,5).

Antimicrobial resistance among urinary tract isolates has recently been reported with an increased frequency all over the world (6-9). Several studies in Iran (10,11) also have reported that the incidence of UTI has been increasing recently and its treatment has become more complicated because of the emergence of pathogens with increasing resistance to antimicrobial agents.

It is necessary to identify the causative agent and spectrum of its antimicrobial susceptibilities in order to treat UTI. Since this spectrum may vary among geographical locations, hospitals and also in different age groups, each institution should carefully plan their antibiotic therapy.

Unfortunately, little has been published regarding Iranian scenario of the range and antimicrobial susceptibility patterns in urinary tract pathogens particularly among children.

This study was performed to find out the frequency of different urinary tract pathogens in children of age group 0 to 5 years and the antimicrobial susceptibility profiles.

PATIENTS and METHODS

A total of 1696 urine specimens from children aged 0 to 5 years with UTI were collected at 55 hospitals from 12 provinces representing different geographical areas in Iran between July and August 2006 (fig. 1). The following cases were excluded: previous history of urinary infection, known urinary malformations (according to prenatal ultrasound and previous medical records), chronic illness, or current prophylactic treatment with antibiotics.

All urine samples were obtained by midstream clean-catch, catheterization or from urine bags. These samples were processed on blood agar and MacConkey media with a standard loop and were incubated at 37 °C overnight. Significant growth was determined as $\geq 10^5$ colony-forming units (CFU)/mL of midstream urine and bag urine samples, and $\geq 10^2$ CFU/mL of a catheter specimen (12).

Isolates were identified by Gram staining and conventional biochemical methods (12). Antimicrobial susceptibility testing by disc diffusion was carried out according to the Clinical and Laboratory Standard Institute guidelines (13) using the following antibiotics: oxacillin, penicillin, erythromycin, ciprofloxacin, ceftriaxone, co-trimoxazole, gentamicin, cefalotin, vancomycin, amikacin, cephradine, and ampicillin. Data management and statistical analysis were performed using SPSS software.

RESULTS

There were 867(51.9%) boys and 805 (48.1%) girls giving a total of 1669 children who enrolled in this study. Their age ranged from 0 to 5 years. The age distribution is showed in table 1.

Table 1. Prevalence of UTI in different age groups

Age Group (months)	UTI Positive	UTI Negative
Up to 1 (n=68)	14 (20.6%)	54 (79.4%)
>1- 12 (n=734)	300 (40.9%)	434 (59.1%)
> 12 - 36 (n=590)	101 (17.1%)	489 (82.9%)
> 36 - 60 (n=304)	23 (7.6%)	281 (92.4%)
Total (n=1696)	438	1258

The male to female ratio was 1.07:1. Occurrence of bacterial urinary tract infections was highest in the age group one month to 1 year (40.9%) and the lowest in the age > 36 to 60 months (7.6%).

Eight different types of pathogens were isolated form the urine samples. The frequency of pathogens and the ranking order among the most prevalent pathogens is shown in table 2.

Table 2. Prevalence of pathogens isolated on urine culture

Pathogen	No. of isolates
E. coli	240 (54.8%)
K. pneumoniae	70 (16%)
Coagulase negative Staphylococcus	50 (11.2%)
Enterobacter spp	42 (9.6%)
Proteus spp	20 (4.6%)
S. aureus	6.0 (1.4%)
Pseudomonas aeruginosa	6.0 (1.4%)
Candida spp	4.0 (1%)
Total	438 (100%)

Escherichia coli, which comprised 54.8% (240) of the isolates, showed high resistance to cotrimoxazole, (85.9%), penicillin (80%), ampicillin (77%). Klebsiella pneumoniae was resistant to penicillin in 88.5%, to ampicillin in 68.5%, and to co-trimoxazole in 74.2% of cases.

Among gram-positive isolates, Coagulase negative Staphylococcus comprised 11.2% of all isolates followed by Staphylococcus aureus (1.4%) showed 80% and 66.7 % resistance to ampicillin respectively, but highly sensitive to Vancomycin (table 3).

DISCUSSION

Urinary tract infection in children is a significant source of morbidity. It is generally agreed that children with UTI require further investigation and continuing urinary surveillance to minimize future complications.

Escherichia coli is the most common cause of urinary tract infection (14). Other microorganisms include Klebsiella spp., Enterobacter spp., Serratia sp., Pseudomonas aeruginosa and other Pseudomonas spp., Enterococci, Staphylococcus saprophytics, Staphylococcus aureus, Staphylococcus epidermidis, Acinetobacter spp., and Streptococci spp. (15-17). Our findings are consistent with these reports.

Gram-positive organisms have received more attention recently as a cause for bacteriuria and urinary tract infection. Coagulase negative Staphylococcus, Streptococci and Enterococci are seen in small numbers but they are recognized as important causes of urinary tract infection (18, 19).

Table 3. Frequency of in vitro antimicrobial resistance spectrum of pathogens isolated from urine cultures at various hospitals in Iran*

	P. aeruginosa	E. coli	K. pneumoniae	CoNS	Enterobacter spp	Proteus spp	S. aureus
Penicillin	89	80	89	71	89	91	78
Ampicillin	93	77	69	80	69	79	70
Oxacillin	ND	ND	ND	58	ND	ND	34
Vancomycin	64	70	58	18	ND	ND	28
Gentamicin	52	37	29	68	12	71	75
Ciprofloxacin	25	12	ND	61	ND	ND	65
Amikacin	33	14	24	ND	ND	25	ND
Co-trimoxazole	70	85.9	74	ND	80	79	ND
Chloramphenicol	71	68	71	59	68	71	59
Ceftriaxone	56	13	20	45	46	ND	ND
Cephalotin	21	13	19	ND	ND	11	27

* % of isolates resistant to antimicrobial agents

We reported the occurrence rate of coagulase negative Staphylococcus to be 11.2%.

Increasing antibiotic resistance among urinary tract isolates (mostly against ampicillin) has been reported from many countries. The resistance rates to ampicillin were found to be 45%, 50% and 100% in children from Canada, Europe and Africa, respectively (20-23). In our study, the frequency of resistance to ampicillin of UTI isolates was 74.2%. This finding is similar to other reports (24,25).

The Results of the present study indicate a high incidence of microbial resistance to ampicillin and co-trimaxzole in urinary tract infections among Iranian children and suggest the physicians to be cautious about treatment with antibiotics.

Regular monitoring is required to establish reliable information about resistance pattern of urinary pathogens for optimal empirical therapy of patients with UTIs. Finally, we suggest that empirical antibiotic selection should be based on the knowledge of local prevalence of bacterial organisms and antibiotic sensitivities rather than on universal guidelines.

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