ANTIBACTERIAL SUSCEPTIBILITY IN URINARY TRACT INFECTION AMONG CHILDREN IN SULAIMANI

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ABSTRACT

Background

Urinary tract infection is a common infection among children with recognized pathogens that can have different susceptibility to antibacterial agents in different communities. It is recognized as a cause of acute morbidity and chronic medical conditions.

Objectives

The aim of this study was to identify the causative agents in pediatric urinary tract infection as well as the antimicrobial susceptibility of the isolated microorganisms.

Patients and Methods

A prospective study involved 86 pediatric patients suspected to have urinary tract infection. Physical examination and ultrasonographic examination were carried out. Urine samples were cultured, examined, and antimicrobial susceptibility was performed on bacterial isolates according to Kirby Bauer disk diffusion method.

Results

Pyuria was found in 60 (70 %) of the urine samples. Twenty nine (39%) samples yielded a positive culture while 31 (61%) of pyuria samples yielded no growth. Seven (19%) urine samples showed no pyuria but yielded a positive culture. The most frequently isolated bacteria were *Escherichia coli* followed by *Proteus mirabilis*, and *Klebsiella pneumoniae*. All *E. coli* isolates were susceptible to nitrofurantoin while 22 (95.6%) isolates out of 23 were susceptible to Amikacin and 78% of *E. coli* were susceptible to ceftriaxone, cefixime and ciprofloxacin. *E. coli* isolates were highly resistant to cotrimoxazole and amoxicillin.

Conclusion

Pediatric urinary tract infections are more common in females than males in all age groups and affect more preschool age group. Common uropathogens were *E. coli* which were commonly resistant to many commonly used antibiotics such as cotrimoxazole and amoxicillin, but were highly sensitive to nitrofurantoin and amikacin.

Keywords: *Urinary tract infection, Children, Antibacterial susceptibility, Sulaimani.*

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INTRODUCTION

Urinary tract infection (UTI) is a common infection in pediatric population; it is recognized as a cause of acute morbidity and chronic medical conditions, such as hypertension and renal insufficiency [1]. Approximately 5% of girls and 1% of boys have an attack of UTI by the age of 11 [2]. After the first UTI, 60-80% of girls will develop a second UTI within 18 months. The prevalence of UTIs varies with age; during the first year of life, the male: female ratio is 2.8-5.4:1 while beyond 1-2 years, there is a striking female preponderance, with a male: female ratio of 1:10[3].

The majority of UTIs in the pediatric age group are caused by *Escherichia coli*, which accounts for 90% of infections. Other gram-negative organisms associated with UTI are *Proteus*, *Klebsiella*, *Enterobacter*, and *Pseudomonas*. Gram-positive organisms are occasionally encountered in UTI infection such as *Enterococcus* and group B *Streptococcus* in the neonatal period. Viral infections, particularly adenovirus, may also occur, especially as a cause of cystitis [3].

UTI occurs when ascending pathogens adhere to the mucosa of the urinary tract, colonize, and potentially multiply and overcome the normal defences of the urinary system [4]. Ninety percent of nephritogenic *E. coli* possess P-fimbriae, which facilitates adherence to uroepithelial cells via cell surface receptors, such as the disaccharide α-Gal (1→ 4) β-Gal (gal-gal) receptor [2]. Newborn and infants with UTI may be asymptomatic or have vague and nonspecific signs including fever, hypothermia, jaundice, poor feeding, irritability, vomiting, failure to thrive, and sepsis [5, 6]. Symptoms of UTI in older children may include fever, urinary symptoms (dysuria, urgency, frequency, incontinence, or hematuria), and abdominal pain, while the presence of fever, chills, and flank pain were suggestive of pyelonephritis [7].

The aim of this study was to identify the causative agents of UTI in pediatric age groups as well as the antimicrobial susceptibility profile of the isolated microorganisms.

PATIENTS AND METHODS

This prospective study conducted over 4 months; from August 2010 till December 2010. It involved pediatric patients suspected to have UTI admitted to Sulaimani Teaching Paediatric hospital. Suggestive symptoms of UTI were dysuria, urgency, frequency, incontinence, hematuria, abdominal pain and back pain. Non specific symptoms were presented like fever, conjugated hyperbilirubinemia (neonate <28 days old), irritability, poor feeding and failure to thrive. Inclusion criteria of the study were; age of less than 15 years, not receiving antibiotics in the past 72 hours, no other detectable source of infection, suggestive signs and symptoms of either upper or lower urinary tract infection and non-contaminated samples of urine.

Detailed physical examination was performed; ultrasonographic examination for urinary tract was carried out. Midstream urine was collected in sterile containers under aseptic techniques, and in young children and infants suprapubic aspiration samples were obtained [8]. Urine samples were cultivated using calibrated loop method, different culture media were used including the MacConkey agar and blood agar (HIMEDIA ®, India). Inoculates were incubated at 37 °C for 24 hours, if no growth appeared they were further incubated for another 24 hours before regarding it as negative culture. General urine examination was also performed on urine samples [9] and the presence of more than 10 pus cells per high power field (hpf) was considered pyuria positive [10].

Identification of bacteria was done based on colonial morphology, Gram staining, biochemical features and bacterial profile using API 20 E system (biomeireux. France). Antimicrobial susceptibility performed according to Kirby Bauer disk diffusion methods [11] using nine antimicrobial agents (Bioanalyse ®, Turkey); amikacin 30 mcg/disc, amoxicillin 25 mcg/disc, ciprofloxacin 5 mcg/disc, ceftriaxone 30 mcg/disc, cefixime 5 mcg/disc, nitrofurantoin300 mcg/disc, nalidixic acid 30 mcg/disc, gentamicin 10 mcg/disc, and trimethoprim/ sulphamethoxazole (cotrimoxazole), 1.25/23.75 mcg/discs.

RESULTS

A total of 86 children were included in this cross sectional study based on suspicion of urinary tract infection; of these 22 (26%) were males and 64 (74%) were females. The ages of the participants ranged from infant less than one year to 15 years. Microscopic urine examination showing pyuria (more than 10 pus cells/hpf) was found in 60 (70 %) of the urine samples. Among these 29 (39%) samples yielded a positive culture while 31 (61%) of pyuria samples yielded no growth. Seven (19%) urine samples although showed no pyuria but yielded a positive culture, Table 1.

Concerning the age of the patients, in the infant age group 4/18(22%) cases were culture positive (1 male and 3 females) and in 1-6 years age group 14/33 (42%) cases (all of them females) were culture positive and in the 7-15 age group 18/35 (51%) cases were culture positive and were female also, Table 2.

Out of the 86 patients, urine from 36 (42%) of patients resulted in a positive culture of bacterial agents, of these two third of the isolates (23, 64%) were due to *E. coli*, 4 (11%) isolates of *Proteus mirabilis*, 3 (8%) of *Klebsiella pneumoniae*, 2 (5%) of *Staphylococcus saprophyticus* and the remaining four isolates were for each *Burkhuldria cepacia*, *Pseudomonas aeruginosa*, *Citrobactor koseri*, and *Enterococcus* spp., Figure 1.

The antimicrobial susceptibility test showed that all *E. coli* isolates (100%) were susceptible to nitrofurantoin while 22 (95.6%) isolates out of 23 were susceptible to amikacin and 78% of *E. coli* were susceptible to ceftriaxone, cefixime and ciprofloxacin. *E. coli* showed less susceptibility to gentamicin, while it showed more resistance to other agents, Table 3. The overall response of the microorganisms showed that Amikacin was effective in most isolates followed by nitrofurantoin and ciprofloxacin.

Table 1. Pyuria among cultures positive (n=36) and culture negative (n=50) urine from the participants.

Culture results	Pyuria	
	Positive No. (%)	Negative No. (%)
Positive culture	29/36 (81)	7/36 (19)
Negative culture	31/50 (62)	19/50 (38)

Table 2. Number and percentage of culture positive and culture negative according to the age groups.

Age (years)	Positive culture		Negative culture		Total	
	Male No. (%)	Female No. (%)	Male No. (%)	Female No. (%)	Male No. (%)	Female No. (%)
< 1	1(25)	3(75)	6(43)	8(57)	7(39)	11(61)
1-6	0(0)	14(100)	5 (26)	14(74)	5 (15)	28(85)
7-17	0(0)	18(100)	10 (49)	7(59)	10(29)	25(71)
Total	1 (1.1)	35 (40.69)	21(24.4)	29 (33.72)	22 (25)	64 (75)

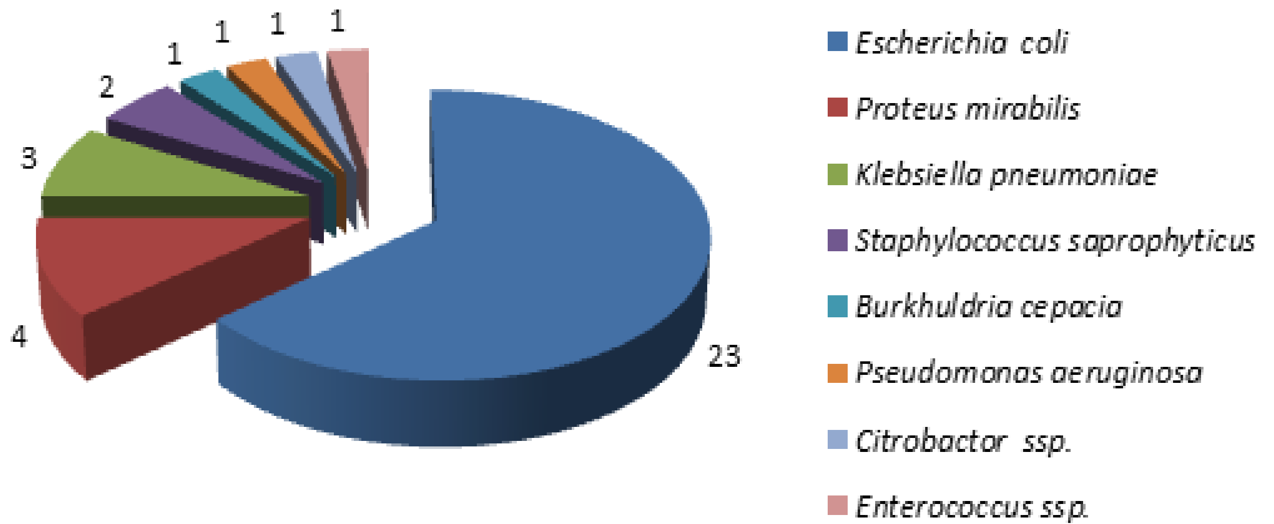

Figure 1. Number of the causative bacterial agents in urinary tract infection among the 36 positive culture samples.

Table 3. Antimicrobial susceptibility response of isolated microorganisms from urine samples.

		Isolated Bacteria							
		E. coli	*P. mirabilis*	*K. pneumoniae*	*S. saprophyticus*	*B.cepacia*	*P. aeruginosa*	*Citrobactor spp.*	*Enter. ssp.*
Total isolates		23	4	3	2	1	1	1	1
Amikacin	S	22	3	1	1	1	1	1	1
	R	1	1	2	1	0	0	0	0
Amoxicillin	S	3	1	1	1	1	0	1	1
	R	20	3	2	1	0	1	0	0
Cefixime	S	18	1	1	1	0	1	1	0
	R	5	3	2	1	1	0	0	1
Ceftriaxone	S	18	3	2	1	0	0	1	0
	R	5	1	1	1	1	1	0	1
Ciprofloxacin	S	18	3	3	1	1	1	1	1
	R	5	1	0	1	0	1	0	0
Gentamicin	S	17	3	2	1	1	0	1	0
	R	6	1	1	1	0	1	0	1
Nalidixic acid	S	11	2	2	1	0	0	0	0
	R	12	2	1	1	1	1	1	1
Nitrofurantoin	S	23	2	2	2	1	0	0	0
	R	0	2	1	0	0	1	1	1
	S	6	0	1	1	0	1	0	0

DISCUSSION

Urinary tract infections are associated with several clinical and laboratory features [5]. In this study pyuria was found in 81% of culture positive urine samples but 62 % culture negative urine samples also showed pyuria of more than 10 pus cells/hpf indicating a none statistically significant relation. As recommended pyuria alone may not indicate the presence of UTI; both Gram stain and dipstick analysis for nitrite and leukocyte esterase perform similarly in detecting UTI in children and are superior to microscopic analysis for pyuria [12, 13].

Usually, fewer than five leukocytes per hpf are found in normal urine; however, higher numbers may be present in urine from females. Leukocytes, like RBCs, may enter the urine through glomerular or capillary trauma; they are also capable of ameboid migration through the tissues to sites of infection or inflammation. An increase in urinary leukocytes (pyuria) indicates the presence of an infection or inflammation in the genitourinary system. Bacterial infections, including pyelonephritis, cystitis, prostatitis, and urethritis, are frequent causes of pyuria. However, pyuria is also present in nonbacterial disorders, such as glomerulonephritis, lupus erythematosus, interstitial nephritis, and tumors. Reporting the presence of bacteria in specimens containing leukocytes is important [14]. Although in diagnosis of UTI, pyuria > 10 wbc/hpf was significantly more specific (82:66.6) than the conventional > 5 wbc/hpf [10], in this study pyuria of 10 pus cells/hpf gave no accurate marker for UTI.

The study showed that the occurrence of UTI in pediatric patients varies widely by age and gender. UTI was more common in females (97%) than males (3%) in all age groups even in infants and this is similar to the study done in Iraq [15] and a study from Pakistan [16]. This is explained by female genitourinary anatomy especially shorter urethra which predisposes them to UTI more than males from intestinal bacteria flora. The study had shown that UTI is more common in preschool age group compared to those above 6 years. Similar results were obtained by other authors [15, 17]. This may be explained by the presence of many risk factors for UTI in preschool children like constipation, encopresis, bladder instability, and infrequent voiding, bathing and back-to-front wiping.

The commonest uropathogens isolated in this study were *E. coli* (64%), followed by *Proteus mirabilis* (11%) and *Klebsiella pneumoniae* (8%). This is close to the result of study done in India [17] in which *E. coli* (47.1%), and *Klebsiella pneumoniae* (14.5%), were common pathogens; also it is close to the results of an Iraqi study [15] where *E. coli* (61.3%), *Proteus* spp. (23.6%), and *Klebsiella pneumoniae* (8%) were found to be common pathogens.

The least common uropathogens identified in our study were *Staphylococcus saprophyticus*, *Burkhuldria cepacia*, *Pseudomonas aeruginosa*, *Citrobactor* spp. (3%), and *Enterococcus* ssp. (3%). This is in agreement with previous studies in Iraq by Aboud M J and that of Chan Sui Po in Hong Kong [15, 18].

The study revealed that the most effective antibiotic for *E coli* was nitrofurantoin followed by amikacin, ceftriaxone, cefixime, ciprofloxacin and gentamicin with the values sensitivity of 100%, 96%, 78%, 78%, 78% and 74% respectively and the least effective drugs for *E coli* were amoxicillin followed by cotrimoxazole and nalidixic acid with resistance values for *E. coli* about 87%, 74% and 52% respectively. This result is in agreement with previous studies [16, 18]. This may indicate the wide spread and irrational use of such agent, especially in our community leading to the development of resistance.

In conclusion, pediatric UTI is more common in females than males in all age groups and affect more preschool children. Common uropathogens were *E. coli* which were resistant to many commonly used antibiotics such as cotrimoxazole and amoxicillin, but were highly sensitive to nitrofurantoin and amikacin.

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