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Original Article

Epidemiology of Urinary Tract Infections in The Preschool Children in Zagazig University Hospital

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Abstract

Background

Urinary Tract Infection is one of the most common bacterial infections among children.. It is noted that the risk of renal damage from Urinary Tract Infection is greatest in children younger than 5 years, thus early diagnosis and prompt treatment are important.

Aim of Work

The aim of this study was to assess the prevalence of urinary tract infection in children attending Pediatric outpatient clinic in Zagazig University Children's Hospital. Also it aimed to determine, related risk factors, isolate the organisms that cause Urinary Tract Infection in children and antibiotics susceptibility patterns

Patients and Methods

This Cross sectional descriptive study, was conducted on 600 children, (377 males and 223 females) from 2 to 7 years old attending to pediatric outpatient clinic Zagazig University Children's Hospital, All patient groups were subjected to full medical history, physical examination, Dipstick analysis by using both nitrite and leukocyte esterase detector, Microscopic examinations and urine culture for positive cases.

Results

The prevalence of Urinary Tract Infection among children included in the current study was (7%). Leukocyte esterase positive were 56 (9.3%), Nitrite positive were 47 (7.8%) and both Leukocyte esterase and Nitrite positive were 17 (2.8%).

Conclusion

The prevalence of Urinary Tract Infection in our study was 7%. Escherichia Coli was the most common organism. Cefotaxime and Amikacin were the most common antibiotic sensitive to the isolates.

Keywords

Urinary tract infections, urine culture, nitrite and leukocyte esterase.

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Introduction

Urinary Tract Infection (UTI) is one of the most common bacterial infections among children [1]. Approximately, 2% of boys and 8% of girls are affected at the age of 7 years old [2]. Urinary tract infection in children is significant source of morbidity. It is noted that the risk of renal damage from UTI is greatest in children younger than 5 years, thus early diagnosis and prompt treatment are important [3]. Factors predispose children to UTI include congenital and functional Abnormalities. Accurate diagnosis is important to ensure adequate therapy and proper follow up is essential to prevent future complication [4]. Seeking laboratory confirmation of diagnosis requires the initial stage of collecting an uncontaminated urine sample and this is a challenge in infants and children who are not toilet trained [5]. Use of dipstick test decrease

Patients and Method

This Cross sectional descriptive study was conducted from February to July 2017 at outpatient clinic, at Zagazig University Children's Hospital. This study was carried out on 600 children, (377 males and 223 females) from 2 to 7 years old attending to pediatric outpatient clinic.

Inclusion criteria

Children were selected in random way considered legible for entry into the study as they met the following criteria:

- Age from 2 - 7 years old.
- Live in Sharkia Governorate and Attended to Pediatric outpatient clinic in Zagazig University Children's Hospital.

Exclusion criteria

- Age below 2 years old and above 7 years old.
- A child with a catheter associated UTI.
- A child diagnosed with congenital anomalies.
- Previous surgery of the genitourinary tract (except circumcision in male children).
- A child with history of chronic renal diseases and Presence of an immunocompromising condition. (e.g., HIV, malignancy, use of chronic corticosteroids or other immunosuppressive agents).

Explanation of the purpose of the study to the parents was done.

Methods All the children included in the study were subjected to the following:

- 1- Detailed history taking with special focus on the presence of urological manifestations (dysuria, loin pain, frequency, supra-pubic pain, change of the colour of urine, enuresis), treatment with certain drugs for long

Results

The prevalence of UTI among children included in the current study was (7%) (Table 1 and Figure 1). Results of the current study show that Children with dipstick LE positive were 56 (9.3%), Nitrite positive were 47 (7.8%) and both LE and Nitrite positive were 17 (2.8%). LE sensitivity is (73.8%), specificity (95.5%), negative predictive value (98%), positive predictive value (55.4%) and overall accuracy (94%). Nitrite sensitivity is (66.7%),

patient's time and money, and may also help in earlier initiation of treatment. Although culture is a gold standard for diagnosis of UTI, it has some disadvantages. Urine culture taken at least 48 hours, well equipped laboratory and trained staff give a reliable result. Whereas dipstick tests have the advantage of being rapid and easy to carry out and can be performed in small laboratories by laboratory technicians [6]. Using prevalence rates as an estimate of the prior probability of disease is the first step in evidence-based practice. In children with low pretest probability of disease, routine diagnostic testing is not necessary. In contrast, in children with high pretest probability of disease, routine diagnostic testing would be appropriate [7].

period, past history of renal diseases or family history of renal diseases. Full

- 2- Clinical examination: With special focus on weight, height and abdominal examination for renal mass or fullness of renal angles.
- 3- Urine samples from children :Collected by midstream clean catch urine sample in sterile cups then then Complete urine analysis were done on this urine specimens by Microscopic examinations where centrifuged urine was examined microscopically for pus cells, WBCs and RBCs morphology. Dipsticks analysis was done by using both esterase and nitrate detectors.
- 4- Urine culture was done for positive cases.

Statistical Analysis

All data were collected, tabulated and statistically analyzed using SPSS 20.0 for windows (SPSS Inc., Chicago, IL, USA) and MedCalc 13 for windows (MedCalc Software bvba, Ostend, Belgium). Quantitative data were expressed as the mean \pm SD & range, and qualitative data were expressed as absolute frequencies (number) & relative frequencies (percentage). Continuous data were checked for normality by using Shapiro Walk test. Percent of categorical variables were compared using Chi-square test or Fisher's exact test when appropriate. Validity of multi-stick test in diagnosis of UTI was calculated using diagnostic performance depend on sample 2x2 contingency tables generation using urine culture as gold standard reference. Sensitivity, specificity, positive predictive value, negative predictive value, accuracy were calculated. All tests were two sided. $P < 0.05$ was considered statistically significant (S), $p < 0.001$ was considered highly statistically significant (HS), and $p \geq 0.05$ was considered non statistically significant (NS).

specificity (96.6%), negative predictive value (97.5%), positive predictive value (59.6%) and overall accuracy (94.5%).

Both Leukocyte esterase (LE) and nitrite sensitivity is (40.5%), specificity (100%), negative predictive value (95.7%), positive predictive value (100%) and overall accuracy (95.8%). Risk factors of UTI in children in our study were uncircumcised males,

prolonged use of antibiotics, family history of UTI, recurrent UTI, enuresis, and constipation. Escherichia Coli was the most common organism that cause UTI in children

in our study .Cefotaxime and Amikacin were the most common antibiotic sensitive to the isolate.

Table 1 : Prevalence of UTI

UTI	All studied sample (N=600)	
	No.	%
Positive	42	7%
Negative	558	93%



Figure 1: Prevalence of UTI

Discussion

This study was an attempt to determine the prevalence of urinary tract infection, microbial pathogens implicated in urinary tract infection and their antibiotic susceptibility patterns in children attended to pediatric outpatient clinic at Zagazig University Children's Hospital. The total number of children included in this study was 600 children from age 2-7 years, 377 child (62.8%) were males and 223 child (37.2%) were females, 179 child (29.8%) from urban areas and 421 child (70.2%) from rural areas.

This study shows that the prevalence of urinary tract infection in children attended to pediatric outpatient clinic at Zagazig University Children's Hospital was 42 (7%) child from 600 child included in this study. Similar to our results [8]. In Giza governorate in Egypt found that the Prevalence of UTI of 1000 apparently healthy school going children, 552 boys (55.2%) and 448 girls (44.8%), were enrolled in this cross sectional prevalence survey was 6% among school aged children.

In the study of Durmišević, et al. [9], in Bosnia and found that UTI was present 352 (6.5%) children, among those 114 (32.4%) were boys and 238 (67.6%) girls. In the study of Shaikh, N., et al. [7], the overall prevalence of UTI in older children (≤ 19 years) with or without fever is reported to be 7.8%. In the study of Akujobi, C., et al. [10], in Nnewi in Nigeria the prevalence of significant bacteriuria among pediatric patients attending Nnamdi Azikiwe University Teaching Hospital is 8%, this study showed that there was high incidence of UTI among the female gender (66.67%) than the male gender (33.33%).

Another study in Menoufiya Governorate in Egypt in study of Abdelhamid et al, [11], Out of 500 children 314

(62.8%) males and 186 (37.2%) females, the prevalence of UTIs among children aged 3-12 years attending to Pediatric Outpatient Clinic in Menoufia University Hospital was (4.8%). On the contrary to our study, Mahmoud., et al. 2016 [12], in Sohag governorate in Egypt where the prevalence of UTIs among primary school children from five primary schools in different parts of the Sohag Governorate, was 0.6% for the initial urinary screening and 0.5% for the second screening.

Results of the current study shows that there was statistically significant difference between males and females in relation to prevalence of UTI, where prevalence of UTI in females was 54.8% (23 females from 42 patients with UTI) while prevalence of UTI in males was 45.2% (19 males from 42 patients with UTI) ($P=0.014$), the highest number of cases (31%) was found among females in age group 5-7 years then among males (28.6%) in age group 2-4 years. Similar to our results, Mohammed., et al. [8] higher prevalence of UTI occurred in girls (11.4%) than boys (1.6%), with statistically significant difference between males and females in relation to prevalence of UTI. In the study of El-Shafie. et al [13], there was statistically significant difference between males and females in relation prevalence of UTI among the screened children, (Table 2).

Table 2: Relationship between sex and prevalence of UTI in the studied cases.

Sex	UTI				Total		Test ‡	p-value (Sig.)
	Negative UTI		Positive UTI					
	No.	%	No.	%	No.	%		
Female	200	35.8%	23	54.8%	223	37.2%	5.987	0.014 (S)
Male	358	64.2%	19	45.2%	377	62.8%		
Total	558	93%	42	7%	600	100%		

‡ Chi-square test.

P < 0.05 is significant.

Sig: significance.

This table shows that there was statistically significant difference between males and females in relation to prevalence of UTI, where the prevalence of UTI in female 54.8 %

(23 female from 42 one has UTI) while the prevalence of UTI in male 45.2% (19 male from 42 one has UTI) (P=0.014)

Results of the current study show statistically significant difference between risk factors as uncircumcised males, family history of UTI, recurrent UTI,

In the study of Sawalha [14], nocturnal enuresis was highly significant to prevalence of UTI (P = 0.035). In the study of Safarinejad [15], the overall prevalence of enuresis was 6.8% , the prevalence of urinary tract pathology was 2.9% among enuretics which indicates high association between UTI and nocturnal enuresis. In the study of Afridi, et al. [16], circumcised males appear to be at lower risk for developing UTI perhaps because of low perurethral and urethral bacterial inoculums, this may be due to the small number of males included in the study. In the study of Isa, M., et al [17] reported that there were

enuresis, and constipation in relation to prevalence of UTI, and statistical significant higher difference between prolonged use of antibiotic in relation to prevalence of UTI. statistically significant difference between bed wetting and UTI. However, the association between UTI and previous history of UTI was insignificant (P > 0.05) in the study of Hossain., et al [18], showed that female sex (P<0.05), constipation (P<0.001), not taking anthelmintic (P<0.001), lack of toilet training (P<0.001) and inadequate water intake (P<0.01) were significant risk factors for urinary tract infection in children , (Table 3).

Table 3: Risk factors for UTI in the studied population.

Risk factors		Total (N=600)		UTI				Test ‡	P-value (Sig.)
				Negative UTI (N=558)		Positive UTI (N=42)			
		No.	%	No.	%	No.	%		
Uncircumcised Males	Absent	594	99%	555	93.4%	39	6.6%	17.214	0.006 (S)
	Present	6	1%	3	50%	3	50%		
Prolonged use of antibiotics	Absent	579	96.5%	547	94.5%	32	5.5%	55.153	< 0.001 (HS)
	Present	21	3.5%	11	52.4%	10	47.6%		
Family history of UTI	Absent	595	99.2%	555	93.3%	40	6.7%	8.434	0.042 (S)
	Present	5	0.8%	3	60%	2	40%		
Recurrent UTI	Absent	586	97.7%	549	93.7%	37	6.3%	18.155	0.002 (S)
	Present	14	2.3%	9	64.3%	5	35.7%		
Enuresis	Absent	554	92.3%	521	94%	33	6%	12.083	0.003 (S)
	Present	46	7.7%	37	80.4%	9	19.6%		
Constipation	Absent	562	93.7%	526	93.6%	36	6.4%	4.814	0.041 (S)
	Present	38	6.3%	32	84.2%	6	15.8%		

‡ Chi-square test.

P < 0.05 is significant.

Sig: significance.

Results of the current study show that Children with dipstick LE positive were 56 (9.3%), nitrite positive were 47 (7.8%) and both LE & Nitrite positive were 17 (2.8%). LE sensitivity is (73.8%), specificity (95.5%), negative predictive value (98%), positive predictive value (55.4%) and overall accuracy (94%). Nitrite sensitivity is (66.7%), specificity (96.6%), negative predictive value (97.5%), positive predictive value (59.6%) and overall accuracy (94.5%). Both Leukocyte esterase (LE) and nitrite sensitivity is (40.5%), specificity (100%), negative predictive value (95.7%), positive predictive value (100%)

and overall accuracy (95.8%). Similar to our results, El-Shafie, et al. [13], found that the sensitivity of the dipstick was 82.6%, specificity was 98.9 %, positive predictive value was 79.1 % and negative predictive value was 99.1 %. So dipstick is a good negative test rather being a good positive test for detection of UTI. However, in the study of Najeeb., et al. [6], found that Combined sensitivity of LE and Nitrite was 75.74% while specificity was 68.90%. He concluded that urine dipstick test may be considered for rapid urinalysis to diagnose UTI, (Table 4 and Figure 2).

In the study of Laosu-angkoon [19], found that the sensitivity of leukocyte esterase test were 63.6% while the combined leukocyte esterase and nitrite test were 66.7%. He concluded that the dipstick test can be used as a diagnostic tool in detecting UTI cases in ER to prevent potential sequel like hypertension and renal scarring.

The study of Taneja, N., et al. [20], found that combined sensitivity of LE and Nitrite was 79.6%, while sensitivity and specificity of LE were 73.5%, 58.5% respectively and for Nitrite were 57.1%, 78.7% respectively. He concluded that for faster diagnosis of UTI,

dipstick tests for leukocyte esterase and nitrite test should be added in routine laboratory practices.

The study of Abdelhamid et al, [11], found that LE sensitivity is (85.8%), specificity (54.1%), positive predictive value (45.9%) and negative predictive value (91.2%). Nitrite sensitivity is (79.3%), specificity (66.3%), positive predictive value (73.9%) and negative predictive value (88.9%). Leukocyte esterase (LE) and nitrite sensitivity is (71.2%), specificity (100.00%), positive predictive value (100%) and negative predictive value (79.4%).

Table 4: Specificity and sensitivity of multi-stick method in relation to culture methods regarding UTI.

	Sensitivity	Specificity	NPV	PPV	Overall accuracy
LE	73.8%	95.5%	98%	55.4%	94%
Nitrite	66.7%	96.6%	97.5%	59.6%	94.5%
LE & Nitrite	40.5%	100%	95.7%	100%	95.8%

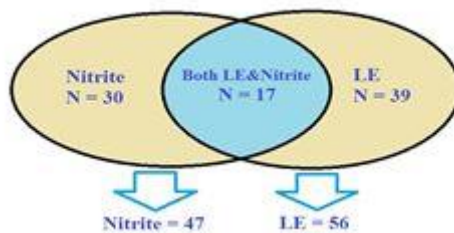


Figure 2: Results of dipstick tests in studied sample.

Results of the current study show that according to culture, the most common infecting organism was E.coli that represent (76.2%) followed by Klebsiella pneumonia (9.5%), Enterococcus Faecalis (7.1%), Proteus mirabilis (4.8 %) and coagulase -ve staphylococci in (2.4%), (Table 5 and Figure 2)

Similar to our results, Lehrasab, et al. [21], the most common organisms responsible for urinary tract infection (UTI) found were E Coli (47.6%) followed by Klebsiella (23.2%) and Proteus (10%), Staphylococcus was found in (7.3%) and Enterobacter in (7.3%) children, and rest (4.6%) were effected with other organisms.

The study of Abdelhamid et al, [11], shows that according to culture, the infecting organism was E.coli in (62.5%), Klebsiella in (12.5%), Enterococcus Faecalis in

(16.7%) and coagulase –ve staphylococci in (8.3%). In the study of Dada, E. and C. Aruwa [22], the predominant bacterial isolate was E. coli (56.8%), followed by S. aureus (18.9%), Klebsiella spp. (16.2%) and P. aeruginosa (8.1%).

In the study of Afridi, et al., [16], the most common urinary pathogens isolated were E.coli (63%), Klebsiella pneumoniae (8%) and Proteus mirabilis (8%). Other pathogens included Pseudomonas aeruginosa (7%), Staphylococcus aureus and Citrobacter 5% each and Enterobacter and Coliform 2% each. In study of El-Shafie, et al [13] the most common organism found in UTI cases culture was E coli (62 %), Enterococcus faecalis (17.3 %), Klebsiella pneumonia (10.3%), and Coagulase negative staphylococci(10.4 %).

Table 5: Infecting organisms in children with culture.

Infecting organisms	Positive Culture (N =42)	
	No.	%
E. coli	32	76.2%
Klebsiella pneumonia	4	9.5%
Enterococcus faecalis	3	7.1%
Proteus mirabilis	2	4.8%
Coagulase -ve staphylococci	1	2.4%

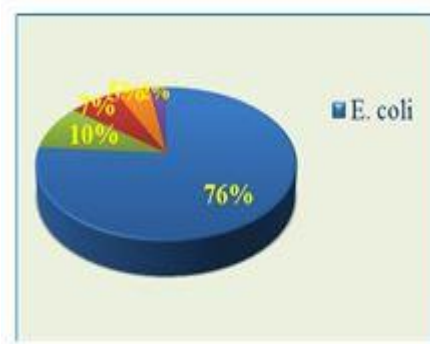


Figure 3: Infecting organisms in children with culture.

Results of the current study show that according to antibiotic sensitivity, 12 (28.6%) patients were sensitive to Cefotaxime, 11 (26.2%) were sensitive to Amikacin, 6 (14.3%) were sensitive to Amoxicillin and Clavulanic acid, 3 (7.1%) were sensitive to Ceftriaxone, 3 (7.1%) were sensitive to Co Trimoxazole, 3 (7.1%) were sensitive to Imipenem, 2 (4.8%) were sensitive to Ciprofloxacin and 2 (4.8%) were sensitive to Nitrofurantoin. Similar to our study of Abdelhamid et al, [11], shows that according to antibiotic sensitivity, (62.5%) patients were sensitive to cefotaxime, (25%) were sensitive to Amikacine and (12.5%) were sensitive to Amoxicillin and clavulanic acid, (Table 6 and Figure4).

In the study of Wu, T.-H., et al [23], the most common uropathogen in primary and recurrent UTIs is E. coli and

cefazolin is the drug of choice for treating such infections in children. In study of Afridi, et al.,[16], Sensitivity of different urinary isolated to Amikacin was highest (82%) followed by meropenem (75%), tazocin (61%) and Sulzone (58%). In the study of Sharma, A., et al. [24], most of the organisms were highly sensitive to Nitrofurantoin and Amikacin. Sensitivity to quinolones and third generation Cephalosporins varied according to the organism. E. coli was 100 % sensitive to Nitrofurantoin. E. coli was sensitive to ofloxacin, cefotaxim and amikacin in 94.4%, 94.7% and 94.7 %, respectively. E. coli was resistant to ampicillin in 91.6 %, cotrimoxazole in 66.6% and nalidixic acid in 63.6 %. Our study is small sample size, not cover large population but may help in meta analysis studies.

Table 6: Number and percentage distribution of antibiotic sensitivity.

Antibiotic sensitivity	Positive Culture (N=42)	
	No.	%
Cefotaxime	12	28.6%
Amikacin	11	26.2%
Amoxicillin/Clavulanic	6	14.3%
Ceftriaxone	3	7.1%
Co Trimoxazole	3	7.1%
Imipenem	3	7.1%
Ciprofloxacin	2	4.8%
Nitrofurantoin	2	4.8%

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Declaration

Ethics approval and consent to participate

This study protocol and the consents were approved and deemed sufficient by Ethical Committee of Pediatric Department, Faculty of Medicine, Zagazig University. And informed written consent was obtained in every case from their legal guardians.

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Conflict of interest

No

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