



## ORIGINAL ARTICLE

# EPIDEMIOLOGY OF URINARY TRACT INFECTIONS IN THE CHILDREN IN ZAGAZIG UNIVERSITY CHILDREN'S HOSPITAL

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## ABSTRACT

**Background:** The most common bacterial infection among children is Urinary Tract Infection (UTI). Early diagnosis and good treatment of UTI is very important as the risk of renal damage is increased in children below the age of five years which result of morbidity. The aim of this study was to estimate the prevalence of urinary tract infection (UTI) in children attending Pediatric outpatient clinic in Zagazig University Children's Hospital. Also to determine related risk factors, isolate the organisms that cause UTI in children and antibiotics susceptibility patterns. **Methods:** This Cross sectional descriptive study, was conducted on 600 children, (377 males and 223 females) from two to seven years old attending to pediatric outpatient clinic ZUH , All patient groups were exposed 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 UTI between children included in the current study was (7%). LE positive were 56 (9.3%), Nitrite positive were 47 (7.8%) and both LE and Nitrite positive were 17 (2.8%). **Conclusion:** The prevalence of UTI was 7 % in our study, E - Coli was detected to be the most common organism, Cefotaxime and Amikacin were detected to be the most common antibiotic sensitive to the isolates.

**Keywords:** Urinary tract infection, urine culture, nitrite and leukocyte esterase.

## INTRODUCTION

The most common bacterial infection between children is Urinary Tract Infection (UTI). [1].

It was found that Eight percent of girls and two percent of boys are affected UTI by the age of 7 years according to recent studies[2].

Early diagnosis and treatment of UTI is very important due the risk of renal disease is increased in children below the age of 5 years which result of morbidity[3].

Congenital and functional abnormalities are the main factors which cause UTI among children and therefore accurate diagnosis, treatment, and follow up is important to prevent

complications[4].

Initial lab investigation to confirm diagnosis of UTI, is an uncontaminated urine sample, which is challenging to collect from infants and children who are not toilet trained[5].

The standard investigation for diagnosis UTI is a urine culture but requires trained staff and specialized equipment for interpretation of results, therefore urine dipstick test is the best initial test because it is inexpensive and time saving when it comes to starting of treatment of UTI, Also it can be performed in small laboratories by lab technicians with minimum training[6].

It's important for physicians to know the

prevalence of UTI in children of different age groups so they can select children for further diagnostic investigation and management[7].

The aim of this work was to detect the prevalence of urinary tract infection (UTI) in children attending Pediatric outpatient clinic in Zagazig University Children's Hospital. Also to determine, related risk factors, isolate the organisms that lead to UTI in children and antibiotics sensitivity patterns of the isolates.

#### METHODS

**Site of the study:** This study was carried out in the pediatric outpatient clinic in Zagazig University Children's Hospital.

**Type of the study:** Cross sectional descriptive study.

**Sample size:** Assuming that total population 6000 (50 cases in a day, five days of working in a week, 1000 cases in a month and 6000 cases in six months) and frequency of UTI in Egypt 11.4% according to study of (8), power of test 80%, confidence interval 95%, the sample size is **600** patients, calculated by epinfo software package version 6.

#### Inclusion criteria:

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

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

#### Exclusion criteria:

- 1- Age below 2 years old and above 7 years old.
- 2- A child with a catheter associated UTI.
- 3- A child diagnosed with congenital anomalies.
- 4- Previous surgery of the genitourinary tract (except circumcision in male children)
- 5- A child has history of chronic renal diseases and found an immune compromising agents as HIV, malignancy, chronic use of corticosteroids or other immunosuppressive drugs).

**Administrative design:** Approval was obtained From Zagazig University Institutional Review Board (ZU-IRB 3303/8-1-2017).

Written informed consent was obtained from all participants' parents and the study was

approved by the research ethical committee of Faculty of Medicine, Zagazig University. The work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

All parents accepted the study and no one rejected the study.

#### Methods:

All the included children in the study were exposed 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 color of urine, enuresis), treatment with certain drugs for long period , past history of renal diseases or family history of renal diseases.
- 2- Full Clinical examination: With special focus on weight, height and abdominal examination for renal masses.
- 3- Urine samples from children Collected by midstream clean catch urine sample in sterile cups 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 by using both esterase and nitrate detectors.
- 4- Urine culture was done to positive cases.

#### STATISTICAL ANALYSIS

All data were analyzed using Minitab 17.0 statistical software (Minitab Inc., Pennsylvania, USA). Continuous variables were expressed as the mean  $\pm$ SD, and the categorical variables were expressed as a number(percentage).

Continuous variables were checked for normality by using Shapiro-Wilk test. Independent sample Student's t-test was used to compare two groups of normally distributed data while ANOVA test was used to compare two independent measurements of normally distributed data in more than 2 groups.

All tests were two sided.  $P < 0.05$  was considered statistically significant (Sig.),  $p < 0.01$  was considered highly statistically significant (HS), and  $p \geq 0.05$  was considered non-statistically significant (NS).

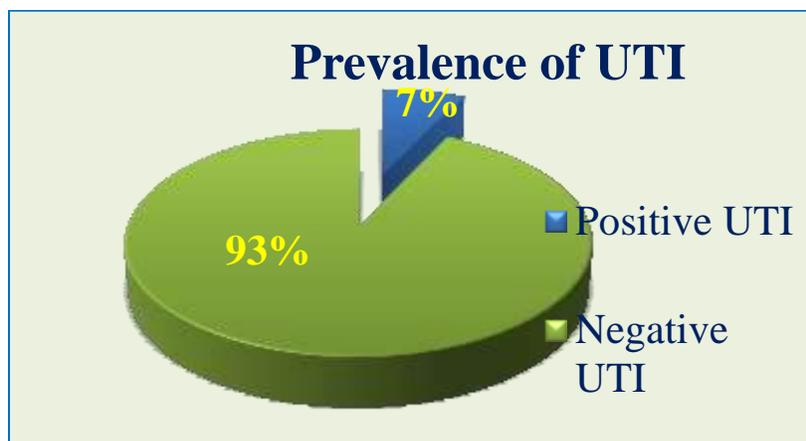


**Table (2):Risk factors for UTI in the studied population.**

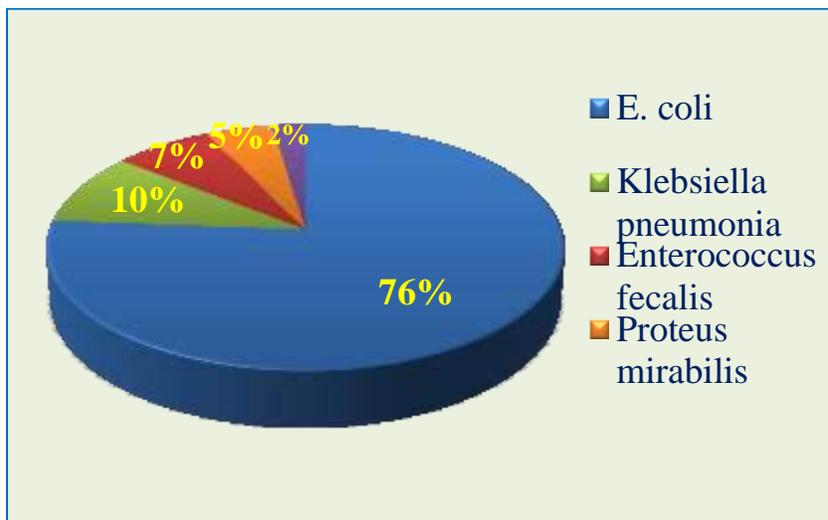
Risk factors		Total (N=600)		UTI				Test ‡	P-value (Sig.)
				Negative UTI (N=558)		Positive UTI (N=42)			
		No.	%	No.	%	No.	%		
Un circumcised Males	Absent	594	99%	555	93.4%	39	6.6%	17.21	0.006 (S)
	Present	6	1%	3	50%	3	50%	4	
Prolonged use of antibiotics	Absent	579	96.5%	547	94.5%	32	5.5%	55.15	<0.001 (HS)
	Present	21	3.5%	11	52.4%	10	47.6%	3	
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%	18.15	0.002 (S)
	Present	14	2.3%	9	64.3%	5	35.7%	5	
Enuresis	Absent	554	92.3%	521	94%	33	6%	12.08	0.003 (S)
	Present	46	7.7%	37	80.4%	9	19.6%	3	
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%		

**Table (3) Specificity and sensitivity of multi-stick method in relation to culture methods regarding UTI.**

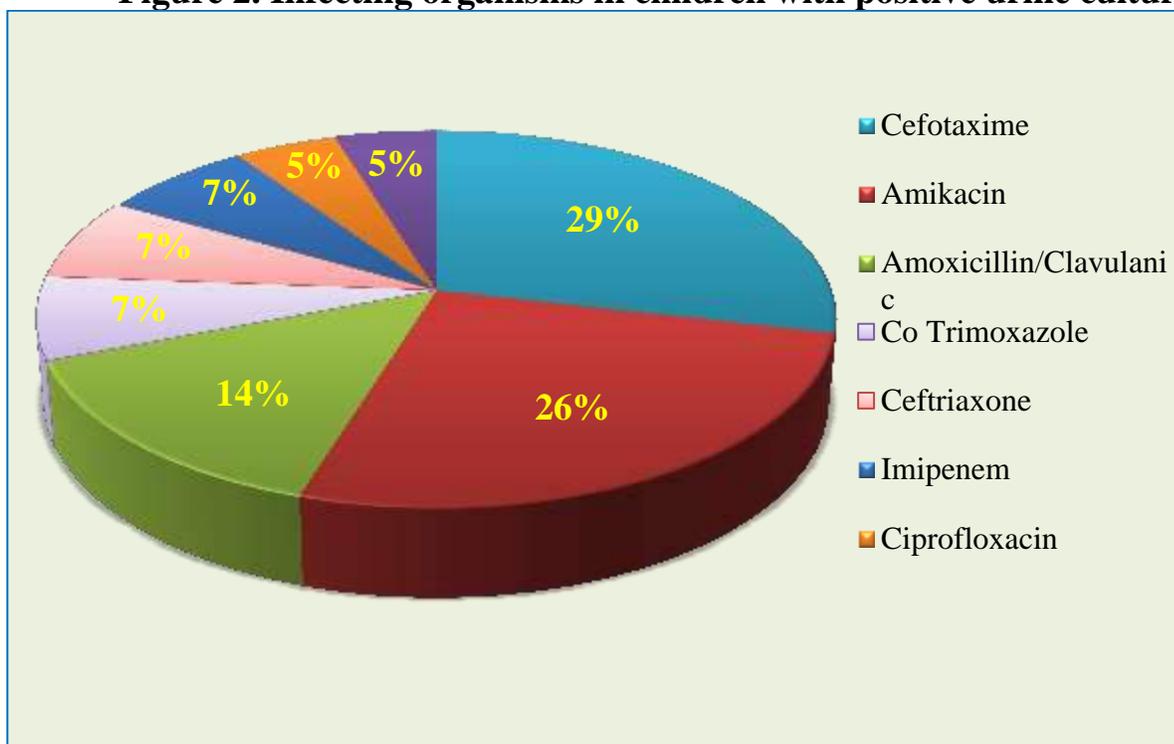
	Sensitivity	Specificity	NPV	PPV	Overall accuracy
LE	73.8%	95.5%	98%	55.4%	94%
Nitrite	66.7%	96.6%	97.5%	59.6%	94.5%
LE & Nitrite	40.5%	100%	95.7%	100%	95.8%



**Figure 1. The prevalence of UTI**



**Figure 2. Infecting organisms in children with positive urine culture.**



**Figure 3. Percentage of distribution of antibiotic sensitivity.**

**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 [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 [7], the overall prevalence of UTI in older children ( $\leq 19$  years) with or without fever is reported to be 7.8%.

In the study of [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 [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%).

However there was no agreement with the study of [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. This is due to presence of many risk factors in our study that leading to this difference.

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 female 54.8 % (23 female from 42 one has UTI) while prevalence of UTI in male 45.2% (19 male from 42 one has 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. This is due to presence of many risk factors in females more than in males.

Similar to our results, [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 [13] , There was statistically significant difference between males and females in relation prevalence of UTI among the screened children.

Results of the current study show statistically significant difference between Risk factors as Un circumcised males, Family history of UTI, Recurrent UTI, 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.

In the study of [14], Nocturnal enuresis was highly significant to prevalence of UTI ( $P=0.035$ ).

In the study of [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 [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 [17], reported that there were 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 [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.

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 [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 [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.

In the study of [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.

In the study of [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.

In the study of [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%).

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%).

Similar to our results [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.

In the study of [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 [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 [16], The most common urinary pathogens isolated were E.coli (63%), Klebsiella pneumoniae (8%) and Proteus mirabilis (8%). Other pathogens included Pseudomonas aurogenosa (7%), Staphylococcus aureus and Citrobacter 5% each and Enterobacter and Coliform 2% each.

In study of [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%)

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 [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.

In the study of [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 [16], Sensitivity of different urinary isolated to Amikacin was highest (82%) followed by meropenem (75%), tazocin (61%) and Sulzone (58%).

In the study of [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 %.

#### CONCLUSION AND RECOMMENDATIONS:

We conclude that the prevalence of UTI in our study was 7%. Risk factors of UTI in children in our study were Un circumcised males, prolonged use of antibiotics, Family history of UTI, Recurrent UTI, Enuresis, and Constipation.

E. Coli was the most common pathogen that causes UTI in children included in our study. Cefotaxime and Amikacin identified as the common antibiotic sensitive to the isolates, Further studies must be done in large population overall Egypt to help in determination of local causative organisms and preventive measures to decline the prevalence of UTI by knowing the predisposing factors and preventing it .

Use of dipstick test decrease patient's time and money, and may also help in earlier initiation of treatment.

#### Proposed application:

Determination the UTI prevalence and the causative organisms and contributing factors help in early and good management with it.

#### Study Limitations:

Our study is small sample size, not cover large

population but it may be considered as a base for other advanced studies.

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#### Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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None declared

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