

ORIGINAL ARTICLE

Prevalence of Urinary Tract Infection among Children; a cross-sectional study in Arar City, Northern Border Area, KSA

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ABSTRACT

Background: Urinary tract infection (UTI) is one of the most common infections in children. The prevalence of UTI during childhood varies by gender, age, and multiple other factors. The most commonly causes of UTI in children are *E. coli* and *Klebsiella* in different parts of the world.

Aim: To evaluate the prevalence of UTI, its etiologic pathogens, presenting symptoms and probable risk factors in our area.

Methods: A retrospective cross-sectional study was conducted on electronic files of 606 pediatric participants of confirmed UTIs from year 2015 -2020 in arar city hospital. These cases were diagnosed after urine culture positive for the respected uropathogens. Urine samples were collected either transurethral in < 1year children and clean voided midstream in elder children under aseptic techniques. The samples were sent to the hospital lab with especial request that we would use these samples for our study. Hospital laboratory followed full protocol that is followed worldwide.

Results: Total of 606 confirmed cases of UTI were used. Of this, 370(61.05%) were females and 236 (38.94%) males. Among them, 253 (41.74%) were <1 year old, 229(37.78%) were 1–5-year-old whereas 124(20.46%) were above 5 years old children. We found that *E. coli* was the most prevalent organism 342(56.23%), followed by *Klebsiella* which was 175(28.8%). *E. coli* was more common in outpatients compared to *Klebsiella* which was the most common aetiologic agent isolated from hospital admitted patients. *Citrobacter*, *Enterococci*, *Actinobacteria* and *Pseudomonas aeruginosa* were commoner in hospital patients. High grade fever, dysuria and foul smelling was the main symptom of *E. coli* positive cases whereas foul smelling was common in *Klebsiella* positive cultures. Constipation was noted to be the most common 198(32.6%) risk factor in our area. Other risk factors were history of instrumentation, history of catheterization, structural abnormalities, and posterior urethral valve abnormalities which were 9.9 %, 9.9 %, 10.2% and 3.30% respectively.

Conclusion: We conclude first; Prevalence of UTI was more common in females than males in < 1 year old group. Second; *E.coli* was the most common bacteria followed by *Klebsiella*. Third; it showed that along with other risk factors, constipation plays a significant role in causation of UTI in our area.

Keywords; UTI, children, risk factors

INTRODUCTION

Urinary tract infections (UTIs) are amongst the commonest infections in children that if not timely treated, can lead to renal injury and systemic illnesses which could be disastrous for the children in their adult life as these scarred kidneys due to recurrent infections will develop hypertension or even kidney failure in future². It is reported that 3% to 5% of girls develop first attack of UTI by 5 years of age whereas, about 1% of boys who develop their first UTI in first year of life especially those who are uncircumcised³. It is also reported that recurrent UTI also is a very common problem in pediatric patients, as it may lead to renal scarring, hypertension, and even end-stage kidney disease⁴. Mainly UTI could be caused by bacteria, but other organisms could also be responsible, e.g.; viruses, parasites and fungi. Gram-negative bacteria are most common especially *E. coli* which is 70-90% responsible for UTIs in children⁵. Other groups of uropathogens are proteus, *klebsiella*, *pseudomonas* and *actinobacteria* etc. whereas only 10% could be Gram-positive bacteria like *enterococcus*, *staphylococcus* and *streptococcus agalactiae*⁶.

As the knowledge of resistance is important, in the same way knowledge of presenting symptoms, risk factors and types of pathogens in the specific area is equally important to deal with this dangerous disease. We found very limited data about present study in other parts of Saudi Arabia. To the best of our knowledge, at present, no such studies have been published describing the prevalence and spectrum of uropathogens in pediatric patients and their probable risk factors in our area.

As the etiological agents of, specific risk factors and typical symptomatology of presentation play crucial role in UTI, therefore

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this research was conducted with the aim of investigating the prevalence of uropathogens, risk factors and pattern of presentation among pediatric patients less than 1 to more than 5 years at Maternity and Child health Teaching Hospital, Arar city, KSA.

MATERIALS & METHODS

Study area: The study was conducted at maternity and child health hospital which is attached with Northern border university as teaching Hospital. This is the main hospital in northern area that provides maternity and child health facilities to community and other referral cases from distant and remote areas of norther area. Therefore, it functions as tertiary and teaching hospital consisting of all facilities of mother and child health problems with PICU, operation theatre and outpatient pediatric department.

Study design and period of study: This is a cross-sectional study designed and conducted with the objective of reviewing the electronic data files of confirmed UTI's pediatric patients, and to know the frequency, pattern of presentation and some of their risk factors of UTI causing in these patients. The study was conducted retrospectively from September 2015 August, 2020.

In this study, we reviewed all children who had UTI confirmed by urine culture and who presented to a tertiary hospital named Maternity and child health hospital, Arar, Saudi Arabia between September 2015, and August 2020. We evaluated electronic files of about 606 confirmed cases of UTI children who were subdivided into three groups, < 1year, 1-5 year and >5-year-old children. Only those children were considered having UTI who had bacterial growth of 10⁵ cfu/ml. Whereas bacterial count of less than 10⁵ cfu/ml and bag urine samples were excluded in our study. We also analyzed the methods of urine collection, urine analysis

and all the imaging studies to rule out the risk factors and the most common symptoms at presentation. All the data from the files of the patients were collected on an Excel file.

Data analysis: Each value was presented as Mean \pm SE. Student's t test was used to compare two means between groups. Means between groups was also compared using ANOVA and post hoc Bonferroni test. A p value <0.05 was considered as statistically significant. All statistical analyses have been performed using statistical software SPSS version 20.

Ethical considerations: To conduct this study permission was obtained from the Research and Ethics Committee at the College of Medicine, Northern Border University, Arar, Saudi Arabia and director of Children and Maternity Hospital in Arar city. Confidentiality of data was maintained throughout the study.

RESULTS

Total of 606 confirmed UTI cases were used. Of this, 370(61.05%) were females and 236(38.94%) males. Out of 606 cases, 253 (41.74%) were <1 year old, 1-5 years old were 229(37.78%) whereas 5 years were 124(20.46%) (Table 2). We found that E. coli was the most common organism. It comprised of 342(56.23%), followed by Klebsiella which was 175 (28.8%) ($P <0.05$). E coli was found to be 154 in <1 year old, 137 in 1-5 years old and 51 in

> 5 years old patients whereas Klebsiella found to be 70 in <1 year, 55 in 1-5 years and 50 in >5 years respectively ($P <0.01$). Enterococcus species was found to be 12, 10, and 8 respectively. Whereas proteus was more common in 1-5 years group. E. coli was more common in outpatients compared to Klebsiella which was the most common aetiological agent isolated from hospital admitted patients. Citrobacter, Enterococci, Actinobacteria and Pseudomonas aeruginosa were commoner in hospital patients. Enterococci species 30(5%), proteus species 30 (5%), Proteus 3(5%), Enterobacter 5(8%), Citrobacter 3(5%), Actinobacteria was 5(0.8%) whereas Staphylococcus was noted to be 13(2.1%) (Table 2). High grade fever, dysuria and foul smelling was the main symptom of both klebsiella and E. coli positive cases. As far as the risk factors were concerned, we found that constipation was the most common risk factor in our area 198(32.6%) followed by other risk factors i.e., instrumentation h/o, catheterization, structural abnormalities, and posterior urethral valve abnormalities as 9.9%, 9.9 %, 10.2% and 3.30% respectively (Table 3). However, in total of 198 patients of constipation, we found E coli was 90, klebsiella 55, enterococcus 3, proteus species 12, pseudomonas species 15, Enterobacter 4, Citrobacter 5, actinobacteria 6 and Staphylococcus was 8. So, the most common was E. coli, Klebsiella followed by pseudomonas.

Table 1. Organisms isolated as regards to age and sex

Organism Isolated	n	%	Gender		Age		
			Males	Females	<1 year	1-5 years	>5 years
E. coli	342.0	56.4	135	207	154	137	51
Klebsiella	175.0	28.9	115	60	70	55	50
Enterococci spp.	30.0	5.0	15	15	12	10	8
Proteus sp	30.0	5.0	25	5	7	15	8
Pseudomonas	3.0	0.5	2	1	2	1	0
Enterobacter	5.0	0.8	2	3	2	1	2
Citrobacter	3.0	0.5	1	2	1	2	0
acinobact	5.0	0.8	2	3	2	2	1
Staphylococcus	13.0	2.1	6	7	3	6	4
Total	606.0	100.0	236	370	253	229	124

Table 2: Correlation between isolated uropathogens and their clinical presentation pattern

Organism Isolated	n	%	High grade fever	Dysuria	Frequency	foul smell	Hematuria	Loin pain	Urgency	Irritability
E. coli	342	56	150	75	12	70	5	5	15	10
Klebsiella	175	29	80	15	12	25	8	5	15	15
Enterococci spp.	30	5	10	3	2	2	3	2	5	3
Proteus sp	30	5	8	3	3	4	2	4	3	3
Pseudomonas	3	0.5	3	0	0	0	0	0	0	0
Enterobacter	5	0.8	1	1	0	2	1	0	0	0
Citrobacter	3	0.5	0	0	0	0	0	1	1	1
Acinobact	5	0.8	1	1	1	1	1	0	0	0
Staphylococcus	13	2.1	7	3	1	0	0	0	1	1
Total	606	100	260	101	31	104	20	17	40	33

Table 3: Incidence of risk factors among causative pathogens causing UTI

Risk factors	no.	%	E. coli	Klebsiella	Enterococci spp.	Proteus sp	Pseudomonas	Enterobacter	Citrobacter	acinobact	Staphylococcus
Constipation	198	32.67	90	55	3	12	15	4	5	6	8
H/O instrumentation	60	9.90	15	25	4	5	6	0	0	0	5
Catheterization	60	9.90	10	32	3	1	10	0	0	0	4
Structural anomalies	62	10.23	10	25	3	2	15	0	0	0	7
Posterior urethral valve	20	3.30	5	5	0	3	3	0	0	0	4
Others	29	4.78	15	5	4	3	2	0	0	0	0
without any risk factors	177	29.2	95	65	0	0	0	5	5	3	4
Total	606	100	240	212	17	26	51	9	10	9	32

DISCUSSION

The aim of present study was to have some idea of local data about the prevalence of etiological pathogens, their risk factors and common pattern of presentation of UTI in pediatric population of our area. Although some studies in other areas of Saudi Arabia have been done but there is no any data of UTI in our area especially northern border region. So, this is the first study to have some clinical data of UTI in children in our area. We reviewed total 606 confirmed cases of UTI including male and females. The age of our study sample was divided in three main groups. Group 1; <1 years old, Group 2; 1-5 years whereas Group 3 consisted of children aged >5 years old. Present data showed that frequency of UTI in females was significantly higher than males in group 3

(Table. 1), whereas the incidence UTI was more predominant in males as compared to the female partners (Group: <1 and 1-5). Out of 606 UTI cases, 370(61.05%) were females and 236 (38.94%) males, whereas 253 (41.74%) were <1 year old, 229 (37.78%) were 1-5 years old and 124(20.46%) were >5 years old (Table. 2). We found that E. coli was the most prevalent organism 342(56.23%), followed by Klebsiella which was 175(28.8%). E coli was found to be 154 in <1 year old, 137 in 1-5 years old and 51 in >5 years. Klebsiella found to be 70 in <1 year 55 in 1-5 years and 50 in >5 years respectively. Females and males were 339 (55.94%) and 267 (44.05%) respectively. Similarly, percentage of UTI was found to be higher in age group <1 year, total 253 patients followed by 1-5 age group number 229 then 124 among > 5 years old group. We found that E. coli was the most prevalent organism

342(56.23%), followed by Klebsiella which was 175(28.8%). E. coli was more common in out-patients compared to Klebsiella which was the most common aetiological agent isolated in admitted patients. Citrobacter, enterococci, actinobacteria and Pseudomonas aeruginosa were more common in hospital patients. UTI is more common in more than 1 year old girls possibly due to structural abnormalities⁸. Whereas incidence of UTI is more in males aged less than 1 year old. This ratio was reported to be 1:2 in one study⁹ whereas 1:4 in another study¹⁰. The reason for this discrepancy needs to be elaborated further. Uropathogens isolated in our study are like some other studies that reported prevalence of 57.7% of E. coli and 36.2% of Klebsiella spp¹¹. One other study¹² reported 40% isolates of E. coli whereas another study¹³ also reported E. coli 79%, Gupta et al 2015 68% of E. coli and 21.2% of Klebsiella spp. and some studies also reported the same results¹⁴.

We also found that constipation was also one of the major (32.6%) and preventable risk factor of UTI in our area, although other risk factors like posterior urethral valve abnormalities and other congenital anomalies could not be excluded entirely. The higher incidence of urinary tract infections in females might be a result of shorter urethra and the proximity of their reproductive organ to the anus. UTI occurs in 3% to 5% of girls and 1% of boys during childhood, with the first attack occurring in girls by 5 years, peaking during infancy and toilet training, while it is common in boys during the first year of life, especially among those who are uncircumcised because during this time of age, they get exposed to pathogens easily^{15,16}.

The pattern and the frequency of bacterial isolates obtained in this study were comparable with different study findings done in different countries. For example, a study conducted in Iran¹⁶ showed that, among bacterial isolates, 40% accounted for E. coli, and this was followed by Klebsiella spp. (17.9%), coagulase-negative staphylococci (12.3%), Enterococcus spp. (8.7%), Pseudomonas spp. (6.7%), and S. aureus (3.6%). A study conducted in Nigeria¹⁷ reported a total of 36 bacterial isolates, of which, E. coli was the predominant organism and was responsible for 52.77% of the cases of UTI, and this was followed by Klebsiella spp (25%), Proteus mirabilis (13.89%), Streptococcus faecalis (5.56%), and Pseudomonas aeruginosa (2.78%). Similarly, a study conducted in Egypt¹⁶ indicated that, among all the bacteria isolated in their study, E. coli and Klebsiella spp. were the most commonly isolated bacteria accounting for 58.1% and 41.9%, respectively. This study was comparable with the study conducted in different areas^{20,24,26}.

In the present study, we also found that constipation was the major risk factor for UTI in pediatric population of our area. We think this could be one of the leading causes of infection in our area. We will elaborate this risk factor in next study which is in progress. It might help us to further elaborate the factors of high incidence of this preventable cause of UTI in our population. It would also help to highlight the important relation more confidently between UTI and constipation in especially recurrent UTI in the area. As we know that UTI is the significant risk of morbidity in children, therefore, extensive evaluation is required in children under 1 year old children so that we could reduce the chances of renal scarring and consequently hypertension and renal failure in late life.

CONCLUSION

Our data showed the prevalence of UTIs in pediatric patients in our city and tried to evaluate the major causative agents involved first time in this area. We also described some important risk factors and pattern of presentation of UTI cases in arar city. Furthermore this data is consistent with usually reported pattern, with E. coli being the most common bacteria followed by Klebsiella. As the constipation is a preventable risk of UTI, it should be further evaluated to rule out the causation of this preventable cause of UTI in our region. It is also suggested that many other areas of Saudi

Arabia should be studied to get further information of the prevalence and pattern of UTI etiology.

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