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Research Article

Prevalence of UTI at a Tertiary Care Facility in Abu Dhabi

Abrar Alzaabi* and Zohra Ashraf Siwji

General Pediatric Department, Al Mafraq Hospital, Abu Dhabi, United Arab Emirates

***Corresponding Author:** Abrar Alzaabi, Pediatrician, SEHA Hospital, Abu Dhabi, United Arab Emirates.

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Abstract

Background: Urinary tract infection (UTI) is a common cause of febrile illness in children. The prevalence of UTI is approximately 7% in febrile children; but varies by age, ethnicity, sex, and circumcision status. Over time, the antibiogram of the uro-pathogens has changed, with emerging resistant strains.

Purpose: We studied the characteristics and microbiota of the children admitted with a possible diagnosis of UTI, over a 2-year period at a tertiary government hospital in Abu Dhabi.

Method: We reviewed the electronic medical records at a tertiary hospital in Abu Dhabi. Children aged 1 month to 12 years of age, admitted for possible UTI between December 2014 to September 2016 were included. Their data particulates were tabulated and expressed as percentages.

Results: The study included 90 children hospitalized with possible UTI, with a female predominance of 78%. Of all the females admitted with possible UTI, the majority were of 3 - 12 years of age (85%). In contrary, most males admitted with possible UTI were of 1 - 3 months of age (50%). 55% of the males were noted to be uncircumcised. The majority (68.9%) of the urine specimens were collected by mid- stream, clean catch method. With reference to the AAP guidelines, 59.8% of the positive urine cultures actually had "significant" growth of bacteria and diagnosed as confirmed UTI cases. The major uro-pathogen identified in them was *E. coli* (77%), of whom- 12% were ESBL positive.

Conclusion: UTI among hospitalized children is more common in females, uncircumcised males and in the younger age group i.e. 1 - 3 months of age. *E. coli* still remains the most common uro-pathogen with emerging ESBL being noted in our population.

Keywords: *Urinary Tract Infection (UTI); E. coli; ESBL*

Introduction

Urinary tract infection (UTI) is a common cause of febrile illness in the pediatric age group. It is associated with significant morbidity and long-term complications such as renal scaring leading to hypertension and/or renal damage and subsequently chronic renal failure.

According to several large prospective studies and a meta- analysis, the overall prevalence of UTI is approximately 7 percent in febrile infants and young children below 2 years of age; but varies by age, race/ethnicity, sex, and circumcision status [1-3]. The rate is quite similar in older children, as demonstrated in a pooled analysis of four studies that included children < 19 years (most of whom were older than two years) and had urinary symptoms and/or fever, in whom the prevalence of UTI was 7.8 percent (95% CI 6.6-8.9) [3].

The leading gram-negative enteric pathogen causing UTI is *Escherichia coli*, accounting for approximately 80 percent of UTI in children [4]. Other gram-negative bacterial pathogens include *Klebsiella*, *Proteus*, *Enterobacter*, and *Citrobacter*. The gram-positive bacterial pathogens include *Staphylococcus saprophyticus*, *Enterococcus*, and, rarely, *Staphylococcus aureus*.

Diagnosis and therapy for febrile children suspected to have UTI, should be tailored based on both urinalysis suggestive of infection, and the presence of significant growth of a uro-pathogen cultured from a urine specimen that is obtained by methods deemed appropriate for these tests [9,10].

Over the recent years, the antibiogram to these organisms has changed, with emerging resistance patterns especially in the members of gram-negative Enterobacteriaceae rising tremendously worldwide; highlighted by the rise of extended spectrum beta-lactamase (ESBL) producing organisms [5-7]. The availability of over the counter antibiotics in the middle east has been noted to being a major contributing factor to the resistance patterns of frequently observed uro-pathogens [8].

In many countries of the Middle East, where antibiotics are available over-the-counter, the resistance patterns of frequently observed uro-pathogens are alarming [8].

Many guidelines exist to recommend the choice of empirical antibiotic treatment, usually based on the knowledge of which organisms are commonly involved and on their antibiotic susceptibility. However, as the latter is known to change over time with the development of antimicrobial resistance, a regular evaluation of the pattern of antibiotic sensitivities is imperative to facilitate the choice of treatment [11].

Purpose of the Study

The purpose of this retrospective, record-based study is to provide a comprehensive review of the prevalence of UTIs in hospitalized children at a tertiary hospital in Abu Dhabi. This study in particular, outlines the microbiological spectrum of the isolated uro-pathogens, the method of collection in addition to significant risk factors that may play a role in the occurrence of UTI in the pediatric age group.

Methodology

This cross- sectional record- based study was undertaken at the General Pediatrics department of Al Mafraq Hospital, SEHA, Abu Dhabi.

All patients were identified retrospectively through the electronic medical records' database at Al Mafraq Hospital, SEHA, Abu Dhabi by searching for the ICD- 9 codes for the admission diagnosis of possible "Urinary tract infection". Children in the age group of 1 month to 12 years of age, admitted to the hospital between December 2014 to September 2016 were included in the study.

The data collected from all pediatric patients admitted to the pediatric medical wards with a possible diagnosis of UTI was entered onto excel sheets. The data retrieval from the electronic medical records' database included the following details: age, gender, nationality, circumcision status, method of urine specimen collection, and urine culture results. We further detailed the microbiological uro-pathogen identified for these pediatric patients.

As it is known that the prevalence of UTI varies by age, race/ethnicity, sex, and circumcision status [15], we further categorized the patients' age groups into 1 - 3 months of age, 4 months to 2 years of age (infancy to toddler age group) and lastly 3 - 12 years of age (early childhood).

As the neonates are considered a high- risk group to invasive infections with congenital and antepartum features playing a role, they were not included into our study group. The above age categorization was used in our study, as presentation of fever under the age of 90 days is managed in a different way to pediatric patients older than 90 days of age who are presenting with fever.

Our study sample was also classified based on nationality in the following method: Emirati, Other Middle Eastern (which included: Yemeni, Omani, Syrian, Palestinian, Qatari, Egyptian), Sudanese, Indian, Pakistani, Bangladeshi, Filipino, and a category for those with undocumented nationality as "Unknown".

The standard departmental protocol for urine collection to diagnose UTI was followed for this study. In children of either sex, under the age of 2 years or not yet continent, if immediate antibiotics therapy was deemed necessary, then the urine was collected by catheterization.

It has been reported that catheterization or suprapubic aspiration is the preferred method of urine collection for dipstick, microscopic examination, and culture of the urine in infants and young children who are not toilet-trained. Whereas, a clean-voided specimen is the preferred method of collection in toilet-trained children [10]. Therefore, parents were always encouraged to collect the urine specimen as deemed to be the preferred and most reliable method.

If the parents refused the bladder catheterization procedure, urine specimen was collected aseptically by the clean-catch method which, when performed adequately, is as reliable as suprapubic aspiration or catheterization [16]. After cleansing of the genitalia and perineum, the clean catch was collected either by a trained and experienced pediatric nurse, or by the child's mother after appropriate explanation and training by the nurse or physician.

For older and continent children of either sex, urine specimen was collected by the mid-stream method. The child and/or parents were instructed on how to clean the genitalia, retract the foreskin in boys and allow urination to start prior to collecting the midstream in an aseptic manner.

However, in our community set-up, some families refuse bladder catheterization procedure for urine specimen collection and also faced difficulty in appropriately collecting the urine specimen via clean catch mid- stream for smaller children or for females. For those minority of cases, the pedi-bag was used for urine collection to test for UTI.

The urine culture results were reviewed and stratified into significant or non-significant growth based on the colony forming units of the bacterial growths in accordance with the AAP guidelines.

The above data particulates which was collected, was then stratified and tabulated into graphs and all the data were expressed as percentages.

Results

We analyzed the pertinent data of all the pediatric patients aged 1 month to 12 years of age with a possible diagnosis of UTI, that were admitted to the pediatric medical wards at Al Mafraq Hospital, Abu Dhabi during the time frame of December 2014 to September 2016.

With regards to the demographics, our study population was categorized into three groups: 1 - 3 months, 3 months to 2 years, and 3 - 12 years; which showed a distribution of 11, 29, and 60% respectively (Figure 1).

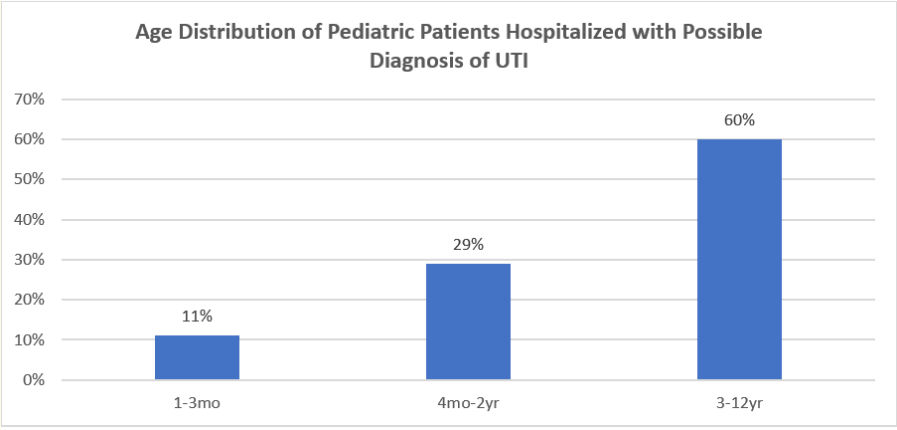

Figure 1: *Age distribution of pediatric patients hospitalized with possible diagnosis of UTI.*

Overall, the pediatric patients admitted to the medical wards with the possible diagnosis of UTI were predominantly females (78%), with males accounting for the remaining 22% (Figure 2).

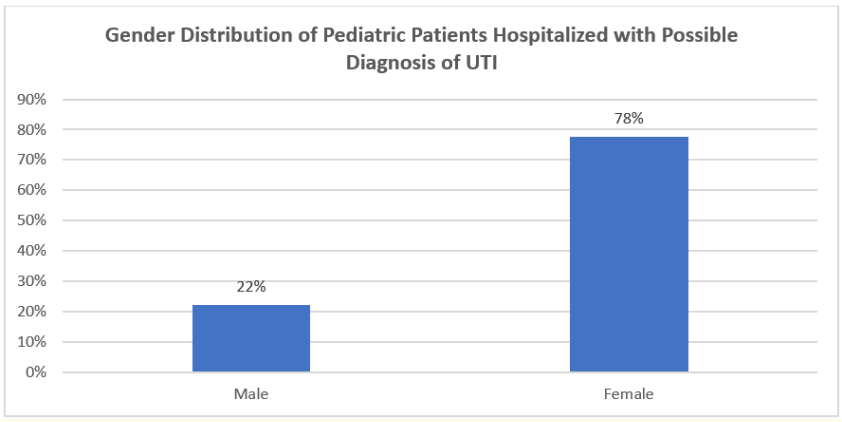

Figure 2: *Gender distribution of pediatric patients hospitalized with possible diagnosis of UTI.*

Looking at the age- group distribution; girls that were admitted with possible UTI were mainly between 3 - 12 years of age (85%). However, in the age group of 1-3 months, there was equal distribution among the genders (i.e. 50% males and 50% females). The correlation between age and gender also identified that males in general had the least frequency of admission to the hospital for possible UTI - particularly in the older age group i.e. only 15% of males between the ages of 3 - 12 years were admitted with the possible diagnosis of UTI (Table 1).

Gender Distribution by Age Groups				
Gender	Age			Total
	1m-3mo	4mo-2yr	3yr-12yr	
Male	5 (50%)	7 (27%)	8 (15%)	20 (22%)
Female	5 (50%)	19 (73%)	46 (85%)	70 (78%)
Total	10 (11%)	26 (29%)	54 (60%)	90 (100%)

Table 1: *Gender distribution by age groups in pediatric patients hospitalized with possible diagnosis of UTI.*

Our study population consisted mainly of the local Emirati patients, accounting for 69% of the study population, followed by other Middle Eastern patients accounting for about 17.8%; which consisted of Yemen, Oman, Qatar, Syria, Palestine and Egypt. The minority of our sample study included patients from Philippines (3.3%), India (3.3%), Pakistan (1.1%), Bangladesh (1.1%) and Sudan (1.1%). Based on the records that were available, about 3.3% of the cases had unknown/ undocumented nationalities (Figure 3).

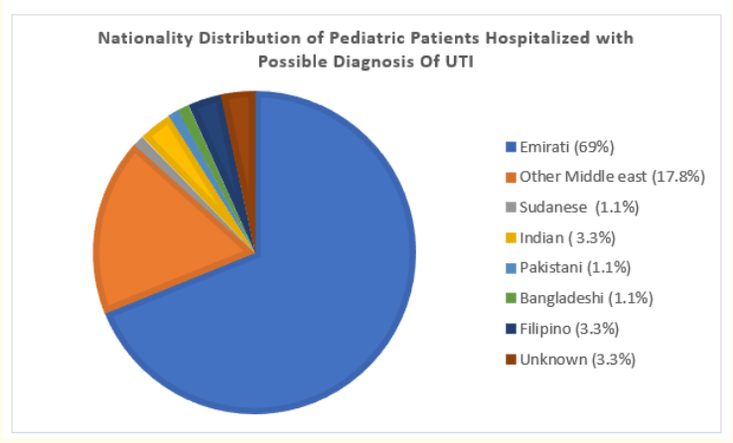

Figure 3: *Nationality distribution of pediatric patients hospitalized with possible diagnosis of UTI.*

In general, most of the male pediatric patients in our study population were uncircumcised accounting for 55%, with the remaining 25% of our male pediatric patients being circumcised. Unfortunately, 4 (20%) of the male patients did not have a documented circumcision status (Figure 4).

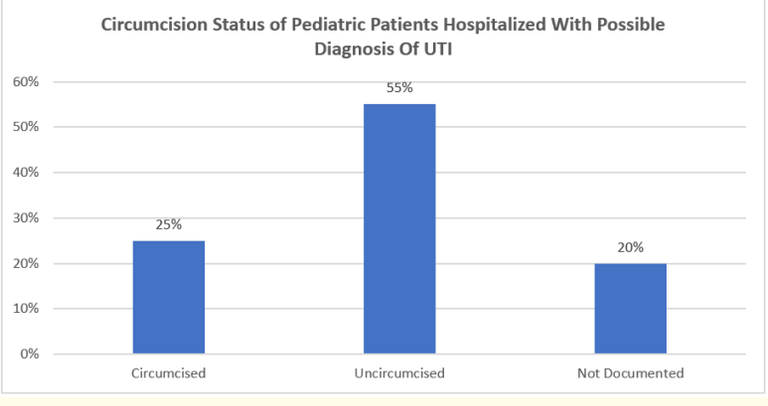

Figure 4: *Circumcision status of pediatric patients hospitalized with possible diagnosis of UTI.*

Urine samples were collected by mid- stream, clean catch method in about 68.9% of the patients and 26.7% of the patients underwent bladder catheterization (Figure 5).

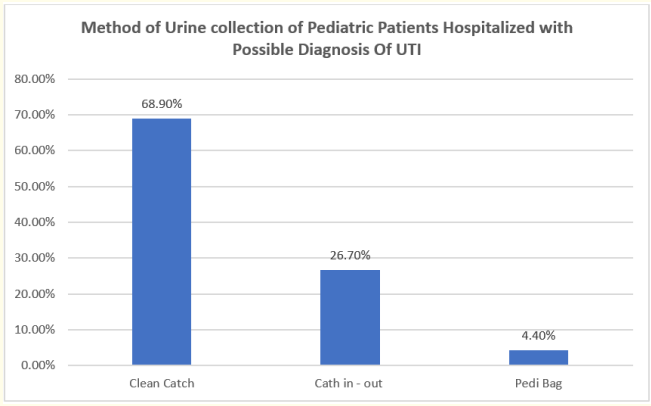

Figure 5: *Method of urine collection of pediatric patients hospitalized with possible diagnosis of UTI.*

It was observed that parents of younger children usually faced difficulty in collecting the urine samples via mid-stream clean catch method. In addition, their parents would often prefer to avoid the bladder catheterization procedure. Therefore, in these patients, urine samples were collected via Pedi-bag method - after appropriate antiseptic measures, to ensure clean collection of the urine samples. These accounted for about 4.4% of the urine specimens collected in our study (Figure 5).

Of the 90 patients that were admitted to the pediatric medical wards with the possible diagnosis of UTI, all but 1 of the urine samples were sent for culture. The urine sample that was not sent for urine culture was negative for both leukocyte esterase and nitrite and therefore, the clinical decision was made to not process the specimen for urine culture.

Of the urine specimens sent for culture, 31.1% of them were reported negative, with (61 out of 90 specimens) 67.8% of them having positive growth of organisms (Table 2).

Urine Culture Results in Pediatric Patients Hospitalized for Possible UTI		
Urine Culture	**Number**	**Percentage**
Positive	61	67.8%
Negative	28	31.1%
Not Documented	1	1.1%
Total	90	100%

Table 2: *Urine culture results in pediatric patients hospitalized for possible UTI.*

As per the American Academy of Pediatrics (AAP) [10], significant UTI is defined as the following:

- Clean sample - Growth of ≥ 100,000 (CFU)/mL of a single uro-pathogen; multiple organisms is considered contamination.
- Catheter sample - Growth of ≥50,000 CFU/mL of a single uro-pathogen.
- Suprapubic sample: Any uro-pathogenic bacteria.

In keeping with the AAP guidelines, we stratified all the 61 positive urine culture results into significant and non-significant growths. Our analysis revealed 53 (87%) of the urine specimens to have significant growth of uro-pathogens while the rest of the 8 (13%) urine specimens yielded non-significant growth of bacteria (Table 3).

Therefore, out of the 90 patients admitted to the hospital with the possible diagnosis of UTI, 53 (59.8%) had true UTI based on the urine culture results (Table 3).

Positive Urine Culture Results	Number	Percentage of positive culture out of the total urine cultures
Significant growth of bacteria	53 (59.8%)	53/90 = 87%
Non-significant growth of bacteria	8 (8.9%)	8/90 = 13%
Total	61 (67.8%)	90 = 100%

Table 3: *Positive urine culture results in pediatric patients hospitalized with possible diagnosis of UTI.*

On further analysis of the 53 hospitalized pediatric patients with confirmed UTI, the majority (75.5%) of them were female patients, with about 24.5% being males (Table 4).

Gender Distribution of Hospitalized Pediatric Patients with Confirmed UTI		
Gender	**Number**	**Percentage**
Males	13	24.50%
Females	40	75.50%
Total	53	100%

Table 4: *Gender distribution of hospitalized pediatric patients with confirmed UTI.*

The major uropathogen identified in the 53 hospitalized pediatric patients with confirmed UTI was *Escherichia coli* accounting for 77% (41 patients), and the rest of the 23% (12 patients) had Non *E. coli* pathogens (Table 5).

Microbiological Profile of Hospitalized Pediatric Patients with Confirmed UTI		
Uro-pathogen	**Number**	**Percentage**
E. coli	41	77%
Non-*E. coli*	12	23%
Total	53	100%

Table 5: *Microbiological profile of hospitalized pediatric patients with confirmed UTI.*

The Non *E. coli* uro-pathogens consisted of gram negative organisms listed in order of frequency: *Klebsiella pneumoniae* (9.4%), *Pseudomonas aeruginosa* (5.6%), *Enterobacter cloacae* (4%), *Klebsiella oxytoca* (2%), and *Proteus mirabilis* (2%) (Table 6).

Non-*E. coli* Uro-pathogens from Significant Urine Cultures of Hospitalized Pediatric Patients with Confirmed UTI		
Non-*E. coli* Uro-pathogens	**Number**	**Percentage**
Klebsiella pneumoniae	5	9.40%
Pseudomonas aeruginosa	3	5.60%
Enterobacter cloacae	2	4.00%
Klebsiella oxytoca	1	2.00%
Proteus mirabilis	1	2.00%
Total	12	23.00%

Table 6: *Non-E. coli uro-pathogens from urine cultures of hospitalized pediatric patients with confirmed UTI.*

A small proportion of our patient profile of hospitalized pediatric patients, with confirmed diagnosis of UTI grew Extended Spectrum Beta Lactamase producing *E. coli* in their urine cultures, accounting for 5 (12%) out of the 41 patients with *E. coli* UTI (Table 7) - majority (4 out of 5, i.e. 80%) being of the female gender (Table 8).

Resistance Patterns of *E. coli* in Hospitalized Pediatric Patients with Confirmed UTI		
***E. coli* from Significant Urine Culture Results**	**Number**	**Percentage**
Non ESBL	36	88%
ESBL	5	12%
Total	41	100%

Table 7: *Resistance patterns of E. coli in hospitalized pediatric patients with confirmed UTI.*

Gender Distribution of Hospitalized Pediatric Patients with Confirmed ESBL *E. coli* UTI		
Gender	**Number**	**Percentage**
Males	1	20%
Females	4	80%
Total	5	100%

Table 8: *Gender distribution of hospitalized pediatric patients with confirmed E. coli UTI.*

Discussion

UTIs are among the most common and frequent illnesses seen in the pediatric population that are known to cause morbidity and mortality, especially in the first 2 years of life [8,12]. To our knowledge this is the most recent retrospective pediatric study that reviews the epidemiology and microbiological spectrum of UTIs in hospitalized children in the capital city of United Arab Emirates.

The epidemiology of pediatric UTIs varies by age, race/ethnicity, sex, circumcision status, and genitourinary malformations [1-3,17].

It has been noted that overall, females have a two- to fourfold higher prevalence of UTI than male infants [3]. This has been attributed to the anatomically shortened urethra in females. Another possible hypothesis is the propensity of bacterial attachment to the female periurethral mucosa that may account for this difference [17]. In accordance with this, our study showed an overall female preponderance of 78%.

On reviewing the gender distribution by age groups, our study displayed the highest percentage of males being admitted to the hospital for possible UTI in the younger age group (i.e. 1 - 3 months) accounting for about 50%, while the least percentage of males was in the older age group (i.e. 3 - 12 years old) accounting for about 15%. Hanna-Wakim., *et al*. mentioned that the prevalence of UTI was higher in all children in their first year of life. After the age of 1 year, it tends to decrease in males as compared to females, due to multiple factors, one of which being circumcision [8].

In general, most of the male pediatric patients in our study population were uncircumcised accounting for 55%. As reported by Shaikh., *et al.* there is a four- to eight-fold higher prevalence of UTI in uncircumcised male infants with fever, as compared to circumcised male infants. This difference has been attributed to two plausible mechanisms. The first mechanism is the increased likelihood of uro-pathogenic bacterial species to bind to the mucosal surface of the uncircumcised foreskin than keratinized skin on a circumcised penis. The mucosa is principally keratinized by 1 year of age, which temporally coincides with the decreasing prevalence of UTI in boys. The second possible mechanism for a higher incidence of UTI in uncircumcised boys is due to the tight foreskin which may cause a partial obstruction of the urethral meatus. In one study of uncircumcised male infants (< 7 months of age), inability to retract the foreskin to expose the urethral meatus was more common among boys with febrile UTI than among those without UTI (85 versus 42 percent). The tightness of the foreskin diminishes with time and is an infrequent finding after one year of age which also corresponds with the decreasing prevalence of UTI in boys [17].

Irrespective of age, sex or circumcision status, the major uro-pathogens identified in our population of hospitalized pediatric patients with confirmed UTI was *Escherichia coli* accounting for 77%. This finding is consistent with many studies and a widely known fact in literature [8,13,14,17].

Over the last two decades, the resistance to antibiotics in members of Gram-negative Enterobacteriaceae rose tremendously worldwide. This has been highlighted by the emergence of extended spectrum beta-lactamase (ESBL) producing organisms [5-8,13,14,17]. Our study demonstrated about 12% of hospitalized pediatric patients having confirmed UTI with ESBL E. Coli.

Conclusion

In summary, our study has shown that pediatric UTI among hospitalized patients, in the capital of United Arab Emirates, generally occurs more common in females and uncircumcised males. As for the males, our study revealed that there is a deceased preponderance for males to develop UTI in the older age group (i.e. 3 - 12 years of age); with an increased frequency of their presentation during the younger age groups (i.e. 1 - 3 months of age). *E. coli* still remains the most commonly encountered bacterial uro-pathogen. In addition, we have also noted a rise in the activity of extended spectrum beta lactamases in our population.

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