

Frequency of Isolation and Antibiotic Susceptibility of Micro-Organisms Causing Urinary Tract Infections in Children

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ABSTRACT

Objective: To determine the frequency of urinary tract infections and the spectrum of microorganisms causing UTI and their antibiotics susceptibility pattern in children age between 1 month and 12 years.

Patients and Methods: In this cross-sectional study, 131 patients of suspected UTI, from the department of pediatric medicine were included, from June-2020 to Nov-2020. 5 milliliters of urine sample were collected and sent to the hospital laboratory for determination of UTI. If UTI was confirmed, samples were further processed to determine the pattern of organisms causing UTI and their antibiotic spectrum.

Results: Mean age of the patients included in this study was 6.07±2.56 years. There were 75 (57.25%) male patients, and 56 (42.75%) female patients. Urinary tract infections were diagnosed in 30 (22.90%) patients. *E. coli* diagnosed in 14 (46.67%) patients. Resistant strains were diagnosed in 3 (10%) patients. Regarding antibiotic sensitivity, 3rd generation cephalosporins and carbapenems were sensitive to many organisms.

Conclusion: *E. coli* is the predominant uropathogen causing UTIs in children. Third generation cephalosporins are optimal initial choice for management of UTI in children.

Keywords: urinary tract infections, causating micro-organisms, antibiotic sensitivity.

INTRODUCTION

Urinary tract infections (UTI) are now recognized as one of the commonest infectious diseases, >10% people experience at least one episode of UTI during their life time.¹ As many as 2% of children have been diagnosed with at least one UTI by the age of 10 years.² It may be an infection of upper urinary tract, lower urinary tract, or both.³

Low socioeconomic status is the major factor for development of UTI, other reported risk factors are; old age, diabetes, recurrent UTI, neurogenic bladder retention, poor perineal hygiene, and anatomic/functional urinary tract abnormalities.^{4, 5} It affects both sexes and all age groups. Boys are more susceptible during the first year of life; thereafter the incidence is greater in girls. Neonates, girls, young women are more susceptible to UTI.⁶ The affected patients may be symptomatic or asymptomatic at presentation; either type of infection if left untreated can upshot serious sequelae.⁷

Several organisms including fungi and viruses are known to cause UTI but bacteria are known to cause more than 95% of cases of UTI. The vast majority of organisms causing uncomplicated UTI are Gram negative bacillus *Escherichia coli*, and *Enterococci*, *Staphylococcus Saprophyticus*, *Klebsiella spp.* and *Proteus mirabilis*. *Escherichia coli* is the most common prevalent organism that solely responsible for more than 80% of UTI cases.⁸

An accurate and timely diagnosis of UTI is important to prevent ascent of infection to upper urinary tract and renal failure. As the number of cases of UTI resistant to antibiotics is increasing day by day. The extensive and inappropriate use of antibiotics has resulted in antibiotic resistance in recent years which has become a worldwide problem.^{9, 10}

This study was aimed to determine the frequency of urinary tract infections and the spectrum of microorganisms

causing UTI and their antibiotics susceptibility pattern in children age between 1 month and 12 years.

METHODS

In this cross-sectional study, we included 131 patients of suspected UTI, from the department of pediatric medicine were included, from June-2020 to Nov-2020. Children of age 1 month to 12 years having fever > 38C with chills, urgency and hesitancy of urination, burning micturition or dysuria, suprapubic or flank tenderness, Pyuria or evidence of sepsis were included. Children with congenital malformations of urinary tract, chronic kidney disease, surgical procedures done on urinary tract, having urinary catheter in place for longer duration, and children with other chronic diseases that can cause chronic UTI like cerebral palsy, neurogenic bladder, traumatic injury to the bladder, urinary retention as a complication of stroke, or the children taking antibiotics from last 2 weeks were excluded. Informed consent was taken from parent/guardians.

After enrollment, complete history to look for evidence of urinary tract infection like burning micturition, dysuria, urgency, hesitancy and frequency of urination, flank pain, fever with chills and rigors, previous history of urinary tract infection, history of chronic kidney disease, congenital malformations of urinary tract was taken.

5 milliliters of clean catch urine sample were collected in sterile container and processed within 1 hour of collection using standard methods. A sterile 4.0 mm platinum wire calibrated loop as used which delivers 0.001 ml of urine. This loop-full urine sample was inoculated on UTI chrome agar, MacConkey agar and blood agar plates and were incubated aerobically at 37°C overnight and for 48 hours in negative cases and read to assess growth of significant bacteria. The specimen was considered positive if more than 5 pus cells/HPF are seen on microscopy or

those with culture concentration of a single organism is at least 10⁵ colonies per ml of urine. Isolates were gram stained. Bacterial identification was based on standard culture and biochemical characteristics of isolates. E coli was identified as medium, pink-to-red colonies and confirmed by positive indole test. Klebsiella pneumoniae are large pink-to-mauve colonies, which was confirmed by negative oxidase and indole test. P mirabilis has translucent blue grey appearing colonies testing negative to indole and oxidase and positive to urease. Enterococcus faecalis is identified by small turquoise mucoid which is negative for catalase and positive for bile esculin. Pseudomonas aeruginosa is identified as clear colonies that is positive for oxidase. Gram negative bacteria will be identified by oxidase test and all other tests of API 20E and API NE (API: analytical profile index). Gram positive organisms were identified by corresponding laboratory test like catalase coagulase, CAMP test and esculin agar. Antibiotic susceptibility of organisms were tested by modified Kirby-bauer disc diffusion technique Mueller Hinton medium using antibiotic disc of oxoid (UK) with the minimum inhibitory concentration (MIC). The susceptibility criteria was applied according to CLSI 2010 guidelines. The organism isolated were tested for sensitivity against different antibiotics discs like levofloxacin, ceftriaxone, ciprofloxacin, amikacin, gentamycin, nitrofurantoin, amoxiciline, imipenam, co-trimoxazole, cephalazoline, cefixime and pipademic acid by measuring the diameter of zone of inhibition around each antibiotic disc. If the zone of inhibition will be > 18mm around any particular antibiotic disc the organism was considered sensitive for that antibiotic and if it was between 14-18 mm it is moderately or intermediary sensitive and if it was <14mm than the organism is considered resistant against that antibiotic.

All data was entered in SPSS version-25 for analysis. Spectrum of microorganisms and their antibiotics sensitivity pattern was presented in form of frequency and percentage.

RESULTS

Mean age of the patients was 6.07±256 years. There were 75 (57.25%) male patients, and 56 (42.75%) female patients.

Urinary tract infections were diagnosed in 30 (22.90%) patients. While remaining 101 (77.10%) were not diagnosed of having UTI on culture reporting (Figure 3).

Regarding spectrum of causing organisms E. coli was the commonest organism diagnosed in 14 (46.67%) patients, S. Aeruginosa in 4 (13.33%) patients, Enterococcus Faecalis in 3 (10%) patients, Klebsella Pneumoia in 3 (10%) patients, Proteus vulgaris in 2 (6.67%) patients, Staphylococcus saprophyticus 2 (6.67%) patients, MRSA in 1 (3.33%) and proteus Spp. in 1 (3.33%) patients (Figure 1).

Regarding Antibiotic spectrum, For E. Coli levofloxacin was sensitive to 92.9% patients, Ceftriaxone in 12 (87.5%), ciprofloxacin and Amikacin in 13 (92.9%), Gentamycin in 12 (87.5%) patients. For Pseudomonas Aeruginosa all drugs were found to be 100% sensitive except ciprofloxacin, Amoxicilin and Co-trimoxazole which shown 75% sensitivity. For MRSA only Levofloxacin, Ceftriaxone and Imipenam were sensitive. For Staphylococcus Saprophyticus, and Proteus Spp. almost all drugs were sensitive. Detailed spectrum is given in Table 1.

Resistant strains were diagnosed in 3 (10%) patients, out of which 2 (6.67%) were E. Coli and 1 (3.33%) were MRSA (Table 2).

All data was entered in SPSS version-16 for analysis. Qualitative variables like gender, age groups, UTI, microorganisms, sensitive strain, resistant strain and multi drug resistant strain and was measured in terms of frequency and percentages and was presented through tables and charts. Mean ± S.D. was calculated for age.

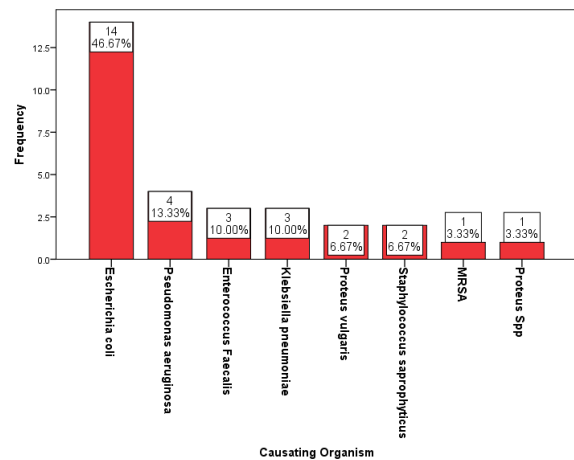


Figure 4. Frequency of Causing Organisms.

Table 1. Antibiotic Susceptibility Patterns of Micro-organisms Causing UTI.

	E. Coli	Pseudo. Aeruginosa	E. Faecalis	K. Pneumoniae	Proteus Vulgaris	S. Saprophyticus	MRSA	Proteus Spp.
Levofloxacin	13 (92.9%)	4 (100%)	3 (10.3%)	3 (100%)	2 (100%)	2 (100%)	1 (100%)	1 (100%)
Ceftriaxone	12 (87.5%)	4 (100%)	2 (66.7%)	3 (100%)	1 (50%)	2 (100%)	1 (100%)	1 (100%)
Ciprofloxacin	13 (92.9%)	3 (75%)	3 (100%)	2 (66.7%)	2 (100%)	2 (100%)	0 (0.0%)	1 (100%)
Amikacin	13 (92.9%)	4 (100%)	3 (100%)	3 (100%)	2 (100%)	2 (100%)	0 (0.0%)	1 (100%)
Gentamycin	12 (85.7%)	4 (100%)	2 (66.7%)	3 (100%)	1 (50%)	2 (100%)	0 (0.0%)	1 (100%)
Nitrofurantoin	13 (92.9%)	4 (100%)	2 (66.7%)	2 (66.7%)	2 (100%)	2 (100%)	0 (0.0%)	1 (100%)
Amoxiciline	10 (71.4%)	3 (75%)	3 (100%)	3 (100%)	2 (100%)	2 (100%)	0 (0.0%)	1 (100%)
Imipenam	14 (100%)	4 (100%)	3 (100%)	3 (100%)	2 (100%)	2 (100%)	1 (100%)	1 (100%)
Cotrimoxazole	10 (71.4%)	3 (75%)	2 (66.7%)	2 (66.7%)	2 (100%)	1 (50%)	0 (0.0%)	0 (0.0%)
Cephalazoline	12 (85.7%)	4 (100%)	3 (100%)	3 (100%)	2 (100%)	2 (100%)	0 (0.0%)	1 (100%)
Cefixime	12 (85.7%)	4 (100%)	3 (100%)	3 (100%)	2 (100%)	2 (100%)	0 (0.0%)	1 (100%)
Pipademic Acid	12 (85.7%)	4 (100%)	1 (33.3%)	2 (66.7%)	2 (100%)	2 (100%)	1 (100%)	1 (100%)

Table 2. Pattern of Resistance.

	Frequency	Percentage
Total Number	03	10%
Name of Resistant Organisms		
<i>E. Coli</i>	02	(6.67%)
<i>MRSA</i>	01	(3.33%)

DISCUSSION

The pediatric population is at higher risk of infections and UTI is among the commonest causes of morbidity in this population. We found UTI in 22.90% patients having suspicion of UTI. Mohanty et al. reported UTI in 14.7% suspected pediatric patients.¹¹ Dash et al. and Mehta et al. reported UTI in 34.5% and 36.6% patients respectively.^{12, 13}

A cross sectional study conducted in 2016 in different hospitals of Pakistan showed that overall prevalence of UTI in indoor and outdoor patients is 21.2% among all age groups out of which 19.4% were of the age between 0 to 20 year, 49.5% were of the age falling in the range 21 to 50 years and 31.1% were above 51 years of age.¹⁴

In present study, *E-Coli* was the most common pathogen diagnosed in 46.67% children, followed by *Pseudomonas Aeruginosa* diagnosed in 13.33% children. While *Klebsiella pneumoniae* and *Enterococcus faecalis* was diagnosed in 10% patients. Woo et al. reported *E. Coli* prevalence in 86.4% cases of UTI, *Klebsiella spp.* in (4.2%) cases. While other less common organisms were *Enterobacter*, *Proteus*, *Enterococcus*, *Citrobacter*, and *Staphylococcus*.¹⁵

Another study conducted by Amber et al. on pattern and antibiotic spectrum of UTI in children, reported *E. coli* as the commonest organism diagnosed in 43.2% patients, *P. aeruginosa* in 15.5%, *Klebsiella pneumoniae* in 12.4%, *Proteus vulgaris* in 5.1% and *Staphylococcus saprophyticus* in 3.8% patients.¹⁴

Due to rapidly emerging resistance to antibiotics, it is becoming difficult to treat UTI as well. As the children are at higher risk of morbidity and mortality due to infections caused by resistant organisms, the use of inappropriate anti-biotics may lead to adverse prognosis. Therefore, the selection of proper empirical antibiotics is very necessary in these patients.¹⁶⁻¹⁸

Thus, we investigated the antibiotic susceptibility patterns of *E. coli* and other pathogens that were isolated in from patients diagnosed with UTI. In present study antibiotic resistance was diagnosed in 10% patients, of which 6.66% patients were having *E. Coli* infection and 3.33% patients were having *MRSA*.

The presence of resistant strains of UTI to routinely available antibiotics in Pakistani patients is due to different factors. Most important of one the unjudicial prescription of anti-biotics, and almost 80 to 90% antibiotics are available over the counter and no prescription is required to get these from pharmacies. Moreover, 3rd general antibiotics are is common practice to treat less virulent organisms such as those causing pharyngitis or otitis. The other reasons are unavailability of infection control departments and policies in our hospitals.¹⁹⁻²¹

CONCLUSION

E. coli is the predominant uropathogen causing UTIs in children. Most of the strains causing UTI are resistant to

first general antibiotics. Third generation cephalosporins are optimal initial choice for management of UTI in children.

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