Original Article

Microorganism causing urinary tract infection among children and their antimicrobial susceptibility patterns

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Objective: To determine frequency of common bacteria causing urinary tract infection (UTI) among toilet-trained children and their antimicrobial susceptibility pattern.

Methodology: This descriptive cross sectional study was completed from October 2020 to March 2021 at pathology unit of Sahara Medical College, Narowal. It included 193 toilet-trained children with culture positive UTI. Demographic details like gender, age, residential area, and clinical findings along with isolated microorganism and antimicrobial sensitivity pattern were recorded. Mid-stream urinary samples were collected and sent to institutional laboratory for urine analysis, culture and antimicrobial sensitivity patterns.

Results: Out of 193 children, there were 108 (54%) female and 91 (47.2%) male. Mean age was 10.56 ± 3.82 years (range 6 – 14). There were 107 (55.4%) children above 10 years of age and 122 (63.2%) belonged to rural areas. Most common bacteria isolated was E. coli in 155 (80.3%) cases. Antimicrobials having highest sensitivity against the causative bacteria include imipenem and meropenem 189 (97.9%), piperacillin tazobactam 187 (96.9%), amikacin 185 (95.8%), fosfomycin 184 (95.3%), gentamycin 178 (92.2%) and sulzone 171 (88.6%).

Conclusion: E. Coli was the commonest bacteria causing UTI among toilet trained children. Antimicrobials with highest sensitivity against the causative organisms include imipenem, meropenem, piperacillin tazobactam, amikacin and fosfomycin.

Keywords: Urinary tract infection, gram-negative bacteria, E.coli, toilet-trained children.

INTRODUCTION

Urinary tract infection (UTI) is the second commonest bacterial infection among children.[1] It is a second most common infection in children after upper respiratory tract infection.[2] Male children are infected more than female children with ratio of 3-5:1. After attaining few years, female children are more affected than male with the ratio of 1:10.[3] Most of the infected male children are uncircumcised. Volitional holding and bladder stasis during toilet training cause UTIs.[4] According to a study about 4% male and 12% female children below 16 years of age get UTIs and recurrence of UTIs is also common among the children.[5] Chronic UTI can lead to long term complications like pyelonephritis, and hypertension and ESRD in adults.[6]

E. coli, Pseudomonas and Klebsiella are the commonest organisms causing UTIs. Gram negative flora of vagina and peri-urethral area also cause of UTIs.[7] Antibiotic selection depend age, previous illness, previous drug and medical history, their antibiotic resistance chart as well as most common causative organisms and antibiotic sensitivity pattern.[8] Multidrug resistance is described as resistance to two or more classes of antibiotics.[9] It is very important to determine antibiotic sensitivity pattern before treating the infection.[10] No such study has been done in the past in Pakistan, so this study was done to determine causative bacteria of UTI among toilet-trained children and their antibiotic susceptibility pattern.

METHODOLOGY

This observational descriptive study was conducted at pathology department of Sahara Medical College, Narowal from October 2020 to March 2021. Sample size was calculated using WHO sample size calculator. Patients were selected using consecutive sampling technique. Approval for study was taken from the institutional ethical review committee. Total 193 toilet-trained children age 6-14 years with UTI confirmed on urine culture were enrolled. Those patients having multiple micro-organisms in urinary culture, having urological problems like urinary stones, vesicoureteric reflux, post-urethral valves and incontinence, mentally retarded patients, children with congenital genitourinary anomalies or those who lost follow-up, were excluded from the study.

Midstream urinary sample was collected and sent immediately to the institutional laboratory for urine examination, culture and antibiotic susceptibility. Urinary culture was considered positive when colony count was > 100,000/cmm of a single organism or it was > 10,000/cmm in symptomatic children with the complaint of fever, urinary incontinence, abdominal pain, vomiting or dysuria etc. Demographic data like gender, age, area of residence and their clinical findings, isolated organism on urinary culture and spectrum of antimicrobial susceptibility were recorded.

Statistical Analysis: Data were analyzed using SPSS version 20.

RESULTS

There were 193 cases in this study including 91 (47%) male and 102 (52.8%) female cases. Mean age was 10.21 ± 2.3 years. Most of the patients (63.2%) belonged to rural areas (Table 1). We found 184 (95.3%) samples showed sensitivity to nitrofurantoin, 189 (97.9%) to imipenem and 185 (95.8%) to amikacin, ciprofloxacin (34.2%), cefixime (48.7%) to fosfomycin, 171 (88.6%) to sulzone, 163(84.4%) to and meropenem, 187 (96.9%) to piperacillin tazobactam Low sensitivity was shown by amoxicillin (29%), and ofloxacin (30%) (Fig. 1).

Micro-organisms isolated from urine samples were E. coli in 155 (80.3%) samples, Klebsiella pneumonia in 26 (13.4%), Enterobacter in 07 (3.6%), Enterococcus in 02 (1.04%) and Proteus mirabilis in 03 (1.5%) samples (Fig. 2). Low sensitivity was shown by amoxicillin (29%), and ofloxacin (30%).

Table 1: Demographic characteristics of the patients (n = 193).

Patients' Characteristics		N (%)
Gender	Male	91 (47.2%)
	Female	102 (52.8%)
Age (Years)	<10	86 (44.6%)
	≥10	107 (55.4%)
Residential Area	Rural	122 (63.2%)
	Urban	71 (36.8%)

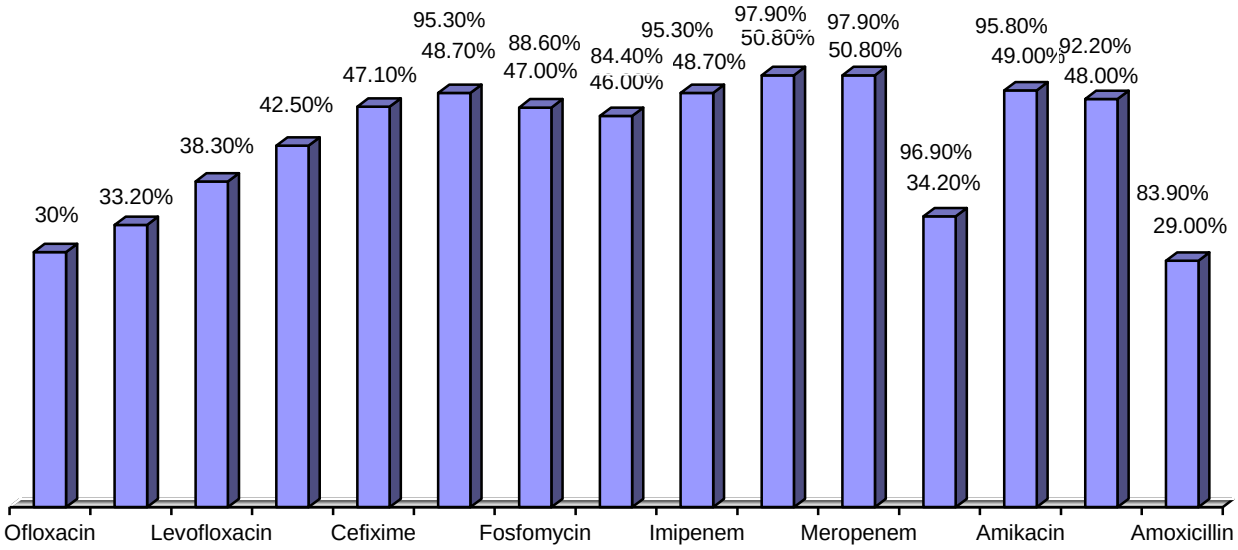

Fig. 1: Antibiotic sensitivity pattern against Gram-negative rods (n = 193).

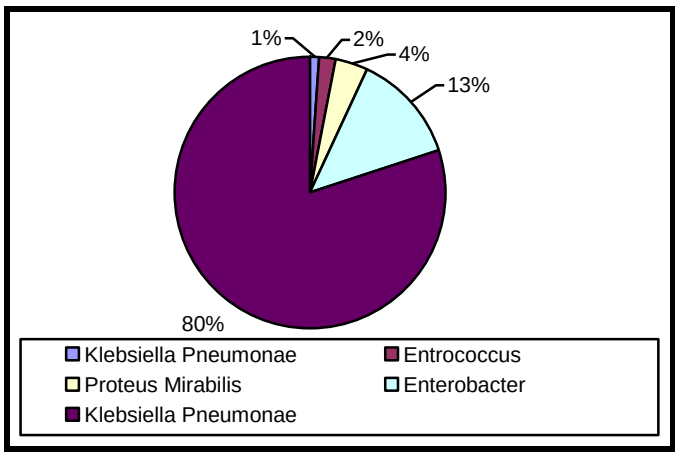

Fig. 2: Frequency of gram-negative bacteria isolated from urine samples (n = 193).

DISCUSSION

Long term complications of UTIs among pediatric population include pyelonephritis, sepsis, renal injury and antibiotic resistance due to frequent use of antimicrobials.[11] Female children are more prone to acquire UTIs than male children due to short urethra size in females.[12]

In our study, 52.8% female children were affected as compared to 47.2% male children. A study found E. coli to be the most common organism causing UTIs followed by Pseudomonas and Gram-negative bacteria were most sensitive to ciprofloxacin (70%), Norfloxacin (63.4%) and ceftriaxone (60%).[13] Leung et al also found E.coli was the most common pathogen causing UTI in 80% – 90% children.[14] In our study E. coli was found in 80.3% cases. Nitrofurantoin (80.9%), Gentamycin (77.9%) and amikacin (65.3%) had highest sensitivity against E. coli causing UTI.[15]

In this study, ciprofloxacin showed low sensitivity (34.2%) against gram-negative rods. Fluoroquinolones are still considered superior to amoxiccilin clavulanate due to its pharmacokinetics. Our findings were totally different from another study reporting 100% sensitivity against gran negative bacteria causing UTIs.[16] Difference in results may be due to change in region. Ceftriaxone is another commonly used antibiotic which showed sensitivity of 50.8% in our study. However, increased resistance against ceftriaxone as 75% was reported from India[16] and 71.4% in Saudi Arabia.[17]

We found very good sensitivity of piperacilin tazobactam, imipenem, meropenem, amikacin, fosfomycin, gentamycin and nitrofurantoin. Zubair et al reported high sensitivity of imipenem (100%), piperacilin tazobactam (100%) and nitrofurantoin (93.2%) while low sensitivity reported for ceftriaxone (45.9%), ciprofloxacin (38.9%) and cefixime (37.35) against gram negative rods causing UTIs among children.[18] Another study by Majeed et al reported high resistance of E. coli, against commonly used antibiotics like amoxicillin (83.4%), amoxiclave (66.4%), gentamycin (66.4%) and ceftriaxone (25%).[19]

This is the first study in our region analyzing common organisms causing UTIs among toilet trained children and antibiotic susceptibility pattern against commonly used antibiotics. Results of his study give an idea of antibiotic susceptibility pattern of gram negative rods and help us to select suitable antibiotic for treating this infection in our region.

CONCLUSION

Escherichia coli was the most common organism among gram negative rods causing urinary tract infection in toilet trained children. Commonly used oral antibiotics among children like amoxicillin clavulanate, nitrofurantoin and fosfomycin showed very good sensitivity pattern against gram negative bacteria.

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