ORIGINAL ARTICLE

Causative Organisms and Their Sensitivity Pattern of Urinary Tract Infection in Children

Sidra Tul Muntaha,[1] Mutassim Ismail,[2] Farhan Hassan[3]

ABSTRACT

Objective: The objective of this study was to determine the frequency of pathogens and their drug sensitivity pattern in children presenting with urinary tract infections.

Study Design: It was a cross sectional study.

Place and Duration of Study: The study was conducted in 6 months from Nov 01, 2013 to Apr 30, 2014 at casualty and outpatient departments of Pediatrics at Benazir Bhutto Hospital, Rawalpindi.

Materials and Methods: All the children between 1-12 years of age with one or more symptoms of UTI were included in study. The collected urine samples of the patients were transported immediately to the laboratory for urinalysis, culture and sensitivity. Cultures were done directly on CLED agar medium and incubated for 48 hours at 37^0C. Sensitivities were checked for Trimethoprim-Sulfamethoxazole, Amoxycillin-Clavulanic acid, Nalidixic acid and others. All data were entered and analyzed in SPSS version 16.

Results: Out of 155 children, 72.26% (n=112) had E.Coli, 14.84% (n=23) had Klebsiella Pneumoniae, 10.32% (n=16) had Staphylococcus Saprophyticus and 2.58% (n=4) had others. These bacterial pathogens were sensitive to Amoxycillin-Clavulanic acid and Trimethoprim-Sulfamethoxazole.

Conclusion: The results of the study revealed that Escherichia coli followed by Klebsiella and Staphylococcus saprophyticus are the leading pathogens of urinary tract infection in children. Out of three antimicrobials studied, Amoxycillin-Clavulanic acid and Trimethoprim-Sulfamethoxazole have been found to be superior in efficacy as compared to Nalidixic acid.

Key Words: *Urinary Tract Infection, Children, Pathogens, Sensitivity.*

Introduction

The term Urinary tract infection (UTI) indicates the invasion by microorganisms of previously sterile urinary system. The worldwide incidence of urinary tract infection in children is 30%.[1] In USA the incidence of UTI in children is 3-7% in girls and 1-2% in boys.[2] The prevalence ranges from 2-8% throughout childhood.[3] However, in Iran the incidence of UTI is comparatively lower than the western world about 3% of girls and 1% of boys experience first episode before reaching 11 years of age.[1] Childhood UTI requires early diagnosis as it causes renal damage by renal scarring leading to end stage renal disease.[4]

Increasing resistance of bacterial pathogens is of worldwide concern that is varied in different regions and even countries.[5] Most UTIs in developing countries are treated on an empirical basis; thus treatment should be based on available local data regarding the susceptibility of common pathogens to antibiotics.[6]

There is increase of antibiotic-resistant strains, which are created because of antibiotic abuse and inappropriate choice of antibiotics; however the recent development of new antibiotics has led to changes in the antibiotic susceptibilities of the pathogens.[7]

Different studies have shown study that the most commonly isolated organisms from urine culture were Escherichia Coli (66.3%), Staphylococcus Saprophyticus (14.9%), Klebsiella Pneumoniae (11%) and the highly active antibiotic against them was Nalidixic acid (70%), and then Amoxicillin-Clavulanic acid (29.9%), Co-trimoxazole (16.4%).[1,8]

This study was designed to determine the microorganisms and the sensitivity patterns of these organisms to various drugs. The result of the study

[1]*Department of Pediatrics*
Yusra Medical & Dental College, Islamabad
[2]*Department of Pediatrics*
Benazir Bhutto Hospital, Rawalpindi
[3]*Department of Community Medicine*
Rawalpindi Medical College
Holy Family Hospital, Rawalpindi

Correspondence:
Dr. Farhan Hassan
Department of Community Medicine
Rawalpindi Medical College
Holy Family Hospital, Rawalpindi
E-mail: farhan.25hd@hotmail.com

Funding Source: NIL; Conflict of Interest: NIL
Received: Aug 01, 2016; Revised: Oct 15, 2016
Accepted: Nov 15, 2016

would provide future guidelines for effective prescribing practices and management of UTIs for our population. The exact information about the infecting organism and pediatric UTIs in a region is usually not available, and if available it is outdated as antimicrobial sensitivity patterns are bound to change over a period of time. This study aims to facilitate the empiric treatment of patients with symptoms of UTIs. Moreover, the data would also help authorities to formulate antibiotic prescription policies, at least for a region.

Materials and Methods

This was cross sectional descriptive study. Duration of the study was six months from Nov 01, 2013 to Apr 30, 2014 and sampling technique was non-probability purposive. All children between 1-12 years of age of either sex presented with one or more clinical symptoms of UTI were included. All children who have already taken antibiotics in the past 24 hours, already catheterized, uncircumcised males or children with phimosis or paraphimosis were not included in study. Basic demographic information including name, age, gender, weight, and height was collected. Midstream urine samples of 155 patients were collected by aseptic measures for routine examination and culture sensitivity in children older than 2 years, by sterile adhesive pediatric urine bag in children up to 2 years and by suprapubic aspiration in children between 1 to 2 years of age, if necessary. The collected samples were transported immediately to the laboratory for urinalysis and culture and sensitivity. UTI was defined by the presence of a pure growth of more than 105 colony forming units of bacteria per milliliter of urine. Cultures were done directly on CLED agar medium for 48 hours. Antibiotics sensitivity was tested using disc diffusion technique by using various antibiotic discs as per guidelines of national committee for clinical laboratory standards.[9] Sensitivities were checked for Trimethoprim-Sulfamethoxazole, Amoxycillin-Clavulanic acid, Nalidixic acid and others. Urine culture and sensitivity reports were evaluated and isolated microorganisms along with their sensitivities to the mentioned drugs were entered in already designed Performa and all the reports were verified by the Pathologist. All data were entered and analyzed by SPSS version 16. Mean and standard deviation were calculated for age, weight and height. Percentages and frequencies were calculated for gender, commonly isolated microorganisms (Escherichia Coli, Klebsiella Pneumoniae and Staphylococcus Saprophyticus) and their sensitivity patterns to various drugs (Trimethoprim-Sulfamethoxazole, Amoxycillin-Clavulanic acid, Nalidixic acid and others).

Results

Age distribution of the patients showed that 56.13% (n=87) were between 1-6 years of age and 43.87% (n=68) were between 7-12 years of age, mean +SD was calculated as 7.54+2.61 years. According to gender, 36.77% (n=57) children were males and 63.23% (n=98) were females. Mean weight and height of the patients were recorded which came out to be 24.48+7.29 Kg and 110.29+35.21 cm respectively.

Frequency of pathogens in children with UTI was recorded as shown in Table I. Sensitivity pattern of various drugs for pathogens was recorded which showed Escherichia Coli (E. Coli) most sensitive to Trimethoprim-Sulfamethoxazole (66%), Klebsiella Pneumoniae to Amoxycillin-Clavulanic acid (74%), and Staphylococcus Saprophyticus to Amoxycillin-Clavulanic acid (76%) as shown in Table II.

Table I: Frequency of Pathogens in Children with UTI (n=155)

Pathogens	No. of patients	%
Escherichia Coli	112	72.26
Klebsiella Pneumoniae	23	14.84
Staphylococcus Saprophyticus	16	10.32
Others	4	2.58
Total	155	100

Table II: Frequency of Sensitivity Pattern of Various Drugs for Pathogens in Children with UTI (n=155)

Pathogens	Sensitivity
Escherichia Coli	Trimethoprim-Sulfamethoxazole (66%) Amoxycillin-Clavulanic acid (62%) Nalidixic acid (51%) Others (18%)
Klebsiella Pneumoniae	Trimethoprim-Sulfamethoxazole (58%) Amoxycillin-Clavulanic acid (74%) Nalidixic acid (46%) Others (11%)
Staphylococcus Saprophyticus	Trimethoprim-Sulfamethoxazole (73%) Amoxycillin-Clavulanic acid (76%) Nalidixic acid (48%) Others (16%)

Discussion

In this study, out of 155 children, 36.77% (n=57) were male and 63.23% (n=98) were females with female to male ratio of 2.5:1.4. Yolbas I et al. in their study analyzed age and gender-wise data of the prevalence of uropathogens in community-acquired urinary infections. They found that all the organisms were more common in females than males with ratio of 3.9:1.1 which is in agreement with our study.[1] Data from other international studies on pediatric patients also report that UTIs are more common in females, which is similar to our finding.[10,11] However unlike our study, Kalantar et al. in his prospective study of 1696 children aged up to 5 years reported male to female ratio of 1.07:1.[12] Jahanzeb et al. in their study included children up to 12 years of age and found that UTI is more common in males with an overall male to female ratio of 1.2:1.[13] During the first year of life males were infected more than females. This was also reported by all other researchers, observed as 2.8-5.4:1.0 in the first year of life and changing to 1:10 in the second year of life because in infancy more common in uncircumcised males and later in life more common in females due to shorter length of urethra in females which shortens the distance of travel for bacteria to reach the urinary bladder.[14]

Frequency of pathogens in children with UTI was recorded, it showed that 72.26% (n=112) had E.Coli, 14.84% (n=23) had Klebsiella Pneumoniae, 10.32% (n=16) had Staphylococcus Saprophyticus and 2.58% (n=4) had others. E. coli (72.26%) was the leading infecting organism of pediatric UTI at our center. This is in consistent with studies reported by Mashouf et al.[15] (57.4%) in Iran, Kalantar et al.[12] (54.8%) in Iran, Brad et al.[16] (58%) in Romania. Data from the above studies showed that E. coli are consistently found predominant uropathogen irrespective of country, community or hospital setting. Our study demonstrated Klebsiella Pneumoniae in 10.32% subjects. Yolbas I et al. in a study, showed similar data with Klebsiella spp. being detected in 20.7%[1] cases and in various parts of the world as 14.0%,[11] 14.5%[14] and 21.0%[13] cases. Findings of study is in agreement with another study showing the most commonly isolated organisms from urine culture were Escherichia Coli (66.3%), Staphylococcus Saprophyticus (14.9%), Klebsiella Pneumoniae (11%) and the highly active antibiotic against them was Nalidixic acid (70%), and then Amoxicillin-Clavulanic acid (29.9%), Co-trimoxazole (16.4%).[1,9] In a study conducted by Nayek K et al, author indicated a lower percentage of E.Coli infections and a higher infection with Proteus and Klebsiella species. This could be explained on the basis of sampling technique and the different proportion of males to females in different studies.[17,18] On the other hand some have given a higher percentage of E.Coli infection as compared to other organisms which is in agreement with our study.[19,20]

We found a valuable laboratory data on antibiotic susceptibilities of uropathogens which allows comparison of the situation in our area with that in other countries and other regions of our country. Amoxycillin-Clavulanic acid and Trimethoprim-Sulfamethoxazole were the most sensitive antibiotics in our study. These results are in agreement with many other published articles.[21,22]

A study in Turkey by Rodríguez-Baño J et al. also reported that with Amoxicillin-Clavulanate, cure rate of patients with cystitis was 93%, cure rates were 93% in children with susceptible isolates (MIC < or =8 µ/mL).[23] A study by Çoban B et al showed sensitivity to trimethoprim-sulfamethoxazole (56.9%), and to amoxycillin-clavulanate (65.2%). They followed up patients for period of 5 years and observed the resistance of E. coli to amoxycillin-clavulanate decreased from 40.3% to 31.3%, while the resistance to trimethoprim-sulfamethoxazole decreased from 45.6% to 34.7%.[24] A study by Jackowska T et al. showed, 86% cases of urinary infection were caused by one of the isolated pathogens i.e. Escherichia coli, Klebsiella pneumoniae or Proteus mirabilis. Escherichia coli was the most common isolated pathogen (70-74%). Frequency of isolating of Klebsiella Pneumoniae grew from 6 to 10%. Likewise, in the period of two years they observed the level of the susceptibility to trimethoprim-sulfamethoxazole (90-91%) remained same and a non-statistically significant lowering of susceptibility to aminopenicillins, and aminopenicillins combined with beta-lactamase inhibitors from 92 to 74% (p=0.2).[25]

Another study by Mirsoleymani SR[26] concluded from 19,223 collected samples that predominant agents of UTI were successively E.coli (65.2%; 95%),

Klebsiella Pneumoniae (26%; 95%), Pseudomonas aeruginosa (3.6%; 95%), Staphylococcus coagulase positive (3.7%; 95%) and Enterobacter species (0.4%; 95%), and our findings are consistent regarding the most common pathogen of the morbidity.

Conclusion

Escherichia Coli followed by Klebsiella Pneumoniae and Staphylococcus Saprophyticus are the leading pathogens in children with UTI. Amoxycillin-Clavulanic acid and Trimethoprim-Sulfamethoxazole are superior in efficacy as compared to Nalidixic acid. Hence Amoxycillin-clavulanic acid or Trimethoprim-sulfamethoxazole can be used safely when urine culture reports are awaited.

REFERENCES

1. Yolbas I, Tekin R, Kelekci S, Tekin A, Okur MH, Ece A, et al. Community acquired urinary tract infection in children pathogens, antibiotic susceptibility and seasonal change. Eur Rev Med pharmacol Sci. 2013: 17; 971-6.
2. Roberts KB. Urinary Tract Infection: Clinical practice guideline for the diagnosis and management of the initial UTI in febrile infants and children 2 to 24 Months. Pediatrics. 2011; 128: 595-610.
3. Pennesi M, L'erario I, Travan L, Ventura A. Managing children under 36 months of age with febrile urinary tract infection: a new approach. Pediatr Nephrol. 2012; 274: 611-5.
4. Hamid F , Md Rafiqul Islam, Paul N, Nusrat N , Parveen R .Urinary Tract Infection in Children: A Review .Delta Med Col J. 2013; 1: 51-7.
5. Chakupurakal R, Ahmed M, Sobithadevi DN, Chinnappan S, Reynolds T. Urinary tract pathogens and resistance pattern. J clin pathl. 2010 ; 63: 652-4.
6. Konca C, Tekin M, Uckardes F, Akqun S, Almis H, Bucak H, et al. An overview of antibacterial resistance pattern of Pediatric community acquired urinary tract infections. 2016; 20: 131-9.
7. Cellen IM, Maneksha RP, McCullagh E, Ahmed S, O'Kell F. An 11 year analysis of prevelant uropathogens and changing pattern of E. coli antibiotic resistance in 38,530 community UTI. Ir J Med Sci. 2013; 182: 81-9.
8. Paryani JP, Memon SR, Rajpar ZH, Shah SA. Pattern and Sensitivity of Microorganisms Causing Urinary Tract Infection at Teaching Hospital. JLUMHS. 2012; 11: 97-100.
9. Reller LB, Weinstein M, Jorgensen JH, Ferraro MJ. Antimicrobial Susceptibility Testing: A Review of General Principles and Contemporary Practices. Clin Infect Dis. 2009; 49: 1749-55.
10. Abdulhadi SK, Yashua AH, Uba A. Organisms causing urinary tract infection in paediatric patients at Murtala Muhammad Specialist Hospital, Kano, Nigeria. Int J Biomed Health Sci. 2008; 4: 165–7.
11. Brkic S, Mustafic S, Nuhbegovic S, Ljuca F, Gavran L. Clinical and epidemiology characteristics of urinary tract infections in childhood. Med Arh. 2010; 64: 135–8.
12. Kalantar E, Motlagh ME, Lornejad H, Reshadmanesh N. Prevalence of urinary tract pathogens and antimicrobial susceptibility patterns in children at hospitals in Iran. Iran J Clin Infect Dis. 2008; 3: 149–53.
13. Jahanzeb Khan Afridi, Mukhtiar Ahmad Afridi, Rahida Karim, Arshia Munir. Causative organisms and their sensitivity pattern of urinary tract infection in children of tertiary care hospital. KJMS. 2014; 7: 290-94.
14. Yoon JE, Kim WK, Lee JS, Shin KS, Ha TS. Antibiotic susceptibility and imaging findings of the causative microorganisms responsible for acute urinary tract infection in children: a five-year single center study. Korean J Pediatr. 2011; 54: 79-85.
15. Mashouf RY, Babalhavaeji H, Yousef J. Urinary tract infections: Bacteriology and antibiotic resistance patterns. Indian Pediatr. 2009; 46: 617–20.
16. Brad GF, Sabau I, Marcovici T, Maris I, Daescu C, Belei O, et al. Antibiotic resistance in urinary tract infections in children. Jurnalul Pediatrului. 2010; 13: 73–7.
17. Mortazavi F, Shahin N. Changing patterns in sensitivity of bacterial uropathogens to antibiotics in children. Pak J Med Sci. 2009; 25: 801-5.
18. Nayek K, Ghosh TN, Chattopadhyay TK, Ghosh N, Banerjee A, Saha I. Clinicoetiological profile and drug sensitivity patterns of urinary tract infections in paediatric patients attending a rural tertiary care hospital. Pak Paed J. 2011; 35: 220-5.
19. Ghorashi Z, Ghorashi S, Ahari HS, Nezami N. Demographic features and antibiotic resistance among children hospitalized for urinary tract infection in northwest Iran. Infect Drug Resist. 2011; 4: 171-6.
20. Bercion R, Mossoro-Kpinde D, Manirakiza A, Le Faou A. Increasing prevalence of antimicrobial resistance among enterobacteriaceae uropathogens in Bangul, Central African Republic. J Infect Dev Ctries. 2009; 3: 187-90.
21. Habib S. Highlights for management of a child with urinary tract infection. Int J Pediatr. 2012; 20: 943653.
22. Saaedeh SA, Mattoo TK. Managing urinary tract infections. Pediatr Nephrol. 2011; 26: 1967-76.
23. Rodríguez-Baño J, Alcalá JC, Cisneros JM, Grill F, Oliver A, Horcajada JP, et al. Community infections caused by extended-spectrum beta-lactamase-producing Escherichia coli. Turk Pediatri Ars. 2014; 49: 124-9.
24. Çoban B, Ülkü N, Kaplan H, Topal B, Erdoğan H, Baskın E. Five-year assessment of causative agents and antibiotic resistances in urinary tract infections. Turk Pediatri Ars. 2014; 49: 124-9.
25. Jackowska T, Pawlik K, Załeska-Ponganis J, Kłyszewska M. Etiology of urinary tract infections and antimicrobial susceptibility: a study conducted on a population of children hospitalized in the Department of Pediatrics at Warsaw Bielany Hospital. Med Wieku Rozwoj. 2008; 12: 705-12.
26. Mirsoleymani SR, Salimi M, Brojeni MS, Ranjbar M, Mehtarpoor M. Bacterial Pathogens and Antimicrobial Resistance Patterns in Pediatric Urinary Tract Infections: A Four-Year Surveillance Study (2009–2012).International Journal of Paediatrics. 2014; 2: 1-6.