ORIGINAL ARTICLE

FREQUENCY OF UROPATHOGENIC BACTERIA AND THEIR ANTIBIOTIC SUSCEPTIBILITY PATTERN IN PAEDIATRIC PATIENTS AT A TERTIARY CARE HOSPITAL

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ABSTRACT

Objective: To find the sensitivity patterns of uro-pathogens to the commonly prescribed antibiotics for UTI in paediatric patients.

Materials and methods: Retrospective analysis of urine culture and sensitivity from the record of 143 patients referred by Paediatric department and reported by pathology department, Lady Reading Hospital Peshawar from January 2018 to June 2018 was done.

RESULTS: The commonest pathogen found was E. Coli(71.23%) followed by Staphylococcus aureus, Enterobacter,Pseudomonasauroginosa and Providencia species. The sensitivity of E. coliwas (27.4%) to Trimethoprim-sulfamethoxazole (9.8 - 39.2%)to commonly used drugs from cephalosporin group and (39.25 %) to Ciprofloxacin. On the other hand, its sensitivity was(100%) to Meronem,(99%) to Gentamycin and Imipenem,(87.2%)to Fosfomycin and (98.9%)to Nitrofurantoin. Multi drug resistance ofE. Coli frequency was 83.39% as per our study.

CONCLUSION: E. Coli is the commonest pathogen causing UTI and its antibiotic sensitivity varies over time and geographical locations.

KEY WORDS: Antimicrobial, sensitivity, Escherichia Coli, Urinary tract, infection.

This article may be cited as: Hussain M, Irshad M, Hayat M, Adeeb H, Ullah I, Khan AJ. Frequency of uropathogenic bacteria and their antibiotic susceptibility pattern in paediatric patients at a tertiary care hospital. J Med Sci 2019; 27: (3) 198-202.

INTRODUCTION

Urinary tract infection (UTI) is the third most common infection in humans after respiratory and gastrointestinal infections[1]. UTI is one of the common problems presenting to the general physicians. In infancy, UTI is more common in boys due to anatomical abnormalities[2]. After infancy UTI is more common in females due to the short length of urethra and ascending infections. Prevalence in neonates has been reported 1-2% mostly boys 3 while it is twice in school girls as compared to neonates [4-7]. Though UTI is not as common in children as in adults but its clinical presentation is often nonspecific. Infant and pre-school children may present with very few localizing features. Their presentation is mostly with systemic symptoms and signs like fever, vomiting, abdominal pain, failure to thrive, failure to eat, septicaemia and shock[8,9]. Older children may present with dysuria, fever, burning micturition and pyuria. Because of nonspecific symptoms, index of suspicion should be high in children for diagnosing UTI. Approximately 40% of children have underlying abnormality of urinary tract[10,6]. Untreated UTI and delayed management can lead to renal scarring and progressive loss of renal function [6, 5, 11]. Timely diagnosis and management with antimicrobials can prevent long term sequalae of UTI in children. Identifying the causative bacteria and its antimicrobial susceptibility by treatment with antibiotics is started empirically[5,11]. Antibiotics susceptibility of common uro-pathogens of a region is crucial in deciding empirical treatment[12,13]. In the situation of growing antibiotic resistance, there is need to continuously evaluate antibiotic susceptibility of common uro-pathogens.

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Date Received: 30th May, 2019
Date Revised: 17th August, 2019
Date Accepted: 10 September, 2019

The changing antimicrobial sensitivity patterns have implications for empirical therapy[5, 11]. Our study aim is to evaluate the antimicrobial sensitivity patterns of bacterial isolates from urine cultures of paediatric patients with suspected clinical features of urinary tract infection and to find local resistance patterns to commonly used antibiotics.

MATERIAL AND METHODS

This retrospective study was conducted at the Department of Paediatrics, Lady Reading Hospital Peshawar from January 2018 to June 2018. All urine samples from Paediatric department submitted to the pathology laboratory for culture and sensitivity were followed and only positive cultures of children up to the age of 14 years were selected for inclusion in the study. The minimum age of patient recorded was 20 days. Data about the age and gender of patients were recorded on a specifically designed proforma. Samples collection was performed under strict aseptic conditions. Midstream clean catch urine samples were collected in most cases at the Department of Paediatrics, Lady reading Hospital Peshawar. In some cases, suprapubic aspiration or transurethral catheterization was performed under aseptic measures, and samples were submittedto the pathology laboratory within one hour of collection. UTI was confirmed by bacterial growth of >105 colony forming units/ml. after urine culture, antimicrobial susceptibility was performed using disc diffusion method according to the Clinical and Laboratory Standards Institute (CLSI) recommendations. Antimicrobial susceptibility testing of bacterial isolates was performed against commonly used antibiotics including Trimethoprim-Sulfamethoxazole (TMP-SMX), Amikacin, Gentamycin, Ciprofloxacin, Amoxicillin clavulanic acid, Cefoperazonesulbactem, Fosfomycin, Cefotaxime, Ceftazidime, Nitrofurantoin, Cephradine, Imipenem, and Meronem.

RESULTS

A total of 337 urine samples were sent to the laboratory for culture and sensitivity from the department ofPaediatrics where143 were positive for bacterial growth.Out of 143 patients with positive urine culture, 120 (83.91%) were females and 23 (16.08%)were males. Female to male ratio was 5.21:1. Overall mean age was 4.8± 3.1years while mean age for female patients was 3.8± 2.7years. Gram negative and gram-positive bacteria isolated from cultures are shown in the table 1 below. The most common organism isolated was E. Coli accounting for 71.32% followed by Staphylococcus aureus 4.8% and Enterobacter 4.1%. Other bacteria isolated were Pseudomonas aeruginosa, Providencia, Klebsiella, Proteus mirabilis, Citrobacter, Enterococcus, Methicillin Resistant Staphylococcus Aureus, and Serratia. Frequencies of the isolated pathogens are alsoshown in the table 1. The antimicrobial sensitivity of E. Coli to the commonly prescribed drugs is shown in the table 2. The sensitivity of E. coli to TMP SMX is 27.4%, Ciprofloxacin is 39.2%, Amoxicillin clavulanic acid 12.7%, Nitrofurantoin 98.93%. Similarly, the antimicrobial sensitivity of this commonly occurring pathogen against thefirst-generation cephalosporin (Cephradine) is (9.8%) and the third-generation cephalosporin (Cefotaxime)is15.6 %, (Ceftazidime)is 11.7 % and (Cefoperazone-sulbactam) is 39.2%. Its sensitivity to Fosfomycin is (87.25%), Nitrofurantoin is (98.93%), Gentamycin is (99%), Amikacin (39.2%), Imipenem is (99%), and Meronem is 100%. Multi-drug resistant E. Coli (MDR E. Coli) is defined as a resistant pathogen to at least one of three classes of antimicrobials. Out of tested antimicrobials 83.39% (n=82) were MDR E. Coli.

Table 1: Frequency and type of bacteria cultured from urine.

S/ No.	Genus	n=143	Percentage
1	Escherichia coli	102	71.32
2	Enterobacter	6	4.19
3	Pseudomonas aeruginosa	5	3.49
4	Klebsiella	4	2.79
5	Proteus mirabilis	4	2.79
6	Serratia	2	1.39
7	Providencia	5	3.49
8	Citrobacter	3	2.0
9	Methicillin resistant S. aureus (MRSA)	3	2.0
10	Staph aureus	7	4.89
11	Enterococcus	3	2.0

Table 2: Antimicrobial sensitivity of E.coli.

S/ no	Drug	n= number	% Sensitivity
1	Trimethoprim-Sulfamethoxazole	28	(27.4%)
2	Cefoperazone/sulbactam	40	(39.2%)
3	Cefotaxime	16	(15.6%)
4	Amikacin	40	(39.2%)
5	Fosfomycin	89	(87.2%)
6	Ciprofloxacin	40	(39.2%)
7	Amoxicillin/clavulanic acid	13	(12.7%)
8	Nitrofurantoin	100	(98.9%)
9	Imipenem	101	(99.0%)
10	Meronem	102	(100%)
11	Cephradin	10	(9.8%)
12	Gentamycin	100	(99.0%)
13	Ceftazidime	12	(11.7%)

Table 3: Antimicrobial sensitivity of uro-pathogens.

S/ No	Drug	E. Coli (n-102) 71.3 %	S. aureus (n=7) 4.8%	Ente-ro-bacter (n=6) 4.1%	Pseudo-monas (n=5) 3.4%	Provi-den-cia (n=5) 3.4%	Kleb-si-ella (n=4) 2.7%	Proteus (n=4) 2.7%	Citro-bac-ter(n=3) 2%	MR-SA (n=3) 3%	Ente-ro-coccus n=3 2%	Serra-tia (n=2) 1.3%
1	TMP- SMX	28 27.4%	3 42.8%	NT	NT	1 25%	NT	NT	NT	NT	NT	NT
2	Cefoperazone/ Sulbactam	4 3.9%	3 42.8%	NT	2 40%	NT	NT	NT	2 66. %	NT	NT	NT
3	Cefotaxime	16 15.6%	3 42.8%	1 16.6%	2 40%	NT	2 50%	NT	NT	NT	NT	NT
4	Amikacin	1 0.9%	3 42.8%	NT	NT	NT	1 25%	NT	NT	NT	NT	NT
5	Fosfomycin	89 87.2%	3 42.8%	NT	3 60%	3 60%	1 25%	1 25%	NT	NT	NT	NT
6	Ciprofloxacin	40 39.2%	5 71.4%	NT	2 40%	3 60%	1 25%	NT	NT	NT	NT	NT
7	Amoxicillin/ clavulanic acid	13 12.7%	NT	NT	NT	NT	2 50%	NT	NT	NT	NT	NT
8	Nitrofurantoin	100 98.9%	5 71.4%	5 83.3%	NT	NT	4 (100%)	NT	3 100%	NT	NT	2 100%
9	Imipenem	101 99.0%	5 71.4%	6 100%	3 60%	4 80%	4 100%	1 25%	3 100%	1 33%	NT	2 100%
10	Meronem	102 100%	5 71.4%	5 83.3%	3 60%	4 80	3 75%	1 25%	3 100%	1 33%	NT	2 100%
11	Cephradin	10 9.8%	1 14%	NT	NT	NT	NT	NT	NT	NT	NT	1 50%
12	Gentamycin	101 99%	4 57%	NT	1 20%	NT	4 100%	NT	2 66.6%	1 33%	2 66.6%	1 50%
13	Ceftazidime	12 11.7%	5 71.4%	NT	1 20%	3 60%	NT	NT	NT	NT	NT	NT

Key: TMP-SMX* = Trimethoprim-Sulfamethoxazole, NT* = not tested

DISCUSSION

UTI in children is a serious morbidity and needs further investigations to find the underlying anatomical and functional abnormality. Children may need continuing surveillance to prevent recurrent infection. Female predominance is reported in our study with female to male ratio of 5.21:1. This ratio varies in different studies done on different age groups but is similar with other studies done in paediatric age group11,14, 15. Our study found that E. Coli (71.32%) is the most common pathogen causing urinary tract infection in children and similar trendsof the most common causative organism were also demonstrated by other studies conducted in Pakistan14, 16-18. E. Coli as the leading cause of UTI has been reported from other regional studies as well 5, 11,12,19. Antibiotics are frequently prescribed in the developing countries, and inadvertent use of antibiotics is the biggest risk of microbial resistance to antibiotics. Physician prescriptions should be based on the regional sensitivity of E. Coli to antibiotics. Evidence based observation shows that those antibioticsprescribed in the previous days are now becoming less effective against E. Coli.In this study, E. Coli sensitivity to Trimethoprim sulfamethoxazole (27.4%), Amoxicillin/clavulanic acid (12.7%), Cefoperazone/sulbrfactem (39.2%), Cephradine (9.8%), Amikacin (39.2%) and Ceftazidime (11.7%) has declined. Increasing resistance to Cephalosporin is being attributed to high level of extended spectrum beta-lactamase (ESBL) production12. Ciprofloxacin is one of the commonly prescribed drugs on outpatient prescriptions but Ciprofloxacin (39.2%) sensitivity has decreased overtime because of overuse and has been reported by studies 4,18,20, 21. Similar reports of penicillin and cephalosporin sensitivity have been reported from other national studies documenting high resistance of E. Coli22,21. The sensitivity of E. Coli to Meronem (100%), Imipenem (99.0%) , Gentamycin (99.0%), Nitrofurantoin (98.9%), Fosfomycin (87.2%) is very high and should be prescribed in clinical practice. Similar sensitivity of imipenem, Gentamycin and Nitrofurantoin has been reported from local and national studies 12,14,22,23. Fosfomycin is increasingly being prescribed for UTI infection caused by E. Coliespecially ESBL producing strains and it has been reported to be highly effective 24,25.MDR E.coli is one of the alarming concerns for physicians treating UTI. Our study reported 83.39% MDR. Similar reports of high frequency of MDR have been reported 14,22.In our study, S. aureus sensitivity to Cephalosporin is low as compared to Nitrofurantoin, Ciprofloxacin, Imipenem and Meronem but a study conducted Pouladfar Gfrom Iran reported contrasting sensitivity of more than 90% 12.

Enterobacter was found to be the third most common (4.1%) pathogen causing UTI in our study and its sensitivity to Imipenem, Meronem, and Nitrofurantoin is shown in table 2. Enterobacter has been implicated in 3-8% of UTI in children26and it is losing sensitivity to third generation cephalosporin as shown by some studies5. Enterobacter sensitivity to Meronem and imipenem in our study is 100% as compared to 50% reported by another study from Iran 12. Klebsiella has been found as the second common UTI causing pathogen after E. Coli as reported by some studies5,12,14 but it is responsible for causing UTI in 2.7% cases in our study. Its sensitivity to Nitrofurantoin and Imipenem is 100% while to Meronem is 75%. Similar sensitivity pattern is reported by another local paper14.Frequencies and antimicrobial sensitivity of Pseudomonas,Proteus, Serratia,Citrobacter,Methicillin resistant staphylococcus aureus (MRSA), Enterococcus and Providencia are shown in table 3. The reports of our study shows that antimicrobial resistance of Nitrofurantoin is very low which favours its empiric use for the treatment of UTI in children before urine culture results are available to the treating physicians.

CONCLUSION

Antimicrobial sensitivity of E. Coli the commonest bacterial cause of UTI varies over time and geographical locations.

RECOMMENDATIONS

Empirical antibiotic prescription should take into consideration the prevailing sensitivity patterns of E. Coli. High frequency of MDR E. Coli is alarming and policy makers should issue guidelines regarding the use of empirical antibiotics and to limit inadvertent use of antibiotics.

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CONFLICT OF INTEREST: Authors declare no conflict of interest

GRANT SUPPORT AND FINANCIAL DISCLOSURE NIL

AUTHOR'S CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under:

Hussain M: Concept, Study design, abstract and facilitation for the study.

Irshad M: Data collection, manuscript, writing.

Hayat M: Data collection manuscript writing and data analysis.

Adeeb H: Methodology, data analysis and data presentation in tables.

Ullah I: Discussion, Conclusion, writing and references using endnote.

Khan AJ: Discussion, final proof reading and corrections.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.