Original Article

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Microbiology Section

Microbiological and Antimicrobial Profile of Pathogens Associated with Pediatric Urinary Tract Infection: A One Year Retrospective Study from A Tertiary Care Teaching Hospital

SAVITHA NAGARAJ, BHUVANESH SUKHLAL KALAL, NIVEDITA KAMATH, SETHUMADHAVAN MURALIDHARAN

ABSTRACT

Introduction: Urinary tract infections in the pediatric population are second only to respiratory tract infections. There is limited information on bacterial resistance to commonly used antibiotics or on the risk factors for increased resistance in these patients.

Settings and Design: A retrospective study was carried out to evaluate the microbiological and antimicrobial profile of uropathogens isolated in between January 2011 and December 2011 from the pediatrics department, St John's Medical College Hospital, a tertiary-care setting in Bangalore, India.

Materials and Methods: Urine samples were collected by the mid-stream "clean catch" method and were tested microbiologically by standard procedures. Antibiotic susceptibility of the isolated pathogens was tested for commonly-used antibiotics by Kirby-Bauer technique according to CLIS guidelines.

Results: Of 1254 samples tested, 357 (28.5%) showed significant growth and 229 (64.3%) were from children less than 5 years of age, more commonly in males. Escherichia coli (54.4%) was the leading uropathogen, resistant to cephalosporin (78%), fluroquinolones (76.8%) and sensitive to aminoglycoside antibiotics (72.6%). Klebsiella spp. was found to be highly resistant to many of the antimicrobials as compared to other gram negative bacilli. The incidence of Candida spp. was higher in pediatric intensive care unit (39%). Pediatric surgery unit had higher rates of isolation (42.7%) and Pseudomonas spp., NFGNB and Enterococcus spp. were common.

Conclusion: High level of antimicrobial resistance amongst the pathogens causing urinary tract infection observed in pediatric population.

Keywords: Antibiotic susceptibility, Children, Uropathogens

INTRODUCTION

Pediatric Urinary tract infection (UTI) ranks second among infections in the pediatric population after the respiratory tract [1]. The incidence of UTI has been described to be higher among the males in children <1 year old and among females in children >1 year of age [2]. Common uropathogens described are *Escherichia coli* and *Klebsiella* spp. Other gram negative bacilli are *Proteus* spp., *Enterobacter* spp., *Pseudomonas aeruginosa* and *Acinetobacter* spp [3]. *Enterococcus* spp. are most common among the Gram positive cocci. Increasing rates of isolation of *Candida* spp. could be a reflection of the increased use of antibiotics. UTI can be characterized by nonspecific symptoms, such as poor feeding, vomiting, irritability, jaundice (in newborns), fever alone or specific symptoms, such as dysuria, frequency, urgency, suprapubic discomfort, and flank pain in older children [2,4]. Congenital abnormalities of the kidneys, pelvi-ureteric junction obstruction, vesico-ureteric reflux, posterior urethral valve and neurogenic bladder are the usual risk factors associated with acquiring UTI and also for recurrent UTI. Appropriate treatment with antimicrobials would help prevent the occurrence of associated complications like renal scarring, hypertension and chronic renal failure [1]. Inappropriate and extensive use of antibiotics has lead to the development of multidrug resistance among the pathogens [4-9].

In the present study we report the microbiological and

antimicrobial profile of uropathogens documented during 2011 from a pediatric population visiting a tertiary care centre for treatment.

MATERIALS AND METHODS

A retrospective study was carried out within St John's Medical College Hospital, a tertiary-care setting in Bangalore, India. In between January 2011 and December 2011, children aged < 18 years who were clinically suspected to have urinary tract infection from Inpatient (IP) and Outpatient (OP) (patients referred with/without treatment from other hospital, post discharge follow up, on an OP basis and some those get hospitalized) were included. The pathogen grown from the first sample of urine was considered in the analysis. Samples with evidence of contamination, grew more than 2 types of organisms or repeated were excluded. Samples of urine could have been either clean catch mid stream samples (after giving appropriate instructions to the care givers), from the urinary catheter or suprapubic aspiration (mentioned on the request). All samples were processed as per standard protocol [10]. All samples having growth of single morphotype of colony with counts 10^4-10^5 (Gram negative bacilli) was considered significant (bacteriuria) and processed for further identification and susceptibility testing. Gram positive organisms growing in counts $<10^4$ were processed if isolated as pure growth. Repeat cultures were requested for samples showing colony counts less than 10^4. Any growth from suprapubic aspirates was considered significant [10]. Antibiotic sensitivity was carried out by Kirby Bauer Method according to the Clinical and Laboratory Standards Institute (CLSI) guidelines-2011 [11].

Vancomycin and meropenem were from Oxoid Basingstoke, UK and remaining antibiotic discs were obtained from HIMEDIA, Mumbai, India. ATCC control strains were used for quality control of media and antibiotic discs.

Statistical analyses were performed using SPSS v 16.0 (SPSS, Inc., Chicago, IL, USA).

RESULTS

A total 1254 children were diagnosed to have UTI during the period January 2011 to December 2011. Of 1254 samples, 357 (28.5%) showed significant bacteriuria (345 samples grew a single pathogen, 9 samples grew 2 types of bacteria and 3 samples grew bacteria and *Candida* spp.). Insignificant bacteriuria, was observed in 30(2.4%) and the rest 867(69.2%) were sterile. Among the significant bacteriuria, 230(64.4%) samples were from children less than 5 years of age and 203(56.8%) were males (151 IP and 52 OP). Males were significantly more ($p< 0.05$) than female in age group of less than 1 year whereas it was more common in female above 5 years. Median age of all children was 3 years (range from 0.2 - 204 months).

The list of isolated microorganisms are shown in [Table/Fig-1]. *E. coli* (55.6%) was the leading uropathogen. The incidence of *Candida* spp. was significantly more ($p < 0.05$) in patients admitted in the pediatric intensive care unit (PICU) (61.5%). Samples received from the pediatric surgery department had higher rates of isolation (42.7%).

Isolates	OPD n(%)	Others n(%)	PICU+PITU n(%)	PS n(%)	PW+PN n(%)	Total n(%)
Citrobacter spp.	3(2.6)	1(2.3)	0	3(3.8)	2(2.6)	9(2.5)
Escherichia coli	80(69.6)	28(65.1)	18(43.9)	26(32.9)	46(59.0)	198(55.5)
Enterobacter spp.	3(2.6)	0	1(2.4)	5(6.3)	1(1.3)	10(2.8)
Klebsiella spp.	3(2.6)	0	1(2.4)	12(15.2)	8(10.3)	24(6.7)
NFGNB	5(4.3)	1(2.3)	0	8(10.1)	3(3.8)	17(4.8)
Proteus spp.	7(6.1)	2(4.7)	0	2(2.5)	1(1.3)	12(3.4)
Pseudomonas spp.	4(3.5)	2(4.7)	1(2.4)	8(10.1)	5(6.4)	20(5.6)
Morganella spp.	1(0.9)	0	0	0	0	1(0.3)
Enterococcus spp.	4(3.5)	5(11.6)	4(9.8)	8(10.1)	11(14.1)	32(9.0)
CONS	3(2.6)	4(9.3)	0	0	0	7(2.0)
S. aureus	0	0	0	1(1.3)	0	1(0.3)
Candida spp.	2(1.7)	0	16(39.0)	6(7.6)	2(2.6)	26(7.3)
Total isolates/N	115/500	43/130	41/119	79/185	78/320	357/1254

[Table/Fig-1]: Frequency distribution of isolate in different departments
OPD: Outpatient Department; PICU: Pediatric Intensive Care Unit; PITU: Pediatric Intensive Therapy Unit; PS: Pediatric Surgery; PW: Pediatric Medicine Ward; PN: Pediatric Nephrology Ward; N: Total no. of sample received from ward; n: no of positive isolates; Others ward includes patients admitted to urology, medicine and other departments

Isolates	Ward	No. (%)	Amp	Cz	Ctx	Cpz	Caz	PT	Gn*	Net	AK	Cot	Nit	Nx	Cip	Lef	Mrp	Cpm	NA
E. coli	In	118(54.4)	91.5	83.9	82.2	83.1	82.2	33.1	55.9	20.3	19.5	70.3	26.3	81.4	82.2	63.6	10.2	82.2	89.8
	Out	80(71.4)	85.0	75.0	70.0	72.5	71.3	31.3	45.0	11.3	6.3	67.5	18.8	72.5	76.3	55.0	1.3	66.3	88.8
Klebsiella	In	21(9.7)	100	85.7	85.7	85.7	85.7	61.9	85.7	61.9	57.1	81.0	66.7	57.1	57.1	42.9	14.3	81.0	71.4
	Out	3(2.7)	100	66.7	66.7	66.7	66.7	66.7	66.7	0.0	0.0	100	66.7	66.7	66.7	66.7	0.0	66.7	66.7
Proteus	In	5(2.3)	100	100	80.0	80.0	80.0	0.0	60.0	80.0	80.0	80.0	80.0	60.0	40.0	40.0	0.0	80.0	80.0
	Out	7(6.3)	57.1	57.1	0.0	14.3	0.0	0.0	0.0	0.0	0.0	42.9	85.7	42.9	14.3	0.0	0.0	28.6	57.1
Pseudo-monas	In	16(7.4)	-	-	-	37.5	43.8	25.0	56.3	37.5	37.5	-	-	-	56.3	-	25.0	-	-
	Out	4(3.6)	0.0	25.0	25.0	0.0	25.0	0.0	50.0	0.0	0.0	0.0	0.0	0.0	25.0	0.0	0.0	25.0	25.0
NFGNB	In	12(5.5)	66.7	100	66.7	66.7	66.7	16.7	25.0	16.7	25.0	58.3	83.3	33.3	25.0	25.0	25.0	58.3	41.7
	Out	5(4.5)	-	-	-	100	100	60.0	40.0	20.0	40.0	-	-	-	40.0	-	40.0	-	-
Enterobacter	In	7(3.2)	85.7	85.7	71.4	71.4	71.4	0.0	28.6	42.9	42.9	57.1	42.9	57.1	42.9	42.9	0.0	42.9	57.1
	Out	3(2.7)	66.7	100	33.3	33.3	33.3	0.0	33.3	33.3	33.3	66.7	33.3	0.0	0.0	0.0	0.0	33.3	33.3
Citrobacter	In	6(2.8)	100	100	100	100	100	100	100	33.3	16.7	100	100	100	100	100	16.7	100	100
	Out	3(2.7)	100	33.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	66.7	0.0	66.7	66.7	0.0	0.0	33.3	66.7
Enter-ococcus	In	28(12.9)	67.9	-	-	-	-	-	67.9	-	-	-	17.9	85.7	92.9	-	-	-	-
	Out	4(3.6)	50.0	-	-	-	-	-	50.0	-	-	-	25.0	75.0	75.0	-	-	-	-
CONS	In	4(1.8)	75.0	-	-	-	-	-	50.0	-	-	-	0.0	50.0	50.0	-	-	-	-
	Out	3(2.7)	0.0	-	-	-	-	-	0.0	-	-	-	0.0	0.0	0.0	-	-	-	-
Mean	In	217	83.9	71.0	67.3	66.8	66.8	29.5	59.0	24.9	24.0	58.1	35.5	71.4	73.7	47.9	10.6	63.6	65.0
	Out	112	76.6	68.5	58.6	60.4	59.5	27.0	40.5	9.9	7.2	58.6	27.0	63.1	64.9	43.2	2.7	57.7	76.6

[Table/Fig-2]: Percentage of antibiotic resistance of individual bacterial pathogens isolated from inpatient and outpatient
In:inpatient, Out:outpatient, Amp: ampicilin, Cz: cefazolin, Ctx: cefotaxime, Cpz: cefoperazone, Caz: ceftazidime, PT: piperacillin+tazobactam, Gn: gentamicin, Net: netilmicin, AK: amikacin, Cot: trimethoprim-sulfamethoxazole, Nit: nitofurantoin, Nx: norfloxacin, Cip: ciprofloxacin, Lef: levofloxacin, Mrp: meropenem, Cpm: cefepime, NA: nalidixic acid, CONS: coagulase negative streptococci, NFGNB: non-fermenting gram negative bacilli, * High level Gentamicin for *Enterococcus* spp. and CONS

Percentage of resistance to commonly used antibiotics among these groups (IP and OP) was not significant. *Escherichia coli* isolated from both IP and OP were was resistant to cephalosporin (83%,71%), fluroquinolones (79%,73%) and sensitive to aminoglycoside antibiotics (68%,80%), nitrofurantoin (74%,82%). *Klebsiella* spp. was commonly isolated from inpatient samples (87%) and was found to be more resistant to many of the antimicrobials as compared to other gram negative bacilli. Resistance to anti-microbial agents for individual pathogens from Inpatients and outpatient is presented in [Table/Fig-2].

DISCUSSION

Our study shows that during the first year of life, UTI is more common in males than females and was similar to those described in several previous studies [3,12]. Pathogens causing UTI were isolated commonly from patients under pediatric surgery. *E. coli* was the most commonly isolated (55.6%), similar occurrence has also been reported in several studies [4,8,13]. The incidence of *Candida* spp. in pediatric intensive care was higher (39%) than studies reported from South India (19.6%) [3]. This could possibly due to prior antibiotic use in these sick children. *Klebsiella* spp. was found to be more resistant to many of the antimicrobials as compared to other Gram negative bacilli, similar reports have also been observed in Nepal [5].

Microbial antibiotic resistance has become a major clinical problem worldwide. Most of the isolates were resistant to multiple antibiotics at our centre. Cephalosporin (first, second and third generation) antibiotics showed least sensitivity to all isolates [3-6,9]. Resistance to fluroquinolones among the bacteria was high, similar levels of resistance was reported from North West India [4]. Among the aminoglycoside antibiotic least resistance was observed to netilmicin and amikacin. Carbapenems showed highest sensitivity to uropathogens. Increasing levels of resistance may be a result of widespread use of antibiotic in the sabsence of prescription, self

medication, over the counter drugs and inappropriate dosing [5,8,9,12]. There is a very high prevalence of *in-vitro* resistance of these organisms to the most commonly used broad-spectrum antibiotics like third generation cephalosporins and fluroquinolones. The indiscriminate use of these antibiotics as empirical treatment for the UTI will promote the emergence of multi-drug resistant strains. Hence continued surveillance and appropriate use of antibiotics is advocated.

The limitations of the study are the retrospective study design, non-uniformity in collecting urine samples, lack of data on clinical response and outcome.

CONCLUSION

Gram negative organisms are the most common uropathogens responsible for urinary tract infection in children. The uropathogens causing UTIs in pediatric population are highly resistant to most of the antibiotics recommended for empiric use in the therapy of UTI.

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AUTHOR(S):

1. Dr. Savitha Nagaraj
2. Dr. Bhuvanesh Sukhlal Kalal
3. Dr. Nivedita Kamath
4. Dr. Sethumadhavan Muralidharan

PARTICULARS OF CONTRIBUTORS:

1. Associate Professor, Department of Microbiology, St. John's Medical College, Bangalore, India.
2. Research Assistant, Department of Microbiology, St. John's Medical College, Bangalore, India.
3. Assistant Professor, Department of Pediatrics, St. John's Medical College, Bangalore, India.
4. Professor and Head, Department of Microbiology, St. John's Medical College, Bangalore, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Savitha Nagaraj,
Associate Professor, Department of Microbiology, St. John's Medical College, Bangalore, India.
Email: savisanju2000@yahoo.com

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