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Original Research Paper

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PREVALENCE OF URINARY TRACT INFECTION AND THEIR ANTIBIOGRAM IN PATIENTS VISITING A RURAL TERTIARY CARE CENTRE OVER FIVE YEARS.

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ABSTRACT

Background: Urinary tract infections are one of the most common bacterial infections. A retrospective study was undertaken to identify the various pathogens isolated from the urine samples and to determine the antibiotic resistance pattern of the major uro-pathogens among patients.

Materials and Methods: A retrospective study was conducted to collect details of uropathogens from 2016 to 2020. Urine samples were collected and examined by microscopy and culture techniques. Isolated microorganisms were identified microscopically, morphologically and using biochemical tests. Antibiotic susceptibility tests were done on Mueller-Hinton agar by the Kirby-Bauer disk diffusion method as per Clinical and Laboratory Standard Institute Guidelines.

Results: The proportion of culture positive urine samples ranged from 25 to 29%. The most common organism isolated was E Coli (63.9%) followed by Klebsiella pneumoniae (20.18%) and Enterobacter aerogens (4.68%). All these organisms showed maximum resistance to Amoxycillin, Aztreonam and Piperacillin. Nitrofurantoin showed better activity against most uropathogens followed by aminoglycosides.

Conclusion: Both penicillin and cephalosporin group have developed significant resistance. Nitrofurantoin can be used for empirical treatment of UTI in those who can take oral drugs.

KEYWORDS : Urinary Tract Infection, Prevalence, Antibiogram

INTRODUCTION

Urinary tract Infections (UTI) are one of the most commonly encountered bacterial infections in clinical practice. It is described as microbial colonization of the urine and infection of the structures of the urinary tract[1]. They account for significant short term morbidity in terms of fever, dysuria and abdominal pain and may sometimes result in permanent scarring of the kidneys[2, 3]. It also causes significant financial burden on the patient and his family. It can be categorised based on the infection site as pyelonephritis (kidney), cystitis (urinary bladder) and urethritis (urethra). It can also be classified as complicated and uncomplicated[4].

It is estimated that, 150 million UTIs occur yearly on a global basis, resulting in more than 6 billion dollars in direct health care expenditures[5]. Almost 95% of all uncomplicated UTIs are caused by bacteria and among them, infections by E.Coli are the commonest accounting for 80-90%[1]. Klebsiella pneumoniae, Enterobacter aerogens, Proteus spp, Pseudomonas aerogenosa, Enterococcus spp, Staphylococcus aueus, and others can also cause UTI[1,6]. The etiology is more diverse in nosocomially acquired UTIs where the above mentioned species and Candida are more common whereas E.Coli will account only for 35 – 50%[7,8].

Globally there is an increase in antibiotic resistance and the same holds good in case of bacteria causing UTI. More interestingly, the resistance pattern that is observed may vary from hospital to community, large to small hospital, state to state and also from country to country[9,10]. This necessitates the importance of using evidence based strategies for treatment. In most of the UTIs , empiric treatment is usually started by the treating physician before sending the sample for culture and sensitivity and for initiating this treatment, an idea about the local prevalence of resistance among the uropathogens becomes very important. Thus an appropriate antibiotic selection reduces the hospital stay and also the financial burden on the patient[11].

Thus it becomes really important to regularly monitor the susceptibility and resistance pattern so that guidelines for empirical treatment can be framed from time to time helping the clinicians in proper management and preventing therapeutic failure. Thus the objective of this study was to assess the prevalence of urinary tract infection, find the common aetiological agents of UTI, the antibiotic resistance pattern of these agents in patients visiting a rural tertiary care hospital in Dakshina Kannada district of Karnataka, India.

MATERIALS AND METHODS

A retrospective study was conducted in a rural tertiary care teaching hospital in Dakshina Kannada district of Karnataka, India which caters population of Dakshina Kannada district, adjoining Kodagu district and Kasaragod district of Kerala, India. Patients whose urine samples were sent for routine examination and culture from the year 2017 to 2020 and with significant growth of a single organism were included in the study. Urine samples with negative culture and no significant growth were excluded.

Sample processing:

Urine samples were collected by a clean-catch midstream, catheterization, or use of urine bags in a sterile container and who has not received antibiotic therapy during the previous 14 days.

Wet mount examination of uncentrifuged urine was performed.

Urine culture was done by a semi-quantitative method on Mac Conkey's agar, CLED medium, blood agar medium and were incubated for 18–24 hours at 37°C. The uropathogens were identified by standard biochemical reactions.

The urine specimen with a growth of $\geq 10^5$ CFU/mL of a single microorganism with a predominant species was considered significant and defined as positive urine culture.

Negative urine culture was defined as no growth, insufficient growth, or a mixed microbial flora with no predominant organism.

The antibiotic susceptibility testing (AST) was carried out using the Kirby Bauer disc diffusion method. The antibiotic discs (Himedia) used for coliforms included Nitrofurantoin(30 μg), Norfloxacin(10 μg), Nalidixic acid(30μg), Cefazolin(30 μg), Cefuroxime(30 μg) , Cefepime(30 μg), ceftazidime(30 μg), Aztreonam(30 μg),Amikacin (30 μg), Gentamicin (10 μg),High

level Gentamicin(120 μg) ,AmoxyClav(20/10 μg), Amoxycillin(10 μg) Ciprofloxacin(5 μg), Ofloxacin(5 μg)Imipenem (10 μg), Meropenem (10 μg), Piperacillin(100 μg), Co-Trimoxazole(1.25/23.75μg) and Vancomycin(5μg).

The interpretation of results was based on the recommendations of the Clinical Laboratory Standards Institute (CLSI)[12].

Permission was obtained from Institutional Ethics Committee before the start of the study.

STATISTICAL ANALYSIS

Data was entered in Microsoft Office Excel 2007 and IBM SPSS version 21 was used for analysis. The data is represented in the form of frequencies and percentages. Chisquare test was used to find statistical significance among categorical variables.

RESULTS

A total of 6054 samples were received from patients with symptoms of urinary tract infection from the year 2016 to 2020 and were processed at Department of Microbiology of the tertiary care centre. Of these 6054 samples, 1656 samples were culture positive.

The proportion of culture positive samples were 29.02%, 28.68%, 25.63%, 27.85% and 26.18% from the year 2016 to 2020. The age wise proportion of culture positive cases in each year is tabulated in Table 1. The maximum proportion of culture positive cases was either in children aged 7 to 12 months or among elderly population above 50 years of age.

Among the culture positive samples, E.Coli was the most common organism that was isolated every year. The proportion of samples with positive E.Coli in each year was 58.08%, 64.55%, 64.23%, 67.10% and 65.14% respectively over five years from the year 2016. Klebsiella pneumoniae was the next common isolate to be identified, followed by Enterobacter aerogens. The proportion of isolates in each year is tabulated in Table 2.

E.Coli was most resistant to Amoxycillin, Aztreonam and Piperacillin. The proportion of resistance was 84.96%, 84.02% and 83.08% respectively. Klebsiella pneumoniae was most resistant to Aztreonam, Piperacillin and Amoxycillin respectively accounting for 82.73%, 80.95% and 71.42%. Enterobacter aerogens was most resistant to Piperacillin, Aztreonam and Amoxycillin respectively accounting for 87.17%, 82.05 and 75.64%. The maximum sensitivity for these organisms was observed for Meropenem, Imipenem and Nitrofurantoin. Amikacin, Gentamicin, Nalidixic acid and Nitrofurantoin were the other antibiotics which were found to be sensitive against these organisms.

Table 1: Prevalence of UTI from 2016 to 2020

Year	Age Group	Received Samples	Positive Samples	Percentage	Overall Prevalence
2016	0 to 6 Months	15	3	20.00 %	29.02 %
	7 to 12 Months	32	7	21.88 %	
	1 to 5 Years	78	21	26.92 %	
	6 to 15 Years	118	35	29.66 %	
	16 to 50 Years	421	112	26.60 %	
	> 50 Years	487	156	32.03 %	
2017	0 to 6 Months	19	4	21.05 %	28.68 %
	7 to 12 Months	46	14	30.43 %	
	1 to 5 Years	56	25	44.64 %	
	6 to 15 Years	113	24	21.24 %	
	16 to 50 Years	432	116	26.85 %	
	> 50 Years	544	164	30.15 %	
2018	0 to 6 Months	11	2	18.18 %	25.63 %
	7 to 12 Months	32	10	31.25 %	
	1 to 5 Years	65	17	26.15 %	
	6 to 15 Years	98	26	26.53 %	
	16 to 50 Years	321	73	22.74 %	
	> 50 Years	542	146	26.94 %	
2019	0 to 6 Months	22	5	22.73 %	27.85 %
	7 to 12 Months	15	5	33.33 %	
	1 to 5 Years	178	41	23.03 %	
	6 to 15 Years	115	29	25.22 %	
	16 to 50 Years	402	115	28.61 %	
	> 50 Years	643	188	29.24 %	
2020	0 to 6 Months	38	9	23.68 %	26.18 %
	7 to 12 Months	26	8	30.77 %	
	1 to 5 Years	233	49	21.03 %	
	6 to 15 Years	117	32	27.35 %	
	16 to 50 Years	337	95	28.19 %	
	> 50 Years	498	134	26.91 %	

Table 2: Frequency of urinary isolates among the culture positive samples

Isolates	Year 2016	Year 2017	Year 2018	Year 2019	Year 2020
E.Coli	194 (58.08%)	224 (64.55%)	176 (64.23%)	257 (67.10%)	213 (65.14%)
K.pneumoniae	73 (21.86%)	78 (22.48%)	57 (20.80%)	66 (17.23%)	62 (18.96%)
P.aerogenosa	18 (5.39%)	9 (2.59%)	7 (2.55%)	13 (3.39%)	8 (2.45%)
E.aerogens	18 (5.39%)	15 (4.32%)	8 (2.92%)	16 (4.18%)	21 (6.42%)
Providencia spp	1 (0.30%)	1 (0.29%)	2 (0.73%)	1 (0.26%)	1 (0.31%)
Citrobacter spp	3 (0.90%)	2 (0.58%)	2 (0.73%)	3 (0.78%)	2 (0.61%)
M.morganii	1 (0.30%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Acinetobacter spp	9 (2.69%)	6 (1.73%)	7 (2.55%)	9 (2.35%)	8 (2.45%)
Enterococci spp	7 (2.10%)	5 (1.44%)	6 (2.19%)	8 (2.09%)	6 (1.83%)
Proteus spp	5 (1.50%)	4 (1.15%)	5 (1.82%)	6 (1.57%)	4 (1.22%)
S.aureus	2 (0.60%)	1 (0.29%)	0 (0%)	0 (0%)	1 (0.31%)
Non Lactose fermenting GNB	1 (0.30%)	1 (0.29%)	1 (0.36%)	2 (0.52%)	0 (0%)
Candida	2 (0.60%)	1 (0.29%)	3 (1.09%)	2 (0.52%)	1 (0.31%)
Total	334	347	274	383	327

Table 3: Resistance pattern of isolates among culture positive samples

Antibiotic	E.coli (%)	K.pne (%)	P.aeu (%)	E.aer (%)	Provid (%)	Citro (%)	M.mor (%)	Acinet (%)	Enterococci (%)	Proteus (%)	Staph (%)	NLF GNB (%)
AK	17.48	23.51	32.73	34.62	0	0	0	25.64	31.25	20.83	0	0
GEN	17.48	26.79	45.45	50	0	0	0	38.46	0	20.83	0	0
HGN	0	0	0	0	0	0	0	0	31.25	0	0	0
IPM	4.89	8.04	18.18	21.79	0	0	0	12.82	0	20.83	0	0
MRP	5.08	5.36	16.36	12.82	0	0	0	25.64	0	0	0	0
CZ	42.48	59.82	69.09	66.67	0	41.67	0	76.92	62.5	62.5	50	20
CXM	37.5	57.14	61.82	65.38	83.33	41.67	0	64.1	46.88	66.67	50	0
CAZ	59.4	70.83	70.91	64.1	83.33	50	100	76.92	31.25	66.67	50	40
CPM	62.88	69.94	67.27	66.67	0	41.67	0	51.28	62.5	58.33	50	0
AT	84.02	82.74	80	82.05	0	41.67	100	92.31	0	83.33	0	0
NIT	7.42	8.93	12.73	11.54	83.33	0	0	7.69	15.63	41.67	0	40
AMX	84.96	71.43	76.36	75.64	0	83.33	100	87.18	15.63	0	50	0
AMC	76.6	50.6	52.73	69.23	83.33	75	100	64.1	31.25	41.67	50	0
PI	83.08	80.95	69.09	87.18	83.33	16.67	100	76.92	0	62.5	50	0
CIP	62.69	44.64	60	51.28	83.33	41.67	100	51.28	31.25	41.67	50	0
NX	30.55	29.76	47.27	39.74	0	41.67	0	38.46	46.88	62.5	50	0
OF	45.21	32.74	54.55	51.28	83.33	41.67	100	64.1	31.25	62.5	50	0
NA	43.98	22.62	40	38.46	83.33	41.67	100	76.92	46.88	62.5	50	0
COT	40.6	56.55	45.45	69.23	83.33	41.67	100	64.1	31.25	41.67	50	0
VA	0	0	0	0	0	0	0	0	43.75	0	50	0

*AK-Amikacin, GEN-Gentamicin, HGN-High Level Gentamicin, IPM-Imipenem, MRP-Meropem,CZ-Cefozolin, CXM-cefuroxime,CAZ-ceftazidime,CPM-cefepime, AT-Aztreonam,NIT-Nitrofurantoin,AMX-Amoxycillin,AMC-Amoxyclav,PI-piperacillin,CIP-Ciprofloxacin,NX-Norfloxacin,OF-ofloxacin,NA-Nalidixic Acid, COT-Cotrimoxazole,VA-Vancomycin.

*E.coli- Escherichia coli, K.pne-Klebsiella pneumonia,P.aeu-Pseudomonas aeruginosa,E.aer-Enterobacter aerogens, Provid-Providencia spp, Citro-Citrobacter spp,M.mor-Morganella morganii, Acinet-Acinetobacter spp, Enterococci-Enterococci spp, Proteus- Proteus spp,Staph-Staphylococcus aureus,NLF-GNB-Non lactose fermenter Gram negative Bacilli.

DISCUSSION

Urinary tract infections (UTIs) are one of the most common bacterial infections among the humans. One of the most important factor which is impacting the management of UTIs is the emergence of resistance among the uropathogens[13]. Thus this study was conducted to assess the prevalence of UTI, the common etiological agents and their antibiotic resistance pattern.

A total of 1665 samples were received from the year 2016 to 2020. The present study showed the proportion of significant bacteriuria to be between 25 to 29% from the year 2016 to 2020. This is similar to a study done in TamilNadu where the prevalence was found to be 30%[14]. Studies conducted at Jamshedpur and Odisha showed the proportion of significant bacteriuria to be 34.9% and 34.5% respectively.

The samples were received from 54.95% males and 45.04% females. The findings showed that females (68.63%) had a higher prevalence of UTI when compared to males (31.36%) in the age group of 0 to 5 years. This difference was also found to be statistically significant. Close proximity of the female urethral meatus to anus and short urethra may be considered as factors which influence the higher prevalence in females[15]. It is reported that during the first year of life, the incidence of UTI is approximately 0.7% in girls and 2.7% in uncircumcised boys[16,17]. After one year of age, girls are much more likely than boys to develop UTI[18,19]. The study also showed that the prevalence of UTI was significantly higher in males (65.98%) when compared to females (34.01%) in the age group of more than 50 years. This finding is similar to study conducted by Sood et al[20]. This is probably because with advancing age, the incidence of UTI increases among males due to prostate enlargement and neurogenic bladder[21].

The present study showed that E Coli was the most commonly isolated organism followed by Klebsiella pneumoniae. These findings are consistent with other studies[22-26]. E Coli, Klebsiella pneumoniae and Enterobacter were most resistant to Amoxycillin, Aztreonam and Piperacillin. Considerable resistance was also seen against oral antibiotics like Ciprofloxacin, Amoxyclav, Cotrimoxazole, Ofloxacin and Nalidixic acid. This situation is likely due to poor access to health care services, irrational prescription of antimicrobials which are available over-the-counter in India. Unqualified practitioners, untrained pharmacists and nurses all over the country use antimicrobials indiscriminately[27]. Similar practices have also been reported from other developing countries, including Nepal and Vietnam[28,29]. Another possible reason for the resistant pattern would be the widespread use of antimicrobials in veterinary practice. The findings in the present study suggest that empirical treatment with these drugs should no longer be appropriate.

In the present study, nitrofurantoin has shown better activity against most uropathogens. This finding is consistent with studies conducted in other parts of India[20,30,31]. Thus nitrofurantoin can be the ideal antibiotic of choice for uncomplicated UTI. The limitation of orally available Nitrofurantoin formulation is that it cannot be recommended for serious upper UTI or for those patients with systemic involvement[32]. Gentamicin and Amikacin were the other antibiotics which showed low resistant rates. Thus these injectable aminoglycosides can be chosen for those hospitalised patients requiring inpatient care.

CONCLUSION

The proportion of culture positive samples were 29.02%, 28.68%, 25.63%, 27.85% and 26.18% from the year 2016 to 2020. Ecoli was the most commonest isolated organism followed by Klebsiella pneumoniae and Enterobacter aerogens. The patient can be started on Nitrofurantoin, Gentamicin or Amikacin empirically after sending the sample for culture and sensitivity.

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