

Prevalence and Antibiogram Profile of Uropathogens in a tertiary care hospital

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ABSTRACT

Background: Urinary tract infection (UTI) is one of the most common health problems worldwide. The current study was undertaken in order to determine the prevalence of UTI among symptomatic patients that were admitted in a tertiary care hospital. The pathogens responsible for UTI were identified and their antibiotic sensitivity patterns were studied.

Methods: Subjects with clinically suspected acute UTI were enrolled in the study and their mid stream urine samples were collected in sterile plastic containers which were completely labeled. Urine samples were plated onto the blood agar and MacConkey agar plates with the help of wire loop under sterile conditions. The inoculated plates were incubated at 37°C for 24 – 48hrs. Organisms were identified and their antibiotic resistance patterns were checked using standard guidelines.

Result: Total samples collected were 765, both from females and males in the age groups 5 to 55 and above. From the total, 251 [32.8%] samples showed positive results [significant bacteriuria]. Gram positive bacteria were responsible for 12.9% and Gram negative bacteria for 87.1% of positive cases of UTI. The most common bacteria causing UTI was *E. coli* (37.4%). We also studied the antibiotic susceptibility pattern of all uropathogens which were isolated. Most of the Gram negative bacteria were sensitive to imipenem. In Gram positive bacteria, maximum sensitivity was noted for vancomycin, teicoplanin and linezolid.

Keywords: Urinary Tract Infections, Antimicrobial Resistance, Significant Bacteriuria

INTRODUCTION

Urinary tract infection (UTI) is one of the most common infection throughout the world that may affect both the lower and the upper urinary tracts. It is acquired from community or hospital at any stage of life. In children, it presents with fever. While in infants, the signs may be poor feeding, vomiting or jaundice. When considering community acquired UTI, bacteria usually enters through the urethra into the bladder and attaches itself to bladder wall by forming biofilms, which can resist the immune response of body^{1,2,3}. The urinary tract infection is an issue in pregnant women⁴, and immunocompromised people. The American academy of Paediatrics has recommended the ultrasonogram of kidneys and voiding cystourethrogram in all the age groups^{5,6}. Most common symptoms of UTI are fever, burning micturition, pain over pubic bone, pale cloudy urine, foul smelling urine, frequency of urination, vomiting, etc. The antibiotic selection against UTI is done by antibiotic sensitivity tests. Antimicrobial resistance is a major problem in the treatment of UTI. Common modes of antibiotic resistance are degradation of antibiotics by enzymes, changes in bacterial structural proteins or decreased permeability of membrane because of antibiotics. Antibiotic resistance may also be spontaneous due to certain mutation or it may build up gradually over a period of time^{7,8}. A regional variation in the frequency of UTI demands for its study. Hence, the current study was undertaken to determine the prevalence of UTI in our area and also check the antibiotic resistance patterns of bacteria among the clinically suspected urine samples.

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MATERIAL AND METHODS

It was a prospective study conducted at Arif Memorial Teaching Hospital, Lahore over a period of 18 months, i.e., from August 2016 till January 2018, after approval by the ethical committee. A total of 765 samples were taken from both genders between age 5 – 55 years. Patients presenting in different departments like General Medicine, Surgery, Gynaecology and Paediatrics were included in this study. Those patients who had recurrent UTI, some structural abnormality of urinary tract, autoimmune disease, patients admitted for surgery were excluded. This study was carried out following the guidelines and consent from the Institutional Research Ethics Committee. Patients were given wide mouthed sterile containers and instructed properly to collect mid- stream urine. Urine samples were brought to the microbiology laboratory immediately and further processed. Each specimen was cultured by standard wire loop onto Cysteine Lactose Electrolyte Deficient (CLED) agar, blood agar and MacConkey agar. The plates were then aerobically incubated at 37°C for 24hrs. After 24hrs, those plates which did not show visible growth were re-incubated for another 24hrs, before discarding them. Since, we used 4 mm internal diameter wire loop, which would collect 0.01 ml of sample, so colony counts of 100 and more, which would be equal to or more than one lakh cfu/ml, was considered positive bacteriuria. Furthermore, the isolates were identified using standard biochemical tests.⁹ According to the Clinical Laboratory Standards Institute (CLSI) guidelines, we used Kirby-Bauer disc diffusion test for antibiotic sensitivity testing.¹⁰ All culture media and antibiotic discs were purchased of Oxoid laboratories, Lahore, Pakistan.

Statistical Analysis: Descriptive analysis like mean and percentages were used to interpret the data.

RESULT

In our study, from the total 765 urine samples, 251 [32.8%] were positive for UTI (Table 1). Its frequency was found more in the females [152] as compared to males [99]. The most common uropathogen was *E. coli* in all the age groups (Table 2). The antibiotic sensitivity patterns of gram negative bacteria to different antibiotics are depicted in Table 3. Antibiotic sensitivity pattern of *Proteus* included imipenem [98.2%], amikacin [98.3%], piperacillin-tazobactam [85.3%], gentamycin [99.6%], ciprofloxacin [98%], norfloxacin [91.4%] and piperacillin [82.9%]. In summary, the antibiotic sensitivity percentage of *Proteus* was above 80%. Also the sensitivity of *Proteus* was below 50% to amoxyclav [35.2%], cefotaxime [39%], nalidixic acid [26.2%]. At the same time, *Klebsiella* showed highest sensitivity to imipenem [99.6%], amikacin [96.2%]. Sensitivity of *Klebsiella* was below 50% for

cotrimoxazole [38.5%] and amoxyclav [26.3%]. All 4 Gram negative bacilli gave maximum sensitivity to imipenem than the rest of antibiotics. All antibiotics we used were sensitive to all Gram negative organisms, except amoxyclav which showed less than 50% sensitivity. *E. coli* gave more than 80% sensitivity to imipenem, nitrofurantoin, amikacin. The sensitivity of *E. coli* to other antibiotics was: ciprofloxacin [31.9%], norfloxacin [28.2%], piperacillin [27.5%], nalidixic acid [15.5%], cefaperazone [12.3%], amoxyclav [18.4%]. This indicates that *E. coli* has less than 50% sensitivity for the above mentioned antibiotics. The sensitivity of *Enterococcus* to vancomycin [82.2%], teicoplanin [88.5%], linezolid [86.7%] and penicillin [09.9%] is given in Table 4. The sensitivity of *Staphylococcus aureus* was penicillin [02.1%], erythromycin [01.8%], tetracycline [93.9%], amikacin [90.5%], linezolid [99.1%]. While the sensitivity of *S. aureus* to vancomycin was 100%.

Table 1: Distribution of UTI as per gender and age

Age in years	Males with UTI		Females with UTI		Total	
	Number	Percentage	Number	Percentage	Number	Percentage
5-15	15	15.2%	10	6.6%	25	9.9%
16-25	10	10.1%	22	14.5%	32	12.75%
26-35	20	20.2%	33	21.7%	53	21.1%
36-45	13	13.1%	35	23.0%	48	19.1%
46-55	16	16.1%	28	18.4%	44	17.5%
Above 55	25	25.3%	24	15.8%	49	19.5%

Table 2: UTI prevalence among different age group with infecting agent percentage

Age group (years)	<i>E. coli</i>		<i>Proteus sp</i>		<i>S. aureus</i>		<i>Klebsiella sp</i>		<i>Pseudomonas sp</i>		<i>Enterococcus sp</i>		Total	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%
5-15	17	18.0	03	9.7	01	8.3	03	5.4	01	2.6	01	5.0	26	10.4
16-25	15	15.9	03	9.7	02	16.7	06	10.7	05	13.2	02	10.0	33	13.1
26-35	18	19.1	10	32.3	04	33.3	10	17.9	06	15.8	04	20.0	52	20.7
36-45	14	14.9	06	19.4	02	16.7	13	23.2	09	23.7	03	15.0	47	18.7
46-55	16	17.0	05	16.1	02	16.7	10	17.9	08	21.0	05	25.0	46	18.3
Above 55	14	14.9	04	12.9	01	8.3	14	25.0	09	23.7	05	25.0	47	18.7

Table 3: Antibiotic Sensitivity Percentage Of Gram Negative Bacilli Uropathogens

Organism	Imp(%)	Nit	Ak	Pit	Gen	Cfs	Cot	Ctx	Cip	Nor	Pip	Nal	Amc
<i>E. coli</i>	98.2	82.3	81.1	75.2	63.5	52.4	50.8	32.3	31.9	28.2	27.5	15.5	18.4
<i>Proteus</i>	99.8	48.2	98.3	85.3	99.6	80.5	68.5	39.0	98.0	91.4	82.9	26.2	35.2
<i>Klebsiella</i>	99.6	53.4	96.2	78.3	78.0	50.1	38.5	62.1	79.1	74.2	23.5	51.1	26.3
<i>Pseudomonas</i>	99.8	45.0	88.3	87.6	89.1	51.0	54.9	56.6	69.7	82.0	74.1	25.3	28.5

Imp – imipenem, Nit – nitrofurantoin, Ak- amikacin, Pit – piperacillin+tazobactam, Gen – gentamycin, Cfs – cefaperazone+sulbactam, Cot – cotrimoxazole, Ctx – cefotaxime, Cip – ciprofloxacin, Nor – norfloxacin, Pip – piperacillin, Nal – nalidixic acid, Amc – amoxyclav

Table 4: Antibiotic Sensitivity Percentage Of Gram Positive Cocci Uropathogens

Organism	P (%)	E	T	AK	GEN	CIP	COT	AMC	LZ	VA	TEI
<i>Enterococcus</i>	09.9	23.1	30.0	22.2	35.6	51.3	35.7	20.0	86.7	82.2	88.5
<i>Staphylococcus sp.</i>	02.1	01.8	93.9	90.5	12.3	32.3	35.1	09.9	99.1	100	87.3

P – penicillin, E – erythromycin, T – tetracycline, AK – amikacin, GEN – gentamycin, CIP – ciprofloxacin, COT – cotrimoxazole, AMC – amoxyclav, LZ – linezolid, VA – vancomycin, TEI – teicoplanin

DISCUSSION

UTI is one of the most common infections affecting individuals worldwide without any age and sex differentiation. In our study 765 urine samples were taken on whole, out of these 251 were positive for uropathogens (32.8%). One study from Karnataka state India reported 26.01% prevalence of UTI¹¹. According to this study, the most common UTI causing organism in all age groups was *E. coli*, which is in consistence with the previous

report¹². Although the common isolate in our study is *E. coli*, but its incidence is less than a report from Western studies, where its rate ranged from 80 – 85%^{13,14,15,16}. After *E. coli*, the second most common bacteria in our study was *Klebsiella* (22.31%). A similar conclusion was obtained in a study done by Somshekhara et al and Hassan et al^{17,18}. Antibiotic sensitivity profile of *E. coli* was imipenem (98.2%) followed by nitrofurantoin (82.3%), amikacin (81.1%), piperacillin-tazobactam (75.2%) and cefotaxime 32.2%. *E. coli* was least sensitive to nalidixic acid (15.5%).

A study of Iregbuetal¹⁹ showed following sensitivity of E.coli: imipenem(98%),amikacin (79%) and nitrofurantoin (67%). While gentamycin and amoxyclave gave 57% and 73% resistance, respectively. The resistance of ampicillin was 99%. Biswaset al²⁰ reported the sensitivity of E. coli to imipenem, meropenem, amikacin and nitrofurantoin as 100%. Furthermore, they reported sensitivity to gentamycin [94.1%] and ceftriaxone (88.2%). In our study, we found sensitivity of Proteus isolates as following: imipenem (99.8%), gentamycin [99.6%], amikacin [98.3%], ciprofloxacin [98%], norfloxacin [91.4%] and amoxyclave [35.2%]. Vinodraiet al²¹ showed 100% sensitivity of Proteus sp. isolates to imipenem, netilmycin and amikacin. A high resistance of Proteus sp to amoxyclav [65%] was reported in a study carried out by Barateet al²². Another study done by Biswaset al²⁰ reported 100% sensitivity of Proteus to gentamycin, imipenem, meropenem, it was followed by amikacin [80%] and ciprofloxacin [70%], while 100% resistance was noted for nitrofurantoin. In the current study, Gram positive isolates showed very low resistance to vancomycin. Staphylococcus isolates were sensitive to vancomycin. A study by Reshmi Gopalakrishnan et al²³ showed that none of the Staphylococcus isolates and the Enterococcus sp were resistant to vancomycin. In this study, Enterococcus sp. (82.2%) was sensitive to vancomycin. The variation in antibiotic sensitivity may be the result of improper exposure of different antibiotics which can lead to the development of antibiotic resistance. According to the results of our study, it is for sure that selecting drugs against uropathogens is challenging since not a single drug can easily be recommended for UTI.

CONCLUSION

The leading pathogen of UTI is E. coli in all the age groups studied. Among these patients, the multidrug resistant strain of E. coli is getting very common. Among the Gram negative bacteria, mostly were sensitive to imipenem. While among the Gram positive, mostly were sensitive to vancomycin, teicoplanin and linezolid. It is important that we stop antibiotic misuse and continue research on multidrug resistant strains so that we could overcome this antibiotic resistance over time.

Ethical approval: The current study was approved by the Institutional Ethics Committee.

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