Original Research Article

Study of antibiogram pattern of organisms isolated from urinary tract infections from a tertiary care hospital from central India

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Abstract

Introduction: Urinary tract infections (UTI) are the most common infection encountered in the life of an individual irrespective of age and sex. Varying degree of antibiotic resistance shown by uropathogens against the routinely used antibiotics in the therapeutic regimen is a serious concern in treatment of UTI. This study was aimed at the isolation and demonstration of antibiogram pattern of organism responsible for acute UTI.

Materials and methods: Clean catched mid stream urine (CCMSU) specimens collected from patients of different age group were cultured on blood agar and Mac Conkey's agar by standard loop culture method. These organisms were further identified by standard methods and antibiotic sensitivity was evaluated using Kirby Bauers disc diffusion method in accordance with CLSI guidelines.

Results: A total of 1230 samples were collected from both males and females of age group 5 to 80. Among the total, 443 (36%) samples were positive for culture and showed significant bacteruria. Gram negative isolates were responsible for majority of infection and 86.9% isolates and Escherichia coli was the predominant among them (37.2%).

Conclusion: Majority of the isolates showed resistance to drugs commonly used to treat UTI. Variations in sensitivity may be due to the inappropriate exposure of different localities as to antibiotics which can drive the development of resistance. From the results of this study, it is certain

that choosing drugs for empiric treatment will be challenging as no single common drug can conveniently be recommended for UTI.

Key words

Urine samples, Isolates, Antimicrobial sensitivity pattern.

Introduction

Urinary tract infections are the lodgement and multiplication of abnormal bacteria on the urinary tract which causes inflammation and subsequent complications. Irrespective of age and gender most of the individuals get affected with UTI in their lifetime. The contamination of the bacteria from the endogenous rectal flora is usually responsible for UTI [1]. The human urinary tract consists kidneys, ureters, urinary bladder and urethra; multiplication of bacteria on any of these regions can give rise to UTI. Women are most susceptible to UTI and nearly 50% of them suffer with UTI in their lifetime [2]. Various study across the globe reveal the importance of gram negative bacilli, Escherichia coli in producing UTI. Less common pathogens include Klebsiella, Pseudomonas, Proteus, Enterobacter, Staphylococcus saprophyticus and Enterococcus species [3]. The present study was undertaken to assess the predominant bacterial agents causing UTI and their resistance pattern against routinely used antibiotics in the region from patients attending a tertiary care centre.

Materials and methods

This prospective study was conducted in a tertiary care hospital over a period of 2 years. The study was approved by the institute ethical committee. Total 1230 samples were collected from both male and female patients of age 5-55 years. Patient present at the departments of Urology, General Medicine, Gynecology, Pediatrics were included in this study. Patients with recurrent UTI, autoimmune disease, structural anomaly in the urinary tract, patient admitted for surgery, in- patient with urinary catheter were excluded from the study. The study was conducted according to the guidelines and approval from the Institutional Research Ethics Committee.

All patients were instructed to collect clean catch mid stream urine specimen into a wide mouthed sterile screw capped container. Urine samples were immediately taken to bacteriology lab and processed.

The specimens were processed with semi quantitative standard loop technique on blood agar and Mac Conkey's agar. The plates were incubated aerobically at 37^{o}C for overnight. Culture plates without visible colonies were re incubated overnight for visible growth, before being discarded. Since, we are using 4 mm internal diameter loop, which collects 0.01 ml of the sample, colony counts of 100 and above which is equivalent to or greater than $>10^{5}$ cfu/ml was considered as significant bacteruria. Further, the isolated organisms were identified by standard bacteriological tests [4]. The standard Kirby-Bauer disc diffusion test as per clinical laboratory Standards institute (CLSI) guidelines were done for antibiotic sensitivity [5]. For internal quality control standard strains of organism like *Staphylococcus aureus* ATCC 25923 and *E. coli* ATCC 25922 were tested parallel with each set of antibiotic.

Results

In this study, a total of 1230 samples of clean catched midstream urine samples were processed from patients of age group from 5 years to 80 years with symptoms of urinary tract infections. In the study 443 samples showed significant bacteruria (36.01%). In the study subjects female gender suffered the most UTI among the tested patients 288 (65.01%) compared with the male gender (**Table - 1**) *Gram-negative* bacilli were the predominant among UTI causing isolates and E. coli was the common organism causing UTI in all the age groups (37.2%) (**Table – 2**).

Table - 1: Distribution of UTI according to gender and age.

Age in years	Males with UTI		Females with UTI		Total	
	Number	Percentage	Number	Percentage	Number	Percentage
05-15	28	18.1	16	5.6	44	9.9
16-25	16	10.2	45	15.7	61	13.8
26-35	30	19.2	63	22	93	21.0
36-45	18	11.8	65	22.4	83	18.7
46-55	25	16.3	52	18.1	77	17.4
Above 55	38	24.4	47	16.2	85	19.2

Table - 2: UTI prevalence among different age group with infectious bacteria percentage.

Age Group (years)	E.coli		Proteus		S.aureus		Klebsiella		Pseudomonas		Enterococcus		Total	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%
01 to 15	29	17.6	4	7.4	2	9.5	4	4.0	3	4.5	2	5.4	44	9.9
16-25	27	16.4	5	9.3	2	9.5	10	10.1	8	11.9	4	10.8	56	12.6
26-35	31	18.8	17	31.5	9	42.9	19	19.2	11	16.4	7	18.9	94	21.2
36-45	25	15.2	11	20.4	2	9.5	22	22.2	15	22.4	5	13.5	80	18.1
46-55	29	17.6	8	14.8	4	19.0	18	18.2	13	19.4	9	24.3	81	18.3
Above 55	24	14.5	9	16.7	2	9.5	26	26.3	17	25.4	10	27.0	88	19.9
Total	165		54		21		99		67		37		443	

Table - 3: Antibiotic sensitivity percentage of gram negative bacilli uropathogens.

Organism	I(%)	Nit	Ak	Pit	Gen	cfs	Cot	Ctx	Cip	Nx	Pi	Na	Amc
E.coli	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
Proteus	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
Klebsiella	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
Pseudomonas	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

I- imipenem, Nit- nitrofurantoin, Ak –amikacin, Gen – gentamycin, Pit – piperacillin+tazobactum, Cfs – cefaperazone+sulbactum, Cot – cotrimozaxole, Ctx – cefotaxime, Cip – cipofloxacin, Nx – norfloxacin, Pi – piperacillin,Na – naldixicacid, Amc – amoxyclav.

Table - 4: Antibiotic sensitivity percentage of gram positive cocci uropathogens.

Organism	P (%)	E	T	AK	GEN	CIP	COT	AMC	LZ	VA	TEI
Enterococcus	09.9	23.1	30.0	22.2	35.6	51.3	35.7	20.0	86.7	82.2	88.5
Staphylococcus (sp)	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

Among the tested antibiotics on gram negative isolates, imipenem showed the highest sensitivity against all the tested isolates whereas for the gram positive isolates vancomycin and teicoplanin showed the highest grade of sensitivity. The sensitivity pattern for various organisms was against antibiotics was depicted in **Table - 3 and 4**. Sensitivity of Proteus, antibiotics were observed in this study include imipenem (98.2%), amikacin (98.3%), piperacillin + tazobactum (85.3%), gentamycin (99.6%), ciprofloxacin (98%), norfloxacin (91.4%) and piperacillin (82.9%). So sensitivity of Proteus to all these antibiotics was above 80%. Sensitivity of Proteus to amoxyclav (35.2%), cefotaxime (39.0%), naldixic acid (26.2%) was below 50%.

The sensitivity of Klebsiella to imipenem (99.6%), amikacin (96.2%), was found to be highest. The sensitivity of Klebsiella to cotrimoxazole (38.5%) and amoxyclav (26.3%), was below 50%. In **Table - 3**, the sensitivity of gram negative organism to different antibiotics were depicted All the 4 gram negative organisms were highly sensitive to imipenem than others. All the antibiotics chosen for study were sensitive to all gram negative bacteria, but to amoxyclav it was less than 50.0%. The sensitivity of *E. coli* to imipenem, nitrofurantoin, amikacin was above 80%. Sensitivity of *E. coli* to ciprofloxacin (31.9%), norfloxacin (28.2%), piperacillin (27.5%), naldixic acid (15.5%), cefaperazone (12.3%), amoxyclav (18.4%). This indicated that the sensitivity of *E.coli* to the above-mentioned antibiotic was below 50%.

In **Table – 4**, sensitivity of Enterococcus to vancomycin (82.2%), teicoplanin (88.5%), and linezolid (86.7%) was depicted,. The sensitivity of penicillin was (09.9%). The sensitivity of *S.aureus* to penicillin and erythromycin was 02.1% and 01.8%, respectively. Sensitivity of *S.aureus* to tetracycline (93.9%), amikacin (90.5%), linezolid (99.1%) was above 90%. The sensitivity of *S.aureus* to vancomycin was 100%.

Discussion

In this study, *E.coli* was the most common organism causing UTI in all age groups which was consistent to the previous report [6]. Presently many multidrug resistant strains of *E.coli* are emerging. Even though our most common isolate was *E. coli*, the rate of incidence is less than the report from to the Western studies, where the corresponding rate were ranges from 80 – 85% [7-10]. Klebsiella was the second most common organism (22.34%) in this study. A study done by Somshekhara, et al. and Hassan, et al. [11, 12] were also found a similar results. Sensitivity of *E. coli* to imipenem was 98.2% followed by nitrofurantoin (82.3%), amikacin (81.1%), piperacillin tazobactum (75.2%) and cefotaxime 32.2%. But *E. coli* was least sensitive to naldixic acid (15.5%).Iregbu, et al. [13] showed 89% sensitivity of *E.coli* to imipenem (98%) amikacin (79%), nitrofurantoin (67%), and ceftriazone. Gentamycin and amoxyclave showed 57% and 73% resistance, respectively. Ampicillin was 99% resistant. Biswas, et al. [14] found 100% sensitivity of *E. coli* to imipenem, meropenem, amikacin and nitrofurantoin followed by gentamycin (94.1%). Furthermore, they reported 88.2% sensitivity to third generation cephalosporin ceftriaxone. In the present study, Proteus isolates were 99.8% sensitive to imipenem followed by gentamycin (99.6%), amikacin (98.3%), ciprofloxacin (98%), norfloxacin (91.4%), amoxyclave (35.2%). A study by Vinodrai, et al. [15] demonstrated that Proteus sp. isolates were 100% sensitive to imipenem, netilmycin and amikacin. Barate, et al. [16], in their study demonstrated that high resistance of Proteus sp to amoxyclav [65%]. Biswas, et al. [14] found 100% sensitivity of proteus sp to gentamycin, imipenem, meropenem, followed by amikacin (80%), ciprofloxacin (70%) with 100% resistance to nitrofurantoin.

In the present study, resistance shown by gram positive isolates to vancomycin is very low. All the isolates of *Staphylococcus* was sensitive to vancomycin. In a study conducted by Reshmi Gopalakrishnan, et al. [17] none of the *Staphylococcus* isolates and *Enterococcus* sp were vancomycin resistant. In the present study, 82.2% of *Enterococcus* sp. was sensitive to vancomycin.

Conclusion

Majority of the isolates showed resistance to drugs commonly used to treat UTI. Variations in sensitivity may be due to the inappropriate exposure of different localities as to antibiotics which can drive the development of resistance. From the results of this study, it is certain that choosing drugs for empiric treatment will be challenging as no single common drug can conveniently be recommended for UTI.

References

1. Patterson JE, Andriole VT. Bacterial urinary tract infections in diabetes. Infect. Dis. Clin North Am., 1997; 11: 735 – 749.
2. Malik S, Rana JS, Nehra K. Prevalence and antibiotic susceptibility pattern of uropathogenic *escherichia coli* strains in Sonipat region of Haryana in India. Biomed Biotechnol Res J., 2021; 5: 80-7.
3. Meiland R, Geerling SE, Hoepelman AIM. Management of bacterial urinary tract infections in adult patients with diabetes mellitus. Drugs, 2002; 62: 1859 – 1868.
4. WHO SEARO. Guidelines on standard operating procedures for microbiology-antimicrobial susceptibility testing, 2006.
5. Forbes B A, Sahm D F, Weissfeld AS. Bailey and Scott's diagnostic microbiology, Mosby Elseveir, 2007; p. 842 – 855.
6. Mehar TM, Khan H, Mohammad khan T, Iqbal S. E.coli urine superbug and its antibiotic sensitivity. J. MED SCI, 2010; 8: 110 – 113.
7. Kothari A, Sagar V. Antibiotic resistance in pathogens causing community-acquired urinary tract infections in India, a multi centre study. J. Infect Dev C tries, 2008; 2: 354 – 358.
8. Kunin CM. Urinary tract infections, 5th edition, Baltimore, Williams and Wilkins, 1997, p. 144 – 147.
9. Kalpana Gupta, Thomas M Hooton, Kurt G. Naber, et al. international clinical practice guidelines for treatment of acute uncomplicated cystitis and pyelonephritis in women: a 2010 update by the infectious disease society of America and the European society for microbiology and infectious disease. Clinical infectious disease, 2011; 52: e103 – e 120.
10. Richard Colgan, James R, Johnson, Michael Kuskowski, Kalpana Gupta. Risk factors for trimethoprim sulfamethoxazole resistance in patients with acute uncomplicated cystitis. AAC, 2008; 52: 846-51.
11. Somashekara S C, Deepalaxmi S, Jaganath N, Ramesh B, Laveesh M R, Govindadas D. Retrospective analysis of antibiotic resistance pattern to urinary pathogens in a tertiary care hospital in South India. J. basic clin. Pharma., 2014; 5: 105-8.
12. Hasan A S, Nair D, Kaurj, Baweja G, Deb M, Agarwal P. Resistance pattern of urinary isolates in a tertiary Indian hospital. J Ayub med collabbottabad., 2007; 19: 39- 41.
13. Iregbu K C, Nwajiobi-Princewill P. Urinary tract infections in a tertiary hospital in Abuja, Nigeria. Afr, j, clinexper microbial., 2013; 14: 169-73.
14. Biswas R, Rabbani, Ahmed H S, Sarker M A, Zafrin N, Rahman M M. Antibiotic sensitivity pattern of urinary tract infection at a tertiary care hospital. Bangladesh crit. Care j, 2014; 2: 21 – 24.
15. Vinod Rai, Lalpranaysingh, Vijay K Ramanani. Evaluation of antimicrobial resistance in urinary isolates of member of enterobacteriaceae among woman attending tertiary care hospital. Indian j microbiology research, 2017; 4: 274-278.
16. Nor Fa, Shams F, Munshi S K, Hassan M, Nor R. Prevalence and antibiogram of uropathogens isolated from hospital and community patients with urinary tract infections in Dhaka city. Journal of Bangladesh academy of science, 2013; 37: 57-63.
17. Rreshmi Gopalakrishnan, B.V. Chandrasekharamurthy. Bacteriological profile and antibiogram of uropathogens among antenatal cases in a tertiary care hospital. Indian J microbial res., 2017; 4: 333-337.