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Original Research Article

Bacterial profile and antibiogram of urine culture isolates in a teritiary care center

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ABSTRACT

Introduction: Urinary tract infections (UTI) are the commonest infections, where people from all age groups including children to older age individuals experience in their life time. Though several microorganisms are attributed as causative agents of UTI like fungi, viruses, bacterial infections are responsible for > 95% of UTI cases.
Untreated UTI can lead to high morbidity and long term complications like renal scarring, hypertension and chronic kidney diseases. There is diversity among uropathogens regionally and gradually becoming more and more difficult to treat leading to therapeutic dead end. And also because of evolving antibiotic resistance phenomenon among uropathogens, regular monitoring is utmost important to provide guidelines for empirical antimicrobial therapy.
Materials and Methods: This is an observational study carried out in the department of Microbiology in Santhiram Medical college and General hospital for a period of three months from January 2019 to March 2019. A total of 550 midstream urine samples were processed from patients of all age groups with suspected UTI symptoms. Urine culture was done by semi quantitative technique.
Results of urine culture were detected as significant and insignificant based on standard Kass criteria. A growth of >=105 colony forming units (CFU)/ml is considered as active UTI with significant bacteruria. Cultures having more than three types of colonies were considered as contaminants. Pathogenic organisms were identified by Gram stain, motility testing and biochemical reactions as per standard microbiological techniques. The antimicrobial sensitivity testing was done by Kirby-Bauer Disc diffusion method.
Results: A total of 550 urine samples were analysed, out of which 192(34.9%) samples were found to have significant bacteriuria and the rest 358 (65%) were either non significant bacteriuria or having very low counts of bacteria or sterile urine. Among the 192 positive samples, 125 (65.1%) were from females and 67 (34.8%) were from males. Predominantly Gram negative bacteria (79.1%) were isolated among culture positive samples followed by Gram positive bacteria (13.0%) and fungi i.e. Candida (5.7%).

1. Introduction

Urinary tract infections (UTI) are the commonest infections, where people from all age groups including children to old er age individuals experience in their life time.[1] Though several microorganisms are attributed as causative agents of UTI like fungi, viruses, bacterial infections are responsible for > 95% of UTI cases.[2] UTI are the most common cause of nosocomial infections among the hospitalised patients and also they are the second commonest reason among people visiting the hospital for treatment.[3] Most commonly UTI are caused by Gram negative enteric bacilli like *Escherichiacoli*(*E.coli*), *klebsiellaspps*, *proteusspps* and Gram positive organisms like *staphylococcus saprophyticus*, staphylococcus *aureus*, *enterococci*.[3]

Incidence of UTI is more commonly seen in women than men due to shorter urethra, large bacterial load in urothelial mucosa, obstruction in the urinary tract, sexual activity and pregnancy.[4] In men with advancing age UTI occurs due to prostatic enlargement and neurogenic

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bladder.[5] Untreated UTI can lead to high morbidity and long term complications like renal scarring, hypertension and chronic kidney diseases.[6] There is a diversity among uropathogens regionally and gradually becoming more and more difficult to treat leading to therapeutic dead end.[7] And also because of evolving antibiotic resistance phenomenon among uropathogens, regular monitoring is utmost important to provide guidelines for empirical antimicrobial therapy. Therefore this study was undertaken to determine the most common causative agents of UTIs and to know their antimicrobial susceptibility patterns.

2. Materials and Methods

This is an observational study carried out in the department of Microbiology in Santhiram Medical college and General hospital for a period of three months from January 2019 to March 2019. A total of 550 midstream urine samples were processed from patients of all age groups with suspected UTI symptoms. Urine culture was done by semi quantitative technique.[8,9]

By means of a calibrated loop, 0.001ml of urine was cultured on both blood agar and Mac Conkey's agar respectively. Results of urine culture were detected as significant and insignificant based on standard Kass criteria.[8,10] A growth of $>=10^5$ colony forming units(CFU)/ml is considered as active UTI with significant bacteruria.[8,10] Cultures having more than three types of colonies were considered as contaminants. Pathogenic organisms were identified by Gram stain, motility testing and biochemical reactions as per standard microbiological techniques.[11] The antimicrobial sensitivity testing was done by Kirby-Bauer Disc diffusion method.[12]

Antibiotics like Ampicillin (10mcg), Amoxycillin-clavulanic acid (20/10mcg), Gentamicin (10mcg), Amikacin (30mcg), Netilmicin (30mcg), Nalidixic acid (30mcg), Ciprofloxacin (5mcg), Norfloxacin (5mcg), Ceftazidime (30mcg), Cefotoxime (30mcg), Cefaperazone sulbactum (75/10mcg), Imipenem (10mcg), Nitrofurontoin (300mcg), Penicillin (10units), Vancomycin(30mcg), Teicoplanin (30mcg), Cefazolin (30mcg), Cefoxitin(30mcg), Piperacillin (100mcg), Piperacillintazobactum (100/10mcg), Cotrimoxazole (25mcg), Doxycycline (30mcg), Clindamicin (2mcg), E rythromycin (15mcg) were tested (HIMEDIA INDIA). Results were analysed using MS EXCELL, 2007 version.

3. Results

A total of 550 urine samples were analysed, out of which 192(34.9%) samples were found to have significant bacteriuria and the rest 358 (65%) were either non significant bacteriuria or having very low counts of bacteria or sterile urine.

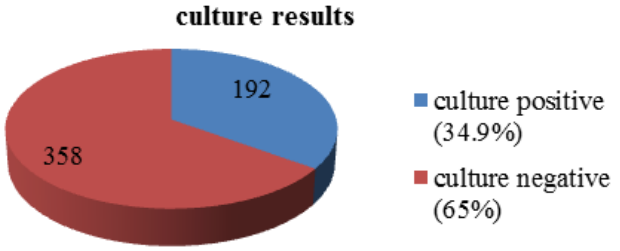

Fig. 1: Culture results of the samples

Among the 192 positive samples, 125(65.1%) were from females and 67(34.8%) were from males. Overall male to female ratio among positive samples is 1:2. The infection rate is high among the age group of 21-30 yrs which is 23.4% followed by 41-50 yrs (13.5%) and 61-70 yrs (13.5%) respectively. Samples submitted from Obstetrics and Gynaecology department showed high positivity rate of 31.7% followed by Nephrology department (15.6%) and General medicine department (13.5%).

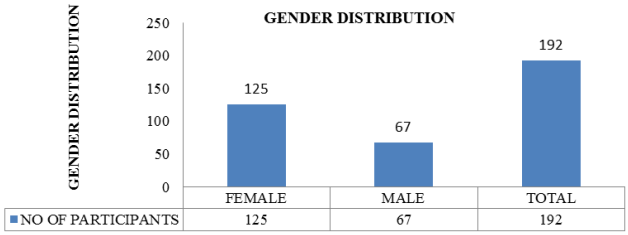

Fig. 2: Gender distribution among culture positive isolates.

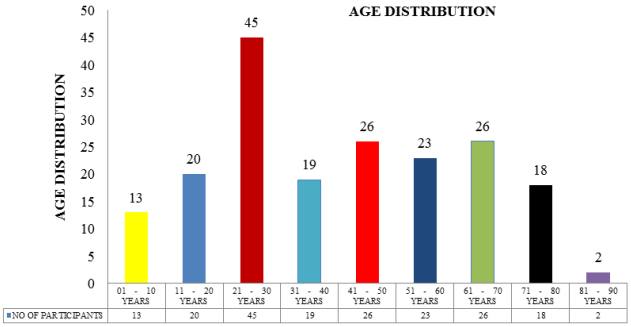

Fig. 3: Age distribution among culture positive samples

Predominantly Gram negative bacteria (79.1%) were isolated among culture positive samples followed by Gram positive bacteria (13.0%) and fungi i.e. Candida (5.7%). Among Gram negative *bacilli E.coli* (60.7%) is the predominant organism and *klebsiella spps* occupies second

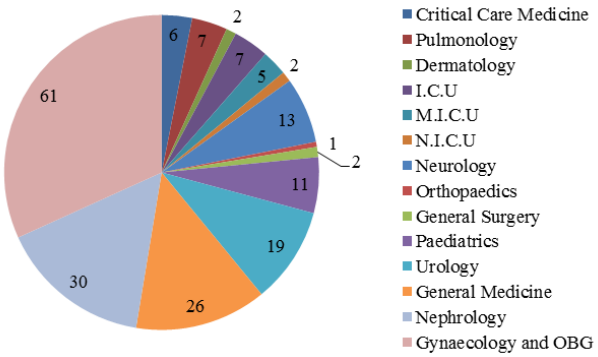

Fig. 4: Department wise distribution of culture positive samples

position with 24.3%. *Pseudomonas spps* showed 9.2% among positive isolates. Among Gram positive bacteria *Enterococcus spps* (52.0 %) was the predominant isolate followed by *Staphylococcus aureus* (44%).

Table 1: Organism distribution among positive isolates

Type of organism	No of organisms	Percentage (%)
Gram negative bacteria	152	79.1 %
Gram positive bacteria	25	13.0 %
Yeast (candida)	11	5.7 %

Table 2: Distribution of Gram negative bacteria

GNB	No. of isolates
E. Coli	93
Klebsiella spps	37
Pseudomonas spps	14
Proteus mirabilis	03
Proteus vulgaris	02
Non fermenting GNB	02
Citrobacter spps	01
Total	152

In our study majority (89.2%) of GNB were belonging to enterobacteriaceae family and few were Non fermenting GNB. Among these Imipenem (95.6%), Nitrofurontoin (94.9%), Amikacin (84.6%) were sensitive. Among the Nonfermenting GNBs, Imipenem and Amikacin were 100%and 75% sensitive respectively.

In our study *E.coli* was showing highest sensitivity to nitrofurontoin (100%) followed by Imipenem (93.5%), Amikacin (90.3%), Netilmycin (84.9%), cefaperazone – sulbactum (75.2%) respectively.

It showed highest resistance to Ampicillin (95.5%). *klebsiella spps* isolates showed highest sensitivity to Imipenem (100%) followed by nitrofurontoin (81.1%), piperacillin - tazobactum (75.6%) and Amikacin (73%) respectively.

Among *Pseudomonas spps* isolates, all were sensitive to Imipenem (100%), followed by Amikacin (78.5%), Amoxy-clav (64.2%) and Piperacillin-Tazobactum (57.1%) respectively. Here nitrofurontoin drug showed sensitivity and resistance patterns of 35.7% and 64.2% respectively. Many *pseudomonas spps* isolates showed resistance towards nalidixic acid (85.7%) followed by ceftazidime (78.5%).

Among the Gram positive organisms all isolates of *staphylococcus aureus* were sensitive to linezolid (100%), vancomycin (100%) and teicoplanin (100%). Majority of them showed resistance to erythromycin (60%) followed by norfloxacin (54.5%). All *enterococcus spps* were sensitive to linezolid (100%), vancomycin (100%) and teicoplanin (100%). Nitrofurontoin and Amoxy-clav showed sensitivity of 69.2% and 53.8% respectively. Most of the *enterococcus spps* isolates were resistant to norfloxacin (92.3%) followed by erythromycin (62%) and gentamicin (69.2%) respectively.

4. Discussion

Prevalence and incidence of UTI varies between nations and areas within a single nation. In our study occurrence of UTI came out to be 34.9% which was comparable to the fin dings of 34.5% by dash et al[13] and 36.6% by Mehta et al[14] but when compared with Mohanty et al[15] study our valves are higher. These variations may be due to differences in the environmental conditions, several host factors, health care practises, standard of living ,education and hygiene practices in each geographical area.

In our study high prevalence of UTI was seen in females 125(65.1%) than in males 67 (34.8%) which correlates with the findings that occurrence of UTI is greater in females as compared to males.[16,17] As discussed earlier the reason for high prevalence of UTI in females can be due to close proximity of urethral meatus to the anus, shorter and wider urethra, pregnancy, less acidic PH of vaginal surface.[18,19] Highest number of the culture positive isolates were from patients between 21-30 yrs of age which is comparable to the studies of Razak et al[3] and Ghadage et al.[20]

Among the organisms isolated there is a predominance of Gram negative bacteria (70.8%) belonging to enterobacteriaceae family which can be due to several factors like adhesion, pilli, fimbriae and P1 blood group phenotype receptors. In our study *E.coli* (48.4%) followed by *Klebsiella spps* (19.2%) and *enterococcus spps* (6.7%) were the most commonly isolated organisms which is comparable to the study done by Ghadage et al. *E.coli* which is a commensal in the GI tract can be a potential source for UTI[21] even the studies of Razak et al,[3] Sohail m et al,[4] Tambekar et al[22] showed similar results. Drugs like Imipenem and Amikacin were highly effective against Gram Negative bacilli which correlates with the studies of Rakesh et al[21] and Cherian et al.[23] Among the members of enterobacteriaceae Imipenem (95.6%), Amikacin (84.6%),

Table 3: Isolation of Gram positive bacteria

Name of the Gram positive bacteria	**No of participants**
Enterococcus spps	13
Staphylococcus aureus	11
Coagulase negative staphylococci	01
Total	25

Table 4: Distribution of Gram negative bacterial isolates and its antibiogram

Antibiotic	**Enterobacteriaceae**		**NFGNB**	
	Sensitivity (%)	Resistance (%)	Sensitivity (%)	Resistance (%)
Ampicillin	3.7	96.3	0	100
Amoxy-clav	37.5	62.5	56.2	43.7
Amikacin	84.6	15.4	75	25
Gentamicin	72.1	27.9	50	50
Nalidixic acid	39	61	18.8	81.2
Ceftazidime	45.6	54.4	18.8	81.2
Cefataxime	23.6	76.4	6.3	93.7
Cefaperazone-sulbactum	74.3	25.7	56.3	43.7
Imipenem	95.6	4.4	100	0
Piperacilln-tazobactum	80.2	19.8	56.3	43.7
Norfloxacin	41.2	58.8	37.5	62.5
Nitrofurontoin	94.9	5.1	37.5	62.5
Cotrimaxazole	49.3	50.7	37.5	62.5

Table 5: Antibiogram of major isolates of Gram negative bacilli.

	E.Coli		***Klebsiella spps***	
Antibiotic	Sensitivity (%)	Resistance (%)	Sensitivity (%)	Resistance (%)
Ampicillin	4.5	95.5	0	100
Amoxy-clav	26.8	73.1	62.1	37.8
Amikacin	90.3	9.7	73	27
Gentamicin	77.4	22.5	59.4	40.5
Netilmycin	84.9	15	70.2	29.7
Nalidixic acid	38.7	61.2	40.5	59.4
Cefotaxime	22.5	77.4	24.3	75.6
Cefaperazone - Sulbactum	75.2	24.7	70.2	29.7
Imipenem	93.5	6.4	100	0
Piperacillin-tazobactum	81.7	18.2	75.6	24.3
Cotrimaxazole	50.6	49.4	48.6	51.3
Nitrofurontoin	100	0	81.1	18.9
Norfloxacin	30.1	69.8	64.8	35.1

Table 6: Antibiogram of *pseudomonas spps*

Pseudomonas spps		
Antibiotic	Sensitivity (%)	Resistance (%)
Amoxy-clav	64.2	35.7
Amikacin	78.5	21.4
Gentamicin	50	50
Netilmycin	42.8	57.1
Nalidixic acid	14.2	85.7
Piperacillin-tazobactum	57.1	42.8
Ceftazidime	21.4	78.5
Norflaxacin	42.8	57.1
Cefaperazone-sulbactum	57.1	42.8
Imipenem	100	0
Cotrimoxazole	42.8	57.1
Nitrofurontoin	35.7	64.2

Table 7: Antibiogram of major isolates among Gram positive organisms

	Staphylococcus aureus		***Enterococcus spps***	
Antibiotic	Sensitivity (%)	Resistance (%)	Sensitivity (%)	Resistance (%)
Amoxy-clav	72.7	27.3	53.8	46.2
Gentamicin	81.8	18.1	30.7	69.2
Norfloxacin	45.5	54.5	7.6	92.3
Cotrimoxazole	63.6	36.3	69.2	30.7
Nitrofurontoin	72.7	27.2	69.2	30.7
Linezolid	100	0	100	0
Vancomycin	100	0	100	0
Teicoplanin	100	0	100	0
Clindamycin	60	40	55	45
Erythromycin	40	60	38	62

Netilmycin (80.9%), piperacillin – tazobactum (80.2%) showed high sensitivity which is similar to the study of Mehrishi P et al[24] and also nitrofurontoin has found out to be the most sensitive drug among the members of enterobacteriaceae which is also comparable to the study of Mehrishi P et al .

Among the nonfermenting isolates Imipenem (100%) and Amikacin (75%) were sensitive respectively which corelates with the study of Deshpande et al.[25] *Pseudomonas spps* showed 57.5% sensitivity to piperacillin-tazobactum where as Baveja et al[26] showed 76.4% and Mehrishi P et al showed 70% respectively. All Gram positive isolates showed 100% sensitivity towards vancomycin , Linezolid and Teicoplanin, Rakesh et al also in his study reported the same.

5. Conclusion

Because of the changing trends in the sensitivity pattern of various antibiotics, it is very much needed to know the antibiogram of common isolates in a particular area or hospital for ensuring better empirical treatment. Our study helped us to know the common isolates and their antibiotic sensitivity and resistance patterns which has helped us immensely to choose appropriate drugs which in turn reduces the burden of emerging antibiotic resistance in our hospital.

6. Source of funding

None.

7. Conflict of interest

None.

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