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STUDY OF BACTERIOLOGICAL PROFILE OF URINARY TRACT INFECTION AMONG PATIENT ATTENDING TERTIARY CARE CENTER

[1]Dr. Abhishek S Goenka, [2]Dr. Rajesh P Karyakarte, [3,*]Dr. Sumit S Aggarwal, [4]Dr. Nitin A Ambhore and [5]Dr. Rupali S Mantri

[1,2,4,5]Department of Microbiology, Government Medical College, Akola Maharashtra- India
[3]Department of Community Medicine, Government Medical College, Akola Maharashtra- India

***Corresponding Author**

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Abstract

Introduction: Urinary Tract Infection (UTI) is the most common bacterial infection in human population and also one of the most frequently occurring nosocomial infection. The prevalence of UTI depends on age, sex, comorbid conditions, genital hygiene etc.
Aims: Present study was conducted to determine the spectrum of causative agents responsible for UTI and to detect the extent of drug resistance.
Methodology: The present cross sectional study was conducted in Government Medical College and Hospital, Akola (Maharashtra, India). The data was collected from 1st January 2013 to 31st December 2014. A total of 261 clean catch, mid-stream urine (10 ml) samples were collected according to study protocol.
Results: In the present study, urine samples from a total of 261 UTI patients were taken for study. Out of them 119 (45.6%) samples belonged to male and 142 (54.4%) belonged to female patients. Out of 261 urine samples, 132 (50.6%) showed significant bacteriuria. Among the tested antibiotics the highest susceptibility shown by the Gram negative bacteria was forPiperacillin-tazobactam, Imipenem, Amikacin and Gentamicin. Amongst Gram positive bacteria's *Staphylococcus aureus* was commonest isolate showing highest susceptibility to Linezolid and Teicoplanin (81.8%).
Conclusion: As drug resistance among bacterial pathogens is an evolving process, regular surveillance and monitoring is necessary to provide physician's knowledge on the updated and most effective empirical treatment of UTIs.

Keywords: Urinary Tract infection (UTI), Antibiogram, Significant Bacteriuria.

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INTRODUCTION

Urinary Tract Infection (UTI) is the most common bacterial infection in human population and also one of the most frequently occurring nosocomial infection (Gastmeir *et al*., 1998).UTIs refer to the presence of microbial pathogens within the urinary tract and it is usually classified by the site of infection as bladder (cystitis), kidney (pyelonephritis) (Gonzalez and Schaeffer, 1999). It has been estimated that globally symptomatic UTIs result in as many as 7 million visits to outpatient clinics, 1 million visits to emergency departments, and 100,000 hospitalizations annually (Razak and Gurushantappa, 2012). The prevalence of UTI depends on age, sex, comorbid conditions, genital hygiene etc. During the first year of life, UTIs are less than 2% in males and females. The incidence of UTIs among the males remains relatively low even after 1 year of age but increases after approximately 60 years of age when the enlargement of the prostate interferes with emptying of the bladder. Urinary tract infection is more common in women because the urethra is short, making it easy for bacteria to spread. Sometimes bacteria can also spread from another part of the body through the bloodstream to the urinary tract (Jaiswal *et al*., 2013). The common etiologic agents of UTI include *Enterobacteriaceae* like *E. coli* and *Klebsiella*spp, as well as Gram positive organisms like *Staphylococci* and *Enterococci* (Iregbu *et al*., 2013). The urethra has resident microflora that colonize its epithelium in the distal portion. In young sexually active women, sexual activity is the cause of 75–90% of bladder infections, with the risk of infection related to the frequency of sex. Urinary catheterization increases the risk of bacteriuriaby 3% to 6%. Treatment of UTI is often started empirically and therapy is based on information determined from the antimicrobial resistance pattern of the urinary pathogens (Wilson and Gaido, 2004).

The prevalence of antimicrobial resistance among urinary pathogens has been increasing worldwide due to injudicious use of antibiotics in practice especially *E. coli*, to previously prescribed drugs like Cotrimoxazole has become a global reality (Manges *et al*., 2001). The aim of this study was to determine the spectrum of causative agents responsible for UTI and to detect the extent of drug resistance. This study is important for clinicians, in order to facilitate the empirical treatment and management of patient with symptoms of urinary tract infection.

MATERIALS AND METHODS

The present study was conducted in Government Medical College and Hospital, Akola (Maharashtra, India). The data was collected from 1st January 2013 to 31st December 2014. A total of 261 clean catch, mid-stream urine (10 ml) samples were collected in a universal container from subjects who have not received antimicrobials within the previous fifteen days. Specimens were transported and processed within 2 hours of collection by the standard microbiological technique (Winn *et al*., 2006; Thompson *et al*., 2003). Isolation of uropathogens was performed by a surface streak procedure on both blood and MacConkey agar using calibrated loops for semi-quantitative method and incubated aerobically at 37^0C for 24 hours (Collee *et al*., 2007). The pathogens were identified by standard microbiological techniques by studying their colony characteristics, morphology and biochemical reactions (Collee *et al*., 2007).

Antibiotic sensitivity was done by Kirby Bauer disk diffusion method on Mueller-Hinton agar plates using commercially available HiMedia discs. The following antibiotics used were: Ampicillin(AMP-10µg), Amikacin (AK-30µg), Ceftazidime (CX-30µg), Cefotaxim (CTX-30µg), Ciprofloxacin (CIP-10µg), Cotrimoxazole(COT-25µg), Gentamycin (GEN-10µg), Imipenem (IMP-10µg), Nitrofurantoin (NIT 300µg), Piperacillin+Tazobactum (PIT-100/10µg), Tobramycin (TOB-10µg), Teicoplanin (TIC-30µg) and Tetracyclin (TE-30µg).

RESULTS

In the present study, urine samples from a total of 261 UTI patients were taken for study. Out of them 119 (45.6%) samples belonged to male and 142(54.4%) belonged to female patients. Prevalence was highest in "11-20 year age group" with 60patients (23%), "21-30 year age group" with43 (16.4%) and followed by "31-40 year age group" with 40 (15.3%) patients. Male were more prevalent in the 00-10, 41-50, 51-60, >60 year age group whereas females were more prevalent in 21-30, 31-40 year age group. (Table1).

Out of 261 urine samples, 132 (50.6%) showed significant bacteriuria. Maximum patients (30 out of 43) showing significant bacteriuria belonged to 21-30 age group with 69.8 % positivity followed by 55.3% growth rate in 0-10 year of age group. Presence of Significant bacteriuria was least (30%) in 11-20, followed by (45%) in 31-40 age group.

Table 1. Age and sex wise distribution of UTI patients

Age Groups (in years)	Male (%)	Female (%)	Total (%)
0-10	30(63.8)	17(36.2)	47 (100)
11-20	16(26.7)	44(73.3)	60 (100)
21-30	16(37.2)	27(62.8)	43 (100)
31-40	13(32.5)	27(67.5)	40 (100)
41-50	15(71.4)	06(28.6)	21 (100)
51-60	19(86.3)	03(13.7)	22 (100)
>60	10(35.8)	18(64.2)	28 (100)
Total	119(45.6)	142(54.4)	261 (100)

Table 2. Distribution of Significant bacteriuria in study subjects according to age group

Age Groups (in years)	Significant bacteriuria (%)		Total no. of UTI patients
	Present	Absent	(%)
0-10	26 (55.3)	21 (44.7)	47 (100)
11-20	18 (30)	42 (70)	60 (100)
21-30	30 (69.8)	13 (30.2)	43 (100)
31-40	18 (45)	22 (55)	40 (100)
41-50	12 (57.1)	09 (52.9)	21 (100)
51-60	14 (63.6)	08 (36.4)	22 (100)
>60	14 (50)	14 (50)	28 (100)
Total	132(50.6)	129 (49.4)	261 (100)

Table 3. Distribution of Significant bacteriuria in study subjects according to sex

Sex	Significant bacteriuria (%)	Sterile sample (%)	Total no. of UTI patients
Male	50(42)	69 (58)	119 (100)
Female	82(57.7)	60 (42.3)	142 (100)
Total	132(50.6)	129 (49.4)	261 (100)

($x2 = 5.21$, df=1, $p=0.011$, $p<0.05$ Statistically Significant)

Out of the total 261 urine samples collected in this study, 132 (50.6%) came out to be positive for isolates. Isolation rate was higher in females (57.7%) as compared to males (42%). Difference between Significant bacteriuria and sex of patient's is found to be statistically significant (Table 3). In this study the Gram negative bacilli accounts for 63.6% (84 out of 132) and gram positive accounts for 36.4% (48 out of 132). Among the gram negative Organism *E. coli* was the most commonly isolated urinary pathogen (52.4%), followed by *Klebsiella* spp. (21.4%) and *Acinetobacter* spp. (14.3%) while only 4 isolates showed Proteus as the causative organism. In the gram positive bacteria the most common organism identified was *Staphylococcus aureus* 33 (68.8%) and the least isolated was enterococci 6 (12.5%). (Table 4)

Pseudomonas and *Proteus* also showed maximum resistance to all the antibiotics except Imipenem and Piperacillin-tazobactam. Amongst Gram positive bacteria's *Staphylococcus aureus* was commonest isolate showing susceptibility to Linezolid and Teicoplanin 81.8%, Gentamicin 72.7%, Amikacin 66.7%, Ceftazidime 57.6% and Ciprofloxacin 54.5% while it was most resistant to Ampicillin 18.2%.

CONS showed relatively higher susceptibility to all the antibiotics tested as compared to *S. aureus*. Only 3 out of 6 *Enterococci* patients showed sensitivities to high concentration gentamicin, demonstrating the rapid emergence of resistance among them.

Table 4. Distribution of positive isolates identified from urine samples (n=132)

Organism		Frequency (%)
Gram positive (36.4%)	*S. aureus*	33(68.8)
	*CONS**	09(18.8)
	Enterococci	06(12.5)
	Total	48(100)
Gram negative (63.6%)	*E. coli*	44(52.4)
	Pseudomonas	06(7.1)
	Klebsiella	18(21.4)
	Proteus	04(4.8)
	Acinetobacter	12(14.3)
	Total	84(100)
	Grand total	132

* CONS-Coagulase negative Staphylococcus Aureus

Table 5.Distribution of Antibiotic susceptibility amongst the bacterial isolates

Drugs	Gram positive			Gram negative				
	S. Aureus (33)	*CONS (9)*	*Enterococci (6)*	*E. coli (44)*	*Klebsiella(18)*	*Proteus (4)*	*Pseudomonas (6)*	*Acinetobacter (12)*
AMP	06 (18.2)	1 (11.1)	1 (16.7)	-	-	-	-	-
CAZ	19 (57.6)	5 (55.5)	-	28 (63.6)	6 (33.3)	1 (25)	1 (16.7)	3 (25)
CTX	12 (36.4)	5 (55.5)	-	30 (68.2)	3 (16.7)	1 (25)	1 (16.7)	3 (25)
NIT	18 (54.5)	6 (66.6)	2 (33.3)	30 (68.2)	6 (33.3)	3 (75)	1 (16.7)	9 (75)
CIP	18 (54.5)	6 (66.6)	2 (33.3)	14 (31.8)	3 (16.7)	1 (25)	3 (50)	3 (25)
GEN	24 (72.7)	9 (100)	3* (50)	35 (79.5)	9 (50)	1 (25)	3 (50)	3 (25)
AK	22 (66.7)	9 (100)	-	36 (81.8)	12 (66.7)	1 (25)	2 (33.3)	9 (75)
COT	12 (36.4)	7 (77.7)	-	17 (38.6)	3 (16.7)	1 (25)	3 (50)	4 (33.3)
TET	27 (81.8)	4 (44.4)	2 (33.3)	14 (31.8)	10 (55.6)	2 (50)	3 (50)	5 (41.6)
LZ	27 (81.8)	8 (88.8)	3 (50)	-	-	-	-	-
TEI	27 (81.8)	7 (77.7)	6(100)	-	-	-	-	-
IPM	-	-	-	40 (90.9)	13 (72.2)	4 (100)	3 (50)	12 (100)
PIT	-	-	-	34 (77.7)	9 (50)	4 (100)	3 (50)	9 (75)

* For *Enterococcus spp*, high concentration gentamicin (120 µg disk) was used. For all other organisms gentamicin (10 µg disk) was used

The antibiogram of the isolated pathogens is shown in Table 5. Among the tested antibiotics the highest susceptibility for the Gram negative bacteria was shown by Piperacillin-tazobactam, Imipenem, Amikacin, Gentamicin and Ciprofloxacin followed by Nitrofurantoin, Norfloxacin and Ampicillin. *E. coli* which was the predominant isolate gave high susceptibility toImipenem 90.9% and Piperacillin-tazobactam 77.7% followed by amino glycosides and β-lactams, *Klebsiella*, the second most isolated organism, also showed high susceptibility to Imipenem 72.2%, Amikacin 66.7%, Tetracyclin 55.6%, Gentamicin and Piperacillin-tazobactam 50% each and Ceftazidime 33.3 %. Similar pattern of susceptibility was shown by Acinetobacter with 100% susceptibility to Imipenem.

DISCUSSION

The present study was conducted in Government Medical College and Hospital, Akola, a total of 261 urine samples from UTI patients who have not received any antibiotics in the last 15 days were tested. Out of them 142(54.4%) belonged to female patients particularly in 21- 40 year age group and 119 (45.6%) samples tomale rather prevalent in the above 40 year age group. Most common prevalence was found in 11-20 year age group having 60 (23%) patients followed by 21-30 year age group having 43 (16.4%).A similar study conducted by Vijaya Swetha, Sreenivasa Rao, (2014**)** observed that out of 568 samples tested 401 (70.59%) were from females and rest 167 (29.40%) samples were from males while age group 21-40 showed 48.3% of patients.

In females UTI was seen commonly in patients between 21-40 years age group due to increased sexual activity during this period and in males it was seen in older age group between 41-60 years (Vijaya Swetha *et al*., 2014). In this study 132 (50.6%) showed Significant bacteriuria. Maximum patients (69.8%) showing significant bacteriuria belonged to 21-30 age group. While N. Suneetha, P. Subbulu (2015) found that out of 139 urine samples 56(40.2%) individuals were having Significantbacteriuria while age group of 21-30yearsshowed 61.1% Significant bacteriuria of all the UTI patients (Suneetha, 2015). Isolation rate was higher in females (57.7%) as compared to males (42%). Difference between Significant bacteriuria and sex of patient's is found to be statistically significant. This correlates with other studies by Bashir *et al*. (2008) and Getenet *et al.* (2011).

A variety of Enteropathogenic bacteria are known to cause UTI worldwide. As is evident from the results, this study demonstrated *E coli* to be the predominant aetiological agent (52.4%) amongst the gram negative bacilli and *Staphylococcus aureus* amongst the gram positive bacteria (68.8%) as the causative agents of UTI. These findings are similar to other studies (Gupta V *et al*. 2002 Orret *et al*,) (Gupta *et al*., 2002) Similarly other causative bacterial agents isolated in this studyinclude species of *Klebsiella, Proteus, Pseudomonas, CONS* and *Enterococcus* (Iregbu *et al*., 2013).The isolates of most of the species exhibited a high rate of resistance to Ampicillin, Co-trimoxazole, Cefotaxim, Norfloxacin and Nitrofurantoin. This pattern of resistance has also been reported within the country from different states (Gupta *et al.,* 2002). From other parts of the world also, such pattern has been reported (Uwaezuoke and Ogbulie, 2006).Gram positives showing high susceptibility to Linezolid, Teicoplanin, Amikacin (Uwaezuoke and Ogbulie, 2006). Among the tested antibiotics the highest susceptibility for *E.coli* was shown by Imipenem (90.9%), Piperacillin-tazobactam (77.7%), Amikacin (81.8%), Gentamicin (79.5%) (Gupta *et al*., 2002). Successful treatment of patients suffering from bacterial UTIs commonly relays on the identification of the type of organisms that caused the disease and the selection of an effective antibiotic agent to that organism. In this study we have shown growing resistance pattern to these anti microbial agents.

Conclusion

As drug resistance among bacterial pathogens is an evolving process, regular surveillance and monitoring is necessary to provide physician's knowledge on the updated and most effective empirical treatment of UTIs. Periodic reassessment of *in vitro* susceptibility pattern of urinary pathogens to serve as a guide for antibiotic therapy since these organisms exhibit resistance to first-line drugs used for UTI infection. In order to prevent or decrease resistance to antibiotics, the use of antibiotics should be kept under supervision, should be given in appropriate doses for an appropriate period of time.

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