Original Article

STUDY OF COMMUNITY AND NOSOCOMIAL UROPATHOGENS AND THEIR DRUG RESISTANCE

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ABSTRACT

Background: Urinary tract infections (UTI) are amongst the most common infectionsencountered in clinical practice. Drug resistant uropathogenshas been increasingly observed, not only in nosocomial UTI but also in community-acquired (CA) UTI leaving very few options for the treatment. CA and nosocomial UTI differ aetiologically, epidemiologically; they also have different antibiotic resistance pattern. Therefore, we planned to study the bacterial aetiology and antibiotic susceptibility of uropathogens in CA and nosocomial UTI and compared them.

Methods: Uropathogens were isolated and identified as per standard microbiological techniques from urine samples of patients with CA and nosocomial UTI. The antibiotic susceptibility testing was performed as per clinical and laboratory standards institute (CLSI) 2012 guidelines.

Results: Amongst 1948 urine samples collected from UTI patients, 1697 (87.1%) were from the CA infections and 251 (12.9%) were from the nosocomial infections.*E. coli* was the most common organism isolated from both CA(60.1%) and nosocomial (33%)UTI. Non-fermenters, enterococci, candida were more common in nosocomial UTI. Resistance to routinely prescribed urinary antibiotics such as norfloxacin and cotrimaxazole was observed in CA strains of *E. coli* and klebsiella.In nosocomial uropathogens, in addition to cephalosporins and aminoglycosides, resistance to piperacillin-tazobactam and carbapenems was observed.Overall, drug resistance was more in nosocomial as compared to CA uropathogens.

Conclusion: The periodic update of local aetiology and antibiotic susceptibility of community and nosocomial uropathogens is necessary.

Key words: Uropathogen, drug resistance, community-acquired UTI, nosocomial UTI

INTRODUCTION

Urinary tract infection (UTI) is a major cause of patient morbidity and health care expenditures for men and women of all age groups.[1] Although *E. coli* is the commonest cause of UTI in both community-acquired (69-80%) and nosocomial (36%) UTI, the percentage of the bacterial species differ in either infections.[2] The aetiological agents of community-acquired (CA) and nosocomial UTI and their antibiotic susceptibility pattern differ from place to place and again over time scale.[3] Enteric bacteria (in particular, *E. coli*) remain the most frequent cause of UTI, although there is some evidence that the percentage of UTIs caused by *E. coli* is decreasing.[4-5] In contrast, significant changes in the causes of nosocomial UTI havebeen reported since 1980.[4,6] Antimicrobial resistance rates are higher among nosocomial strains. Further, the failure of empirical treatment of CA UTI with commonly-used, orally-administered drugs have been seen in more than a third of cases.[7] Hence, bacterial aetiology and antibiotic susceptibility of uropathogens in community and nosocomial UTI in a tertiary care centre set-up was studied.

METHODS

A prospective study was conducted at a tertiary care hospital from July 2010 to November 2012.The sample size was calculated by using formula,

$$n = \frac{\left\{Z_{1-\alpha/2}\sqrt{P(1-P)} + Z_{1-\beta}\sqrt{P_1(1-P_1) + P_2(1-P_2)}\right\}2}{(P_1 - P_2)^2}$$

[P_1 = 281/1697 = 0.1656, P_2 = 206/251 = 0.8207, P = 0.49315, α = 0.05, $Z_{1-\alpha/2}$ =1.64, Power $Z_{(1-\beta)}$ = 1.28 (90% power)]

Clinically diagnosed cases of UTI with age more than 12 years were included in the study. UTI cases were divided into CA and nosocomial. Infections are considered nosocomial if they first appear ≥ 48 hours after hospital admission. All thepatients with nosocomial UTI were catheterized. In the patients with CA UTI, midstream clean catch urine sample was collected. In the patient with nosocomial UTI (catheterized patient), the sample was collected from the catheter tube. Sampleswere preferably collected prior to antimicrobial therapy (The sample size calculated was 10 for each group i.e. 10 positive urine samples of both groups should be included in study. However, we have taken 281 positiveurinesamples from CA UTIand 206 positiveurine samples from nosocomial UTI).Samples were inoculated on blood and MacConkey agar and uropathogens were identified by standard microbiological procedures.[8]Antibiotic susceptibility testing of uropathogens was performed as per clinical and laboratory standards institute (CLSI) 2012 guidelines.[9]

RESULT

A total of 1948 urine samples from patients with clinical diagnosis as UTI were processed. Amongst these, 1697 (87.1%) were from the CA infections and 251(12.9%) were from the nosocomial infections. The significant growth was observed in 281 (16.6%)urine samples from CA UTI patients, whereas 206 (82.1%) urine samples from nosocomial UTI patients showed growth. Socio-demographic profile of patients showing age and gender is shown in Table 1 & Table 2.

Table 1: Age and sex distribution of CA UTI patients with significant bacteriuria (n = 281)

Age (Years)	Male (%)	Female (%)	Total (%)
13 – 20	5 (5.7)	11 (5.7)	16 (5.7)
21 – 30*	11 (12.5)*	68 (35.2)*	79 (28.1)
31 – 40	16 (18.2)	51 (26.4)	67 (23.8)
41 – 50	12 (13.6)	23 (11.9)	35 (12.5)
51 – 60	10 (11.4)	12 (6.2)	22 (7.8)
> 60*	34 (38.6)*	28 (14.5)*	62 (22.1)
Total	88 (31.3)	193 (68.7)	281

* - p ≤ 0.001

Table 2.Age and sex distribution of nosocomial UTI patients with growth (n = 206)

Age (Years)	Male (%)	Female (%)	Total (%)
13 – 20	12 (11.1)	9 (9.2)	21 (10.2)
21 – 30	11 (10.2)	11 (11.2)	22 (10.7)
31 – 40	11 (10.2)	10 (10.2)	21 (10.2)
41 – 50	12 (11.1)	11 (11.2)	23 (11.2)
51 – 60	14 (13)	12 (12.2)	26 (12.6)
> 60	48 (44.4)	45 (45.9)	93 (45.2)
Total	108 (52.4)	98 (47.6)	206

Table 1 show that CA UTI was more common in females (68.7%) as compared to males (31.3%). Amongst females, majority of patients (61.7%) were in the age group of 21-30 and 31-40 years. In males, CA UTI was more common (38.6%) in the age group > 60 years. Table 2 shows that in nosocomial UTI, there were 52.4% males and 47.6% females. Majority of patients (44.4% males, 45.9% females) were from the age group > 60 years.

Table 3.Aetiology of Community Acquired (CA) and Nosocomial UTI

Uropathogens	Uropathogens		p value
	CA UTI (%)	Nosocomial UTI (%)	
Sample	**281**	**206**	
E. coli	169 (60.1)*	68 (33)*	< 0.001
Klebsiella spp	43 (15.3)*	12 (5.8)*	0.014
K. pneumoniae	42	12	
K. oxytoca	01	00	
Citrobacter spp	03 (1.1)	01 (0.5)	
Cit. koseri	02	01	
Cit. freundii	01	00	
Enterobacter spp	10 (3.6)	03 (1.5)	
Ent. aerogenes	05	00	
Ent. cloacae	05	03	
Proteus spp	01 (0.4)	00	
Pr. mirabilis	01	00	
Pseudomonas aeruginosa	05 (1.8)*	19 (9.2)*	0.003
Acinetobacter spp	18 (6.4)*	27 (13.1)*	0.009
A. baumannii	12	19	
A. calcoaceticus	03	04	
A. lwoffii	03	04	
Alcaligenes faecalis	00	01 (0.5)	
Brevundimonas spp	00	01 (0.5)	
Myroides spp	01 (0.4)	00	
Staphylococcus spp	06 (2.1)*	14 (6.8)*	0.01
S. aureus	01	14	
S. saprophyticus	05	00	
Enterococcus spp	06 (2.1)*	34 (16.5)*	< 0.001
En. faecalis	05	09	
En. faecium	01	25	
Candida spp	11 (3.9)*	24 (11.7)*	0.014
C. albicans	07	15	
C. glabrata	02	03	
C. parapsilosis	01	03	
C. tropicalis	01	02	
C. krusei	00	01	
Total (As a single isolate)	273 (97.2)	204 (99)	
Mixed growth	08 (2.9)	02 (1)	
E. coli& A. baumannii	03	01	
E. coli &S. saprophyticus	01	01	
K. pneumoniae & En. faecalis	02	00	
C. freundii& A. baumannii	01	00	
C. freundii& En. faecalis	01	00	

*p < 0.05

Aetiological profile of CA and nosocomial UTI is shown in Table 3. It shows that, *E. coli* was the most common (60.1%) organism isolated from CA UTI followed by other enterobacteria (20.3%) viz. klebsiella, citrobacter, enterobacter and proteus. Whereas in

nosocomial UTI, *E. coli* was the most common (33%) uropathogen followed by enterococci (16.5%).

Results of antimicrobial susceptibility testing of enterobacteriaceae, non-fermenter and gram positive coccal urinary isolates are shown in Table 4, 5 and 6 respectively.

In this study (Table 4), it was observed that resistance to routinely prescribed urinary antibiotics such as norfloxacin, cotrimaxazole has been introduced even in CA strains of *E. coli* whereas the nosocomial strains became highly resistant to these drugs. In addition to this, resistance to aminopenicillin, first and second generation cephalosporins ranged from 20-25% in CA strains of *E. coli* whereas the nosocomial strains showed complete resistance to these drugs. Although the resistance to piperacillin-tazobactam and carbapenems was not observed in CA strains of *E. coli* but it had been introduced in the nosocomial strains. High resistance to aminoglycosides was observed in nosocomial strains. Resistance was not observed for fosfomycin.

Table 4: Antimicrobial resistance amongst enterobacteriaceae isolates in community acquired and nosocomial UTI

Drugs	*E. coli*		*Klebsiella spp*		*Citrobacter spp*		*Enterobacter spp*		*Pr. mirabilis*		Total	
	CA(%)	Nos.(%)	CA(%)	Nos.(%)	CA(%)	Nos.(%)	CA(%)	Nos.(%)	CA(%)	Nos.(%)	CA(%)	Nos.(%)
Sample	**173**	**70**	**45**	**12**	**5**	**1**	**10**	**3**	**1**	**0**	**234**	**86**
NIT	0*	14 (20)*	0*	5 (41.7)*	0	1 (100)	0	3 (100)	1 (100)	-	1 (0.4)*	23 (26.7)*
p	< 0.001		< 0.001								< 0.001	
NX	69 (39.9)*	63 (90)*	23 (51.1)*	12 (100)*	1 (20)	1 (100)	2 (20)*	3 (100)*	0	-	95 (40.6)*	79 (91.9)*
p	< 0.001		0.001				0.035				< 0.001	
COT	60 (34.7)*	60 (85.7)*	21 (46.7)*	11 (91.7)*	2 (40)	1 (100)	2 (20)*	3 (100)*	0	-	85 (36.3)*	75 (87.2)*
p	< 0.001		0.050				0.035				< 0.001	
CB	17 (9.8)*	52 (74.3)*	5 (11.1)*	9 (75)*	2 (40)	1 (100)	0	3 (100)	0	-	24 (10.3)*	65 (75.6)*
p	< 0.001		< 0.001								< 0.001	
AMP	35 (20.2)*	70 (100)*	45 (100)	12 (100)	5 (100)	1 (100)	10 (100)	3 (100)	1 (100)	-	96 (41)*	86 (100)*
p	< 0.001										< 0.001	
AMC	35 (20.2)*	70 (100)*	32 (71.1)*	12 (100)*	5 (100)	1 (100)	10 (100)	3 (100)	1 (100)	-	83 (35.5)*	86 (100)*
p	< 0.001		0.030								< 0.001	
CEP	44 (25.4)*	70 (100)*	15 (33.3)*	12 (100)*	4 (80)	1 (100)	10 (100)	3 (100)	1 (100)	-	74 (31.6)*	86 (100)*
p	< 0.001		< 0.001								< 0.001	
CXM	44 (25.4)*	70 (100)*	14 (31.1)*	12 (100)*	4 (80)	1 (100)	10 (100)	3 (100)	1 (100)	-	73 (31.2)*	86 (100)*
p	< 0.001		< 0.001								< 0.001	
CX	9 (5.2)*	28 (40)*	4 (8.9)*	5 (41.7)*	3 (60)	1 (100)	10 (100)	3 (100)	0	-	26 (11.1)*	37 (43)*
p	< 0.001		0.010								< 0.001	
CTX	11 (6.4)*	52 (74.3)*	5 (11.1)*	9 (75)*	0	1 (100)	0	3 (100)	0	-	16 (6.84)*	65 (75.6)*
p	< 0.001		< 0.001								< 0.001	
CPM	11 (6.4)*	52 (74.3)*	5 (11.1)*	9 (75)*	0	1 (100)	0	3 (100)	0	-	16 (6.84)*	65 (75.6)*
p	< 0.001		< 0.001								< 0.001	
PIT	0*	6 (8.6)*	0*	2 (16.7)*	0	0	0	1 (33.3)	0	-	0*	9 (10.5)*
p	0.002		0.041								< 0.001	
IPM	0*	6 (8.6)*	0*	2 (16.7)*	0	0	0	1 (33.3)	0	-	0*	9 (10.5)*
p	0.002		0.041								< 0.001	
MRP	0*	6 (8.6)*	0*	2 (16.7)*	0	0	0	1 (33.3)	0	-	0*	9 (10.5)*
p	0.002		0.041								< 0.001	
GEN	15 (8.7)*	49 (70)*	4 (8.9)*	10 (83.3)*	0	0	2 (20)	2 (66.7)	1 (100)	-	22 (9.4)*	61 (70.9)*
p	< 0.001		< 0.001								< 0.001	
AK	0*	21 (30)*	0*	4 (33.3)*	0	0	0	1 (33.3)	0	-	0*	26 (30.2)*
p	< 0.001		0.001								< 0.001	
TOB	15 (8.7)*	35 (50)*	4 (8.9)*	7 (58.3)*	0	0	0	2 (66.7)	0	-	19 (8.1)*	44 (51.2)*
p	< 0.001		0.002								< 0.001	
NET	4 (2.3)*	28 (40)*	2 (4.4)*	5 (41.7)*	0	0	0	1 (33.3)	0	-	6 (2.6)*	34 (39.5)*
p	< 0.001		0.007								< 0.001	
TE	89(51.5)*	70(100)*	27 (60)*	12(100)*	3 (60)	1 (100)	6 (60)	3 (100)	1 (100)	-	126 (53.9)*	86 (100)*
p	< 0.001		0.006								< 0.001	
FO	0	0	-	-	-	-	-	-	-	-	0	0

Nos. - Nosocomial UTI

NIT – Nitrofurantoin, NX – Norfloxacin, COT – Cotrimaxazole, CB – Carbenicillin, Ampicillin – Ampicillin, AMC – Amoxyclav, CEP – Cephalothin, CXM – Cefuroxime, CX – Cefoxitin, CTX – Cefotaxime, CPM – Cefepime, PIT – Piperacillin-tazobactam, IPM – Imipenem, MRP – Meropenem, GEN – Gentamicin, AK – Amikacin, TOB – Tobramycin, NET – Netilmicin, TE – Tetracycline, FO – Fosfomycin; * $p \leq 0.05$

Table 5.Antimicrobial resistance amongst gram negative non-fermentative bacilli in UTI

Drugs	*P. aeruginosa*		*Acinetobacter spp*		*Myroides spp*		*Alc. faecalis*		*Brevundimonas spp*		Total	
	CA (%)	Noso. (%)	CA (%)	Noso. (%)	CA (%)	Noso. (%)	CA (%)	Noso. (%)	CA (%)	Noso. (%)	CA (%)	Noso. (%)
Sample	**5**	**19**	**18**	**27**	**1**	**0**	**0**	**1**	**0**	**1**	**24**	**48**
NX	1 (20)*	17(89.5)*	8 (44.4)*	27 (100)*	1 (100)	-	-	1 (100)	-	1 (100)	10 (41.7)*	46 (95.8)*
p	0.005		< 0.001								< 0.001	
CB	2 (40)	16 (84.2)	3 (16.7)*	25 (92.6)*	1 (100)	-	-	1 (100)	-	1 (100)	6 (25)*	43 (89.6)*
p			< 0.001								< 0.001	
CAZ	0*	15 (79)*	6 (33.3)*	26 (96.3)*	1 (100)	-	-	1 (100)	-	1 (100)	7 (29.2)*	43 (89.6)*
p	0.003		< 0.001								< 0.001	
CTX	0*	15 (79)*	6 (33.3)*	26 (96.3)*	1 (100)	-	-	1 (100)	-	1 (100)	7 (29.2)*	43 (89.6)*
p	0.003		< 0.001								< 0.001	
CPM	0*	15 (79)*	6 (33.3)*	26 (96.3)*	1 (100)	-	-	1 (100)	-	1 (100)	7 (29.2)*	43 (89.6)*
p	0.003		< 0.001								< 0.001	
PIT	0	6 (31.6)	3 (16.7)	9 (33.3)	1 (100)	-	-	0	-	0	4 (16.7)	15 (31.3)
IPM	0	6 (31.6)	3 (16.7)	9 (33.3)	1 (100)	-	-	0	-	0	4 (16.7)	15 (31.3)
MRP	0	6 (31.6)	3 (16.7)	9 (33.3)	1 (100)	-	-	0	-	0	4 (16.7)	15 (31.3)
AT	0*	15 (79)*	3 (16.7)*	26 (96.3)*	1 (100)	-	-	1 (100)	-	1 (100)	4 (16.7)*	43 (89.6)*
p	0.003		< 0.001								< 0.001	
GEN	1 (20)	11 (57.9)	1 (5.6)*	21 (77.8)*	0	-	-	1 (100)	-	1 (100)	2 (8.3)*	34 (70.8)*
p			< 0.001								< 0.001	
AK	0	9 (47.4)	0*	12 (44.4)*	0	-	-	0	-	0	0*	21 (43.8)*
p			< 0.001								< 0.001	
TOB	0*	10(52.6)*	0*	16 (59.3)*	0	-	-	1 (100)	-	1 (100)	0*	28 (58.3)*
p	0.047		< 0.001								< 0.001	
NET	0	8 (42.1)	0*	12 (44.4)*	0	-	-	0	-	0	0*	20 (41.7)*
p			< 0.001								< 0.001	
TE	2 (40)	17 (89.5)	12 (66.7)*	27 (100)*	1 (100)	-	-	0	-	0	15 (62.5)*	44 (91.7)*
p			0.016								0.003	
COT	-	-	8 (44.4)*	27 (100)*	-	-	-	-	-	-	8(33.3)†*	27(56.3)‡*
p			< 0.001								< 0.001	
CL	0	0	-	-	-	-	-	-	-	-	0	0

Noso. - Nosocomial UTI; NX – Norfloxacin, CB – Carbenicillin, CAZ – Ceftazidime, CTX – Cefotaxime, CPM – Cefepime, PIT – Piperacillin-tazobactam, IPM – Imipenem, MRP – Meropenem, GEN – Gentamicin, AK – Amikacin, TOB – Tobramycin, NET – Netilmicin, TE – Tetracycline, COT – Cotrimaxazole, CL – Colistin; * - $p < 0.05$; † - n = 18; ‡ - n = 27

Table 6.Antimicrobial resistance amongst gram positive cocci in community acquired and nosocomial UTI

Drugs	*Staphylococcus spp*		*Enterococcus spp*		Total	
	CA (%)	Nos. (%)	CA (%)	Nos. (%)	CA (%)	Nos. (%)
Sample	**7**	**15**	**9**	**34**	**16**	**49**
NIT	0	3 (20)	0	10 (29.4)	0*	13 (26.5)*
p					0.016	
NX	1 (14.3)*	12 (80)*	0*	28 (82.4)*	1 (6.3)*	40 (81.6)*
p	0.007		< 0.001		< 0.001	
COT	2 (28.6)*	15 (100)*	-	-	2 (28.6)†*	15 (100)§*
p	< 0.001				< 0.001	
PEN	2 (28.6)*	14 (93.3)*	1 (11.1)*	25 (73.5)*	3 (18.8)*	39 (79.6)*
p	0.004		0.001		< 0.001	
AMP	-	-	1 (11.1)*	25 (73.5)*	1 (11.1)‡*	25 (73.5)||*
p			0.001		0.001	
CX	1 (14.3)*	10 (66.7)*	-	-	1 (14.3)†*	10 (66.7)§*
p	0.034				0.034	
GEN ¶	1 (14.3)	9 (60)	0*	20 (58.8)*	1 (6.3)*	29 (59.2)*
p			0.001		< 0.001	
STP ¶	-	-	0*	23 (67.6)*	0‡*	23 (67.6)||*
p			< 0.001		< 0.001	
AK	0	3 (20)	-	-	0†	3 (20)§
TOB	0	7 (46.7)	-	-	0†	7 (46.7)§
NET	0	6 (40)	-	-	0†	6 (40)§
TE	2 (33.3)*	15 (100)*	3 (33.3)*	34 (100)*	5 (31.3)*	49 (100)*
p	< 0.001		< 0.001		< 0.001	
VA	0	0	0	0	0	0
LZ	0	0	0	0	0	0

Nos. – Nosocomial UTI; NIT – Nitrofurantoin, NX – Norfloxacin, COT – Cotrimaxazole, P – Penicillin G, A – Ampicillin, CX – Cefoxitin, GEN – Gentamicin, STP- Streptomycin, AK – Amikacin, TOB – Tobramycin, NET – Netilmicin, TE – Tetracycline, VA – Vancomycin, LZ – Linezolid
* - $p < 0.05$, †-n = 7, ‡-n = 9, § -n = 15, ||-n = 34; - For *Enterococcus spp*, high level gentamicin (120 µg) and streptomycin (300 µg) disk was used. For all other organisms gentamicin (10 µg) disk was used.

Amongst klebsiella (Table 4), nosocomial strains showed more resistance to urinary antibiotics (nitrofurantoin, norfloxacin, cotrimaxazole and carbenicillin) and aminoglycosides as compared to CA strains. Resistance to piperacillin-tazobactam and carbapenems was not observed in the CA strains of klebsiella, whereas it was as high as 16.7% in the nosocomial strains.

In this study (Table 5), nosocomial strains of *Pseudomonas aeruginosa* and acinetobacter showed more resistance to norfloxacin, third and fourth generation cephalosporins and aztreonam as compared to the CA strains. Few nosocomial strains showed resistance to imipenem and meropenem. All isolates of *Pseudomonas aeruginosa* were susceptible to colistin.

In this study (Table 6), amongst staphylococci, nosocomial strains showed more resistance as compared to CA strains. Amongst enterococci, only nosocomial strains showed resistance to urinary antibiotics and high level resistance to aminoglycosides. Further in enterococci, resistance to penicillin G and ampicillin was significantly ($p = 0.001$) more in nosocomial strains as compared to CA strains. All staphylococcal and enterococcal isolates were susceptible to vancomycin and linezolid.

DISCUSSION

Urinary tract is the most common organ system to experience bacterial infections. UTIs are challenging, not only because of the large number of infections that occur each year, but also due to the drug resistance in uropathogens.

Epidemiologically, UTIs are subdivided into community-acquired (CA) infections and nosocomial (catheter-associated) infections.[10] CA and nosocomial UTI differ aetiologically, epidemiologically; they also have different antibiotic resistance pattern.

In this study (Table 1), CA UTI was more common in females (68.7%). This might be as a result of shorter and wider urethra in females. Amongst females, majority of patients (35.2%) were in the age group of 21-30 years ($p = 0.001$), which is a sexually active and child bearing age group. In males, CA UTI was more common (38.6%) in the age group of > 60 years ($p < 0.001$). The increase is probably in part related to prostatic disease and the resultant instrumentation. In nosocomial UTI, majority of patients (45.2%) were from the age group of > 60 years (Table 2).This might be due to the fact that elderly patients are more prone to infections.

In the study (Table 3), *E. coli* was the most common (60.1%) organism isolated from CA UTI followed by other enterobacteria (20.3%). Enterobacteria including *E. coli* are the commensals of gastrointestinal tract which easily invade the urinary tract leading to UTI. Amongst staphylococci, *Staphylococcus saprophyticus* predominated in CA UTI. This corresponds to the fact that *Staphylococcus saprophyticus* is a prevalent pathogen during the period of sexual activity in women.[11]

Although *E. coli* was the most common organism isolated fromnosocomial UTI in this study (Table 3); its isolation was significantly less ($p < 0.001$)as compared to that in CA UTI. In this study, enterococciwere thesecond most common organism causing nosocomial UTI. High rate of enterococcalcolonization of foley's catheter among hospitalized patients was found to benoteworthy in the study conducted by Desai et al[12]suggesting that catheterizationdoes play a role in increasing the risk of infection due to enterococci. Amongstenterococcal species,*Enterococcus faecalis* was more common in CA UTI whereasin nosocomial UTI *Enterococcus faecium* predominated in this study (Table3). *Enterococcus faecalis* and *Enterococcus faecium* are the species mostcommonly recovered from clinical specimens.[13]In the study, acinetobacter ($p = 0.009$), candida ($p = 0.014$), *Pseudomonasaeruginosa* ($p = 0.003$) and *Staphylococcusaureus*($p = 0.01$)were more commonly isolated from nosocomial UTI as compared to CA UTI. As these organisms harbourin the hospital environment, they were predominantly seen in nosocomial UTI.

The antibiotic resistance in uropathogens is increasing worldwide inboth outpatients as well as hospitalized patients. Understanding the impact of drugresistance is of critical importance as the changing rate of antibiotic resistance has alarge impact on the therapy of UTIs.

In this study (Table 4), enterobacteria are the causative agents in CA UTI in as much as80% of cases (Table 3). Enterobacteriaceae isolates in CA UTI showed 99.6%susceptibility to nitrofurantoin and 89.7% susceptibility to carbenicillin (Table 4).Hence, either of these drugs can be given as an empirical drug in CA UTI. Irrationalprescription of antimicrobials, their availability over-the-counter, unqualifiedpractitioners and untrained pharmacists and non-standard doses for inadequatedurations are leading to development of increasing level of antimicrobial resistance.Tada et al[14]reported that among the β-lactam antibiotics, imipenem had the widestcoverage against *E. coli* isolates (100%) in both CA and hospital-acquired UTI,followed by fluoroquinolones(95 to 100%) and amikacin (80% to 97%).Patel etal[15]reported fluroquinolones (gatifloxacin,levofloxacin), erythromycin and linezolid (ingram positives) as the most useful antibiotics because they inhibited the mostcommonly isolated UTI pathogens whereas nitrofurantoin, ampicillin and nalidixicacid which were poorly effective against majority of the organisms isolated in theirstudy.

In this study (Table 5),nosocomial gram negative bacilli showsusceptibility to amikacin in the range of 56.2-69.8% and to carbapenems 69.7-89.5%. Nosocomial gram positive cocci show 80% susceptibility to amikacin and100% susceptibility to vancomycin (Table 6). Hence, combination of a carbapenem,amikacin and

vancomycin can be used as an empirical treatment in nosocomial UTI.

CONCLUSION AND RECOMMENDATION

To conclude, CA and nosocomial UTI differ aetiologically. Hence, theknowledge about the aetiology of CA and nosocomial UTI can help in managementof either types of UTI.Nitrofurantoin and carbenicillin can be given as an empiricaltreatment in CA UTI. However, a combination of a carbapenem, amikacin andvancomycin can be used as an empirical treatment in nosocomial UTI. In oursettings, the drug resistance was increasingly observed in nosocomial UTI as well asin CA UTI where it was traditionally absent.Therefore,regular monitoring of aetiologyof UTI and antibiotic susceptibility profile of uropathogens will help clinicians tochoose appropriate antibiotic for the treatment of UTI and reduce overzealous,indiscriminate use of antibiotics.Also, this will reduce the spread of drug resistantstrains in both hospital and in community.In a health care setting, a very little extraventure on antimicrobial resistance survey can facilitate to accrue extremely practicalinformation of the resistance pattern.

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