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ORIGINAL ARTICLE

Antimicrobial sensitivity and resistance pattern in urinary isolates in Bhaktapur Hospital

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Abstract

Introduction: Urinary tract infections (UTIs) are the most common bacterial infections encountered in clinical practice. The emergence of antimicrobial resistance (AMR) among uropathogens complicates treatment strategies. Regional variations in AMR patterns necessitate localized studies to guide empirical treatment effectively. Bhaktapur Hospital, a key healthcare provider in the region, provides a unique opportunity to study in this regard, contributing to better management protocols. The study aims to find out the common isolates in the urine culture and their AMR pattern to the commonly prescribed antibacterial drugs.

Method: The study is of descriptive design using hospital clinical and laboratory record of urine culture and sensitivity reports analysis within the period of 2080 Kartik to 2081 Ashoj (1 year). The approval for the study was taken from Bhaktapur Hospital (Ref no. 1034/082).

Result: Majority of patient of urinary tract infection were of female sex, 646 (82.6%) and within the reproductive age group, 477(61%). Common urinary isolates were found E. coli 571(72.8%%), Klebsiella 135(17.2%), Staphylococcus aureus 42(5.4%), Citrobacteria 16(2%), Actinobacter 8(1%), Pseudomonas 7(0.9%) and Proteus 3(0.4%). Antimicrobial resistance was present in all types of isolates. Urinary isolates displayed resistance in higher percentage to common antimicrobial drugs used for UTIs treatment in the institution, namely: Amoxicillin, Cefepime, Cefixime, Ciprofloxacin, Ceftazidime, Ceftriaxone, Levofloxacin and Ofloxacin. Only Amikacin, Gentamicin and Imipenem displayed satisfactory activity against urinary isolates.

Conclusion: This study substantiates the existence of uropathogens resistant to the commonly used antibiotics. Further studies are needed to identify the resistance pattern with the clinical scenario and explore the ways to tackle them.

Keywords: Antimicrobial**,** Resistance, Urinary Isolates

INTRODUCTION

Urinary tract infections (UTIs) are among the most common bacterial infections encountered in clinical practice.[1] They account for significant morbidity and financial burden on healthcare systems worldwide.[2] Urinary tract infections (UTIs) are triggered by various pathogens, primarily by Escherichia coli, Klebsiella pneumoniae, Proteus mirabilis, Enterococcus faecalis, and Staphylococcus saprophyticus.[3] Initially, broad spectrum antibiotics are used to treat UTIs empirically which are then de-escalated to specific antibiotics depending on information obtained from the urinary isolates susceptibility pattern to the antimicrobial.

Antimicrobial resistance is a growing concern globally and in Nepal.[4] The emergence of antimicrobial resistance (AMR) among uropathogens complicates treatment strategies, leading to poor clinical outcomes, uncertainty and risen health care expense.[5] Tackling this concern necessitates thorough planning and prompt action; hence, it is crucial to observe the typical antimicrobial isolation trends and the present sensitivity and resistance rates of commonly utilized antibacterial drugs against these isolated organisms. Regional variations in antimicrobial sensitivity and resistance patterns necessitate localized studies to guide treatment effectively.[6] Bhaktapur Hospital, a key healthcare provider in the region, provides a unique opportunity to study the AMR patterns in urinary isolates, contributing to better management protocols and choice of empirical antibiotics use in UTIs.

The present study monitored the common antimicrobial isolation patterns and the current sensitivity and resistance levels of frequently used antibacterial medications against these isolated pathogens. The study could serve as a wake-up call raising awareness among stakeholders about the threat to public health of antibiotic resistance and having prompt action plan to combat it.

METHOD

This was a retrospective cross-sectional study using data from the laboratory record of Urine Culture and Sensitivity report within the period of 1 year (2080 Kartik to 2081 Ashoj B.S) of Bhaktapur Hospital.

Inclusion criteria included the patients of all age groups and genders with clinically suspected UTI and underwent for urine culture and sensitivity test. Urine samples were processed following standard microbiological techniques in the laboratory. Significant bacterial growth (≥105 CFU/mL) was identified using biochemical tests and automated systems.

For Antimicrobial Sensitivity Testing: Kirby-Bauer disc diffusion method was employed in accordance with CLSI guidelines, 2024.[7] Antibiotics tested included: Penicillins (e.g., Amoxicillin), Cephalosporins (e.g., Ceftriaxone, Cefepime), Aminoglycosides (e.g., Gentamicin, Amikacin), Fluoroquinolones (e.g., Ciprofloxacin, Levofloxacin), Carbapenems (e.g., Imipenem, Meropenem) and Nitrofurantoin. For the data analysis descriptive statistics were used to summarize demographic data and isolates distribution. Antimicrobial resistance patterns were expressed in frequency, percentages. Ethical clearance and permission was obtained from Bhaktapur Hospital (Ref No. 1034/082) for the study.

RESULT

The study shows that the UTIs disproportionately affecting women 646(82.6%). Likewise, reproductive age group (15-49years) are found more suffered from UTIs 477(61%) followed by elder group (>49years) accounts for 269(34.4%).

The prevalence of the UTIs is found 782(9.6%) out of the total 8145 urine C/S samples in this study table 1 shows that the most common urinary isolates are E. coli 571(72.8%) followed by Klebsiella 135(17.2%), S. Aureus 42(5.4%), Citrobacteria 16(2%) etc.

Table 2. Antibiotics Sensitivity and Resistance Pattern of the Isolated Organisms (n=782)

Organism isolated	*f* (%)
E.coli	571 (72.8%)
Citrobacteria	16 (2%)
Klebsiella	135 (17.2%)
S. Aureus	42 (5.4%)
Actinobacteria	8 (1.0%)
Pseudomonas Aeruginosa	7 (0.9%)
Proteus	3 (0.4%)
Total	782 (100.0%)

In the study, there found 782 (9.6%) urine samples are culture positive with various bacterial isolates out of the total 8145 urine C/S test report within the study period. Out of the 782 with confirmed urinary tract infections, their culture and sensitivity reports substantiate multiple drug resistance.

Table 2 shows that the commonly prescribing antibiotics resistance pattern to the isolated urinary pathogens. Antimicrobial resistance was found in all types of isolates. Commonly prescribed antibiotics Amoxicillin, Cefepime, Cefixime, Ciprofloxacin, Ceftazidime, Ceftriaxone, Levofloxacin and Ofloxacin are displaying resistance in high percentage (>20%). While Amikacin, Gentamicin and Imipenem are found having lower resistance pattern ranging from 2%-6%.

There were 571 infections due to E. coli, the highest antibiotic resistance was to Amoxicillin (393/483;78.6%), Ceftazidime (153/365;41.9%), Cefixime (220/548; 40.1%), Cefepime (90/271;33.2%), Ofloxacin (119/518;33%), Ciprofloxacin (153/506;30.2%), Ceftriaxone (107/404;26.5%) and Levofloxacin (106/468; 22.6%). There was seen some resistance to Imipenem (16/528; 3%).

Table 2A. Antibiotics sensitivity and resistance pattern of the isolated organisms (n=782)

Sn.	Bacterial isolates (UTI) Infections	Antibiotic Sensitivity & resistance profile of the isolated organisms in urine samples											
		Amikacin		Amoxicillin		Cefepime		Cefixime		Ceftazidime		Ciprofloxacin	
		S	R	S	R	S	R	S	R	S	R	S	R
1	Escherichia coli	538	25	107	393	181	90	328	220	212	153	353	153
		95.6%	4.4%	21.4%	**78.6%**	66.8%	33.2%	59.9%	40.1%	58.1%	41.9%	69.8%	30.2%
2	Klebsiella pneumoniae	125	5	20	106	52	31	70	56	33	35	68	51
		96.2%	3.8%	15.9%	**84.1%**	62.7%	37.3%	55.6%	44.4%	48.5%	51.5%	57.1%	42.8%
3	Staphylococcus Aureus	42	0	6	30	4	0	5	8	3	0	23	12
		100%	0%	16.7%	**83.3%**	100%	0%	38.5%	61.5%	100%	0%	65.7	34.3%
4	Citrobacteria	15	1	0	16	8	4	4	12	1	4	10	4
		93.8%	6.2%	0%	100%	66.7%	33.3%	25%	75%	20%	80%	71.4%	28.6%
5	Actinobacteria	8	0	1	3	1	3	4	3	4	1	5	2
		100%	0%	25%	75%	25%	75%	57.1%	42.9%	80%	20%	71.4%	28.6%
6	Pseudomonas Aeruginosa	6	1	2	2	1	0	4	3	4	2	1	3
		85.7%	14.3%	50%	50%	100%	0%	57.1%	42.9%	66.7%	33.3%	25%	75%
7	Proteus	3	0	0	3	1	0	1	2	0	0	3	0
		100%	0%	0%	100%	100%	0%	33.3%	66.7%	0%	0%	100%	0%

S: Sensitive, R: Resistant

Table 2B. Antibiotics sensitivity and resistance pattern of the isolated organisms (n=782)

Sn.	Bacterial isolates (UTI) Infections	Antibiotic Sensitivity & resistance profile of the isolated organisms in urine samples											
		Ceftriaxone		Gentamicin		Imipenem		Levofloxacin		Nitrofurantoin		Ofloxacin	
		S	R	S	R	S	R	S	R	S	R	S	R
1	Escherichia coli	297	107	527	23	512	16	362	106	519	42	399	119
		73.5%	26.5%	95.8%	4.2%	96.7%	3%	77.4%	22.6%	92.5%	7.5%	77%	33%
2	Klebsiella pneumoniae	63	28	127	26	114	5	67	38	111	22	90	38
		69.2%	30.8%	83%	17%	95.8%	4.2%	63.8%	36.2%	83.5%	16.5%	70.3%	29.7%
3	Staphylococcus Aureus	31	0	40	1	12	0	22	6	38	2	32	5
		100%	0%	97.6%	2.4%	100%	0%	78.6%	21.4%	95%	5%	86.5%	13.5%
4	Citrobacteria	8	2	15	1	14	0	10	2	14	2	11	4
		80%	20%	93.8%	6.2%	100%	0%	83.3%	16.7%	87.5%	12.5%	73.3%	26.7%
5	Actinobacteria	3	2	8	0	7	0	3	3	6	0	5	0
		60%	40%	100%	0%	100%	0%	50%	50%	100%	0%	100%	0%
6	Pseudomonas Aeruginosa	5	0	7	0	6	0	4	1	4	3	6	0
		100%	0%	100%	0%	100%	0%	80%	20%	57.1%	42.9%	100%	0%
7	Proteus	1	2	3	0	2	0	3	0	3	0	1	2
		33.3%	66.7%	100%	0%	100%	0%	100%	0%	100%	0%	33.3%	66.7%

S: Sensitive, R: Resistant

There were 135 infections with K. pneumoniae; the highest antibiotic resistance among routinely used medications were to Amoxicillin (106/126; 84.1%), Ceftazidime (35/68; 51.5 %), Cefixime (56/126; 44.4%), Cefepime (31/83; 37.3%), Levofloxacin (38/10536.2%), Ceftriaxone (28/91; 30.8%) and Ofloxacin (38/128; 29.7%) (Table 2).

DISCUSSION

The study shows that the UTIs disproportionately affecting women (82.6%). Women are especially more prone to developing UTI due to anatomical factors: close proximity of the female urethra to the anus that allows bacterial quick access to the bladder.[8] Likewise, reproductive age group (15-49years) are found more suffered from UTIs (61%) followed by elder group (>49years) accounts for 34.4%. The reproductive age group covers the very sexually active and prime reproductive years of a woman: Sexual activity and pregnancy were reported to increase the risk of having UTI.[9] Older adults are also more prone to UTIs due to the high rates of urinary retention, urinary incontinence, presence of comorbidities, declining immune responses.[10]

The prevalence of UTIs is found 9.6% in this study which is lower than other studies; 24.3% in KIST hospital, Lalitpur and 16% in Tribhuvan University Teaching Hospital (TUTH) Kathmandu.[11,12]

The present study reveals that the most common urinary isolates are E. coli (72.8%) followed by Klebsiella (17.2%), S. Aureus (5.4%), Citrobacteria (2%) etc. Similar other study also found the predominant organisms responsible

for UTI are mostly the E. coli causing 80–85% of urinary tract infections.[13] E. coli is identified as the most common organism of UTIs; 62.1% followed by K. pneumoniae 10.2% lower than the present study.[12]

The study substantiates the commonly prescribing antibiotics resistance pattern to the isolated urinary pathogens. Antimicrobial resistance is found in all types of isolates. Commonly prescribed antibiotics are displaying resistance to E. coli in high percentage; amoxicillin (78.6%), ceftazidime (41.9%), cefixime (40.1%), cefepime (33.2%), ofloxacin (33%), ciprofloxacin (30.2%), ceftriaxone (26.5%) and levofloxacin (22.6%) as well as of Klebsiella to amoxicillin (84.1%), ceftazidime (51.5 %) and cefixime (44.4%). A review article from Nepal reported highest resistance of *E. coli (*>50%) for all the tested drugs: amoxicillin, cefixime, amoxicillin-clavulanate, nalidixic acid, ceftazidime and cefotaxime.[14] Another study has reported an alarmingly high prevalence of resistance of E. coli to cefotaxime (59.3%), ciprofloxacin (57%) and ceftazidime (27%) as well as of Klebsiella to cefotaxime (47.3%), ceftazidime (35.5%) and ciprofloxacin (32.2%).[15]

Only amikacin, gentamicin and imipenem are found having minimal resistance against urinary isolates as in similar other study.[16]

Study limitations include the single-hospital setting, which might not represent the scenario of other hospitals and missing information on referring departments for outpatients and other clinical characteristics that might be associated with culture positivity and resistance, as the study was mainly based on available hospital records.

CONCLUSION

UTIs are among the most common infections worldwide, disproportionately affecting women within reproductive age group. The most common urinary isolates are E.coli 571(72.8%) followed by Klebsiella 135(17.2%). Antimicrobial resistance is found in all types of isolates. There is found highest resistance of *E. coli to* amoxicillin (78.6%), Ceftazidime (41.9%) and Cefixime (40.1%).

DECLARATIONS

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Conflict of Interest

None

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None

Consent of the Study

It was not taken as it was laboratory based retrospective study.

Consent of Publication from Authors

Consent was given by all authors for the publication.

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