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ORIGINAL ARTICLE

Urinary Tract Infection, Bacteriological Profile and its Antibiotic Susceptibility in Tertiary Center

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ABSTRACT

Introduction: Urinary tract infection is one of the common bacterial infections seeking treatment in clinical practice. A variety of organisms are associated with UTI and the most common organisms are Escherichia coli and other coliforms. Bacteriological investigations of UTI are not complete without an antibiotic sensitivity test of the isolate. The extensive and inappropriate use of antimicrobial agents has invariably resulted in the development of antibiotic resistance which, in recent years, has become a major problem worldwide. This study aims to determine the bacteriological profile and antibiotic sensitivity patterns and their disease association in a tertiary center.

Methods: This study was conducted in the Department of Urology, College of Medical Sciences and Teaching Hospital, Chitwan, Nepal over a period of one year (January 2021 to December 2021). All cases of suspected UTI were sent for urine culture and sensitivity tests were evaluated in this study. Disease associated with UTI, bacteriological profile, and antibiotic sensitivity patterns were evaluated.

Results: A total of 1987 cases were sent for urine culture and sensitivity test. The total culture-positive cases were 404 (20.3%). The most common age group for the culture-positive test was 60-70 years (17.3%) followed by 70-80 years (17.1%). Prevalence was higher in females (56.9%) compared to males (43.1%). Escherichia coli (59.8%) was the most common pathogen isolated followed by Klebsiella species (10.6%) and Pseudomonas aeruginosa (4.4%). Most of the isolates showed susceptibility to amikacin (90.61%), gentamicin (83.76%), and imipenem (73.91%).

Conclusions: The increasing trend of resistant strains depicts the random use of antibiotics and requires continuous monitoring of their resistance. Antibiotic susceptibility patterns must be continuously and periodically evaluated to select the appropriate regimen to treat UTI

CONFILICT OF INTEREST : None

INTRODUCTION

Urinary tract infections (UTIs) are counted among the most common infection, exceeding in frequency among ambulatory patients only by respiratory and gastrointestinal infections.[1, 2] It can be either community-acquired or hospital-acquired. Normally, urine

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in the urinary bladder is sterile.[3] The common etiological agents are escherichia coli (E. Coli), pseudomonas, proteus and klebsiella.[1, 3, 4] Bacteriological investigations of UTI are not complete without an antibiotic sensitivity test of the isolated organism. Microorganisms causing UTIs vary in their susceptibility to antimicrobials from place to place and from time to time.[5]

UTI can involve infection from the urethra to the kidneys. Symptoms in the case of cystitis include painful and frequent urination whereas conditions like high fever and flank pain are seen in pyelonephritis.[6]

Due to the empirical use of antibiotics in infectious diseases and the lack of standardization in antimicrobial susceptibility tests, resistance to the commonly used antimicrobial agent is increasing year by year. Knowing the common isolated urinary tract pathogens and their antimicrobial susceptibility is beneficial in planning treatment protocols.[7] Continuous monitoring of its resistance, a rational prescription of antibiotics, and respect for hygiene are required as a result of the evolutionary and worrying character of the antibiotic resistance of pathogenic bacteria.[8]

The urine bacteriological examination remains the key examination for the positive diagnosis of this infection, it allows us to identify the responsible germ and to study its sensitivity to antibiotics. The isolation of the microorganism responsible for UTI, reveals that the gram-positive coccus, the gram-negative bacilli, and especially Enterobacteriaceae microorganisms are the most implicated germs in these infections.[8]

Common pathogenic organisms include gram-negative enteric bacilli, especially Escherichia coli and Klebsiella species (GNBs have developed complex mechanisms of resistance against most of the potent antibiotics) and gram-positive organisms like Staphylococcus saprophyticus and Enterococcus species.[9]

In almost all cases, there is a need to start treatment before the final microbiological results are available which may lead to antibiotic resistance due to frequent misuse of antibiotics. To aid better decision making the physician must have current knowledge of the organisms and should advise a bacteriological examination of urine samples along with their antibiogram to know the trend of antibiogram of uropathogens in the regions. Prompt diagnosis and timely antimicrobial treatment help to minimize renal scarring and progressive kidney damage.[10]

METHODS

A cross-sectional study was conducted in the Department of Urology, College of Medical Sciences and Teaching Hospital over a period of one year (January 2021 to December 2021). Prior to the study, permission was obtained from the Institutional Review Committee of the College of Medical Sciences and Teaching Hospital. All patients presenting in OPD and admitted to the ward with symptoms of UTI such as fever, dysuria, increased frequency of urination, and loin pain were included in this study. Mid-stream urine was sent for culture. CLED (Cystine-Lactose-Electrolyte-Deficient) agar culture medium was used for urine culture. A contaminated urinary sample was excluded from this study. Parameters like age, sex, and associated disease of the patients were taken into account from the central laboratory of the College of Medical Sciences. Pathogens were isolated and antibiotic sensitivity was also taken into account. Required clinical history and examination findings were noted. Patients were asked to follow up with a urine culture sensitivity report.

Antibiotics were started according to the sensitivity report and asked to follow up after one week. All the data were manually collected and analyzed using Excel wherever necessary. The collected data were checked for completeness and coded. Then data were entered into MS Excel and then data analysis was done using SPSS-16 software. Categorical variables were presented in the form of tables with frequency and percentage.

RESULTS

Out of 1987 urine samples that were analyzed, 404 samples (20.3%) were found to have significant bacteriuria and the remaining 1583(79.7%) samples were either non-significant bacteriuria or very low bacterial count or sterile urine after 24 hrs of aerobic incubation at 37° C.

Sample	No. of Patient	Percent
Sterile after 24 hrs of aerobic incubation at 37° C	1583	79.7
Culture positive sample	404	20.3

Table 1: Sociodemographic characteristics of the patients n=1987

Variables	No. of Patient	Percent
Age group		
<10	150	7.5
10-20	93	4.7
20-30	265	13.3
30-40	313	15.8
40-50	303	15.2
50-60	280	14.1
60-70	297	14.9
70-80	206	10.4
>80	80	4.0
Mean±SD	45.89±21.79	
Gender		
Female	1009	50.8
Male	978	49.2

Out of the 1987 urine samples that were collected, 313 (15.8%) were from the 30-40 age group with female predominance (50.8%). Out of the 404 samples, the prevalence was higher in females (56.9%) compared to males (43.1%). The overall infection rate was highest in the age group of 60-70 years (17.3%).

Table 2: Age and gender-wise distribution of culture-positive sample n=404

Culture Sample	Total numbers	Percent
Female	230	56.9
Male	174	43.1
Age group		
Age group		
<10	22	5.4
10 20	16	4.0
20 30	47	11.6
30 40	53	13.1
40 50	42	10.4
50 60	65	16.1
60 70	70	17.3
70 80	69	17.1
>80	20	5.0

Escherichia coli (59.8%) was the predominant uro-pathogen isolated followed by Klebsiella spp (10.6%) and Pseudomonas aeruginosa (4.4%).

Table 3: Pathogenic microorganisms isolated in culture

Microorganism	Total numbers	Percent
Acinetobacter Baumanii	10	2.5
Candida albicans	12	3.0
Citrobacter freundii	2	0.5
Contaminats grown, repeat sample after aseptic precaution	53	13.1
Enterococcus Species	17	4.2
Escherichia coli	242	59.8
Klebsiella pneumoniae	42	10.6
Proteus mirabilis	7	1.7
Pseudomonas aerugi-nosa	18	4.4
Staphylococus aureus (MRSA)	1	0.2

The susceptibility pattern among gram-negative bacilli has shown maximum sensitivity to Amikacin, Gentamicin, and Imipenem Maximum resistance was seen against Amoxiclav and cloxacillin. Among the gram-positive organisms higher sensitivity was seen with Cefoperazone, Cefotexime, Ciftazidine, Cifixime, Cipro, Cloxacillin, Colistin, Clotrimazole, Gentamicin, Imipenem, and Levoflox. Maximum resistance was seen against Amoxyclav, Ampicillin, Ampicillin/Sulbactum, Azithromycin, Cefepime, Cefixime, Cefotaxime, Colistin and Gentamicin.

Table 4: Antibiotic Sensitivity pattern according to organism (in percentage)

A	B	C	D	E	F	G	H	I	J
Amikacin	80	100	47.366	90.61	50	87.5	90	70.37	50
Amoxyclav			100						50
Ampicllin				3.79					
Ampicillin/Sulbactum	50		10	13					
Azithromycin			12.5	7.35				9	
Cefepime			25	15.38					
Cefoperazone	100		57.14	60.6		25	50	18.18	100
Cefotexime	16.66		77.77	67.09	100	62.5	71.42	42.85	
Ciftazidine	43.75		54.16	50.13	100	55.55		42.1	100
Cifixime	27.27		35.29	28.97	50	35.89	50		
Cipro	66.66		63.15	56.65	50	98.61	71.42	64.48	100
Cloxacillin			50						100
Colistin	100		62.5	52		90	100	100	
Cotrimazole	77.77		52.94	55.6	50	65.38	62.5	16	100
Gentamicine	71.42		50	83.76	50	33.33	14.28	55	
Imipenem	100		42.85	73.91		25	50	36.36	100
Levoflox	75		53.84	59.67	100	78.26	57.14	57.14	100

Note : A = Antibiotics, B = Acinetobacter baumanii, C = Citrobacter freundii, D = Enterococcus sapps, E = Escheric haia coli, F = Klebsiella oxytoca, G = Klebsiella pneumoniae, H = Proteus valgaris, I = Pseudomonas aeruginosa, J = Staphylococus aureus

DISCUSSION

UTI is one of the common problems encountered around the world. Irrespective of age, sex, marital status, religion or geographical area UTIs can occur in any group of patients. In our study period, the total number of samples was 1987. Out of which 1583 (79.7) samples were sterile and 404 (20.3) samples showed growth. Similar results were seen in the study done by Subedi et al (17.4%), Edirisinghe et al (31%), and Benerjee et al (24.5%).[4,5,11]

Among the culture-positive samples 230 (56.9%) patients were females and 174 (43.1%) were males. Similar findings of increased incidence of UTIs in females were found in other several studies by Latika J Shah et al (77.4%), and Subedi N Pudasaini S et al (84.8%). This high incidence of UTI in females could be due to short urethra, and urethral opening in the vicinity to the perineum where there is high colonization of enteric bacteria.[11,16]

In our study, the most common organism isolated was Escherichia Coli (59.8%) followed by Klebsiella pneumonia (10.6%), Pseudomonas aeruginosa (4.4%) and Enterococcus Species (4.2%). The findings of our study are in accordance with a study done by Humayun et al had E Coli (70 %), K. pneumoniae (14%). Most of the other studies also showed E Coli as the most common pathogen to cause UTI.[3]

Aminoglycosides like Amikacin and Gentamycin are highly sensitive drugs, these drugs are sensitive to almost all types of pathogens in the urinary tract. In our study also E coli being the most common pathogen in UTI is sensitive to Amikacin and gentamycin in 90.6% and 83.7 %, ciprofloxacin and levofloxacin in 56.6% and 59.6%, imipenem in 73.9%, cefotexime 67.9% and cotrimazole in 55.6%. In a study done by Kibret M et al, E. coli showed a significantly high degree of sensitivity rates to nitrofurantoin (96.4%), norfloxacin (90.6%), gentamicin (79.6%) and ciprofloxacin (74.7%) and significantly high resistance rates to erythromycin (89.4%), amoxicillin (86.0%) and tetracycline (72.6%) were documented (p=0. 001).[12]

Latika J Shah, Geeta M Vaghela, Hetvi Mahida et al., conducted a study in 2015 in which, out of total 232 patients who were clinically diagnosed with UTI, Isolates were detected in 177 (76.29%) samples. Out of these, 137 (77.40%) were female.

The most common organism found positive was Escherichia Coli. E. coli was highly sensitive to Amikacin and Nitrofurantoin. Whereas, E.coli was highly resistant to Ampicillin and Nalidixic acid. The antibiotic sensitivity pattern of Klebsiella and Acinitobacter shows that they were also highly sensitive to Amikacin. Klebsiella and Acinobacter were highly resistant to Ampicillin and Gentamycin. The pattern of resistance to commonly used antibiotics for treating UTI alerts us against indiscriminate usage of antibiotics.[16]

Next common pathogens Klebsiella pneumonia and Pseudomonas aeruginosa are sensitive to Amikacin at 87.5% and 70.37%, gentamycin in 33.3 % and 55%, ciprofloxacin 98.6% and 71.4%, levofloxacin 78.26% and 57.1%, imipenem in 25% and 36.36%, cefotexime 62.5% and 42.85% and cotrimazole in 65.38% and 16%. Similarly in a study Klebsiella pneumoniae showed the highest resistance against co-trimoxazole (23.75%) and ciprofloxacin (23.75%). (Bacteriological Profile and Antibiotic Resistance in Patients with Urinary Tract Infection in Tertiary Care Teaching Hospital in Western Rajasthan India.[17]

CONCLUSIONS

Urinary tract infection is a common problem throughout this area, early clinical diagnosis along with urine culture and starting appropriate antibiotics according to culture reports is very necessary for infection control and prevention of resistance of organisms to antibiotics and also preventing uncomplicated UTI going into complicated UTI. E. coli is the most common organism isolated followed by Klebsiella pneumonia and Pseudomonas aeruginosa in urine culture in our center. Aminoglycosides, fluoroquinolones and cephalosporin groups of drugs are highly sensitive to isolated organisms from the urinary tract in our center.

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