PREVALENCE AND ANTIBACTERIAL SUSCEPTIBILITY TESTING PATTERN OF BACTERIAL PATHOGENS CAUSING URINARY TRACT INFECTIONS IN COMMUNITY

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ABSTRACT

BACKGROUND

To determine the prevalence and antimicrobial susceptibility pattern of isolated bacteria from suspected urinary tract infections in the community.

Urinary Tract Infection (UTI) is a term applied to a variety of conditions ranging from asymptomatic presence of bacteria in the urine to severe infection of the kidney with sepsis.

METHODS

Mid-stream urine samples were collected in aseptic conditions and processed. The organisms were identified based on cultural characteristics, microscopy and biochemical reactions. The antibiotic susceptibility testing was done by Kirby Bauer disc diffusion method.

RESULTS

Out of 401 samples, bacterial isolates were positive for 43 samples. Among them most prevalent organism is *Escherichia coli* followed by *Klebsiella pneumoniae*, *Enterococcus*, *Staphylococcus*, *Pseudomonas* and *Proteus Spp*.

CONCLUSION

In this study most of the organisms are resistant against ampicillin and sensitive against nitrofurantoin and amikacin. So the empirical treatment of the UTI patients with these drugs can give immediate recovery from the infection, so that further systemic spread of the infection can be prevented.

KEYWORDS

UTI, Antibiotic Susceptibility Test, Kirby Bauer Disc Diffusion Method.

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INTRODUCTION

Urinary Tract Infections (UTIs) are the second most common infections in community. Incidence of UTI is higher in women than men because of short urethra, absence of prostatic secretions, pregnancy and easy contamination of urinary tract with faecal flora.⁽¹⁾ It has been estimated that 150 million people were infected with UTI per annum worldwide, which is costing global economy more than 6 billion US dollars.⁽²⁾

An estimated 50% of women experience at least one episode of UTI at some point in their lifetime and between 20% and 40% of women have recurrent episodes. Approximately, 20% of all UTIs occur in men.⁽³⁾ UTI may be defined as a condition in which bacteria are established and multiplying within the urinary tract. Diagnosis requires demonstration of bacteriuria. Exceptions to this include patients with pyogenic abscess of kidney or perinephric tissue, obstructed pyonephrosis or bacterial prostatitis in whom the urine may be sterile. Some definitions are necessary because the infection of the urinary tract may result from microbial invasion of any of the tissues extending from urethral orifice to the renal cortex.⁽⁴⁾

Urinary tract infection is said to exist when pathogenic microorganisms are detected in the urine, urethra, bladder, kidney or prostate with or without the presence of specific symptoms. In most instances, growth of more than 10⁵ organisms per millilitre from a properly collected midstream "Clean-Catch" urine sample indicates infection.⁽⁵⁾ UTI is a bacterial infection affecting urinary tract. When bacteria from the rectal area enter the urinary tract via the urethra to the bladder and multiplies in the urine, an infection occurs. In many cases bacteria first travel to the urethra and when they get multiplied an infection can occur. An infection limited to the urethra is called urethritis. If bacteria move to the bladder and multiply, bladder gets infected and it is called cystitis. If the infection is not treated promptly, bacteria may then travel further up the ureters to multiply and infect the kidneys called pyelonephritis.⁽⁶⁾

The patients with UTI shows signs and symptoms like burning pain on urination, urinary frequency or urgency, urinary incontinence, blood in the urine, foul-smelling urine, and fever with chills in cases of more serious infection.⁽⁷⁾ Patients with sexually transmitted infections as well as urethritis, cervicitis and vulvovaginitis from other causes can present with symptoms similar to cystitis. Some patients with ureterolithiasis may have only mild flank pain or lower urinary tract symptoms. Pelvic inflammatory disease, appendicitis and sigmoid diverticulitis are among the entities which have been misdiagnosed as acute cystitis.⁽⁸⁾ Acute UTI is one of the most important causes of morbidity, occasionally becoming life-threatening, forcing the general population to seek medical attention and accounting for considerable health care costs. Wide spectrums of organisms are

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implicated in its aetiology, the most common being *Escherichia coli* and other gram negative bacteria followed by gram positive organisms.^(9,10)

MATERIALS AND METHODS

The present study was conducted in patients attending outpatient department in our hospital. It was a prospective study, which was done in duration of 6 months' period. Patients attending different clinical OP departments with signs and symptoms of UTI were selected for the study, as this work is aimed to assess the prevalence and antibiogram of bacterial pathogens causing UTI in the community. Clean catch midstream urine samples were collected from each patient in a 20 mL calibrated sterile screw-capped universal container. The specimens were labelled, transported to the microbiology laboratory and analysed within 6 hours. In each container boric acid (0.2mg) was added to prevent the growth of bacteria in urine samples. All patients were well instructed for proper collection of sample aseptically prior to sample collection to avoid contaminations from genital flora.

Verbal informed consent in local language was obtained from all patients prior to specimen collection. The sample was inoculated for semi-quantitative culture on Cystine-Lactose-Electrolyte-Deficient (CLED) media using a calibrated loop. The culture plates were incubated at 37°C for 18-24 hrs. under aerobic conditions. A specimen was considered positive for UTI when an organism was cultured at a concentration of 10⁴ cfu/mL and >5 pus cells per high-power field were observed on microscopic examination of the urine.⁽¹¹⁾ Identification of bacterial growth was determined by Gram's staining and standard microbiology techniques.

Gram negative bacteria were identified by the standard biochemical tests.^(12,13) and Gram positive microorganisms were identified with the corresponding laboratory tests like catalase, coagulase and mannitol test for *Staphylococcus aureus*.⁽¹⁴⁾

The sensitivity of the strains against various antibiotics was determined by using antibiotic sensitivity discs, namely

ceftazidime (CTZ) 30 mcg, cefotaxime (CTX) 30 mcg, cefepime (CPM) 50 mcg, piperacillin (PIT) 100/10 mcg, amoxycylav (AMC) 10 mcg, methicillin (MET) 30 mcg, penicillin G (PG) 10 units, ampicillin (AMP) 10 mcg, vancomycin (VA) 30 mcg, linezolid (LZ) 30 mcg, gentamicin (GEN) 50 mcg, amikacin (AK) 30 mcg, nalidixic acid (NA) 30 mcg, ciprofloxacin (CIP) 5 mcg, norfloxacin (NX) 10 mcg, co-trimoxazole (COT) 25 mcg, nitrofurantoin (NTF) 300 mcg, cefoxitin-30 µg. The antibiotic characteristics of the 43 isolates were analysed by Kirby Bauer disk diffusion method.⁽¹⁵⁾ as per NCCLS guidelines. For the staphylococcus strains, MRSA was detected by using cefoxitin-30 µg incubating at 35°C. Minimum Inhibitory Concentration (MIC) ≥22 mm is considered as sensitive i.e. MSSA, whereas MIC ≤21 mm considered as MRSA. MIC for vancomycin was determined by agar dilution method (CLSI guidelines, 2011).⁽¹⁶⁾

RESULTS

Out of 401 samples processed 43 (10.7) gave significant growth pathogen. Out of 43 total isolates 35 (81%) are from female patients, whereas 8 (19%) are from male patients.

Total No. of Isolates	Female	Male
43	35(81%)	8(19%)

Table 1: Showing the Total Number of Uropathogens

Of the significant 43 isolates gram negative aerobic rods accounted for 74.4%, whereas remaining 25.6% belonged to Gram positive cocci.

Among 43 isolates, *Escherichia coli* is the most prevalent organism (46.5%), followed by *Klebsiella pneumoniae* (18.6%), *Proteus* (4.05%), *Pseudomonas* (4.65%), *Enterococcus* spp. (16.2%) and *Staphylococcus aureus* (9.3%).

Total No. of Samples	401	E. coli	K.pneumoniae	P.aeruginosa	Proteus mirabilis	S.aureus	Enterococcus spp.
Isolates	43	20	8	2	2	4	7
Percentage		46.5%	18.6%	4.65%	4.65%	9.3%	16.27%

Table 2: Showing the Prevalence of Different Uropathogens

Antibiotics	E.coli. ⁽²⁰⁾		K.pneumoniae. ⁽⁸⁾		P.aeruginosa. ⁽²⁾		Proteus mirabilis. ⁽²⁾		S.aureus. ⁽⁴⁾		Enterococcus spp. ⁽⁷⁾	
	S	R	S	R	S	R	S	R	S	R	S	R
CTZ	7	13	4	4	1	1	1	1	NT	NT	NT	NT
CTX	7	13	4	4	1	1	1	1	3	1	6	1
CPM	11	9	5	3	1	1	1	1	NT	NT	NT	NT
PIT	16	4	6	2	2		2		NT	NT	NT	NT
AMC	15	5	5	3	2		2		NT	NT	NT	NT
PG	NT	NT	NT	NT	NT	NT	NT	NT		4		7
AMP		20	NT	8		2		2			2	5
VA	NT	NT	NT	NT	NT	NT	NT	NT	4		7	
LZ	NT	NT	NT	NT	NT	NT	NT	NT	4		7	
GEN	14	6	5	3	2		1	1	2	2	2	5
AK	17	3	6	2	1	1	2		4		NT	NT
NA	8	12	3	5	1	1		2	2	2	1	6
CIP	7	13	2	6	1	1	1	1	1	3	4	3
NX	8	12	3	5	1	1	1	1	1	3	3	4
NIT	17	3	7	1	NT	NT	2		3	1	4	3
COT	6	14	4	4	NT	NT	1	1	1	3	NT	NT

Table 3: The Antibiogram of the Organisms Against Different Antibiotics

NT: Not tested

Antibiotics	E.coli. ⁽²⁰⁾		K.pneumoniae. ⁽⁸⁾		P.aeruginosa. ⁽²⁾		Proteus. mirabilis. ⁽²⁾		S.aureus. ⁽⁴⁾		Enterococcus spp. ⁽⁷⁾	
	S	R	S	R	S	R	S	R	S	R	S	R
CTZ	35%	65%	50%	50%	50%	50%	50%	50%	NT	NT	NT	NT
CTX	35%	65%	50%	50%	50%	50%	50%	50%	75%	25%	85.7%	14.3%
CPM	55%	45%	62.5%	37.5%	50%	50%	50%	50%	NT	NT	NT	NT
PIT	80%	20%	75%	25%	100%		100%		NT	NT	NT	NT
AMC	75%	25%	62.5%	37.5%	100%		100%		NT	NT	NT	NT
PG	NT	NT	NT	NT	NT	NT	NT	NT		100%		100%
AMP		100%		100%		100%		100%			28.5%	71.5%
VA	NT	NT	NT	NT	NT	NT	NT	NT	100%		100%	
LZ	NT	NT	NT	NT	NT	NT	NT	NT	100%		100%	
GEN	70%	30%	62.5%	37.5%	100%		50%	50%	50%	50%	28.5%	71.5%
AK	85%	15%	75%	25%	50%	50%	100%		100%		NT	NT%
NA	40%	60%	37.5%	62.5%	50%	50%		100%	50%	50%	14.3%	85.7%
CIP	35%	65%	25%	75%	50%	50%	50%	50%	25%	75%	57.1%	42.8%
NX	40%	60%	37.5%	62.5%	50%	50%	50%	50%	25%	75%	42.8%	57.1%
NIT	85%	15%	87.5%	12.5%	NT	NT	100%		75%	25%	57.1%	42.8%
COT	30%	70%	50%	50%	NT	NT	50%	50%	25%	75%	NT	NT

Table 4: Percentages of Sensitivity and Resistance Pattern of all Isolated Organisms

DISCUSSION

Among 401 urine samples processed 43 (10.7%) samples were positive for uropathogens. It is almost similar to that of study conducted by Mohammed Akram et al.⁽¹⁷⁾ in which it was 10.86%. The prevalence of UTI occurred more in females than in males. Of 43 isolates 81% of the isolates are from female patients, whereas 19% are from male which is correlating with the study conducted by Afsana Fatema Noor et al.⁽¹⁸⁾ as their study also showing the prevalence of female 79% and male 21%. UTIs are caused by a variety of microorganisms including both gram positive and gram negative ones. The aetiology of UTI has been regarded as well-established and reasonably consistent. Out of 43 isolates the most prevalent organism is Escherichia coli, which is about 46.5%, almost similar to that of in the study done by Rosa Daza et al.⁽¹⁹⁾ showing 47% E. coli. The prevalence of Klebsiella spp. in present study was 18.6%. This is very much similar to that of study conducted by Devanand Prakash et al.⁽²⁰⁾ showing the prevalence of Klebsiella 18.7%.

In present study, isolation of P. aeruginosa was 4.6% which is in harmony with study conducted by Hari P Kattel et al.⁽²¹⁾ showing the prevalence of Pseudomonas aeruginosa 5.01%. Regarding the gram positive cocci, the prevalence of Enterococcus spp. is 16.27%, which is correlating with the result of Amit A Rangari et al.⁽²²⁾ showing Enterococcus spp. as 20%, which is just nearer to present study. In the present study the prevalence rate of Staphylococcus aureus is 9.3%, which is same as that in the study conducted by Devanand Prakash et al.⁽²⁰⁾ in which the prevalence of S. aureus was 9.68%. Drug resistance among uropathogens has increased over the past few decades because of their widespread indiscriminate use, easy availability and over the counter sale. This is heading us toward the use of higher spectrum antibiotics like amoxycylav, third generation cephalosporins and nitrofurantoin.⁽²³⁾

Therefore, the magnitude of the problem should be accessed properly and in an accurate way. In present study 85% of the gram negative rods are susceptible to Nitrofurantoin, which can be compared with the study conducted by D. J. Farrell et al.⁽²⁴⁾ showing 96.3% and with study of Hari P Kattel et al.⁽²¹⁾ which is showing 79.2% susceptibility to Nitrofurantoin.

CONCLUSION

Gram-negative bacteria were the major causes of urinary tract infection. Among them Escherichia coli were found significantly the most predominant than others. Majority of Gram-negative bacteria showed susceptibility towards Amikacin, Nitrofurantoin. Selection of antimicrobials for UTI should be guided by culture and sensitivity for empirical treatment.

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