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ORIGINAL ARTICLE

Antibiotic Sensitivity and Resistance Patterns in Complicated Urinary Tract Infections

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ABSTRACT

Background: It is important to diagnose UTIs and identify the bacteria causing them in order to choose the best antibiotic treatment and prevent the emergence of antibiotic resistance.

Objective: The aim of this study was to determine the antibiogram in Complicated Urinary Tract Infections at tertiary care hospital.

Material and Methods: The current cross-sectional multicentre study was carried out at MMC, DHQ hospital Kohat, AWKUM, KUST from February 2023 to August 2023 after taking permission from the ethical committee of the institute. A total of 127 individual with complex urinary tract infections of both genders and different age group (16 to 80) years were included. Midstream urine samples were taken in sterile containers from each individual and were sent immediately to the microbiology lab for culturing. Samples were stored at 4°C if they were delayed. These samples were inoculated on blood agar and MacConkey and incubated for 24-48 hours and colonies were counted according to the lab protocols. Severe bacteriuria was defined as growth of greater than 105 CFU/mL. Antibiotic susceptibility profile was done using both disc diffusion and the VITEK-2 compact system direct Antimicrobial Susceptibility Testing (AST). The isolated bacteria were tested for sensitivity to commonly prescribed drugs. All the data was analyzed using SPSS version 26.

Results: A total of 127 individuals were examined in this study out of which 43.3% were male and 56.65% were female. The most prevalent uropathogen in our study was E. Coli which was followed by Staphlococcus aureus and Klebsiella pneumoniae **.** E.coli was highly sensitive to colistin followed by fosfomycin, imipenem, meropenem, Amikacin, Nitrofurantoin ,Piperacillin / Tazobactum and ciprofloxacin while it was highly resistant to Cefixime followed by Co amoxiclave and Co-trimoxizole respectively. Similarly K Pneumoniae was 100% resistant to ciprofloxacin, levofloxacin and moxifloxacin while sensitive to imipenem and meropenem. P.uroginosa was 100% resistant to trimoxizole, ciprofloxacin levofloxacin and colisten. S.aureus was (100%) sensitive to Piperacillin/Tazobactum followed by imipenem and leofloxacin respectively while 100% resistant to moxifloxacin, nitrofurantoin and cefixime.

Conclusion: The present study concluded that the most prevalent bacteria causing urinary tract infections are E. coli followed by S. aureus and K. pneumonia. Most of these bacteria were sensitive to imipenem and meropenem and resistant to commonly prescribed antibiotics.

Keywords: Antibiotic Sensitivity; Resistance; Urinary Tract Infections.

INTRODUCTION

Infections in any area of the urinary system are referred to as urinary tract infections (UTIs). It is a common bacterial infection that enters the sterile urinary system through the urethra. These microorganisms reside on the skin and rectum. Cystitis, or bladder infection, is the most common type of UTI. UTIs can also be referred to as pyelonephritis, which are kidney infections.[1] Diagnosis is made using the symptoms, signs, and urine analysis of affected persons.[2] The severity of the infection, the causative agent, and the immune response all affect UTI symptoms.[3] Urinary tract infections can be either simple or complex.

These infections can become complicated in males, pregnant women, immune-compromised peoples, and those with fevers, renal involvement, stones, sepsis, urinary obstruction, or catheters. Both gram-positive and gram-negative bacteria are involved in the urinary tract infections.[5] Mostly urinary tract infections are caused by Proteus species, Staphylococcus, Streptococcus, Klebsiella pneumonia, and Escherichia coli. Various studies showed that many factors are associated with these infections like age, gender, previous UTIs, hospitalization and catheterization, and low socioeconomic status.[6-7] Urine dipsticks and microscopes are the main diagnostic tools used when a urinary tract infection is suspected[8]. The organism and its sensitivity to antibiotics are revealed by aseptically collecting midstream urine and cultivating it. Though, the pathogenic bacterium has established antibiotic resistance as a consequence of empirical UTI treatment.[9] Every year, over six billion dollars is spent on UTIs, which impact nearly 150 million individuals worldwide.[10] Numerous studies have shown that antibiotic resistance poses a threat to UTI treatment.[11-12] Geographical location, environment, and kind of healthcare facility (primary, tertiary, or other) all affect uropathogen antibiotic susceptibility. Antimicrobial resistance can also result from improper use of antibiotics, and Colitis caused by Clostridium difficile.[13] Gram-negative bacteria, such as Escherichia coli, caused 48.8% of UTIs, while gram-positive bacteria accounted for 23% and 76.9% of UTIs, respectively, in a prior study that found UTIs in 65.1% of Pakistani urine test participants.[14] The current study was conducted to find out the antibiotic sensitivity and resistance patterns in complicated urinary tract infections at tertiary care hospital.

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MATERIAL AND METHOD

The current cross-sectional multicentre study was carried out at MMC, DHQ hospital Kohat, AWKUM, KUST from February 2023 to August 2023 after taking permission from the ethical committee of the institute. The sample size was determined by using WHO calculator and the sample method was sequential non-probability. A total of 127 individual with complex urinary tract infections of both genders and different age group (16 to 80) years were included while individuals who used antibiotics within 24 hours, used catheter, DJ stent and immune-compromised peoples were exclude from the study. Written permission was taken from each individual before starting the study. Midstream urine samples were taken in sterile containers from each individual and were sent immediately to the microbiology lab for culturing. Samples were stored at 4°C if they were delayed. These samples were inoculated

on blood agar and MacConkey and incubated for 24-48 hours and colonies were counted according to the lab protocols. Severe bacteriuria was defined as growth of greater than 105 CFU/mL. Antibiotic susceptibility profile was done using both disc diffusion and the VITEK-2 compact system direct Antimicrobial Susceptibility Testing (AST). The isolated bacteria were tested for sensitivity to commonly prescribed drugs. All the data was analyzed using SPSS version 26.

RESULTS

A total of 127 individuals were examined in this study out of which 55(43.3%) were male and 72 (56.65%) were female as presented in figure 1. All the samples yielded growth (100%). The mean age of the study participant was 44.8 (ranged 16-80) years. Among the isolated bacteria Gram negative were 107(84.2%) and gram positive were 20(15.7%).Out of the total gram negative bacteria 57(53.2%) were obtained from females and 50(46.75%) were from males. gram positive bacteria were recovered from 15(75%) female and 5(25%) males. The most prevalent uropathogen in our study was E. Coli 77 (60.0%), which was followed by Staphlococcus aureus 13 (10.2%) and Klebsiella pneumoniae 14 (11.0%) as presented in table 2. Antibiotic susceptibility patreen of gram negative bacteria showed that E.coli was highly sensitive to colistin (100%) followed by fosfomycin (96%) imipenem (94%), meropenem (93%), Amikacin (90%), Nitrofurantoin (89%), Piperacillin / Tazobactum(88%) and ciprofloxacin (70%) while it was highly resistant to Cefixime(80%) followed by Co amoxiclave, (71.8%) Co trimoxizole (67%), ceftriaxone (66%), Moxifloxacin (65%) respectively. Similarly K Pneumoniae was 100% resistant to ciprofloxacin, levofloxacin and moxifloxacin while sensitive to imipenem and meropenem. P.uroginosa was 100% resistant to trimoxizole, ciprofloxacin levofloxacin and colisten. The antibiotic susceptibility profile of gram negative bacteria is shown in table 2. Among the gram positive bacteria S.aureus was (100%) sensitive to Piperacillin/Tazobactum followed by imipenem and leofloxacin 75% respectively while 100% resistant to moxifloxacin, nitrofurantoin and cefixime. Enterococcus was 100% sensitive to nitrofurantoin, and gentamicin but was 100% resitant to leofloxacin followed by ciprofloxacin 89%. S.pyogen was sensitive to ciprofloxacin and ceftriaxone 100.Antibiogram of gram positive bacteria is presented in table 3.

Table 1: Culture Reports Results

Uropathogen	N%
E.coli	77(60.0%)
K. pneumoniae	14(11.0%)
S. aerugenosa	12(9.4%)
Burkholderia cepacia	2(15.7%)
Enterobacter	1(0.7%)
S. aureus	13(10.2%)
S. pyogenes	1(0.7%)
Enterococcus	7(5.5%)
Total	127

Table 2: Antibiogram of Gram Negative Bacteria

Antibiotics		E.coli	K.pneumoniae	P .aerugenosa	Enterobacter
Gentamicin	S	55.8%	25%	24%	0
	R	44.2%	75%	76%	100
Meropenem	S	93%	68%	25%	100%
	R	7%	32%	75%	0
Imipenem	S	94%	66%	38%	100%
	R	6%	33%	61%	0
Colistin	S	100%	66%	0	0
	R	zero	34%	100%	100%
Amikacin	S	90%	62	38%	100%
	R	10%	38%	62%	Zero
Pepracillin/tazobactum	S	88%	56	57%	100%
	R	12%	44	43%	0
Cefixime	S	20%	0	0	0
	R	80%	100%	0	0
Fosfomycin	S	96%	64.3%	0	100
	R	4%	35.7%	0	0
Nitrofurantion	S	89%	41.7%	0	100
	R	11%	58.3%	100%	0
Moxifloxacin	S	45%	0	0	0
	R	65%	100%	0	0
lovofloxacin	S	50%	0	0	0
	R	50%	100%	100%	100
Ciprofloxacin	S	70%	0	0	0
	R	30%	100%	100%	100%
Ceftriaxone	S	44%	6.3%	0	100%
	R	66%	93.8%	0	0
Co amoxiclave	S	29%	12.5%	16%	0
	R	71%	87.5%	84%	0
Co-trimoxizole	S	33%	25%	zero	100%
	R	67%	75%	100%	0

Table 3: Antibiogram of Gram Positive Bacteria

Antibiotics		S.aureus	Enterococcus	S.pyogen
Gentamicin	S	17%	100%	0
	R	83%	0	0
Meropenem	S	63%	0	0
	R	37%	o	0
Imipenem	S	75%	0	0
	R	25%	0	0
Colistin	S	50%	0	0
	R	50%	0	0
Amikacin	S	50%	0	0
	R	50%	0	0

Pepracillin/tazobactum	S	100%	0	0
	R	0%	0	0
Cefixime	S	0	0	0
	R	100	0	0
Fosfomycin	S	60%	25%	0
	R	40%	75%	0
Nitrofurantion	S	0	100%	0
	R	100%	0	0
Moxifloxacin	S	0	0	0
	R	100%	0	0
levofloxacin	S	75%	0	0
	R	25%	100	0
Ciprofloxacin	S	30%	11	100%
	R	70%	89%	0
Ceftriaxone	S	16%	0	100%
	R	84%	0	0
Co amoxiclave	S	26%	75%	0
	R	74%	25%	0
Co-trimoxizole	S	47%	0	0
	R	53%	0	0

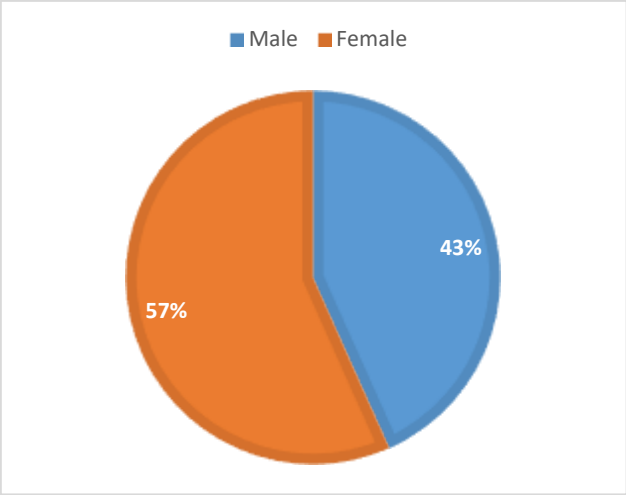

Figure 1: Age Wise Distribution of the Study Particepents

DISCUSSION

Urinary tract infections are one of the most prevalent infections diagnosed in outpatients as well as hospitalized individuals. These infections are mostly caused by bacteria which are clinically called uropathogens. Both gram positive and gram negative bacteria are responsible for these infections[14] For the right treatment of these infections, the susceptibility pattern is crucial, especially when the antibiotic is used repeatedly and causes resistance to grow.[15]

Understanding the evolving trends of antibiotic resistance in a given area is also crucial. The situation that exists in a specific area may not always be reflected in published data because research conducted elsewhere may show differences in the pattern of microorganisms involved in the causation, as well as in their sensitivity and resistance to various antibiotics, which in turn may depend on the pattern of antibiotic prescriptions in that area. This suggests that research into the current patterns of antibiotic sensitivity in the local population is necessary. Regional variations in antibiotic resistance are notable, with developing nations exhibiting the highest levels of resistance.Therfore the current study was conducted to find out the antibiogram in complicated urinary tract infections at tertiary care hospital. A total of 127 individuals were examined in this study Among the isolated bacteria Gram negative were 84.2% and gram positive were 20(15.7%). the findings of our study are similar to a study conducted in Pakistan by Khatoon et el [14]in which the gram negative bacteria were most common(80%). our results are also comparable to the study of Iqbal etal.[15]The most prevalent uropathogen in our study was E. Coli 77 60.0%, which was followed by Staphlococcus aureus 10.2% and Klebsiella pneumoniae 11.0%. these findings are similar to the privous study conducted in pakistan. [15] Antibiotic susceptibility pattern of gram negative bacteria showed that E.coli was highly sensitive to colistin (100%) followed by fosfomycin (96%) imipenem (94%) , meropenem(93%), Amikacin (90%) , Nitrofurantoin (89%),Piperacillin / Tazobactum(88%) and ciprofloxacin (70%). An earlier study conducted in Peshawar showed that E. coli was sensitive to Meropenem (89.39%), Imipenem (87.12%), and Fosfomycin (83.33%) which support our study.[16] According to another study, E. Coli was 98.97% sensitive to Fosfomycin, Piperacillin/Tazobactum, and Imipenem, and 100% sensitive to Meropenem and Amikacin .[17] The most susceptible bacteria to Meropenem was Klebsiella pneumoniae. In Pakistan, E. Coli has the highest sensitivity to Meropenem.[18] these results are comparable to our study. . Among the gram positive bacteria S.aureus was (100%) sensitive to Piperacillin/Tazobactum followed by imipenem and leofloxacin 75% respectively while 100% resistant to moxifloxacin, nitrofurantoin and cefixime. Shehbaz Ahmad et al.[17] found that Stpah areus had 100% sensitivity to Meropenem, Imipenem, Fosfomycin, and Amikacin. in the present study E.coli was highly resistant to Cefixime followed by Co amoxiclave, Co trimoxizole,ceftriaxone and Moxifloxacin respectively. Ahmad et al. reported that E. coli in Peshawar had 100% resistance to piperacillin, cefotaxime, ceftazidime, doxyxycline (95.88%), and ciprofloxacin (93.81%). Klebsiella was shown to be 100% resistant to piperacillin, 97.30% resistant to cefotaxime and ceftazidime, and 89.19% resistant to ciprofloxacin. Erythormycin, Ciprofloxacin, Cefotaxime, Ceftazidime, and Piperacillin/Tazobactam all caused 100% resistance in Stap aureus.[17]

CONCLUSION

The present study concluded that the most prevalent bacteria causing urinary tract infections are E. Coli followed by S. aureus and K. pneumonia. Most of these bacteria were sensitive to imipenem, amikacin, nitrofurantoin, and meropenem and resistant to commonly prescribed antibiotics such as cefixime and ciprofloxacin.So it is highly recommended to diagnose UTIs and identify the bacteria causing them in order to choose the best antibiotic treatment and prevent the emergence of antibiotic resistance.

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