

ANTIMICROBIAL SUSCEPTIBILITY PATTERNS OF UROPATHOGENS

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ABSTRACT

Objectives: To identify the common bacterial pathogens responsible for UTI along with their antimicrobial susceptibility.

Material and Methods: The study was conducted in the Department of Pathology, Khyber Medical College, Peshawar and Mardan Medical Complex, Mardan. A total of 95 patients with history of UTI (58 Females & 37 males) were included in the study. Urinary Samples were collected and cultured. Antibiotic sensitivity against the cultured organisms were tested with "amikacin, nitrofurantoin, co-trimoxazole, imipenam, cefipime, cephalothin, cefotaxime, cefalexin, ceftazidime, levofloxacin, tobramycin, norfloxacin, cefuroxime and Nalidixic acid". Culture showed *Escherichia Coli* (*E. Coli*) at 76.8% followed by *Pseudomonas aeruginosa*(6.3%), *Citrobacter freundii*(3.15%), *Enterobacter* spp (2.1%), *Morganella* sp (2.1%), *Staphylococcus aureus* (1.05%) and *Proteus mirabilis*(1.05%). *E. coli* sensitivity to antibiotics varied from 93% for Imipenem to 02% for Nalidixic Acid. Ampicillin was reported as the most resistant antibiotic for *E. coli* (100%). *Pseudomonas* spp. was susceptible to Imipenem (100%) and 100% resistant to many antibiotics.

Conclusion: *E. coli* and *Pseudomonas aeruginosa* are responsible for urinary tract infection. *E. coli* is most susceptible to ciprofloxacin, which should be the first line of treatment in UTI.

INTRODUCTION

Urinary tract infection (UTI) is one of the most common infections in humans¹. It affects almost all age groups. It is seen in all age groups, and subsides without prompt treatment². Even in advanced countries including USA the financial burden is enormous³. The incident of infection in urinary tract is significantly raised in female as compared to male. Nearly fifty percent of females will UTI at least once in their life. The choice of treatment is dependent on whether it is complicated or uncomplicated⁴. *Escherichia coli* is the cause of about 80% of uncomplicated UTIs in outpatients^{4,5,6}. Beside *E. coli* other Gram negative organisms involved are "*Pseudomonas aeruginosa* *Klebsiella* spp, *Enterobacter* spp., and, *Proteus* spp", While *Enterococcus* spp, *Staphylococci* and *Streptococci* are among Gram positive pathogens causing UTI in 5 to 15% of the cases^{7,8}. The spectrum of bacteria involved in UTIs which are also complicated is very wide⁴. There is quite a variation in the antimicrobial susceptibility pattern of

UTI causing bacteria in different regions of the world. This susceptibility pattern also changes with time⁹. The treatment choices are primarily based on the regional data of antimicrobial susceptibility. Unfortunately it is observed that usually only complicated UTI's are sent for culture and so the data for uncomplicated UTI is very deficient^{6,8,9}. Another serious issue in UTI treatment is the consistent emergence of antimicrobial resistance. The main culprit in this growing resistance is the unnecessary prescription and misuse of antibiotics¹⁰. Since the resistance to antimicrobial is changing dynamically day by day and from region to region, there is an urgent need to constantly update the empirical treatment based on the sensitivity pattern of the causative bacteria.

This study aimed to find the frequently occurring bacterial pathogens responsible for Urinary Tract Infections (UTI) along with their antibiotic susceptibility in patients.

MATERIAL AND METHODS

The study was conducted in the Department of Pathology, Khyber Medical College, Peshawar and Mardan Medical Complex, Mardan. A total of 95 patients with history of UTI and age range from 04-79 years (58 females and 37 males) were included in the study.

Patients who has used antibiotic within last one week and had large fluid intake with in previous one

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hour before coming to clinic were excluded. Clean catch midstream urine samples were collected in sterile containers after obtaining informed consent from patients or parents in case of children. Within next 30 minutes after sample collection, using standard calibrated loop, 1µl of urine sample was put on the surface of blood agar and Cysteine Lactose Electrolyte Deficient (CLED) agar and subsequently incubated aerobically at 37°C for 18-24 hours.

Colony forming units (cfu) of $\geq 10^5$ was significant for UTI while count below that was considered as non significant bacteriuria or negative for culture. Pathogens were identified according to Gram reaction, morphology and biochemical features. "Muller Hinton agar" plates were used for antibiotic sensitivity discs to determine positive cultures after incubating these plates at 37°C for 18-24 hours and subsequently reading the result after 24 hours. Re incubation of Negative cultures for another 24 hours was done and in case of no growth was reported at the end of 48 hours of incubation. As per Clinical and Laboratory Standards Institute (CLSI) 2014, Kirby Bauer Disc Diffusion method was used to assess antimicrobial sensitivity of the isolated pathogens. Different antibiotic discs including "amikacin, nitrofurantoin, co-trimoxazole, imipenam, cefipime, cephalothin, cefotaxime, cefalexin, ceftazidime, levofloxacin, tobramycin, norfloxacin, cefuroxime and pipedemic acid" were used to test the sensitivity. Microscopic examination of urine sample was performed after centrifuging 10 ml of urine sample at 2000g for 5 minutes. After discarding the supernatant, samples were examined for pus cells at high magnification. A count > 5 per high power field were considered significant for infection.

RESULTS

E. coli was the most predominant microorganism (76.8%) isolated from urine of the patients in this study, followed by Pseudomonas aeruginosa (6.3%), Citrobacter freundii (3.15%), Enterobacter spp (2.1%), Morganella sp (2.1%), Staphylococcus aureus (1.05%) and Proteus mirabilis (1.05%). Results of antibiotic susceptibility of the isolates are shown in Table 1. E. coli sensitivity to antibiotics varied from 93% for IMP to 02% for NA. Ampicillin showed almost 100% resistance with E. coli and S. aureus. Enterobacter spp. showed (76.4%) sensitivity to Gentamicin and (84.7%) resistance to Ampicillin. S. aureus was seen to be 84.2% sensitive to Gentimicin while 100% resistance to Nalidixic Acid. Pseudomonas spp was seen in 1% isolates with 100% susceptibility to Imipenem and total resistance to many other antibiotics.

Table 1: Different Antibiotic Sensitivity to E.Coli

S. No.	Antibiotic		Sensitivity %
	Code	Medicine	
1.	IPM	Imipenem	93
2.	AK	Amikacin	90
3.	MEM	Meropenem	89
4.	ATM	Aztreonam	66
5.	CN	Gentamicin	63
6.	CTX	Cefotaxime	60
7.	CAZ	Ceftazidime	52
8.	CIP	Ciprofloxacin	50
9.	CRO	Ceftriaxone	47
10.	EN	Enoxabid	47
11.	NOR	Noroxin	30
12.	UR	Uroxin	20
13.	AMC	Amoxacillin	05
14.	NA	Nalidixic Acid	02

DISCUSSION

The urinary infection can involve any part of the genital tract from urethra to renal parenchyma. The underlying cause of this infection is the retrograde ascent of perineal flora through the urethra. It especially affects the females because of the shorter and wider urethra. Regional monitoring of the causative bacteria and their susceptibility patterns provides the clinician with data that determines the selection of empirical treatment¹⁴.

Mostly UTIs are bacterial in nature and require broad spectrum antibiotic treatment. The Choice of antibiotics are Fluoroquinolones, cephalosporins and aminoglycosides. Cephalosporins including cephadrine, cefaclor, cefotaxime and ceftazidime act as inhibitor of cell wall and are used frequently for treatment for gram negative infection. The mechanism of action of Fluoroquinolones including ciprofloxacin, ofloxacin, enoxacin and sparfloxacin is to inhibit the activity of essential enzymes (DNA gyrase and topoisomerase) for the DNA replication. The aminoglycosides act by inhibiting the bacterial protein synthesis commonly used is gentamicin, kanamycin, and amikacin^{10,15}. The selection of antimicrobials for treatment should not be arbitrary but on knowledge of regional data on microbial isolates and their sensitivity to antibiotic. Based on these data regional empirical therapy is recommended for effective control of infection. We found that E.coli was resistant to Gentimicin and Ampicillin at 73.69%, Sulpphamethaxazole (SXT) 69.74% at and cephalothin 88.16%). These findings are similar to previous studies in USA¹⁶ and Iran¹⁷. The study further showed 26.32%

resistance to ciprofloxacin followed by and 15.79% to imipenem, nitrofurantoin (9.22%), and ceftroxime (15.79%). The best response against these bacteria was observed with nitrofurantoin, gentamicin, norfloxacin, and vancomycin that corresponds to regional and international findings^{18,19}. Resistance to SXT, ampicillin, and cephalothin has increased significantly all over the world¹¹. At the same time susceptibility to ciprofloxacin, nitrofurantoin, and imipenem is seen in our region and so are the most effective treatment in UTI. The reason for the low resistance in these antibiotics may be due to their relative expense and because they are not easily available. Thus, these drugs could be considered as alternative options in empirical treatment of UTIs²⁰. Since *E. coli* is the most commonly cultured isolate, its susceptibility should be considered foremost. The most effective antibiotic against *E. coli* is ciprofloxacin in comparison to other commonly used antibiotics such as ampicillin SXT. Therefore ciprofloxacin should be the first line of treatment in UTI². It is imperative that indiscriminate use of these and all other antibiotics be stopped at all levels so that resistance does not increase and the choice of available and effective antibiotics is not limited.

CONCLUSION

E. coli is the most susceptible organism in urinary tract infection and is sensitive to ciprofloxacin.

RECOMMENDATION

Frequent antibiotic resistance is alarming one and the health care providers should ensure judicious use of antibiotic after sensitivity testing. More over preventive and promotive health education is required for infection control.

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AUTHOR'S CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under:

- Ahmad N:** Conceived the idea.
- Ahmad I:** Data collection.
- Mohtasimbillah:** Data analysis and followup.
- Rehman O:** Statistical analysis.
- Faqir F:** Overall supervision.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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