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Antibiotic Resistance in Adult Patients with Urinary Tract Infection due to Escherichia Coli

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ABSTRACT

Objective: To determine emerging antibiotic resistance of Escherichia Coli among isolated from the patients with urinary tract infection.

Study Design: Cross-sectional study.

Place and Duration of Study: Pathology Department, Sahara Medical College, Narowal Pakistan, from Mar to Aug 2022.

Methodology: Two hundred cases of multi drug resistance urinary tract infection (UTI) were studied, and *E. coli* was isolated in their urine specimen. Cases of either gender were included with age >15 years. Data of the patients was documented on a proforma regarding demographic data, WBC count, urine culture and antibiotic susceptibility pattern result of the isolated pathogen. After detection of the pathogen (*E. coli*), antibiotic susceptibility patter was determined using Kirby Bauer disc diffusion method on Mueller Hinton agar. Antibiotic susceptibility of *E. coli* was determined against commonly used antibiotics.

Results: In our study, multidrug resistant *Escherichia Coli* (*E. coli*) was detected in 139(69.5%) cases. There were 78(39.0%) males and 122(61.8%) females. Age of the patients ranged from 14-65 years, with a mean age of 33.4±9.1 years. One hundred and seventy-one (85.5%) cases were resistant to cephalosporins, 173(86.5%) to quinolones, 86(43.0%) to aminoglycosides, and 27(13.5%) were resistant to carbapenems.

Conclusion: Multidrug resistant *E. coli* infection is common among patients with urinary tract infection. *E. coli* was resistant to most of the commonly used antibiotics, but it showed good sensitivity to carbipenems, penicillins and amikacin.

Keywords: Antibiotic Sensitivity, Escherichia Coli, Multi Drug Resistance, Urinary Tract Infection.

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INTRODUCTION

Infection of kidneys, ureter, urinary bladder and urethra are common now a days and are called urinary tract infections (UTI).[1] According to a study, UTIs are present in 25% of the patients reporting to hospitals due to any type of infection.[2] Patients with vague symptoms or without any symptom of UTI but having bacteriuria can be labelled as having urinary tract infection.[3] Bacteriuria is defined as having >105 colony forming units per milliliter (ml) of the sample.[4]

A previous study reported that about one million cases worldwide with UTI are reported to hospital daily.[5] Symptoms of UTI include frequency of urine, burning sensation during urination, pain in lower abdomen or in the back, sometimes smelly, cloudy or dark color urine, tiredness and malaise.[6] Normal flora can reside in urinary tract including S. faecalis, S. epidermidis and Corynebacterium. Pathogens climb up from urethra to urinary bladder and start growing there, leading to urinary tract infections. UTIs caused by E. coli can be treated by many antimicrobials like trimethoprim-sulfamethoxazole, nitrofurantoin for uncomplicated infection, while ceftriaxone, quinolones, carbapenems and amino-glycosides are used for complicated infections.[7] Incidence of multidrug resistant. E coli infection has been increased significantly due to misuse of antibiotics in our community. Different populations have their own pattern of antibiotic resistance.[8] A national study conducted previously has reported multidrug resistance pattern of E. coli 80% against carbapenems, 68% against, co-amoxiclav 60% against cephalosporins and 52% against aminoglycosides.[9] Whereas these pathogens were sensitive to tazobactam/piperacillin (70%) and amikacin (62%).[10]

We conducted this study to determine emerging antibiotic resistance of Escherichia Coli among isolated from the patients with urinary tract infection.

METHODOLOGY

This cross-sectional study was conducted at the Department of Pathology, Sahara Medical College, Narowal Pakistan, from March to August 2022, after

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approval from the Insitutional Ethical review Committee.

Inclusion Criteria: Patients of either gender, with age >15 years having multi-drug-resistant urinary tract infection (UTI) and E. coli isolated in their urine specimen were included.

Exclusion Criteria: Immunocompromised patients, and those with a history of malignancy, diabetes mellitus, tuberculosis or any other chronic disease were excluded.

Sample size was calculated using WHO online sample size calculator, taking prevalence of urinary tract infection in adult population of Pakistan as 13.6%.[9] The estimated sample size was 181, but we included 200 patients. Non-probability consecutive sampling was use to collect data, after obtaining informed consent.

Data regarding age, gender, white blood cell (WBC) count, urine culture and antimicrobial sensitivity pattern results were documented on a proforma. Antibiotic susceptibility pattern of E. coli was determined. Demographic data of the patients and positive findings on the laboratory investigations like WBC count, urine culture and antibiotic susceptibility pattern and result of the isolated pathogen were documented. After detection of the pathogen, antibiotic susceptibility pattern was determined using Kirby Bauer disc diffusion method on Mueller Hinton agar. Antibiotic susceptibility of E. coli was determined against commonly used antibiotics such as amoxicillin, piperacillin, cefepime, clavulanic acid, ceftriaxone, cefoparazone sulbactam, cefuroxime, ceftazidime, ofloxacin, ciprofloxacin, levofloxacin, cephradin, tobramycin, gentamycin, amikacin, linezolid, doxycycline, meropenem, imipenem, aztreonam and sulphamethoxazole.

Data was analyzed using Statistical Package for Social Sciences (SPSS) version 20. Qualitative data was presented as percentages and quantitative data as means and standard deviations. Chi-square test was used to check for association. A *p*-value <0.05 was considered statistically significant.

RESULTS

Urine samples of 620 cases were taken having urinary tract infection and pathogens were isolated in 350(56.4%) cases. Out of 350 cases E. coli was isolated in 200(57.0%) cases. Data of 200 cases was included in this study having E. coli as a causative pathogen of urinary tract infection. There were 78(39.0%) males and 122(61.8%) females. Age of the patients was from 15 to 65 years with mean age of 33.4±9.1 years. Majority of cases were adults between 30-60 years of age (Figure). On microscopic examination of urine, few pus cells (3-20 cells) were found in 32(16%) cases, numerous puss cells (20-40 cells) in 116(58%) and field full (>40 cells) found in 52(26%) cases. One hundred and twenty-two (61%) cased were from a rural background and 78(39%) cases from urban areas.

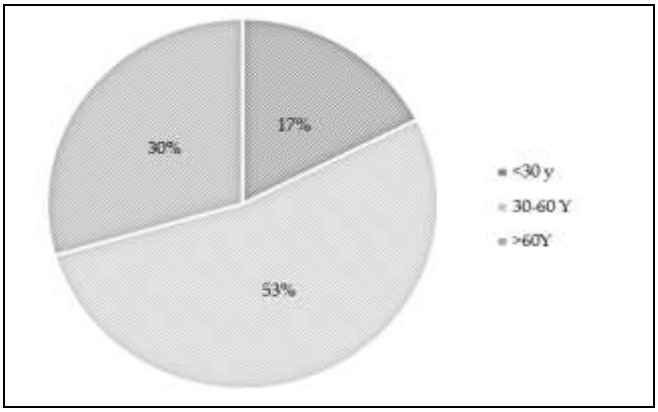

Figure: Age Distribution of Respondents (n=200)

Table: Antimicrobial Susceptibility Pattern of E. coli isolated in Study Cases (n=200)

Antibiotics	Resistant n(%)	Fully Sensitive n(%)	Partially Sensitive n(%)
Piperacillin	58(29.0%)	92(46.0%)	50(25.0%)
Amoxicillin clavulanic acid	41(20.5%)	83(41.5%)	76(38.0%)
Cefepime	157(78.5%)	19(9.5%)	24(12.0%)
Ceftriaxone	178(89.0%)	15(7.5%)	07(3.5%)
Cefuroxime	178(89.0%)	15(7.5%)	07(3.5%)
Cefoperazone-sulbactam	66(33.0%)	91(45.5)	43(21.5%)
Ceftazidime	125(62.5%)	33(16.5%)	42(21.0%)
Cephradine	180(90.0%)	12(6.0%)	08(04.0%)
Ciprofloxacin	177(88.5%)	16(8.0%)	07(3.5%)
Ofloxacin	178(89.0%)	15(7.5%)	07(3.5%)
Levofloxacin	164(82.0%)	22(11.0%)	14(7.0%)
Norfloxacin	174(87.0%)	18(9.0%)	08(4.0%)
Amikacin	56(28.0%)	99(49.5%)	45(22.5%)
Tobramycin	110(55.0%)	30(15.0%)	60(30.0%)
Gentamycin	93(46.5%)	57(28.5%)	50(25.0%)
Linezolid	196(98.0%)	01(0.5%)	03(1.5%)
Doxycycline	145(72.5%)	21(10.5%)	34(17.0%)
Sulphamethoxazole	187(93.5%)	08(4.0%)	05(2.5%)
Imipenem	28(14.0%)	156(78.0%)	16(8.0%)
Meropenem	25(12.5%)	160(80.0%)	15(7.5%)
Aztreonam	102(51.0%)	20(10.0%)	78(39.5%)

In our study, 135(67.5%) cases had multidrug resistant (MDR) UTI, and out of these 87(43.5%) cases were males and 113(56.5%) were females. Antimicrobial sensitivity and resistant pattern was determined for each case against commonly used antimicrobials. One hundred and seventy-one (85.5%)

cases were resistant to cephalosporins, 173(86.5%) to quinolones, 86(43.0%) to aminoglycosides, and 27(13.5%) were resistant to carbapenems. Most sensitivity was noted against meropenem (80.0%) and imipenem (78.0%), which can be seen in Table.

DISCUSSION

Urinary tract infection is very common in our community irrespective of age and gender.[11] Risk factors of UTI include young or old age, and female gender.[12] It is a most common nosocomial infection reported in our setups. Antimicrobial resistance is increasing in E. coli with the passage of time and it is a challenge for the physicians to prescribe an appropriate antimicrobial.[13] This study was conducted to document our experience regarding prevalence of multidrug resistant (MDR) E. coli causing urinary tract infection and its antimicrobial susceptibility pattern. Data analysis was done to determine E. coli infection in various age groups and gender distribution. In our study local population was taken of different socioeconomic status.

Most of the study cases belonged to poor families with compromised quality of life, and poor sanitation. One study reported pathogens in 25% of the urine samples taken from the patients having urinary tract infection, mostly of them were females (60%). Similarly in our study 61.8% cases were having urinary tract infection with female predominance. They also reported that E. coli was isolated in >50% cases. In their study, 57% E. coli were sensitive to macrolides and 51% were sensitive to cephalosporins.[14] In our study 171(85.5%) cases were resistant to cephalosporins, 173(86.5%) were resistant to quinolones, 86(43%) were resistant to aminoglycosides, and 27(13.5%) were resistant to carbapenems. Most sensitivity was noted against meropenem (80%) and imipenem (78%). Pouladfar *et al.,* conducted a study in Iran that reported MDR urinary tract infection with pyuria in 15% cases with age >80 years and that they were asymptomatic. They concluded that risk factors of multi drug resistant UTI include old age, anomalies of urinary tract or genitalia, urinary tract stones, dehydration and diabetes mellitus.[15]

In our study most of the cases (53%) were between 30 to 60 years of age. According to a local study conducted in Swat, Pakistan by Noor *et al.,* antimicrobial susceptibility pattern of 150 cases was determined with UTI infection due to MDR E. coli. In their study, female cases were more (28.9%) in the age group of 21 to 30 years, and E. coli showed maximum sensitivity to cephradine, doxycycline, amoxicillin, co-trimoxazole, ciprofloxacin, ceftriaxone, cefixime and cephalexin.[16] In our study, 171(85.5%) cases were resistant to cephalosporins, 173(86.5%) were resistant to quinolones, 86(43%) were resistant to amino-glycosides, 27(13.5%) were resistant to carbipenems while maximum sensitivity was noted against meropenem (80%) and imipenem (78%). Previous studies have shown that excessive misuse of antibiotics, hospital stay and urinary catheterization lead to the development of MDR UTI.[17-19] A study conducted by Gajdács *et al.,* on the cases of UTI reported high resistance of E. coli against Ampicillin, sulbacam, ampicillin, trimethoprim and sulpha-methoxazole. While resistance against cephalosporins was 27.6%, levofloxacin 43.6% and ciprofloxacin 47.3%.[20] As compared to our study, 78% sensitivity was found against imipenem and 80% against meropenem 80% and a high resistance was found against ciprofloxacin (88.5%) and levofloxacin (82%).

LIMITATIONS OF THE STUDY

Our study had certain limitations. Technique of sample collection and testing for antimicrobial susceptibility could have been improved further. More antibiotics could have been added while testing antimicrobial sensitivity pattern. Determining antibiotic susceptibility pattern is observer dependent so chances of error were present.

CONCLUSION

Urinary tract infection due to multi drug resistant (MDR) E. coli was common in adults, females and people from rural areas. Resistance was found against cephalosporins, quinolones and aminoglycosides while maximum sensitivity was found against carbapenems.

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Authors' Contribution

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

SNH & KF: Data acquisition, data analysis, critical review, approval of the final version to be published.

GHB & RNK: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

SZ & UA: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

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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