ANTIBIOTIC RESISTANCE PATTERNS OF ESCHERICHIA COLI IN URINARY TRACT INFECTIONS AT A TERTIARY CARE HOSPITAL, LAHORE

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ABSTRACT

Background and objective: As a chronic nosocomial and community-acquired infections, Escherichia coli (E. coli) has become a major global health concern. Finding the pattern of antibiotic susceptibility in Escherichia coli isolated from urine specimens was the aim of the current study.

Methods: It was descriptive Cross-Sectional study conducted at Shalamar Teaching Hospital in Lahore in the Micro-biology section of the Pathology Department from June 1st, 2020 to November 30th, 2020. Patients exhibiting symptoms and indications of urinary tract infections (UTIs) had urine samples taken. The samples were processed on the Cystine Lysine Electrolyte-Deficient (CLED) Agar and identified as E. coli by biochemical profile. Antibiogram of E. coli was determined by Kirby-Bauer method.

Results: A total of 165 E. coli isolates were available for analysis.. Among the tested antibiotics, Colistin exhibited the highest sensitivity of 164(99.4%), followed by Fosfomycin 156(94.5%), Imipenem 153 (92.7%), and Meropenem 150(90.9%). Nitrofurantoin demonstrated a sensitivity of 141(85.5%), while Gentamicin had a sensitivity of 110(66.7%). Piperacillin/Tazobactam, Cotrimoxazole, Ceftriaxone and Cefotaxime, Ciprofloxacin, Cefuroxime, Amoxicillin-Clavulanic Acid, and Ampicillin exhibited sensitivities of 60(36.4%), 31(18.8%), 28(17.0%), 28(17.0%), 24(14.5%), 13 (7.9%), 11(6.7%), and 3(1.8%), respectively. Notably, E. coli was isolated more frequently from female patients (72.7%) than from male patients (27.3%).

Conclusion: Current study revealed that antibiotic resistance is emerging in E coli. However, Colistin, Fosfomycin, Imipenem, Meropenem, and Nitrofurantoin are the most effective drugs and, depending on the clinical situation, can be chosen empirically for the treatment of UTI caused by E. coli.

Key words: Urinary tract infections, E. Coli, Sensitivity pattern.

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In humans, pathogenic bacteria cause several infections. The Urinary Tract is a sterile system except for the lower urethra which may have some normal flora. The ascending invasion of the system by bacteria is the cause of urinary tract infections (UTIs). The UTI caused at different levels of the tract by microbial colonization or inflammation is called Urethritis (Urethra), Cystitis (Urinary Bladder), and Pyelonephritis (Kidneys).[1,2]

The bacteria causing UTIs are many and varied. Of them, the most prevalent are the Gram-Negative Bacilli of the Enterobacterales family, and the most widespread cause of UTIs is Escherichia coli.[3] Community and hospital acquired UTIs are brought about by E. Coli, which can also occasionally result in major secondary health problems.[4,5] It is thought to be the cause of about 85% of UTIs that occur in the community and 50% of UTIs that occur in hospitals.[6]

Understanding the E. Coli antibiogram is crucial

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for starting an efficacious empirical therapy.[7,8] In developing countries, treatment costs, morbidity, and mortality are increased by multidrug-resistant (MDR) E. coli UTIs.[9,10] Microorganisms use a variety of techniques, such as genetic material modification, recombination of foreign DNA in bacterial chromosomes, and horizontal gene transfer, to develop drug resistance.[11] National differences exist in the resistance patterns of microorganisms, ranging from community-acquired to hospital-acquired, and from smaller to larger hospitals.[12]

Antibiotic resistance is becoming an increasingly pressing issue in Pakistan as a result of improper and excessive antibiotic use.[9,13] Antibiotic resistance is not systematically monitored nationally, and there is not enough data available to accurately estimate the issue.[14] The current study set out to identify the sensitivity and resistance pattern of E. coli that causes UTI in our hospitalized patients. In order to avoid or lessen the likelihood of problems, the results will assist the doctors in initiating empirical therapy in these situations. The outcomes might also add to the national database.

METHODS

This descriptive cross-sectional study was conducted at Microbiology section, Pathology Department, Shalamar Teaching Hospital Lahore, Pakistan. The duration of study was 6 months from June 01st, 2020 to November 30th, 2020. Urine sample of the patients with symptoms of urinary tract infection received in Tertiary care Hospital Laboratory were analyzed for the presence of infection with E.Coli. All age groups from both genders were included. Duplicate samples from the same patient during the period of illness were excluded.

Samples of urine which were positive for E. Coli were analyzed further for sensitivity. Following a centrifugation of the samples, the sediments were grown mostly on a media that is specifically for urine ie CLED (cystine lysine electrolyte deficient) Agar and incubated for a full day at 37°C. Gram staining, the Oxidase reaction, and basic biochemical tests such inoculation on Triple Sugar Iron Agar slant, citrate utilization, urease generation, and the Indole test were used to identify the isolates as E. coli.[15]

E. Coli's antibiotic susceptibility was evaluated on Mueller Hinton Agar using the Kirby Bauer Disc diffusion method.[16] On the Mueller Hinton Agar plate, 0.5 McFarland standard units of bacterial inoculum were added in order to produce a confluent growing lawn. Amoxicillin, Ampicillin, Cefotaxime, Ceftriaxone, Cefuroxime, Ciprofloxacin, Colistin, Co-Trimoxazole, Fosfomycin, Gentamicin, Imipenem, Meropenem, Nitrofurantoin, and Piperacillin-Tazobactam discs containing antibiotics were arranged on the plates and incubated for a whole day at 37°C. Based on their zones of inhibition, the isolates were categorized as sensitive or resistant in accordance with the Clinical Laboratory guidelines Institute (CLSI) guidelines. The statistical analysis was carried out utilizing the SPSS 20.0 program (SPSS Inc). Frequency distribution was calculated for qualitative data i.e. Gender and Antibiotic Sensitivity and resistance pattern.

RESULTS

Between June 1st, 2020 and November 30th, 2020, 165 E. Coli isolates were reported for the current inves-tigation. According to the data below, of the 165 E. Coli isolates, the frequency was higher in females 120/165 (72.7%) than in males 45 (27.3%).

The results of current study revealed that E. coli had a high level of resistance against Ampicillin 162 (98.2%), Amoxicillin 154 (93.3%), Cefuroxime 152 (92.1%), Ciprofloxacin 141 (85.5%), Ceftriaxone and Cefotaxime 137 (83.0%) and Co-trimoxazole 134 (81.2%). Whereas high rate of sensitivity was found against Colistin 164 (99.4%), Fosfomycin 156 (94.5%), Imipenem 153 (92.7%) and Meropenem 150 (90.9%) as shown in the table-2:

Table 1: *Gender wise distribution of UTI infection caused by E.coli.*

Gender	Frequency
Male	45 (27.3%)
Female	120 (72.7%)

Table 2: Pattern of Antibiotic Susceptibility and Resistance in E.coli.

Antibiotics	Sensitive (%)	Resistant (%)
Amoxicillin	11 (6.7%)	154 (93.3%)
Ampicillin	3 (1.8%)	162 (98.2%)
Cefotaxime	28 (17%)	137 (83%)
Ceftriaxone	28 (17%)	137 (83.0%)
Cefuroxime	13 (7.9%)	152 (92.1%)
Ciprofloxacin	24 (14.5%)	141 (85.5%)
Colistin	164 (99.4%)	1 (0.6%)
Co-trimoxazole	31 (18.8%)	134 (81.2%)
Fosfomycin	156 (94.5%)	9 (5.5%)
Gentamicin	110 (66.7%)	55 (33.3%)
Imipenem	153 (92.7%)	12 (7.3%)
Meropenem	150 (90.9%)	15 (9.1%)
Nitrofurantoin	141 (85.5%)	24 (14.5%)
Piperacillin tazobactam	60 (36.4%)	105 (63.6%)

DISCUSSION

Microbial invasion of the urinary system is the source of infections in the urinary tract (UTI's) and the problems that usually accompany them.[17] UTIs can strike anyone of any gender, however they seem to strike women more frequently. The prevalence of UTIs in women is thought to be between 50 and 70 percent.[18] Since women's urethras are shorter and their perineum are more anatomically shaped like that, they are more likely to suffer urinary tract infections.[19] There is a global increase in reports of E. coli and antimicrobial resistance. Growing concerns are being expressed about the rising rate of resistance in both wealthy and developing nations.[20] Microorganisms that are exposed to two or more antibiotic groups can develop multi-drug resistance (MDR) through creation of enzymes that are resistant to the antibiotics, modification of the drugs' target sites, efflux pump mechanism, and genetic mutation.[21] The treatment of UTI is becoming increasingly complex due to the growth in antibiotic resistance in bacteria, which is a global concern.[22]

The 165 E. Coli isolates included in this study were resistant to Ampicillin 162 (98.2%), Amoxicillin 154 (93.3%), Cefuroxime 152 (92.1%), Ciprofloxacin 141 (85.5%), Ceftriaxone and Cefotaxime 137 (83.0%), and Co-Trimoxazole 134 (81.2%) following suit. On the other hand, strong rates of sensitivity to Meropenem 150 (90.9%), Fosfomycin 156 (94.5%), Imipenem 153(92.7%), and Colistin 164 (99.4%) were discovered. While some investigations revealed 100% resistance to Penicillin, resistance to the Penicillin group of antibiotics is growing daily in many parts of the world.[23] Resistance to additional β-Lactam antibiotics, such as cefuroxime (92.1%), ceftriaxone (83%) and cefotaxime (83%), was also quite high, deeming these medications unsuitable for empirical prescription for the management of UTIs.

Penicillin and Cephalosporin are not effective against UTI infections in underdeveloped nations like Pakistan, and our findings imply that these antibiotics shouldn't be used empirically to treat UTIs. The fact that these antibiotics are ineffective does not imply that they are not utilized elsewhere in the globe to treat UTIs brought on by Ecoli. Penicillin and cephalosporins were found to be effective against a greater percentage of E. coli in a few reports.[24] These medicines were effective against E. coli-caused UTIs in Pakistan ten years ago.[25]

A high level of antibiotic resistance to both cephalosporin and penicillin has been found in E. coli, according to numerous investigations carried out in Pakistan.[26] In the current study, gentamicin shown a low level of resistance of 33 percent. E. Coli has previously been treated with fluoroquinolones, most notably ciprofloxacin. Nonetheless, the current study's discovery that E. Coli exhibited 85% resistance to ciprofloxacin is in line with the findings of the previous publication.[27] The current study's findings demonstrate the efficacy of imipenem, colistin, meropenem, and fosfomycin as medications for treating UTIs caused by E. coli.

CONCLUSION

According to the current study, E. coli-caused UTI infections had a higher rate of drug resistance. When treating a UTI brought on by multi drug resisant E. coli, Fosfomycin, Imipenem, Meropenem, advised as first-line antibiotics. Moreover, the presence of E. Coli that was isolated from UTIs exhibiting drug resistance suggests that antibiotics should be prescribed and closely monitored following sensitivity and culture testing.

Ethical Approval:
The ethical Approval was obtained vide letter no. SNDC-IRB/AL/90/2021

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