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ORIGINAL ARTICLE

Antibiotic susceptibility patterns of bacteria isolated from patients with community acquired urinary tract infections.

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ABSTRACT… Objective: The emergence of multi-drug resistant uro-pathogenic bacteria has negatively impacted the treatment of urinary tract infections. The objective of this study was to identify the rising rates of resistance of uro-pathogenic bacteria to antimicrobials. **Study Design:** Retrospective Analysis of Bacteria Isolated from urine cultures of adult outpatients with complicated or long-term urinary tract infections was done. **Setting:** Out- patient Clinics of Independent University Hospital, An Urban Tertiary Care Teaching Hospital in Faisalabad. **Period:** July 2021 to July 2022**. Material & Methods:** Urine samples from patients advised urine cultures after presenting with symptoms of urinary tract infections were included using convenience sampling technique. **Results:** The most common etiologic agent isolated was E.coli, followed by Klebsiella, Pseudomonas and Staphylococcus saprophyticus. The drugs with the highest susceptibility were ciprofloxacin (56.3%), nitrofurantoin (53.1%), and imipenem (44.8%). Nalidixic acid (40.6%), sulfamethoxazole-trimethoprim (37.5%), and erythromycin (25%) had low efficacy, while penicillin G and co-amoxiclav failed to work on all bacterial isolates in this study. **Conclusion:** The rising rates of resistance of uro-pathogenic bacteria to multiple drugs indicate the employment of good antibiotic stewardship practices by clinicians in outpatient clinics, to decrease the burden of infections in the communities.

Key words: Antibiotic Resistance, Community-acquired Infections, Multi-drug Resistant Bacteria, Uro-Pathogenic Bacteria, Urinary Tract Infections.

INTRODUCTION

Urinary tract infections (UTI) are one of the most common bacterial infections presenting in outpatient clinics. Globally, 150 million people are affected with UTIs each year.[1] Urinary tract infections are caused by a wide spectrum of bacteria, involving both Gram-positive and Gram-negative bacteria, and fungi. The most common organism associated with UTI is the Gram-negative bacteria, E. coli, in both community-acquired and hospital-acquired infections. Other causes include Klebsiella pneumoniae, Pseudomonas aeruginosa, Staphylococcus saprophyticus and less commonly, Proteus mirabilis.[2]

Patients suffering from symptomatic UTI need antibiotic therapy. However, the samples received in a microbiology lab are usually those collected from patients with complicated UTI, as patients with uncomplicated UTI are rarely advised urine cultures.[3] The non-judicious use of antibiotics has led to the emergence of resistant uropathogens that are a significant threat to public health.[4] Uropathogenic E. coli (UPEC) are quickly becoming resistant to the conventional antibiotics used in the treatment of UTI, namely fluoroquinolones, cephalosporins and aminoglycosides.[5] Pakistan reports the incidence of Multi-drug resistant (MDR) UPEC in the range 30-79%.[6] The clinical implications of MDR UPEC put an economic strain on hospitals and pharmaceuticals.[7] It is important to map the antibiotic susceptibility patterns of uro-pathogens to advise the physicians on the effective treatment of UTIs.[8]

MATERIAL & METHODS

The objective of this study was to detect the

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trends in antibiotic resistance to bacteria causing community-acquired UTI in patients with long-term or complicated infections.

A retrospective study was conducted using convenience sampling, including patients that were advised urine cultures after presenting with symptoms of long-term or complicated UTI, at the outpatient department in Independent University Hospital, Faisalabad, during July 2021-July 2022. Patients were adults between the ages 21 to 90 years. In-patients and children were excluded from this study.

The data was analyzed with SPSS 23. Specimen collection protocol at the lab involved a clean-catch urine sample by collecting the sample of urine in midstream in a graduated sterile container. The patients were instructed to wash their hands before giving samples and to clean their perineum for possible contamination of samples with normal flora. The samples were immediately transported to the microbiology lab and processed without delay. Urine samples were directly inoculated onto Blood agar (Oxoid) and CLED agar (Oxoid) plates using sterile wire loops. After 24 hours of aerobic incubation at 38-45°C, the positive cultures were examined microscopically and via biochemical identifications tests. Antibiotic sensitivity testing was performed on positive cultures using the Kirby-Bauer disc diffusion method according to the criteria of Clinical and Lab Standards Institute (CLSI).[9] Bacterial suspensions were prepared by emulsifying 2–5 pure colonies in nutrient broth (Oxoid), adjusted to 0.5 McFarland standard. A sterile cotton swab was dipped into the bacterial suspension and swabbed on the surface of Mueller-Hinton agar plate (Oxoid). Standard antibiotic discs were placed aseptically onto the inoculated Mueller Hinton agar plates and were incubated at 38-40°C for 24 hours. The diameters of the zones of inhibition were measured using mm of scale. The zones of inhibition were reported as susceptible or resistant based on CLSI guidelines 2020.[9] The antibiotic discs that were used were; Penicillin G 10 µg, Co-amoxiclav 10 µg, Cefepime 30 µg, Ceftriaxone 30 µg, Cefoxitin 30 µg, Ciprofloxacin 10 µg, Imipenem 10 µg, Nitrofurantoin 50 µg, Septran 25 µg, Erythromycin 10 µg and Nalidixic acid 30 µg.

RESULTS

During July 2021- July 2022, 64 urine samples were submitted for microbiological profiling and antibiotic susceptibility. The patients were both males (46.9%) and females (53.1%), between the age group (21-85 years). 32 samples gave negative bacterial cultures. Amongst the other 32 positive cultures, E. coli was the most common pathogen isolated (21), followed by Klebsiella (5), Pseudomonas (3), and Staphylococcus saprophyticus (3). The results are shown in the Figure-1.

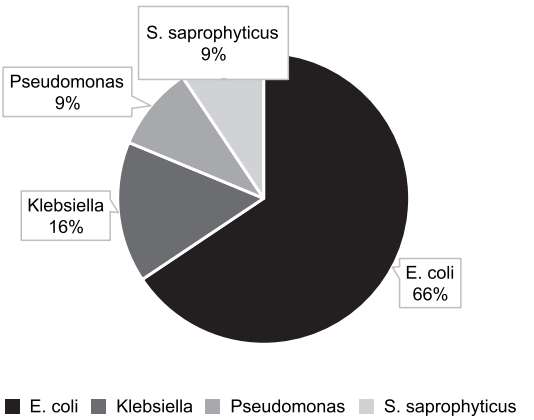

Figure-1. Isolation rates of bacteria in positive urine cultures

The highest incidence of multi-drug resistant strains was noticed in E. coli, as shown in Table-I, with 100% resistance noticed against penicillin G and co-amoxiclav. E. coli strains showed the most susceptibility (71.4%) to Nitrofurantoin. In general, E. coli showed susceptibility to most number of drugs; ceftriaxone, cefoxitin, nitrofurantoin, imipenem, sulfamethoxazole-trimethoprim, and nalidixic acid. Klebsiella isolates showed most susceptibility to ciprofloxacin (80%), and were 100% resistant to penicillin G, co-amoxiclav, cefoxitin, nitrofurantoin, and sulfamethoxazole-trimethoprim. Pseudomonas isolates showed resistant to most drugs used in this study, with complete resistance noticed against penicillin G, co-amoxiclav, cefoxitin, nitrofurantoin, imipenem, and sulfamethoxazole-trimethoprim. It was most susceptible (66.6%) to ciprofloxacin. S. saprophyticus showed high susceptibility (66.6%)

to the most number drugs compared to the other isolates. The gram-positive organism was equally susceptible to ciprofloxacin, nitrofurantoin and nalidixic acid.

Bacterial Isolates	Pattern	P	AMC	CRO	FOX	CIP	F	IPM	SXT	E	NA
E. coli	*S* *R*	0 21	0 21	5 16	2 19	10 11	15 6	10 11	5 16	- -	9 12
Klebsiella spp.	S R	0 5	0 5	1 4	0 5	4 1	0 5	3 2	0 5	- -	3 2
Pseudomonas spp.	S R	0 3	0 3	1 2	0 3	2 1	0 3	0 3	0 3	- -	1 2
S. saprophyticus	S R	0 3	0 3	1 2	0 3	2 1	2 1	- -	2 1	1 2	0 3
Total	S R	0 32	0 32	8 24	2 30	18 14	17 15	13 16	12 20	1 3	13 19

Table-I. Antibiotic susceptibility patterns of urinary bacterial isolates, July 2021-July 2022

Abbreviations: S Sensitive, R Resistant, P Penicillin G, AMC Co-amoxiclav, CRO Ceftriaxone, FOX Cefoxitin, CIP Ciprofloxacin, IPM Imipenem, SXT Sulfamethoxazole-trimethoprim, E Erythromycin, NA Nalidixic acid

In this study, ciprofloxacin was the most successful drug, with 56.3% of the positive cultures showing susceptibility to it (Table-II). Nitrofurantoin was effective against 53.1% of the isolates, with most E. coli isolates being susceptible to the drug. Penicillin G and co-amoxiclav were the least successful drugs in this study, with all the isolates showing resistant to the two drugs.

Antibiotics	% Susceptibility
Penicillin G	0
Co-amoxiclav	0
Ceftriaxone	25
Cefoxitin	6.2
Ciprofloxacin	56.3
Nitrofurantoin	53.1
Imipenem	44.8
Sulfamethoxazole-trimethoprim	37.5
Erythromycin	25
Nalidixic acid	40.6

Table-II. Percentage of susceptibility to drugs for patients with UTI in patients between July 2021-July 2022

DISCUSSION

Ciprofloxacin appears to be the most successful drug in this study, effective against 56.3% of the bacterial isolates. Despite this outcome, 52.4% of E.coli showed resistance to this drug. The widespread use of Ciprofloxacin has increased the incidence of uropathogenic E. coli.[10,11]

Nitrofurantoin appears to be second in line, being successful against 53.1% of the isolates. 71.4% of the E. coli detected were susceptible to nitrofurantoin. It has been the recommended drug of choice in the treatment of uncomplicate UTI.[12,13] However, this finding is also relative, since both the Klebsiella and Pseudomonas isolates, showed complete resistance to the drug. The results in this study show ciprofloxacin as the most successful treatment against Klebsiella and Pseudomonas in UTI[14], a finding that is contradicted by.[15,16]

Imipenem is active against most bacteria causing urolgical diseases.[17] In this study, Imipenem showed an overall success rate of 44.8%. It was successful against E. coli (47.6%) and Klebsiella (60%) isolates. It has been widely used in the treatment of complicated UT1.[18]

The results demonstrate a disturbing outcome to the use of beta-lactam drugs in the treatment of UTI. 100% of the bacteria isolated were resistant to penicillin G and co-amoxiclav. This alarming effect can be attributed to the prevalence of extended-spectrum beta-lactamase (ESBL) producing bacteria, that are rapidly emerging worldwide.[19,20]

CONCLUSION

All bacterial isolates in this study showed complete or rapidly acquiring resistance to drugs used as first-line agents in the treatment of UTIs. Antibiotic over-prescription in clinics has led to an increase in the prevalence of MDR bacteria causing

community-acquired UTI in Faisalabad. A good antibiotic stewardship practice by the doctors will afford the patient a better chance of recovery and stunt the emergence of drug-resistant bacteria in the community.

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