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"ANTIMICROBIAL SUSCEPTIBILITY PATTERN OF ORAL ANTIBIOTICS AMONG PATHOGENS ISOLATED FROM URINARY TRACT INFECTION (UTI) PATIENTS"

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ABSTRACT This is a cross-sectional study of microorganisms isolated from mid-stream urine samples obtained from 100 patients with suspected urinary tract infection (UTI). It was conducted for over a period of 1 month at Department of Microbiology, Mysore Medical College. All microorganisms were identified by calibrated loop technique. Antimicrobial susceptibility was determined using the disc diffusion method (Kirby–Bauer test). Overall 100 microorganisms were isolated of which the most common uropathogen was Escherichia coli (60%) followed by Enterococcus species (14%). Among all the isolates amoxicillin showed 100% resistance and maximum sensitivity was shown by Fosfomycin (89%). Although oral antibiotics have been effective in treating UTIs over several decades, the increased misuse of these antibiotics has led to antimicrobial resistance. Hence this study will enhance understanding the re-emergence in the sensitivity patterns of oral antibiotics against uropathogens which would be essential for physicians to make right decisions regarding empirical treatment for urinary tract infections.

KEYWORDS : Urinary tract infection, oral antibiotics, antibiotic suspectibility.

INTRODUCTION

Urinary tract infections (UTIs) stand out as common bacterial infections affecting individuals across diverse settings, encompassing both community and hospital environments making them one of the most prevalent diseases in medical practice today, with an estimated 150 million cases annually worldwide[1]. This condition, which impacts people of all age groups, exhibits a higher incidence in women. An estimated 50% of women experience at least one episode of UTI at some point in their lifetime and between 20% and 40% of women have recurrent episodes[2,3] Approximately 20% of all UTIs occur in men[4].

Over several decades, antibiotics have effectively treated bacterial infections. However, the increasing misuse of antibiotics in recent years has given rise to global antimicrobial resistance, posing a severe threat to public health. Recent reports indicate that approximately 700,000 people worldwide succumb annually to infections caused by antimicrobial resistance (AMR), and this number could escalate to 10 million by 2050[5].

Empirical treatment remains the predominant approach for treating urinary tract infections (UTIs), leading to the potential misuse of antibiotics. Apart from Cephalosporins, uropathogens are demonstrating heightened resistance to antibiotics such as Cotrimoxazole, Quinolones, and Nitrofurantoin. The escalating prevalence of multidrug-resistant bacteria causing UTIs has compelled clinicians to turn to Carbapenems, Colistin, and Fosfomycin as therapeutic alternatives. The increasing prevalence of drug resistance in uropathogens poses a considerable public health challenge, emphasizing the ongoing need for continuous screening of antibiotic susceptibility in organisms responsible for urinary tract infections (UTIs).

Earlier oral antibiotics were quite effective in treating UTIs over several decades, but now because of increased misuse of these antibiotics has led to antimicrobial resistance. However after a prolonged gap of limited use, sensitivity of these oral antibiotics against uropathogens has increased. Hence, Aim of our study is to know the antibiotic susceptibility pattern of oral antibiotics among patients presenting with urinary tract infections at our hospital.

METHODS

The current study was carried out in the Department of Microbiology at Mysore Medical College and Research Institute over a period of 1 month. The clinical specimens were collected from patients attending outpatient departments (OPDs) and those who were admitted in the wards and ICUs, who presented with complaints of increased frequency of micturition, dysuria, abdominal pain, fever.

Sample Collection

All study participants were instructed to collect a midstream urine sample in sterile containers with a wide mouth. In case of catheterized patients, sample from catheter was collected by disinfecting a portion of the catheter tubing with 70% alcohol. For suprapubic aspirate, under local anesthesia using 18-gauge, short bevel spinal needle 10 ml of urine was aspirated and transferred to a sterile container. Within an hour of being collected, samples were processed at the microbiology lab. In case of any delay of >2 hours is expected, urine sample were stored at 4°C in the refrigerator for a maximum of 24 hours.

Sample Processing

Once the sample is received in the laboratory, direct microscopy was seen immediately. Then for isolation of bacterial pathogens calibrated loop technique was used. A sterile loopful urine sample was inoculated into blood agar media and MacConkey agar media. The inoculated culture plates were incubated for 24 hours at 37°C. If the colony count was between 10^4CFU/ML - 10^5CFU/ML it was considered to be significant bacteriuria. The isolated bacteria were further identified using standard microbiological methods. Antibiotic susceptibility was performed by the Kirby-Bauer disc diffusion method on Mueller Hinton agar and the following antibiotics were tested Amoxicillin, Cotrimoxazole, Nitrofurantoin, Ciprofloxacin, Fosfomycin and Linezolid.

Method of data quality assurance and data analysis

Following data collection, all questionnaires underwent thorough examination to ensure completeness, accuracy and internal consistency, thereby eliminating any instances of missing or inconsistent data, which were subsequently discarded. Corrected data were entered into the Statistical Package for Social Sciences (SPSS) statistical software version 25 for the analysis. Quantitative variables were summarized by calculating their mean and standard deviation. On the other hand, qualitative variables were summarized by percentage. Necessary bivariate analysis and statistical tests were conducted.

RESULTS

Gender Distribution

A total of 100 urinary isolates obtained from patients presenting with UTI were included in the study. The patients include female (58%) and male (42%).

Table 1 – Gender Distribution

Sex	No. of specimens
Female	58
Male	42

Age Distribution

Among the 100 isolates majority of them (n = 100) were from patients aged between 56–74 years (Female-15, Males-14). Only five isolates were obtained from the old age group (> 75 years). In pediatric age group seventeen isolates were obtained.

Table 2- Age Distribution

AGE (YEARS)	MALE	FEMALE	TOTAL
<18	8	9	17
19-36	5	17	22
37-55	13	14	27
56-74	14	15	29
>75	2	3	5

Organisms Isolated

Among the 100 isolates, the most common organism found was *Escherichia coli* 60% (n = 60) followed by *Enterococcus spp*14% (n = 14), *Klebsiella spp*9% (n = 9), *Acinetobacter spp*8% (n = 8), *Pseudomonas spp*8% (n = 8) were isolated. Less often *Proteus spp*1% (n = 1) were isolated.

Table 3 – Total Number Of Pathogens Isolated

ORGANISMS ISOLATED	NO. OF ISOLATES
Escherichia coli	60
Enterococcus species	14
Klebsiella species	9
Acinetobacter species	8
Pseudomonas species	8
Proteus species	1

Antibiotic Susceptibility Pattern

E.coli being the most common isolate, it showed maximum susceptible to Fosfomycin (88%) followed by Cotrimoxazole (45%) and Nitrofurantoin (33.3%). Among *Enterococcus species* 86% were found susceptible to Linezolid followed by Nitrofurantoin (21%). Majority of *Klebsiella species (*44%) showed susceptibility to Fosfomycin.

Table 4: Antibiotic Susceptibility Pattern Of Isolated Organism

Organism isolated	Amoxicillin		Cotrimoxazole		Nitrofurantoin		Ciprofloxacin		Fosfomycin		Linezolid	
	S	R (n,%)	S (n,%)	R (n,%)	S (n, %)	R (n,%)	S (n, %)	R (n, %)	S (n, %)	R (n, %)	S (n, %)	R (n, %)
E.coli(n=60)	0	60, 100 %	27, 45%	33, 55%	20, 33. 3%	40, 66.7 %	5, 8.3 %	55, 91.7 %	53, 88. 3%	7, 11.7 %	0	60 100 %
Enterococcus spp (n=14)	0	14, 100 %	2, 14.2 %	12, 85.8 %	3, 21. 4%	11, 78.6 %	0	14, 100 %	2, 14. 2%	12, 85.8 %	12, 85. 8%	2, 14. 2%
Klebsiella spp(n= 9)	0	9, 100 %	1, 11.1 %	8, 88.9 %	2, 22. 2%	7, 77.8 %	2, 22.2 %	7, 77.8 %	4, 44. 4%	5, 55.6 %	0	9, 100 %
Acinetobacter spp (n=8)	0	8, 100 %	3, 37.5 %	5, 62.5 %	5, 62. 5%	3, 37.5 %	1, 12.5 %	7, 87.5 %	3, 37. 5%	5, 62.5 %	0	8, 100 %
Pseudomonas spp (n=8)	0	8, 100 %	1, 12.5 %	7, 87.5 %	6, 75 %	2, 25%	3, 37.5 %	5, 62.5 %	2, 25 %	6, 75 %	0	8, 100 %
Proteus spp (n=1)	0	1, 100 %	1, 100 %	0	1, 100 %	0	0	1, 100 %	1, 100 %	0	0	1, 100 %

DISCUSSION

Urinary tract infections caused by bacteria are common reason for seeking medical attention in the community. The effective management of patients with bacterial UTIs depends on accurately identifying the bacteria and selecting the most appropriate antibiotic treatment.

A total of 100 urinary isolates obtained from patients presenting with UTI were included in the study. The patients included 58% of female and 42% of male. Similar results were found in a study done by Smita Sood et.al and Ravi Gupta et.al (62.42% Females, 37.7% males)[6]. The prevalence of UTI is higher in women compared to men, primarily due to anatomical factor i.e.,due to short urethra.

In our study the majority of the isolates (n = 100) were from patients aged between 56–74 years (n=29) and five isolates were obtained from the old age group (> 75 years). A study conducted by Saera Suhail Kidwai et.al, Ayesha Nageen et.al showed that the mean age of the patients with significant bacteriuria was 48.5±12 years in which 83(45.6%) patients were between 45-60 years of age[7]. This can be mainly due to age-related risk factors like malnutrition, uncontrolled diabetes mellitus, poor bladder control leading to urinary retention or incontinence, long-term hospitalizations etc.

The study demonstrates *Escherichia coli* as the leading uropathogen accounting to 60% followed by, *Enterococcus spp*14% and *Klebsiella spp*9%. This is in consistent with the finding study done by Smita Sood et.al and Ravi Gupta et.al[6], where they isolated 61.84% of *Escherichia coli* followed by *Enterococcus spp*9.24% and *Klebsiella spp*6.64%. In other study done by Dias Neto et.al [8] the major isolates was *E.coli 58%*, followed by *Klebsiella* species. The members of Enterobacteriaceae family especially *Escherichia coli* and *Klebsiella spp* are identified as vital causative agents of UTI as they possess number factors including adhesion, pili, fimbriae and P1 blood group genotype receptor, which contribute to the attachment of bacteria to urothelium[9].

Among all the isolates amoxicillin showed 100% resistance and maximum sensitivity was shown by Fosfomycin (89%). *Escherichia coli* being the most common isolate, it showed 53% sensitivity to Fosfomycin followed by Nitrofurantoin (27%). In a study done by Inam Ullah et.al, 72.6% of isolates were sensitive to Nitrofurantoin and 25.9% were sensitive to Cotrimoxazole[10]. Similarly study done by Smita Sood et.al and Ravi Gupta et.al showed least resistance to Nitrofurantoin (5.77%) and 77.8% and 74.5% resistance to Norfloxacin and Ciprofloxacin respectively. Considering the fact that Nitrofurantoin efficacy in treating UTI, coupled with its oral administration and high concentration in urine, it stands as a preferable option for empirical use in uncomplicated UTIs [6].

In our study the 2nd most common organism isolated was *Enterococcus species* (14%) which showed 86% sensitivity to Linezolid followed by Nitrofurantoin (21%). A study done by Mohammed Javad et.al showed 98% of *Enterococcus* species were sensitive to Nitrofurantoin and 97.9% were sensitive to Linezolid. Similarly a study done by Goel et.al reported that *E.fecalis* isolated from UTI patients was highly sensitive to Linezolid (100%) and Nitrofurantoin (86%)[11].

Among the 100 isolates 8% were *Pseudomonas* species and 1% was *Proteus* species which showed 37.5% sensitivity to Ciprofloxacin. A study conducted by Inam Ullah Khan et.al showed that 12% of the isolates were *Pseudomonas* species which showed 15.4% sensitivity to Ciprofloxacin.

CONCLUSION

Majority of the urinary isolates were found sensitive to Fosfomycin and Nitrofurantoin proving that there has been a re-emergence in the susceptibility for oral antibiotics after a prolonged period of limited use. As bacterial pathogens continuously develop drug resistance, it is imperative to conduct routine surveillance and monitoring studies across diverse regions of the country which helps us to know the changing pattern of susceptibility of various antibiotics. These efforts are essential for physicians which enable them to make right decisions regarding empirical treatment and also to avoid the misuse of higher antibiotics.

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