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A PROSPECTIVE STUDY ON ETIOLOGICAL PROFILE AND PATTERN OF DRUG RESISTANCE BY UROPATHOGENS ISOLATED FROM A TERTIARY CARE HOSPITAL IN WAYANAD

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ABSTRACT **Introduction:** Urinary Tract Infection is a spectrum of diseases caused by microbial invasion of the urinary tract that extends from the renal cortex of the kidney to the urethral meatus. These are primarily caused by bacteria, mostly Gram-negative organisms from the family Enterobacteriaceae, which can infect regardless of age. The aim of this study was to find out the most prevalent bacteria causing UTI and the most vulnerable age group with UTI and also to identify the percentage of Community-acquired and Hospital-acquired UTIs. **Materials and Methods:** The study was conducted at the Microbiology Department of Dr. Moopens Medical College, Wayanad, Kerala, over a period of 3 months. All the urine samples obtained from patients to diagnose UTI were processed for identification by culture, morphological and biochemical tests. Antibiotic sensitivity was performed using Kirby- Bauer disc diffusion using standard and confirmatory method as per CLSI guidelines. **Results:** Out of 722 samples cultured for isolating the bacteria, 212 (29.4%) samples showed significant growth of organisms. The major isolates identified were 99 E.coli (46.6%), 28 Klebsiella species (13.2%), 16 Enterococcus spp., (7.5%), and 14 Pseudomonas aeroginosa (6.6%). Among 212 samples with significant growth, 153 (72.2%) were Hospital-acquired infections, and 59 (27.8%) were Community-acquired infections. Out of 212 samples with significant growth, 153(72.2%) were hospital-acquired infections and 59 (27.8%) were community-acquired infections. **Conclusion:** Escherichia coli was found to be the most prevalent uropathogens followed by Klebsiella species. These organisms displayed high-level antimicrobial resistance. For preventing the spread of antimicrobial resistance it is important to plan antibiotic policies. This will also help to decrease the aimless use of antibiotics thereby prevent the further development of antimicrobial resistance.

KEYWORDS :

INTRODUCTION

Urinary Tract Infection (UTI) is an infection of the urethra, bladder, or kidney. It is one of the most prevalent infections worldwide, with a significant economic burden [1,2]. Women are more prone to UTIs due to the structural and physiological characteristics of the urethra. At least one UTI will occur in more than 60% of women's lifetimes, and 20–30% of these women will have recurrent UTIs every six months [1]. Earlier research showed that almost 80% of UTIs were caused by Uropathogenic Escherichia coli. The prevalence of pathogens varies among different regions and different studies [1]. Among the family Enterobacterales, Escherichia coli accounts for more than 80% followed by other Enterobacterales such as Klebsiella spp., Enterobacter spp., and Pseudomonas aerogenosa. Potential Gram-positive Uropathogens include Enterococcus spp. and Staphylococcus saprophyticus [3].

Pathogen-caused infections make up 25%–60% of all nosocomial infection scenarios (mostly because of catheter-associated infections), and 10%–30% of infections in community settings [4]. Nosocomial UTIs are the most common infectious pathologies, responsible for 25–50% of infections overall [5,6]. The study of the bacterial transmission and drug resistance of UTI is helpful for the prudent use of antibiotics. However, the distribution and drug resistance are regional and temporal, and the experience of different countries and regions is only for reference. Recent studies have indicated that the prevalence of antibiotic resistance in gram-negative uropathogens varies widely across the world. Bacteria distribution and drug resistance varies greatly in different countries and regions. Active surveillance can alert people to the spread of resistant strains. Therefore, actively monitoring the distribution patterns and drug resistance of local UTI bacteria, promoting responsible antibiotic usage, and reducing the formation of drug-resistant strains are all important. [7,8].

The present study was designed to determine the prevalence of drug-resistant organisms in UTI patients of different age groups, which helps the risk assessment for recurrent UTIs and facilitates the appropriate antibiotic selection.

AIMS AND OBJECTIVES

- To find out the most prevalent Uropathogens.
- To identify the percentage of Community-Acquired UTI (CA-UTI) and Hospital Acquired UTI
- To find out the most effective drug from each class of antibiotics.

MATERIALS AND METHODS

A study was conducted during a period of 3 months starting from March 2023 to May 2023 at DM Medical College, Wayanad, Kerala, India. A total of 722 urine samples were collected from patients.

Sample Collection and Culture

Non-repetitive clean catch midstream urine was collected from patients suspected of UTI in a sterile container. Samples were sent to the laboratory within 2hrs of collection.

Significant bacteriuria was identified using routine bacterial culture by inoculating the samples to MacConkey agar and Blood agar and incubated at 37°C. The number of colonies was counted and calculated.

Inclusion Criteria

Specimens collected in dry, clean, leak-proof containers with proper labeling were included in the study.

Exclusion Criteria

Specimens collected in leaking containers, and specimens which are not properly labeled were excluded from the study.

Bacterial identification and Antibiotic Susceptibility testing

Isolated strains were subjected to colony morphology, gram staining, and biochemical methods such as Coagulase, Catalase, Oxidase, Indole, Mannitol, TSI, Urease, and Citrate test. Susceptibility testing was performed using Kirby- Bauer disc diffusion method. All the interpretation is based on Clinical Laboratory Standards Institute (CLSI) guidelines [10].

Phenotypic Detection Of ESBL

The isolates was subjected to susceptibility to third-generation cephalosporin using ceftazidime and cefotaxime discs. The isolates that produced a zone of inhibition of diameter ≤22mm for ceftazidime(30 µg) and ≤27mm for cefotaxime(30 µg) will be

screened as ESBL producers. All isolates that will be screened as ESBLs will be subjected to a combination disc method as a confirmatory test, which involved Ceftazidime and Cefotaxime alone and combined with clavulanic acid (10 µg). An increase in the zone of inhibition ≥5mm for either antimicrobial agent in combination with clavulanic acid versus its zone when tested alone will confirm ESBL production [1,9].

Phenotypic Detection Of Metallo-beta-lactamase (MBLs)

Screening of MBL production will be carried out using Imipenem, and Meropenem discs. Two imipenem discs was placed on a plate inoculated with the test organism, and 10 µl of 0.5 M EDTA solution was added to one disc. A zone diameter difference between the imipenem and imipenem + EDTA discs of ≥7mm will be interpreted as a positive result for MBL production [1].

Phenotypic Detection Of MRSA

MRSA isolates were detected using 1mg of oxacillin disc on Muller Hinton agar supplemented with an additional 5% NaCl and cefoxitin disc diffusion test and results is interpreted according to CLSI guidelines [10].

Phenotypic Detection Of MDR

The isolates resistant to at least one antibiotic in at least 3 different antimicrobial categories is considered as MDR [1].

Statistical Analysis

Data entry and statistical analysis were performed using SPSS software.

RESULTS AND DISCUSSION

Out of 722 samples cultured for isolating the bacteria, 212 (29.4%) samples showed significant growth of organisms, (Fig.1). Among 212 isolates, 99 (46.6%) were E.coli, 28 (13.2%) were Klebsiella spp., 16 (7.5%) were Enterococcus spp., 14 (6.6%) were Pseudomonas spp., 11(5.1%) were Enterobacter spp., 9 (4.2%) were Candida non-albicans, 8 (3.7%) were Citrobacter spp., and others were Acinetobacter, Candida albicans, Proteus species, Staphylococcus aureus, Methicillin Resistant Coagulase Negative Staphylococcus aureus (MRCoNS), Providencia spp., Streptococcus, Gram Negative Non-Fermenting Bacilli (GNNFB), and Methicillin Sensitive Cogulase Negative Staphylococcus aureus (MSCoNS) (Fig.2).

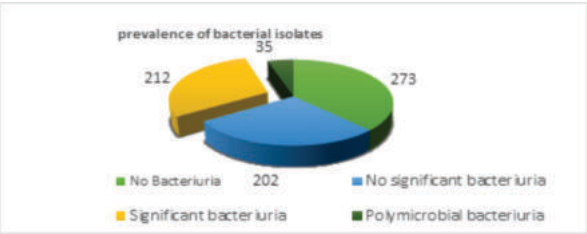

Figure1. Prevalence Of Bacterial Isolates

Figure 2. Graph Showing The Etiological Profile Of Uropathogens.

Out of 212 samples with significant growth, 153 (72.2%) were from IP patients and 59 (27.8%) were from OP patients (Table 1.)

Table.1. Percentage Of Hospital-acquired And Community-acquired Infection.

IP/OP	No. of samples	No. of samples with significant growth	Percentage (%)
HAI	504	153	30.35%
CAI	218	59	27%
Total	722	212	

Out of 212 bacterial isolates, 76 isolates were drug-resistant strains, 55 (72.4%) were ESBL, 11 (14.5%) were MDR, 7 (9.2%) were MBL, 2 (2.6%) were MRSA and 1 (1.3%) were MSSA (Table 2.)

Out of these 76 drug-resistant isolates, 61 were Hospital-acquired and 15 were Community-acquired.

Table 2. Various Drug-resistant Isolates.

Drug-resistance	No. of isolates	Percentage
ESBL	55	72.4
MDR	11	14.5
MBL	7	9.2
MRSA	2	2.6
MSSA	1	1.3
Total	76	100

Among the 722 samples tested for antibiotic susceptibility with cephalosporins, cefuroxime, cefotaxime, ceftazidime, and cefoperazone were the drugs tested, Cefoperazone (88) was the most sensitive drug and cefuroxime (18) showed the least sensitivity.

Among the 722 samples tested for antibiotic susceptibility with Aminoglycoside, Amikacin (68) was the most sensitive drug, and Gentamycin (64) showed the least sensitivity.

Among the 722 samples tested for antibiotic susceptibility with Quinolones, Norfloxacin (49) was the most sensitive drug, and Ciprofloxacin (30) showed the least sensitivity (fig 3)

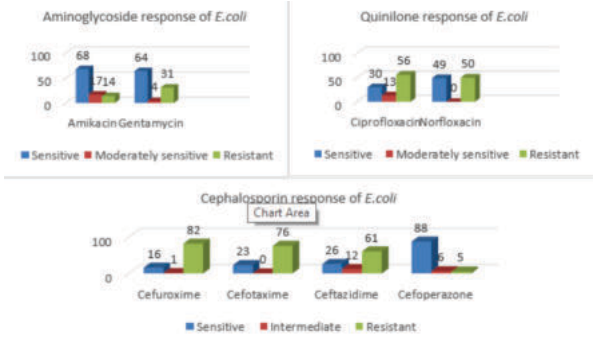

Fig 3

CONCLUSION

This study shows that the rate of drug resistance is common with most of the uropathogens. The type resistance prevalent in Wayanad is mostly ESBLs. The infection rate is more among patients coming from the community. It is important to plan community as well as hospital antibiotic policies to decrease the spread of drug-resistant microorganisms. This will decrease the aimless use of antibiotics and prevent the further development of antimicrobial resistance.

REFERENCES

1. Huang L, Huang C, Yan Y, Sun L, Li H. Urinary Tract Infection Etiological Profiles and Antibiotic Resistance Patterns Varied Among Different Age Categories: A Retrospective Study From a Tertiary General Hospital During a 12-Year Period. Front Microbiol. 2022 Jan 27;12.
2. Seid M, Markos M, Aklilu A, Manilal A, Zakir A, Kebede T, et al. Community-Acquired Urinary Tract Infection Among Sexually Active Women: Risk Factors, Bacterial Profile and Their Antimicrobial Susceptibility Patterns, Arba Minch, Southern Ethiopia. Infect Drug Resist. 2023;16:2297–310.
3. Mahony M, Mcmullan B, Brown J, Kennedy SE. Multidrug-resistant organisms in urinary tract infections in children. Available from: https://doi.org/10.1007/s00467-019-04316-5
4. Behzadi P, Urbán E, Gajdács M. Association between Biofilm-Production and Antibiotic Resistance in Uropathogenic Escherichia coli (UPEC): An In Vitro Study. Diseases. 2020 Jun 7;8(2):17.
5. Behzadi P, Urbán E, Matuz M, Benkő R, Gajdács M. The Role of Gram-Negative Bacteria in Urinary Tract Infections: Current Concepts and Therapeutic Options. In: Advances in Experimental Medicine and Biology. Springer; 2021. p. 35–69.
6. Shrestha A, Acharya J, Amatya J, Paudyal R, Rijal N. Detection of Beta-Lactamases (ESBL and MBL) Producing Gram-Negative Pathogens in National Public Health Laboratory of Nepal. Int J Microbiol. 2022;2022.
7. Henry Oladeinde B, Omoregie R, Olley M, Anunibe JA. Urinary tract infection in a rural community of Nigeria. N Am J Med Sci. 2011 Feb;3(2):75–7.
8. Okojie RO, Omorokpe VO. A survey on urinary tract infection associated with two most common uropathogenic bacteria. African Journal of Clinical and Experimental Microbiology. 2018 Jun 6;19(3).
9. Ghadiri H, Vaez H, Razavi-Azarkhiavi K, Rezaee R, Haji-Noormohammadi M, Rahimi AA, et al. Prevalence and antibiotic susceptibility patterns of extended-spectrum ß-lactamase and metallo-ß-lactamase-producing uropathogenic Escherichia coli isolates. Lab Med. 2014 Nov 1;45(4):291–6.
10. Clinical and Laboratory Standards Institute. Methods for Dilution Antimicrobial Susceptibility Tests for Bacteria That Grow Aerobically; Approved Standard. 9th Edition. CLSI document M07-A9. Wayne, PA: Clinical and Laboratory Standards Institute ; 2012.