ASIAN JOURNAL OF PHARMACEUTICAL AND CLINICAL RESEARCH

INNOVARE ACADEMIC SCIENCES
Knowledge to Innovation

Vol 16, Issue 9, 2023

Online - 2455-3891
Print - 0974-2441

Research Article

PREVALENCE OF URINARY TRACT INFECTIONS AMONG FEMALES OF REPRODUCTIVE AGE GROUP IN TERTIARY CARE TEACHING HOSPITAL

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Received: 12 March 2023, Revised and Accepted: 26 April 2023

ABSTRACT

Objective: The purpose of the current study is to isolate, characterize, and evaluate the antibiotic susceptibility profile of the pathogenic bacteria causing urinary tract infections (UTIs) in females of reproductive age.

Methods: This is a cross-sectional descriptive study carried out in a Tertiary care teaching hospital for 1 year. A total of 100 urine samples from female patients in the reproductive age range of 15–44 years constitute the study's sample size. Clean catch midstream urine samples were taken in sterile containers and inoculated on a different culture medium, such as cysteine, lactose, and electrolyte-deficient agar, to isolate the UTI pathogen. MacConkey agar was inoculated in parallel to target the growth of Gram-negative bacilli. Thereafter, using the common microbiological procedures, all positive cultures with significant bacteriuria were identified at the species level based on the colony features, Gram-staining reaction, and pattern of biochemical profiles. To investigate the pattern of antibiotic susceptibility, the disc diffusion method was used.

Results: Among the 100 study cases, the prevalence of UTI was seen in 38% of individuals and UTI was absent in 62% of individuals. Among the females (38% cases) who had UTI, 81% had symptomatic UTI and 19% had asymptomatic UTI. Among the 81% symptomatic individuals of UTI, all they showed burning micturition followed by 74% of individuals showed dysuria Among the uropathogens isolated, majority were *Escherichia coli* (40.7%) followed by CONS (22.3%) Majority of the *E. coli* isolates showed sensitivity to piperacillin/tazobactam and nitrofurantoin.

Conclusion: If left untreated, UTI is a significant public health issue. Early detection and timely treatment will lower the risk of developing further UTI complications, as well as the patient's pain, length of stay in the hospital, and economic loss.

Keywords: Urinary tract infection, *Escherichia coli*, Dysuria, Reproductive age group, Antibiotics.

 DOI: http://dx.doi.org/10.22159/ajpcr.2023v16i9.47816. Journal homepage: https://innovareacademics.in/journals/index.php/ajpcr

INTRODUCTION

The most prevalent infectious disease is urinary tract infection (UTI), which is defined as "presence of microbial pathogens in the urinary system." With 10% of women experiencing an infection each year and 60% having an infection at some point in their life, they are quite common in people between the ages of 16 and 35 years. Because the urethra in women is smaller and positioned nearer to the anus, women are more likely than men to develop UTIs. Due to the loss of beneficial vaginal flora as a woman enters menopause, her risk of UTIs rises [1,2]. Microbes may trigger kidney, ureter, bladder, or urethra UTIs, which can result in symptomatic or asymptomatic conditions. Asymptomatic bacteriuria is the term used to describe a situation when the urine contains substantial amounts of bacteria but no symptoms are present. A bladder infection is another name for a lower UTI. Burning urine, frequent urination (or an urge to urinate) without vaginal discharge, and severe discomfort are the most typical symptoms. These symptoms might range from moderate to severe, and they typically past 6 days in healthy women. Along with the typical signs of a lower UTI, such as bloody urine or visible pus in the urine, symptoms of an upper UTI or pyelonephritis, including flank discomfort, fever, nausea, and vomiting, have been recorded [3]. The incidence rate and annual cost of treatment for UTIs are both very high in both the community and in hospitals. The most accurate way to diagnose a UTI is to collect midstream or catheter urine and do a bacteriological culture on it. Frequently isolated bacteria found in UTI are *Escherichia coli* followed by *Enterococcus faecalis*, *Klebsiella pneumoniae*, *Proteus* spp., *Acinetobacter* spp., and *Staphylococcus aureus*, *Staphylococcus saprophyticus*. Gram-positive uropathogens causing both simple and complicated UTIs have been reported in many different nations. It is difficult to treat UTIs because antibiotic-resistant bacteria cause more death, morbidity, and expense. UTIs are among the most frequent bacterial infections picked up in both the community and hospitals, despite the fact that they are self-limiting. Patients with asymptomatic bacteriuria typically get their bacteria from colonizing flora in the periurethral space, vagina, or gut [4,5]. Bacteria that contaminate urologic fluids may be introduced into individuals who have had urinary tract instrumentation since the genitourinary system is sterile except for the distal urethra. Following the ascent of bacteria through the urethra into the bladder, and occasionally with continued ascent to the kidneys, asymptomatic bacteriuria develops. The organisms then continue to live in the urinary tract without causing the host to react in a way that would induce symptoms or irritate them. A recurrent UTI may be made worse by factors such as the host's genetic propensity, insufficient bladder emptying, or the presence of a foreign body. 80–85% of community-acquired UTIs are caused by *E. coli*, while 5–10% is by *S. saprophyticus*. Antibiotics are the cornerstone of the treatment of UTIs. Yet, increasing antibiotic resistance is creating concern about the future of treating patients with complex and recurrent UTI. The incidence of resistance to antibiotics and other medications is common among uropathogens, and antibiotic use is strongly correlated with this resistance. So as to assure the effectiveness of the antibiotics administered, it is crucial to do antibiotic sensitivity testing before therapy [5]. The present study is aimed to isolate and identify the pathogenic microorganisms causing UTIs in females of reproductive age group and to study the antibiotic susceptibility pattern of isolated pathogenic microorganisms.

METHODS

This is a cross-sectional descriptive study carried out in a tertiary care teaching hospital for 1 year. The total sample size of the study was 100 urine samples from female patients of the reproductive age group of 15–44 years. The study was conducted only after taking a patient consent form.

Inclusion criteria

Females of reproductive age group (15–44 years) residing in the study area, who were apparently healthy and willing to participate in the study.

Exclusion criteria

Females receiving any form of antibiotic therapy, menstrual women, females with known urinary tract anomalies, and females who were pregnant were all excluded from the study.

Sample collection and processing

Urine samples from the morning midstream were collected and within 2 h of collection, 10 mL of urine in a sterile container was sent to the bacteriology laboratory. Urine from a Foley catheter tip, urine in broth medium, urine specimens received more than 2 h after collection without refrigeration, and samples obtained in non-sterile containers were all subject to the sample rejection criteria.

Clean catch midstream urine samples were taken in sterile urine containers and inoculated on a different culture medium, such as cysteine, lactose, and electrolyte-deficient (CLED) agar, to isolate the UTI pathogen. Urine samples were plated within 2 h of collection to prevent false positive results. The majority of possible uropathogens, including Gram-positive cocci like *S. aureus*, *S. saprophyticus*, and *Enterococcus* spp., can grow more readily on CLED agar. MacConkey agar was inoculated in parallel to target Gram-negative bacilli. For 24 h, urine cultures were incubated at 35–37°C in ambient air. After overnight incubation at 37°C for 12–24 h colonies were counted to check significant growth. Colony counts of bacterial growth of > 10^5/mL of urine were significant. All positive cultures with significant bacteriuria were then identified at the species level by their colony characteristics, Gram-staining reaction, and the pattern of biochemical profiles using the standard microbiological techniques.

Asymptomatic UTI was defined as the presence of more than 1×10^5 colony forming units per milliliter of one organism in a culture of clean voided midstream urine in a patient without fever or clinical signs of UTI. A symptomatic UTI is one that has at least 10^3 colonies in a single culture and any of the clinical signs of a UTI.

The biochemical tests include carbohydrate fermentation tests with glucose, lactose, sucrose, xylose, mannitol, and maltose tests for the detection of indole, coagulase, urease, oxidase and catalase production, methyl red test, Voges-Proskauer test, citrate utilization, nitrate reduction test, and triple sugar iron agar test are used.

Antibiotic susceptibility testing is done using the disc diffusion method. The basis of disc diffusion is the identification of an inhibitory zone that is inversely correlated with bacterial susceptibility to the antibiotic contained in the disc. The diffusion of the antimicrobial agent into the seeded culture media results in a gradient of the antimicrobial. AST was performed according to CLSI guidelines using Muller–Hinton agar plates using the concentration of antibiotics per discs, recommended by the WHO experts committee on biological standardization. The plates were incubated at 37°C for 16–18 h. The inhibition zone was measured according to CLSI guidelines (CLSI Catalogue, 2016) (Collee, 2006). Finally, the result was reported as sensitive (S), intermediate (I), or resistance (R) by measuring the diameter of the zone of inhibition in mm.

RESULTS

Among the 100 study subjects, 55 subjects were in the age group of 15–30 years and 45 subjects were in the age group of 31–44 years. Based on the socio-economic status using BG Prasad scale, around 10% of individuals belonged to class V status, 46% belonged to Class IV socio-economic status, 30% belonged to Class III socio-economic status and 9% belonged to class II status and 5% belonged to class I status. Based on the marital status, 63 subjects were married and the rest 37 subjects were unmarried. Among the 100 study cases, the prevalence of UTI was seen in 38% of individuals and UTI was absent in 62% of individuals. Among the females (38% cases) who had UTI, 81% had symptomatic UTI and 19% had asymptomatic UTI. Among the 81% symptomatic individuals of UTI, all they showed burning micturition followed by 74% of individuals showed dysuria and 70% showed incontinence. Very less 2% showed the vomiting (Fig. 1). Among the 38% UTI cases, 27% were culture positive and 11% were culture negative. Among the uropathogens isolated, majority were *E. coli* (40.7%) followed by CONS (22.3%) and *Proteus* species in 18.5% cases followed by other organisms (Fig. 2). The antibiotic susceptibility pattern of isolated uropathogens is shown in Fig. 3 and Tables 1-7. Majority of the *E. coli* isolates showed sensitivity to piperacillin (PIP)/tazobactam (TAZ) and nitrofurantoin (NIT). Most of the CONS isolates were sensitive to VAN and TE. *Proteus* species were sensitive to imipenem (IMP), PIP/TAZ, and NIT. Isolated strain of *Pseudomonas aeruginosa* was sensitive to cefazolin/clavulanic acid (CAC), PIP and NIT. *S. aureus* is sensitive to all tested antibiotics except cotrimoxazole (COT) and ciprofloxacin (CIP). *Klebsiella* strain was sensitive to tetracycline (TET), high-level gentamicin (HLG), NIT whereas *Citrobacter* species is sensitive to all tested antibiotics except ampicillin (AMP), A/S, and CIP.

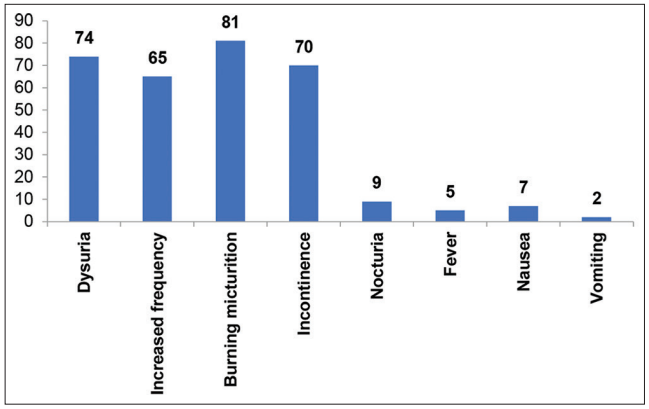

Fig. 1: Distribution of symptoms among the symptomatic urinary tract infection patients in study population

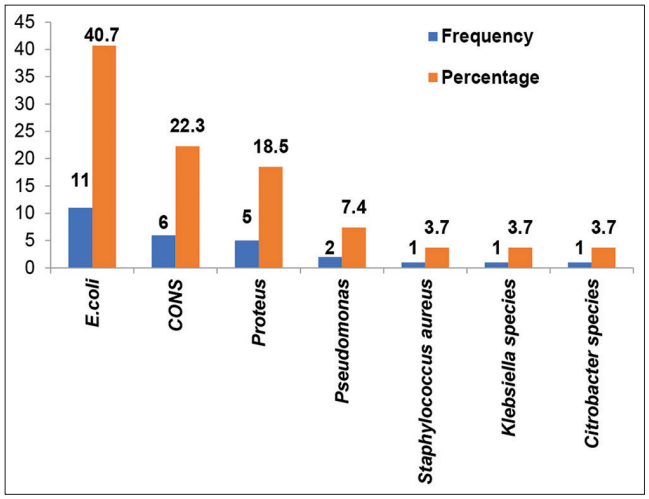

Fig. 2: Distribution of pathogenic microorganisms among the urinary tract infection cases

Table 1: Antibiotic sensitivity pattern of *Escherichia coli*

Antibiotics	Number of sensitive strains and sensitivity (%)
Amikacin	5 (45)
Ampicillin	4 (36.6)
High level gentamicin	8 (72.7)
Nitrofurantoin	9 (90.9)
Ciprofloxacin	4 (36.6)
Imipenem	6 (54.5)
Cotrimoxazole	4 (36.6)
Piperacillin/tazobactam	11 (100)

Table 2: Antibiotic sensitivity pattern of CONS

Antibiotics	Sensitivity (%)
Erythromycin	5 (83.3)
Cotrimoxazole	3 (50)
Gentamicin	4 (66.6)
Ciprofloxacin	3 (50)
Vancomycin	6 (100)
Teicoplanin	6 (100)
Piperacillin	5 (83.3)

Fig. 3: Antibiotic susceptibility testing of uropathogens

Table 3: Antibiotic sensitivity pattern of *Proteus* species

Antibiotics	Sensitivity (%)
Amikacin	3 (60)
Ampicillin	3 (60)
High level gentamicin	4 (80)
Nitrofurantoin	5 (100)
Ciprofloxacin	2 (40)
Imipenem	5 (100)
Cotrimoxazole	4 (80)
Piperacillin/tazobactam	5 (100)

Table 4: Antibiotic sensitivity pattern of *Pseudomonas aeruginosa*

Antibiotics	Sensitivity (%)
Amikacin	1 (50)
Ceftazidime	1 (50)
Ceftazidime/clavulanic acid	2 (100)
Nitrofurantoin	2 (100)
Ciprofloxacin	1 (50)
Imipenem	1 (50)
Piperacillin	2 (100)

Table 5: Antibiotic sensitivity pattern of *Staphylococcus aureus*

Antibiotics	Sensitivity (%)
Erythromycin	1 (100)
Cotrimoxazole	0
Gentamicin	1 (100)
Ciprofloxacin	0
Vancomycin	1 (100)
Teicoplanin	1 (100)
Piperacillin	1 (100)

Table 6: Antibiotic sensitivity pattern of *Klebsiella* species

Antibiotics	Sensitivity (%)
Amikacin	0
Chloramphenicol	0
High level gentamicin	1 (100)
Nitrofurantoin	1 (100)
Ciprofloxacin	0
Ampicillin	0
Tetracycline	1 (100)

Table 7: Antibiotic sensitivity pattern of *Citrobacter* species

Antibiotics	Sensitivity (%)
Amikacin	1 (100)
Ampicillin	0
Ampicillin/sulbactam	0
Nitrofurantoin	1 (100)
Ciprofloxacin	0
Imipenem	1 (100)
Cefuroxime	1 (100)

DISCUSSION

Untreated UTIs pose a serious threat to people's quality of life. This necessitates early UTI detection and treatment. The purpose of our study was to determine the prevalence of UTI in women of reproductive age. In the current study, 45 subjects were between the ages of 31 and 44, and 55 subjects were between the ages of 15 and 30. The distribution of socio-demographic traits was found to be remarkably similar to the conclusions of earlier studies [6-8]. Among the 100 study cases, the prevalence of UTI was seen in 38% of persons while UTI was missing in 62% of individuals.

The results were in accordance with Muthulakshmi and Gopalakrishnan (2017) [9]. Among the 38 UTI subjects, 81% had symptomatic UTI and 19% had asymptomatic UTI. Whereas Muthulakshmi and Gopalakrishnan (2017) [9] showed 76% of patients showed symptomatic UTI and 24% showed asymptomatic UTI and these results correlate to our study. In 2012, Shaifali *et al*. [6] observed that in the study population, 73.4% had burning micturition, 43.9% had increased frequency, and 20.1% had painful voiding. We obtained the same outcomes in our study. All of the 81% of people with UTI symptoms displayed burning urination,

followed by 74% of people who had dysuria, and 70% of people who had incontinence. Just 2% of people demonstrated vomiting. Many clinical signs such as fever, nausea, vomiting, groin pain, nocturnal incontinence, cloudy or bloody urine, fatigue, and confusion were also described in few other investigations [10-13]. With 11/27 (40.7%), *E. coli* was shown to be the most common bacterial uropathogen. This result is comparable to studies showing 40–46% of *E. coli* isolates in UTI infections [10-12,14]. *E. coli* was shown to be the most prevalent isolate in two studies from India and Sudan, and there is a rising trend for *Klebsiella* spp. to be the most potent urinary pathogen [15,16]. The bacteria that cohabit in female reproductive systems and intestines are typically the responsible parties for non-symptomatic bacteriuria in females. UTIs are produced by a variety of viral determinants, including adhesions and inactivity brought on by the uterus [13,15]. Majority of the *E. coli* isolates showed sensitivity to PIP/TAZ and NIT. Most of the CONS isolates were sensitive to VAN and TE. *Proteus* species were sensitive to IMP, PIP/TAZ, and NIT. Isolated strain of *P. aeruginosa* was sensitive to CAC, PIP, and NIT. *S. aureus* is sensitive to all tested antibiotics except COT and CIP. *Klebsiella* strain was sensitive to TET, HLG, and NIT whereas *Citrobacter* species is sensitive to all tested antibiotics except AMP, A/S, and CIP. *E. coli* showed resistance to AMP, COT, CIP etc. and this implies that these drugs are not recommended to use as empirical therapy for UTI, particularly in this study area. However, NIT and gentamicin could be considered for the treatment of UTIs. There are fewer options available to clinicians for the treatment of UTIs as bacterial uropathogenic resistance to routinely used antimicrobial agents [16].

CONCLUSION

If left untreated, UTI is a significant public health issue. 38% of females in the reproductive age group had UTIs, with the prevalence being higher in those who had UTI symptoms when they first appeared. Patients may have severe discomfort as a result of the UTI symptoms, which can lower their quality of life. Early detection and treatment of UTIs help avoid complications, and lessen the patient's pain, length of stay in the hospital, and economic loss.

AUTHORS CONTRIBUTIONS

All the authors have contributed equally.

CONFLICT OF INTERESTS

Declared none.

FUNDING

Nil.

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