



## Antibiotic Sensitivity Pattern in Urinary Tract Infections at a Secondary Care Hospital in Oman

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### Abstract

**Objective:** The study aims to identify strains of bacterial organisms causing urinary tract infections (UTI), and to determine the pattern of antibiotic susceptibility at a secondary care hospital in Samail, Oman.

**Methods:** A retrospective evaluation of microbiological culture sensitivity data was conducted using the database of total 155 patients reported with UTI infection between the months of July to December 2016 (6 months) at the department of microbiology in Samail Hospital in Oman.

**Results:** Out of total 559 cases in database cultured for UTI organism 155 patients met the inclusion criteria with a positive test and the remaining 404 patients showed negative test results either mixed growth or absence of microorganisms. Data was analyzed for 155 UTI cases reported at Samail Hospital. UTI was more commonly observed among age groups 25 - 36 years (n = 37, 24%) and less frequently among age group of 37 - 48 years (6%). The infection was highly prevalent among females (n = 106, 68%) compared to males (n = 49, 32%). *E. coli* predominated to cause UTI in 118 patients (76%). Other organisms isolated from remaining 37 (24%) patients included *Klebsiella pneumonia* (n = 2, 6%), *Pseudomonas aeruginosa* (n = 3, 3%), and others. Empirical treatment for UTI included antibiotics such as amoxicillin, ciprofloxacin, co-amoxiclav, cefuroxime, and nitrofurantoin. High level of resistance was observed with ampicillin (n = 102, 66%) followed by cephradine (n = 48, 31%). The level of sensitivity was more with ciprofloxacin, co-amoxiclav, and nitrofurantoin. *E. coli* isolated from most patients showed the highest sensitivity to ciprofloxacin (57%), co-amoxiclav (50%) and nitrofurantoin (49%) but with noticeable resistance to ampicillin (66%).

**Conclusion:** Study concludes that UTI are common among the age group of 25 - 36 years highly affecting females more than males. *E. coli* predominated to cause UTI. Most isolated organisms showed the highest resistance to ampicillin and highest sensitivity to ciprofloxacin. ciprofloxacin may be a better empirical choice compared to amoxicillin among Omani population.

**Keywords:** Urinary Tract Infection; Drug Sensitivity; Drug Resistance; Organism

### Introduction

Urinary tract infection (UTI) is an inflammatory process occurring in the kidney, ureter, bladder, or adjacent structures that occurs when microorganisms (usually *Escherichia coli*) enter through the urethra [1]. UTI occurs anywhere in the urinary system involving the urethra, bladder, ureters or kidneys [2]. It is the most common disease reported in the urology clinics across the globe, and still, it is a reason for significant morbidity and even mortality in modern medicine. The overall incidence of UTI is approximately 12.3% with a female to the male frequency of 2:1. Around 15 - 20% of all females may get UTI at some period of their lives [3].

UTIs are more common in women than men, primarily because women have a short urethra that is located close to the vagina and rectum [4]. Etiology is influenced by factors such as age, diabetes,

spinal cord injury, urinary catheterization, and other factors [5]. The majority of patients had symptoms of UTI including urinary frequency, urinary urgency, burning on micturition, blood in the urine, strangury, suprapubic pain, or a change of urine color or scent [6].

Organisms that cause UTI like bacteria, viruses (such as adenoviruses in the pediatric patient), fungi (such as *Candida* spp. in sexually active females or indwelling catheters) and protozoa. Common pathogens implicated in UTIs are bacteria primarily gram-negative organisms with *Escherichia coli* having a prevalence of 80%. Other gram-negative pathogens include *Klebsiella pneumonia*, *Enterobacter species*, *Proteus mirabilis*, *Pseudomonas aeruginosa*, and *Citrobacter*. In addition to *E. coli*, *Staphylococcus saprophyticus* and *Streptococcus agalactiae* have also been isolated as causative pathogens during pregnancy [7,8].

The reference standard to diagnose UTI is the urine culture that is performed when there is doubt about the etiology of clinical presentation or when the history may indicate a different diagnosis. In the absence of a urine culture, microscopic examination of a clean catch urine specimen that has been centrifuged for five minutes with the supernatant fluid poured off can be used to confirm the diagnosis. The number of bacteria > 15 bacteria/hpf (high-power fields) noted on microscopic examination of clean catch, spun urine has 95% specificity for UTI [9].

An ultrasound of the urinary tract was performed for all patients to exclude other pathologies (e.g. stones, anatomical abnormalities, obstructive uropathy). Renal function testing included serum creatinine and estimated glomerular filtration rate (GFR). Complete blood picture and blood culture tests were done for patients with fever to determine if there were infections elsewhere in the body [10].

Antibiotic sensitivity is the microbial susceptibility to antibiotics [11]. The antimicrobial agent with the highest level of activity against gram-negative bacilli was Amikacin which was restricted to hospital use while Cefuroxime, Ciprofloxacin, Fosfomycin, Gentamicin, and Nitrofurantoin showed acceptable levels of activity [12,13].

Antibiotic resistance is the ability of a bacterium or other microorganisms to survive and reproduce in the presence of antibiotic at doses that are intended to be effective against them [14]. The massive use and inappropriate choice of antibiotic are considered the most significant factors to the development of bacterial resistance to antimicrobials. Several factors and abnormalities of UTI interfere with its natural resistance to infection includes sex and age, disease hospitalization and obstruction [15]. Many times, physicians resort to prescribe broad-spectrum antibiotics of specific antibiotics in the view of resistance of the causative organism to the antibiotic. Poor patient compliance and incomplete course of antibiotic therapy have also contributed in the evolution of resistance to many antibiotics [16,17].

## Materials and Methods

The study was conducted in Department of Microbiology at Samail Hospital, Oman. A retrospective evaluation of bacterial culture sensitivity data for Microbiology laboratory reports of UTI cases by reviewing microbiology culture sensitivity data reports from the database for a period of 6 months from July to December 2016. The study and analysis took place between March 2017 to May 2017.

## Sampling

A total number of 155 patients with urinary tract infection enrolled. Patients with positive tests result that confirms urine tract infection was included in the study, there were no restrictions on age, gender, or race. On the other hand, the study excluded patients with a negative test result that have mixed growth and no microbial findings.

## Study Procedure

A data collection form was designed to gather the information from the microbiology records on matters like a number of cases with UTI reported, strains of bacteria isolated and the number of sensitive and resistant antibiotics for the respective bacterial strain. Data analysis was performed to evaluate the percentage of cases with a pattern of sensitivity and resistance using appropriate statistical methods.

## Ethical Consideration

The study was approved by the graduation project committee in school of pharmacy and permission from the Microbiology Department of Samail Hospital in Oman was obtained prior to the commencement of the study. The confidentiality of the data was assured by Microbiology Department, where data abstracted anonymously with no referral any patients' identification and record numbers were the tool for identification of records

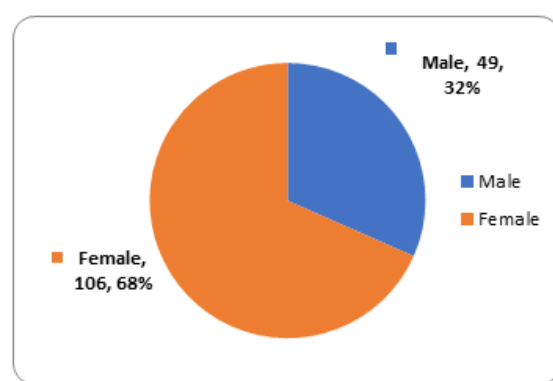
## Result

Out of total 559 cases in database cultured for UTI organism 155 patients met the inclusion criteria with a positive test and the remaining 404 patients showed negative test results either mixed growth or absence of microorganisms.

## Demographic Characteristics

Data was analyzed for 155 UTI cases reported at Samail Hospital. UTI was more commonly observed among age groups 25 - 36 years (n = 37, 24%), 1 - 12 years (n = 33, 21%), > 60 years (n = 32, 21%) and less frequently among age group of 37 - 48 years (n = 10, 6%).

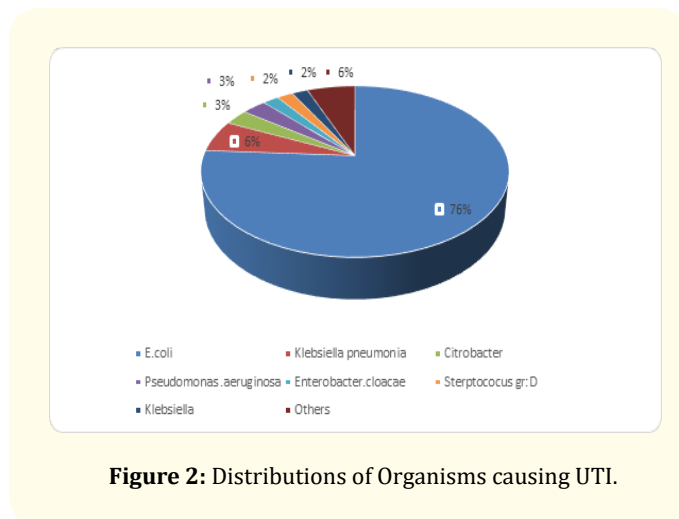
The study observed a higher frequency of UTI among females (n = 106, 68%) than males (n = 49, 32%). The gender distribution is shown in figure 1.



**Figure 1:** Distribution of Male and Female Patients with UTI.

## Pathogens

*E. coli* predominated to cause UTI among 118 (76%) patients. Other organisms isolated among remaining 37 patients (24%) included *Klebsiella pneumonia* (6%), *Pseudomonas aeruginosa* (3%), *Citrobacter* (3%), *Streptococcus group D* (2%), *Enterobacter cloacae* (2%), *Klebsiella* (2%) and others (6%) like *Proteus mirabilis* (1%), *Enterococcus* spp. (1%), *Coccobacilli* Gram positive (1%), coliform (1%), *Enterobacter aerogenes* (1%) and Group B *streptococcus* (1%). The distribution of organisms causing UTI is showing in figure 2.



**Figure 2:** Distributions of Organisms causing UTI.

About 28% of patients were prescribed with empirical antibiotic treatment for UTI with Amoxicillin (n = 48). The other antibiotics used as empirical treatment are ciprofloxacin (n = 17, 11%), co-amoxiclav (n = 16, 10%), cefuroxime (8%), nitrofurantoin (n = 1, 1%) and remaining (n = 65, 42%) patients were not on any antibiotic.

## Culture Sensitivity Analysis

High level of resistance was observed to Ampicillin (66%) followed by cephradine (31%). The level of sensitivity was higher with Ciprofloxacin (61%) followed by Co-amoxiclav (48%) and Nitrofurantoin (43%).

*E. coli* isolated from most patients exhibited a high degree of sensitivity to Ciprofloxacin (57%), Co-amoxiclav (50%) and Nitrofurantoin (49%). Ampicillin was resistant among the majority of cases (66%). *Klebsiella pneumonia* was highly sensitive to Co-amoxiclav (70%), cephalixin (50%) and Ciprofloxacin (70%), and resistant to Ampicillin (90%). *Pseudomonas aeruginosa* was sensitive to Ciprofloxacin (60%) nalidixic acid (80%) and resistant to Ampicillin (40%), Co-amoxiclav (40%), penicillin (40%) and sulfisoxazole (40%).

## Discussion

The study aimed to identify strains of bacterial organisms causing UTI among Omani population and also to determine the pattern of antibiotic susceptibility revealed that *E. coli* is the most common organism and was observed to be highly sensitive to Ciprofloxacin. The frequency of bacteriuria was higher among patients aged be-

tween 25 - 36 years (26%). The other age groups affected by UTI were with age 1 - 12 years (21%) and > 60 years old (21%) and less common among age 37 - 48 years (6%).

Jiffri, *et al.* showed that the incidence of bacteriuria was higher in patients with ages 41 - 52 years old (35.3%) and this percentage decrease by (15.5%) with age 29 - 40 years old and less incidence among age of 77 - 87 years (1.7%) [6]. Mounir M., *et al.* reported that the incidence of bacteriuria was higher in a patient aged 51 - 64 years and this percentage is less (29.4%) with age 15 - 50 years old and lesser among age of < 14 years old (3%) [18].

High frequency of urinary tract infection was reported among females (68%) than males (32%). Mounir M., *et al.* showed that the prevalence of infection is also common in females (67.6%) than male (32.4%) [18]. Jiffri ALO., *et al.* studied that the infection is most common in females (56.9%) than males (43.1%) [6]. Abubakar. E reported that the incidence of infection was higher in females with the prevalence of 54.3%, while in males the recorded value was 45.7% [19].

Among bacterial isolates, *E. coli* reports were the highest (78%) followed by *Klebsiella pneumonia* (6%), *Pseudomonas aeruginosa* (3%), *Citrobacter* (3%), *Streptococcus group D* (2%) *Enterobacter cloacae* (2%), *Klebsiella* spp. (2%), *Proteus mirabilis* (1%), *Enterococcus* spp. (1%), Gram positive *coccobacilli* (1%), *Coliform* (1%) and *Enterobacter aerogenes* (1%).

The sensitivity and resistance pattern of all isolated organism to different antibiotics shown a higher level of resistance to Ampicillin (66%) and Cephradine (31%). Antibiotics like Ciprofloxacin (61%), Co-amoxiclav (48%) and Nitrofurantoin (43%) have shown high sensitivity to these organisms. Zaeri H study reports that sensitivity of all UTI pathogens is very low to Ampicillin (6.9%) and higher for Cefotaxime (83.6%) and Ciprofloxacin (78.2%) [18,20,21].

In this study, the most commonly prescribed empirical treatments were Amoxicillin (28%) followed by Ciprofloxacin (11%), Co-amoxiclav (10%), Cefuroxime (8%) and Nitrofurantoin (1%). These results disagree with the guidelines of empirical antibiotic use in UTI. Such empirical treatment should base on known susceptibility and resistance as reported in the literature and the doctors need to know more information about local susceptibility patterns [22].

Ciprofloxacin during the evenings as there is a list for approved antibiotics to be prescribed as a program for antibiotic use restriction. To prescribe broad spectrum antibiotics such as Meropenem, Ciprofloxacin, Caspofungin and other broad-spectrum antibiotics in cases that need such drugs, attention by specialized physicians is required which is available only in the morning hours [23].

The study is a retrospective one which make the documentation less reliable, also the duration of data collection is relatively small. The study was for a uni-center in Oman. Hence, results may

not be generalizable across Oman. Further studies should be done across the nation to enhance the generalizability of the research [24-44].

### Conclusions and Recommendations

UTI is a common disease among the age group of 25-36 years highly affecting females than males among the targeted population of this study. Most isolated organisms were highly resistant to Ampicillin, Cephadrine. On the other hand, highest sensitivity was shown in antibiotics like Ciprofloxacin, Co-amoxiclav, and Nitrofurantoin. *E. coli* predominated to cause UTI among the population. Ciprofloxacin may be a better empirical choice than Amoxicillin among Omani population.

The study recommends that each hospital should adopt programs for rational use of antibiotics, and antibiotic stewardship to minimize the resistance, in addition to antibiograms. The choice of empirical antimicrobial for infections such as UTI needs to consistent with the antibiogram and of the hospital and should be also recommended based on sensitivity data in the Omani population. Policies in hospitals for antibiotic restriction of use need to be coherent with the international standards of antibiotic stewardship in order to minimize restrictions on general practitioners and allow them to prescribe the proper antibiotic, while, provision of continuous medical education and sharing the antibiogram among physicians will come up with best practices and best empirical antimicrobial choices.

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