

A Review on Common Bacteria Causing Urinary Tract Infection

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ABSTRACT

Background: Urinary tract infection (UTI) remains a common clinical problem in both the community and health care associated settings. In Pakistan, this is also a common issue and each patient should be carefully assessed to ensure that a correct diagnosis is made and that antimicrobial therapy is appropriately prescribed. UTI is a common problem and it effect's both gender and all ages.

Aim: To determine the most frequent bacterial agents causing Urinary Tract Infections (UTI) in patients who referred to Microbiology laboratory Quaid-e-Azam Medical College, Bahawalpur.

Methods: The cross-sectional descriptive, observational study was conducted at the department of Microbiology Quaid-e-Azam Medical College, Bahawalpur over 6 months period. Clean catch mid stream urine was collected and the specimens were cultured for isolation of microbial agents of urinary tract infection. The isolated bacteria were identified using biochemical test. The diffusion susceptibility test was used to determine susceptibility of bacterial agents to antibiotics. Data was analyzed by descriptive statistics using SPSS software version 19.

Results: In this study, 167(83.5%) out of 200 patients presented numerous (positive) leucocytes in urine detail report. For these 167(83.5%) patients, the urine culture and sensitivity was performed. Out of these 167 patients, E-coli were the most common bacteria found in about 100(59.8%). The other bacteria are Pseudomonas 7(4.1%), Proteus 15(8.9%) Klebsiella 6(3.5%), enterococcus 3(1.7%), and staphylococcus 2 (1.1%). Most of the patients were sensitive to cephalosporin, amikacin and third generation cefixime and ceftriaxone.

Conclusion: Gram negative bacilli is responsible for urinary tract infection and most frequent isolated bacteria was E-coli. The most effective antibiotics are cephalosporin, third generation cefixime, ceftriaxone and amikacin, in patients.

Keywords: Urinary Tract Infection, Bacteria, Antibiotics

INTRODUCTION

Urinary Tract Infection (UTI) is described as the microbial invasion of any tissues of the urinary tract and is the second most common clinical symptom for experimental antimicrobial treatment in primary and secondary care^{1,2}. In addition, the number of urine samples in comparison with the other specimens in medical microbiology laboratories is very large². Urinary tract infection (UTI) is an inflammatory response of the urothelium to bacterial invasion that is usually associated with bacteriuria and pyuria³. It is common clinical problem which can affect all age groups, but the women are more susceptible than men, due to several clinical factors including anatomic difference and hormonal effects⁴.

Normally, the urinary tract is sterile, but urinary tract infections can be caused by a variety of conditions. They can cause complicated or uncomplicated, symptomatic or asymptomatic infections. Anatomically can be divided into upper and lower tract infections^{3,4,5,6}. UTIs are classified as

uncomplicated or complicated. Uncomplicated UTIs occurs in healthy patients with structurally and functionally normal urinary tracts. Complicated UTIs are those that are associated with co morbid conditions that prolong the need for treatment or increase the chance for therapeutic failure. These conditions include abnormalities of urinary tract that impede urine flow, the existence of a foreign body (e.g. indwelling catheter, stones), or infection with multidrug resistance pathogen. Despite involvement of upper urinary tract, pyelonephritis can be considered uncomplicated when it occurs in a healthy patients^{2,3}. Clinical manifestations can vary from asymptomatic bacterial colonization of bladder to irritative symptoms such as frequency and urgency associated with fever, chills and flank pain, and bacteremia associated with severe morbidity including sepsis and death⁴.

The international studies have shown that UTIs in women are very common; therefore, one in five adult women experience UTI in her life and it is extremely common, clinically apparent, worldwide patient problem^{11,12,13}.

Despite the presence of several antibacterial factors such as the pH, urea concentration,

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osmolality, various organic acids, salt content of the urine, urinary inhibitors to bacterial adherence e.g., Tamm-Horsfall protein (THP), bladder mucopolysaccharide, low-molecular-weight oligosaccharides, secretory IgA and lactoferrin, the uropathogenic bacteria are able to adhere, grow and resist against host defenses that finally resulting in colonization and infection of the urinary tract^{12,14,15,16}.

The microbiological findings associated with acute uncomplicated UTI are highly consistent: 55–60% of episodes are caused by *Escherichia coli*, and 5–15% is caused by *proteus*, *Enterococcus*, *Klebsiella*, *Pseudomonas* and *Staphylococcus aureus*. Uropathogens are assumed to originate primarily from the bowel flora; although other potential reservoirs have not been well²². Several authors around the world have reported the Gram negative bacteria of *E.coli* and *Klebsiella* spp. being the most frequent organisms causing UTIs^{16,17,19}. *E.coli* causes 70-95% upper and lower UTIs¹³. Studies conducted in Iran suggested that *E.coli* is the most common cause followed by *klebsiella*, *enterobacter* and others.²⁰ One of the studies conducted in India also suggest that the gram negative organisms like *E-coli* was the most predominant organism and a similar study in Karachi also proved the same²¹. The aim of our study was to isolate common pathogen agents involving uncomplicated UTI and determination of their antibiotics susceptibility of the patients referred to Microbiology Laboratory Quaid-e-Azam Medical College, Bahawalpur, Pakistan.

METHODOLOGY

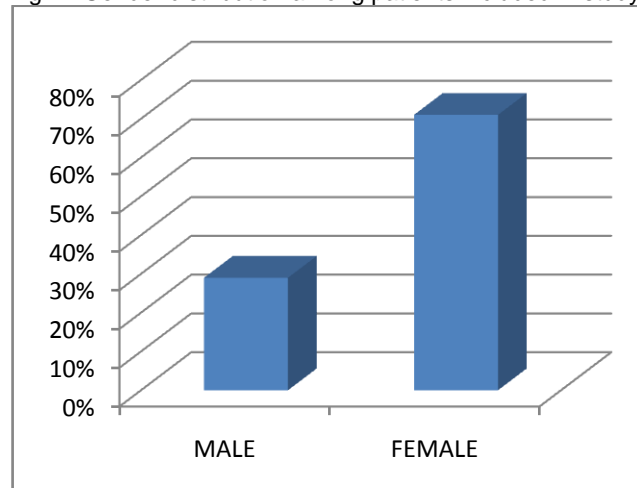
The study was carried out at the Department of Microbiology, Quaid-e-Azam Medical College Bahawalpur, Pakistan. This study is a descriptive cross sectional observation study and no clinical trials are performed. Therefore as long as there is no breach of patient's data confidentiality, there is no ethical issue involved. All patients with age greater than 18 with either gender, with urinary tract infection were included in the study. Patients with a history of genitourinary surgeries, recurrent urinary tract infection, or those already on antibiotics were excluded from the study. A total of 200 samples of patients with suspicion of urinary tract infection were studied and underwent different diagnostics procedures and categorized into multiple isolated organism. Data collected included variables such as age, gender and isolated organism. Data was analyzed by descriptive statistics in term of frequencies and percentage mean (+/-) standard deviation using statistical package for social science (SPSS) software version 19. An informed consent

was taken from all patient and ethical procedures were followed. Data was delinked for patient identity and due care was taken for ensuring confidentiality of the records.

RESULTS

A total of 200 cases were included in the study. Out of these 87(29%) were males and 113(71%) patients were females as shown in Fig 1

Fig. 1: Gender distribution among patients included in study

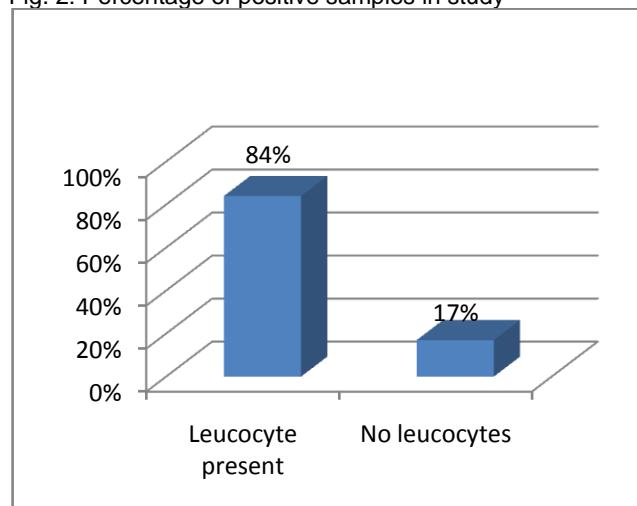


A total of 167(83.5%) patients found with isolated organism and 33 (16.5%) with no bacteria. All those cases where no bacteria found were excluded from the study shown in Table 1.

Table 1. Detection of bacteria in sample

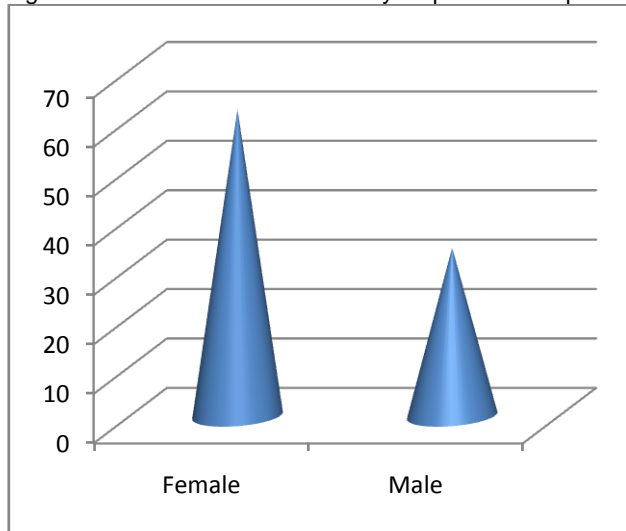
Total Population	%age	Bacteria /Leucocytes
No Bacteria (n=33)	83.5	No
Organism isolated (n=167)	16.5	Present

Fig. 2: Percentage of positive samples in study



Out of these 167 patients, 110 were females (65.8%) and 57 were male (34.1%) (Fig. 3)

Fig. 3: Gender distribution in leucocytes positive samples



The isolated organism is then further studied and e-coli were found to be the most common with 59.8% of the patients, followed by Proteus, Pseudomonas, Klebsiella, Enterobacter and Staphylococcal species, as shown in Table 2.

Table 2: Patterns of organisms isolated from urine

Organism Isolated	n	%age
E coli	100	59.8
Proteus	15	8.9
Pseudomonas	7	4.1
Klebsiella	6	3.5
Enterococcus	3	1.7
Staphylococcus	2	1.1

Also it was seen that high level of bacterial resistance was seen with Ampicillin, Erythromycin, gentamicin, which has caused considerable attention and most of the patients are sensitive to Levaquin, ciprofloxacin, third generation cefixime and ceftriaxone (Table 3) which is similar to previous studies done for antibiotic susceptibility.

Fig. 3: Patterns of organisms isolated from urine samples

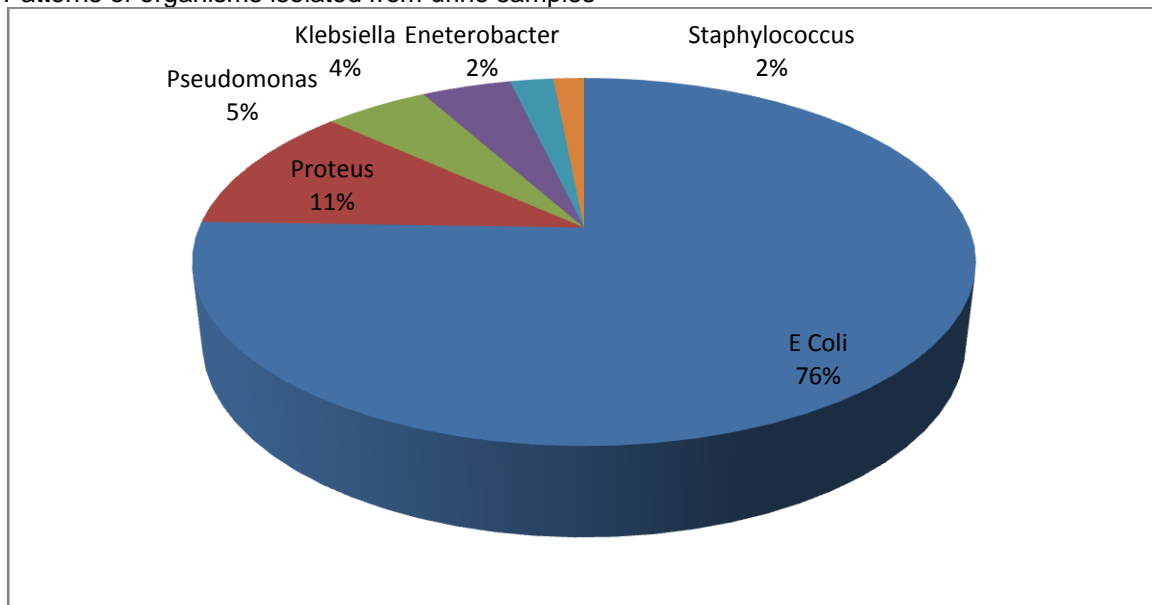


Table 3: Antibiotic susceptibility of organisms

Antibiotics	E Coli	Proteus	Pseudomonas	Klebsiella	Enterobacter	Staphylococcus
Ampicillin	S	R	R	R	R	R
Erythromycin	S	R	R	S	R	R
Gentamicin	S	S	S	R	R	R
Amikacin	S	S	S	S	S	S
Ceftriaxone	S	S	S	S	S	R
Cefixime	S	S	S	S	S	S
Levaquin	S	S	S	S	S	S
Ciprofloxacin	S	S	S	S	S	S

DISCUSSION

Urinary tract infection (UTIs) are the amongst commonest infections observed in a hospital setting and second commonest infections accounting for nearly 25% of all infections seen in general population. The pattern of antimicrobial susceptibility and resistance is different in different region. The current study highlights the relationship between gender, isolated bacterial agents and antibiotic susceptibility for empirical use of antibiotic in uncomplicated urinary tract infections and their outcome after use of susceptible antibiotic against isolated bacteria.

The healthy urinary tract like the other systems is normally able to resist bacterial infections. Numerous studies have indicated that the frequency of UTI is greater in women than in men. The large intestine and the perineal area serve as a reservoir for pathogenic bacteria such as *Escherichia coli*. Different studies have demonstrated that women who are prone to urinary tract infections possess epithelial cells with significantly more receptors for uropathogenic bacteria than healthy controls^(3, 4, 7-9, 20).

UTI is one of the most common infectious diseases which have been most extensively studied in the field of clinical practices⁽¹⁰⁾. Usually, UTI is caused by *Escherichia coli* and different studies have shown an alarming increase in resistance of this bacteria in invasive infections like urinary tract infections^{1,3,13,14,15,21}. Furthermore, UTI is caused by coliforms and *Enterococcus* spp. because of their presence in high numbers on the perineum^{3,22}.

In this paper *Escherichia coli* has been found as the most common uropathogenic bacteria. Studies show that 50% women will have UTI at-least once in their life time while UTI in male are complex. Finding during this study were similar to other studies and general guidelines of infections of urinary tract²⁶.

In this study, majority of adults who have UTI, were females mainly due to the structural and anatomical difference like shorter urethra and microflora. The gender distribution in this study reported the statistically predominance of females 65.8%. Previous studies shows that approximately 1 in 3 women will require antimicrobial treatment for UTI before age 24, and 40% to 50% of women will have UTI during their life time. This result is more or less similar to those reported from different studies²⁴.

A study conducted in Lahore; Pakistan shows the prevalence of UTI with the highest prevalence of *E-coli* (80%) followed by *Staphylococcus aureus* (9.4%), *Proteus* species (5.4%) and *Pseudomonas* species (5.2%). Also a study conducted at the department of emergency medicine, Ziauddin

University Hospital, Karachi showed *E-coli* was the most common bacteria found in about 150(59.8%). The other bacteria are *Pseudomonas* 18(7.2%), *Proteus* 37(14.7%), *Klebsiella* 16(6.4%), *enterococcus* 20(8%), and *staphylococcus aureus* 10(4%). The predominant uropathogen found in our study was *Ecoli*, and this finding is concordance with other studies, however different results have been reported. The difference and similarity in distribution and type of microorganism may result from different host factors, environment conditions, health care practices, socioeconomic standards, hygiene practices and education programs in each region²³.

The enterobacteriaceae family was the most common microorganism found in urinary tract infection and among that *Ecoli* was the most predominant uropathogen which is 59.8% account in present study, which is somehow similar to previous studies done in different part of the globe. The prevalence of gram-positive cocci was not high in this study. The prevalence of gram-positive cocci was not high in this study. High level of bacterial resistance was seen with Ampicillin, Erythromycin, Amikacin which has caused considerable attention and most of the patients are sensitive to Levofloxacin, ciprofloxacin, third generation cefixime and ceftriaxone (Table 3) which is similar to previous studies done for antibiotic susceptibility.

CONCLUSION

It is concluded that gram-negative bacilli (*Enterobacteriaceae*) were responsible for UTI. The most predominant uropathogen was *Ecoli* in most patients referred to Quaid-e-Azam Medical College Bahawalpur. Pakistan and most effective antimicrobial agents for treatment are cephalosporin, ciprofloxacin, Levofloxacin, Amikacin and third generation cephalosporins.

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