Journal of Advances in Microbiology Research

E-ISSN: 2709-944X
P-ISSN: 2709-9431
JRM 2025; 6(1): 138-142

www.microbiojournal.com
Received: 16-02-2025
Accepted: 18-03-2025

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Microbiological study of the most common bacteria of UTI in tertiary care hospital with its effective antibiotics

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DOI: https://www.doi.org/10.22271/micro.2025.v6.i1b.208

Abstract
The Urinary tract infection is the commonest infection nowadays in community and in health care industries as it has been observed all over the world. The data shows the clear pictures of bacteria which causes UTI, commonly are Uropathogenic *E. coli* (UPEC) is the most common causative organisms for UTIs. Gram-negative and Gram-positive bacteria residing in the colon also cause UTI at large scale such as Enterococcus faecalis, Proteus mirabilis, and Klebsiella pneumoniae Staphylococcus saprophyticus, Group B Streptococcus (GBS), and Pseudomonas aeruginosa.
There are several common causes of UTIs. It demonstrates that there are numerous ways that people can get UTIs. For example, UTIs are common during pregnancy, catheter-induced UTIs, recurrent UTIs, and diabetes; they can occur in babies as a result of diapers and unsanitary toilets; it can be occurred in hospitalized patients by the hospital health care workers through unhygienic hand washing practice or by handling a Foley catheter in an unsterile manner.

Keywords: Urinary tract infection, *Escherichia Coli* spp, (UPEC) Uropathogenic

Introduction
Common reasons of UTI is vary it shows that people get UTI through many reasons [1]. The urinary tract infection is the first most common infection even it comes in list of common infection after respiratory infection. We may easily find that urinary tract infection always connects with the nosocomial infection which is very common in hospital and somehow it may be the cause of death of a patient in a very large scale.
The urinary tract infection may become the common infection during Hospitalization, due to less immunity of the Patient especially with long stay of the patient, poor hygiene of the patients and negligence of the hand hygiene may increase the chances of UTI in hospitalized patients. The inappropriate treatment of a patient in term of experimental treatment of a patient with incorrect antibiotics creates a condition of "super bugs [2].
Urinary tract infections (UTIs) are infections that can occur in the urethra (urethritis), bladder (cystitis), or kidneys (pyelonephritis) and are one of the world's most common infectious diseases, affecting 150 million people each year, with significant morbidity and high medical costs
Urinary tract infection is one of the commonest infections seen in clinical practice. Lack of compliance and unjustified antibiotic prescriptions has resulted in bacterial resistance and is proving as a major challenge in the management of these infections. Our aim was to identify the sensitivity pattern of commonly used antibiotics against urinary tract infections so as to suggest an improvised line of action against bacteria causing urinary tract infections [3-5].
Antibiotic-resistant Gram-negative bacteria are more prevalent in hospitals than in community samples (e.g., carbapenemase-resistant *Enterobacteriaceae*) [6].
Healthcare associated infection (HAI) has emerged as an important health problem throughout the world, causing significant mortality and morbidity [7].
HAI is defined as clinical infection that develops after 48 hours of admission to a hospital for treatment of a different initial illness. These infections were neither overtly present nor within the incubation period at the time of admission, and are often due to organisms\endemic in the hospital [8].
In 1885, Escherich (1857-1911) separated it from infants' feces.
Gram-negative, non-sporulating, rod-shaped, facultative anaerobic, and coliform, *Escherichia coli* is a common bacterium found in food, the environment, and the lower

stomach of warm-blooded animals. *Proteus* can also be discovered in a variety of environmental settings, including as hospitals and long-term care homes. It is not uncommon for proteus species to colonize hospitalized patients' skin and mucosa, leading to opportunistic nosocomial infections. It is among the frequent reasons why hospitalized patients who are having urinary catheterization get UTIs. [9].

UTIs are mostly caused by Uropathogenic *Escherichia coli* (UPECs). UPECs adhere to the bladder epithelium when they first colonize a human host. Following adhesion, bacteria invade urothelial epithelial cells, where they can multiply and create dense intracellular bacterial clumps that resemble biofilms [10].

Only some of the species of *enterococci* bacteria cause clinical infections in humans, including Enterococcus faecalis (also called *E. faecalis*) and *Enterococcus faecium* (or *E. faecium*). *Enterococci* are thought to be beneficial organisms of the human digestive system, but they can also be harmful. They are frequently associated with HAIs and cause urinary tract infections (UTIs) *E. faecalis and E. faecium* are the most prevalent *enterococcal* species in humans [11].

Klebsiella is a Gram-negative, non-motile, and rod-shaped bacteria. The bacterium has a capsule it is resistant to the environment and action of disinfectants as well as many antibiotics, which makes it lethal.

It contains endotoxin, capsular and somatic antigens, and a complex antigenic structure. Some strains are also able to release exotoxin. These microbes can cause sepsis, conjunctivitis, meningitis, pneumonia, acute intestinal infections, and urogenital infections in lambs [12].

Staphylococci are Gram-positive cocci about 0.5 - 1.0 μm in diameter. They sometimes develop in short chains, but more often in pairs and clusters. Because *staphylococci* divide in two planes, the clusters form. Since *streptococci* typically grow in chains, their structure aids in differentiating them from micrococci and *staphylococci.*

While urinary catheterization, prolonged hospitalization, or complex UTI are known risk factors for S. *aureus* UTI [13]

Proteus mirabilis is a Gram-negative bacterium which is well-known for its ability to robustly swarm across surfaces in a striking bulls'-eye pattern. Clinically, this organism is most frequently a pathogen of the urinary tract, particularly in patients undergoing long-term catheterization [14].

P. mirabilis is capable of causing symptomatic infections of the urinary tract including cystitis and pyelonephritis and is present in cases of asymptomatic bacteriuria, particularly in the elderly and patients with type 2 diabetes [14-16].

P. aeruginosa is a non-fermenter gram-negative bacillus with a large intrinsic resistance to multiple antibiotics. This characteristic, paired with its quick ability to acquire new antimicrobial resistance, makes this pathogen a growing problem in infectious disease pathology, especially when nosocomial in origin [17, 18].

Aims and Objectives

1. To determine the incidence rate of symptomatic urinary tract Infection in intensive care unit set- up.
2. To isolate the organisms involved in symptomatic UTI.
3. To determine the antimicrobial sensitivity pattern of the isolates.
4. To determine the highest number of symptomatic UTI in male and female gender.

Methodology

Urine specimens were collected from 100 OPD/IPD patients, who had symptoms of UTI. It has between collected February to July 2023.Before collection, we instruct to patient for collect the clean catch midstream urine sample, the female patients were required to wash the pudendum and disinfect the urethral parts, and the male patients were required to wash the urethral parts and prepuce. A midstream urine specimen was then collected by aseptic methods, approx.10ml of urine was collected in a sterile container: Urine specimens were transported to the laboratory within 1-2 hours of collection for testing.

1. Urine sample collection
2. Urine microscopy.
3. Urine chemical analysis
4. Urine culture.
5. Urine Gram staining
6. Biochemical testing
7. Urine antibiotics sensitivity test.

Results

1. This 6-month study has been done in M.P. Birla hospital tertiary care Hospital in IPD and OPD 100 patients to find out the common Bacteria and its most sensitive antibiotics and their respective group.
2. This study shown the most common mean age was 43 for both of the gender.
3. We got the 56 numbers of Female patients and 44 Male Patients.
4. The prevalence of UTI found more in Female Patients and the number of female Patients were high.
5. The common causative agent of UTI is from gram negative bacilli family that is *Klebsiella* spp.
6. The number of urine culture positive case were 43 out of 100 that is 43% of it.
7. The most common bacteria was *klebsiella* spp. (17) that was 39% out of 43 positive cases.
8. Second most bacteria found *E.coli* spp. (9) that was 20% out 43 positive cases.
9. Rest of the other bacteria that wash found are as below.
10. *Enterococcus* spp. (5) 11%.
11. *Staphylococcus aureus* (4) 9%.
12. *Pseudomonas* spp. (3) 6%.
13. *Proteus* spp. (2.3)1%.

Discussion

By this six month of study period it reveals that the UTI is still a common problem for both sex male and Female. The highest number were found of female patient due to their Physiology of genital organ, the prevalence of UTI were high, in female patient and it was less in Male patients.

The highest sensitive antibiotic is Tigecycline which belong to third generation tetracycline group of Antibiotics (88%), the second most sensitive Antibiotic is Doxycycline (51%) the third most sensitive antibiotic is Meropenem (46%) the fourth most sensitive group is Imipenem and imipenem/cillastin it belongs to Beta lactam antibiotics family (44%).

Table 1: Table of sensitive antibiotics with their percentage

S. No.	List of Antibiotic	Percentage of sensitive Antibiotic
1.	Amikacin	34%
2.	Amoxicillin/Clavulanic Acid	27%
3.	Ampicillin/Sulbactum	30%
4.	Azithromycin	6%
5.	Aztreonam	16%
6.	Ciprofloxacin	18%
7.	Cefazolin	9%
8.	Cefixime	2%
9.	Cefuroxime	4%
10.	Cefepime	16%
11.	Cefepime/Tazobactam	39%
12.	Cefoperazone/Sulbactam	37%
13.	Doxycycline	51%
14.	Doripenem	44%
15.	Ertapenem	39%
16.	Faropenem	28%
17.	Gentamycin	34%
18.	Linezolid	NIL
19.	Levofloxacin	41%
20.	Moxifloxacin	25%
21.	Norfloxacin	6%
22.	Ofloxacin	23%
23.	Piperacillin/Tazobactum	37%
24.	Ticarcyclin/Clavulanicacide	27%
25.	Vancomycin	39%
26.	Colostin	40%

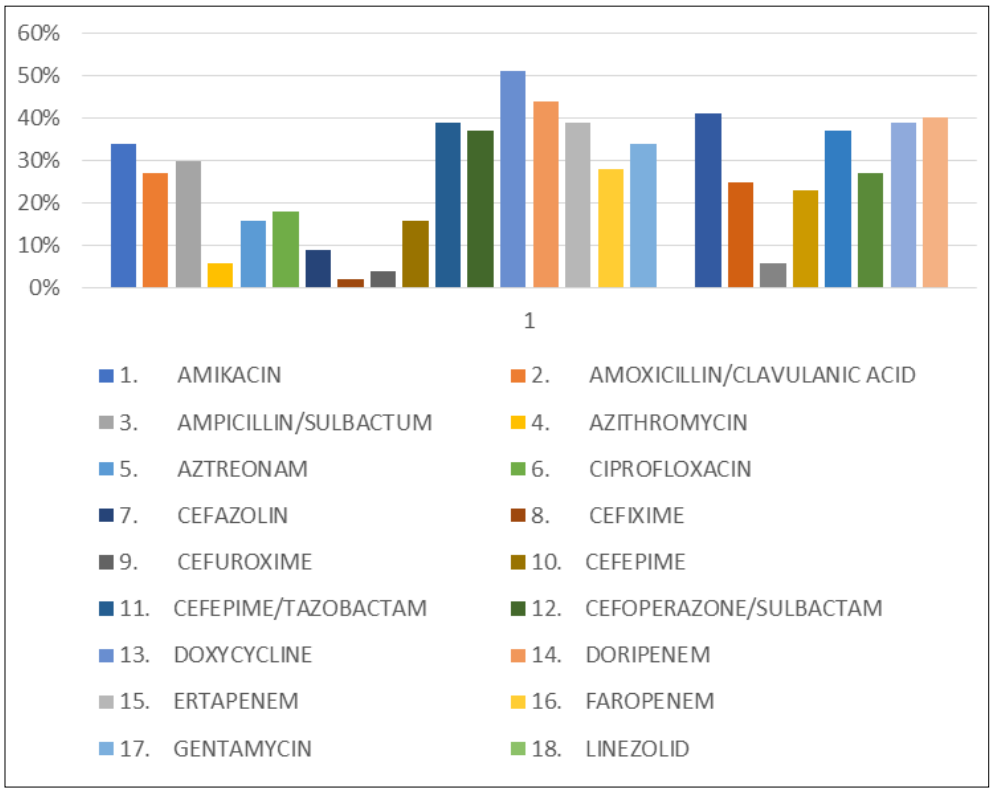

Fig 1: Graph of Antibiotic sensitivity

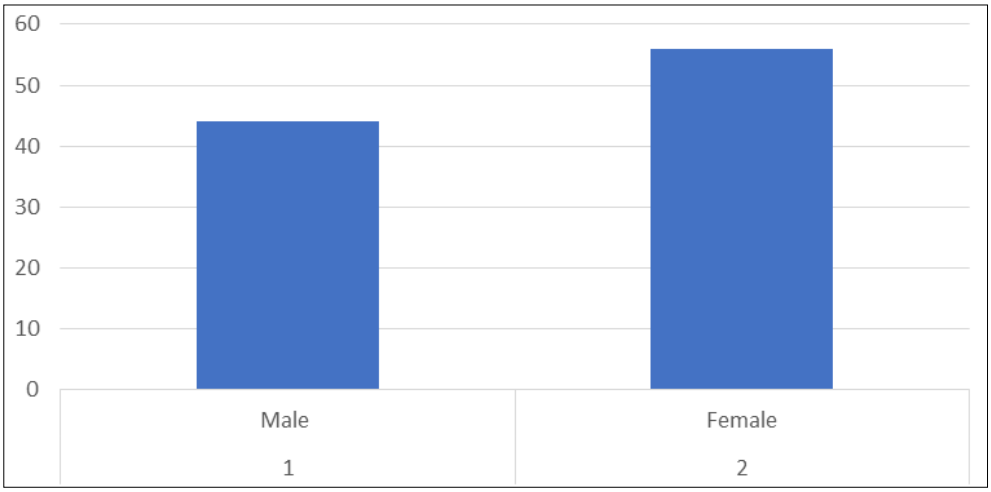

Fig 2: Number of male and female patients

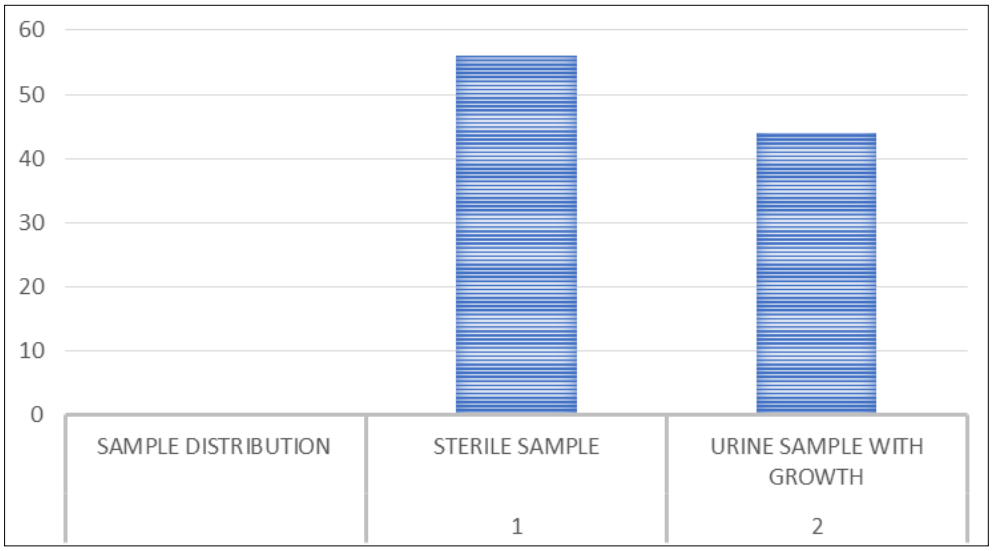

Fig 3: Number of sterile and unsterile samples

Conclusion

This cross-sectional study conducted at M.P. Birla Hospital Satna and aimed at detecting one of the most common bacteria of UTI in tertiary care hospital with its effective antibiotics.

We got the highest sensitive antibiotic is Tigecycline which belong to third generation tetracycline group of Antibiotics (88%) and the second most sensitive Antibiotic is Doxycycline (51%) which belongs to the tetracycline antibiotics and the third most sensitive antibiotic is Meropenem (46%) which belongs to the group carbapenem and the fourth most sensitive group is Imipenem and imipenem/cillastin it belongs to Beta lactam antibiotics family (44%) Rest of the other antibiotics also found sensitive in many cases of U.TI. which is mentioned in below table.

Healthcare associated infection i.e. Associated urinary tract infection. Development of UTI is common in critically and non-critical patients it is based on patient previous history and he or she clinical condition. Emphasis should be placed on management and reducing the rate of UTI rather than prophylaxis in order to reduce the incidence UTI.

Culture and susceptibility testing play an important role in the management of UTI. The assessment of risk of UTI should be evaluated antimicrobial resistance is a growing threat worldwide. The Cephalosporin group is now going toward the Resistance category there is an increasing resistance to third generation cephalosporin's among Gram negative bacilli. The prevalence of extended spectrum beta lactamases constitutes a serious threat to current -lactam therapy leading to treatment failure.

There is increase in the emergence of multidrug resistant isolates causing UTI. In order to decrease the incidence of drug resistance, prophylactic use of antibiotics should be discouraged.

Knowledge of resistant pattern can help in implementing proper antibiotic therapy and infection control policy such as avoidance of overuse of antimicrobials, use of drugs for which pathogens are sensitive.

Urinary tract infection (UTI) is one of the most common bacterial infections encountered by clinicians in developing countries. Area-specific monitoring studies aimed to gain knowledge about the type of pathogens responsible for urinary tract infections and their resistance patterns may help the clinician to choose the correct empirical treatment. Therefore, the aim of this study was to determine the common bacteria and antibiotic resistance pattern of the urinary pathogens isolated from patients.

This study finding shows that *Klebsiella* isolates were the predominant pathogens and the presence of bacterial isolates with very high resistance to the commonly prescribed drugs that in turn leaves the clinicians with very few alternative

options of drugs for the treatment of UTIs.

As drug resistance among bacterial pathogens is an evolving process, routine surveillance and monitoring studies should be conducted to provide physicians knowledge on the updated and most effective empirical treatment of UTIs.

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How to Cite This Article
Choubey S, Siddiqui S. Microbiological study of the most common bacteria of UTI in tertiary care hospital with its effective antibiotics. Journal of Advances in Microbiology Research. 2025;6(1):138-142.