



An Overview: Antibiotic Sensitive Pattern in Urinary Tract Infection

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ABSTRACT

Urinary tract infections (UTIs) are the inflammatory disorders of the urinary tract caused by the abnormal growth of pathogens. Urinary tract infections can be community acquired or nosocomial. Symptoms of UTIs such as fever, burning sensations while urinating, LAP, itching, formation of blisters and ulcers in the genital area, genital and supra pubic pain, and pyuria generally depend on the age of the person infected the location of the urinary tract infected. *E.coli* is the major etiologic agent in causing UTI, which accounts for up to 75%-90% of cases whereas *Staphylococcus saprophyticus* causes an estimated 5 - 1 5% of UTIs frequently in younger women. *P. mirabilis*, *Klebsiella* species, *P. aeruginosa* and *Enterobacter* species are less frequent offenders. Less commonly, Enterococci, *G. vaginalis* and *U. urealyticum* are also known agents in UTIs. Due to the rapidly evolving adaptive strategies of bacteria, the etiology of UTI and antibiotic resistance profile of bacterial uropathogens have changed considerably over the past years, both in community and nosocomial infections. Treatment of UTIs cases is often started empirically and therapy is based on information determined from the antimicrobial resistance pattern of the urinary pathogens.

Keywords: Urinary tract infection, pathogens, antibiotic, antibiotic sensitivity, *E.coli*, antibiotic resistance.

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INTRODUCTION

Urinary tract infections (UTIs) are the inflammatory disorders of the urinary tract caused by the abnormal growth of pathogens^{1,2}. Urinary tract infection is known to cause short-term morbidity in terms of fever, dysuria, and lower abdominal pain (LAP) and may result in permanent scarring of the kidney. Urinary tract infections (UTI) affect any part of the urinary tract and include mainly cystitis (bladder infection), pyelonephritis (kidney infection) and urethritis (urethra infection) showing tissue damage, burning, painful urination, urgency and increased urinary frequency, suprapubic pain, pain in renal angle, fever and other systemic manifestations but asymptomatic cases may also occur^{3,4}.

Urinary tract infections can be community acquired or nosocomial. Community-acquired urinary tract infections (CA-UTIs) are defined as the infection of the urinary system that takes place in one's life in the community setting or in the hospital environment with less than 48 hours of admission. Community-acquired UTI is the second most commonly encountered microbial infection in the

community setting^{5,6}. Urinary tract infections may be asymptomatic, acute, chronic, and complicated or uncomplicated, and the clinical manifestations of UTIs depend on the portion of the urinary tract involved, the etiologic organisms, the severity of the infection, and the patient's ability to mount an immune response to it. Both asymptomatic and symptomatic UTIs pose a serious threat to public health care, hence reducing the quality of life and resulting into work absenteeism⁷.

Symptoms of UTIs such as fever, burning sensations while urinating, LAP, itching, formation of blisters and ulcers in the genital area, genital and supra pubic pain, and pyuria generally depend on the age of the person infected the location of the urinary tract infected². Urinary tract infection can be either symptomatic or asymptomatic. Patients with significant bacteriuria who have symptoms referable to the urinary tract are said to have symptomatic bacteriuria. Asymptomatic bacteriuria (ABU) is a condition characterized by presence of bacteria in two consecutive clear voided urine specimens both yielding positive cultures ($\geq 10^5$ cfu/ml) of the same uropathogen, in a patient without classical symptoms. *E.coli* is the major etiologic agent in causing UTI, which accounts for up to 75%-90% of cases whereas *Staphylococcus saprophyticus* causes an estimated 5 - 1 5% of UTIs frequently in younger women. *P. mirabilis*, *Klebsiella* species, *P. aeruginosa* and *Enterobacter* species are less frequent offenders. Less commonly, Enterococci, *G. vaginalis* and *U. urealyticum* are also known agents in UTIs. Gram-positive organisms are even less common in which Group B Streptococcus, S.



aureus, *S. saprophyticus* and *S. haemolyticus* are recognized organisms⁸.

Due to the rapidly evolving adaptive strategies of bacteria, the etiology of UTI and antibiotic resistance profile of bacterial uropathogens have changed considerably over the past years, both in community and nosocomial infections. Many studies conducted from the USA and Europe have revealed increasing antibiotic resistance among uropathogenic *E. coli* to ampicillin, trimethoprim, and sulfonamides. Apparent shift in the etiological agents of urinary tract infection and associated problem of antibiotic resistance amongst bacterial uropathogens from time to time and from one institution to another have initiated health institution to carry out continuous evaluation of UTI from the view point of their spectrum and drug susceptibility testing⁹. Accurate identification of bacterial uropathogens and determining their drug susceptibility pattern are critical for efficient management of patients with UTI. They are also associated with significant clinical and financial benefits, via the reduction of mortality rates and overall hospitalization costs¹⁰.

In view of this, identification and antimicrobial susceptibility testing of clinical isolates by means of fully automated systems have become a common practice in many laboratories. The VITEK 2 compact system is a new automated system designed to provide accurate identification and susceptibility testing results for most clinical isolates of both Gram-positive and Gram-negative bacteria. Apart from accurate identification and susceptibility testing shortened turnaround times, improved specimen handling, enhanced quality control, reproducibility and the ability to track results are further advantages of the system. Unfortunately, health care providing institutions, identification and drug susceptibility profile of bacterial uropathogens have been carried by conventional methods that appeared to be inferior to the fully automated systems¹¹.

Treatment of UTIs cases is often started empirically and therapy is based on information determined from the antimicrobial resistance pattern of the urinary pathogens¹². However, a large proportion of uncontrolled antibiotic usage has contributed to the emergence of resistant bacterial infections^{7,13}. As a result, the prevalence of antimicrobial resistance among urinary pathogens has been increasing worldwide. Associated resistance, i.e. the fact that a bacterium resistant to one antibiotic is often much more likely to be resistant to other antibiotics, drastically decreases our chances of getting a second empirical attempt right¹⁴. Resistance rates to the most common prescribed drugs used in the treatment of UTIs vary considerably in different areas world-wide. The estimation of local etiology and susceptibility profile could support the most effective empirical treatment¹⁵. Therefore, investigating epidemiology of UTIs (prevalence, risk factors, bacterial isolates and antibiotic sensitivity) is fundamental for care givers and health planners to guide the expected interventions.

Women are more prone to UTIs than men because in females, the urethra is much shorter and closer to the anus than in males¹⁶ and they lack the bacteriostatic properties of prostatic secretions. The female genital tract is closely related to the bladder and this relationship makes the spread of diseases possible from one tract to the other¹⁷. Therapeutic decision should be based on accurate, up-to-date anti-microbial susceptibility pattern. Interim data have been published from a European multi-Centre survey that examined the prevalence and antimicrobial susceptibility of community acquired pathogens causing uncomplicated UTI in women¹⁸. The duration of treatment for adult has received much attention. Traditionally, a course of 7-10 days has been advocated, still this is the recommendation for treating men.

The introduction of antimicrobial therapy has contributed significantly to the management of UTIs. The antimicrobial agents used in treatment of UTI include cell wall inhibitors like penicillin, third generation Cephalosporins (Cefotaxime, Cephadrine, Ceftazidime and Cefaclor), DNA gyrase inhibitors like Fluoroquinolones (Ciprofloxacin, Ofloxacin, Sparfloxacin and Enoxacin) and Aminoglycosides (Amikacin, Gentamycin and Kanamycin) that are protein synthesis inhibitors. Inappropriate and extensive use of antibiotics has led to the development of multidrug resistance among the pathogens¹⁹. In patients with suspected UTI, antibiotic treatment is usually started empirically, before urine culture results are available. To ensure appropriate treatment, knowledge of the organisms that cause UTI and their antibiotic susceptibility is mandatory²⁰. The ever changing pattern of sensitivity indicates the importance of continuous investigation for updating relevant data for intended use as guidelines for appropriate treatment by the physicians.

Commonly Antibiotic used in treatment of Urinary Tract Infection:²¹

Oral Therapy:

AGENTS
Sulfonamides
Trimethoprim-sulfamethoxazole
Penicillins:
Ampicillin Amoxicillin-clavulanic Acid
Cephalosporins:
Cephalexin Cefaclor Cefadroxil Cefuroxime Cefixime Cefprozil Cefpodoxime



Tetracyclines:
Tetracycline Doxycycline Minocycline
Fluoroquinolones:
Ciprofloxacin Norfloxacin Levofloxacin
Nitrofurantoin
Aminoglycosides:
Azithromycin Amikacin Fosfomycin

Parenteral Therapy:

AGENTS
Aminoglycosides:
Gentamicin Tobramycin Amikacin
Penicillin:
Ampicillin Ampicillin-sulbactam Ticarcillin-clavulanate Piperacillin-tazobactam
Cephalosporins, first-, second-, and third-generation
Carbapenems/ Monobactams:
Imipenem-cilastatin Meropenem Ertapenem Aztreonam
Fluoroquinolones:
Ciprofloxacin Levofloxacin

Uses of Antibiotic Sensitivity Patterns:

Help to guide the physician in choosing antibiotics.

The accumulated results on different pathogens their sensitivity will guide the physician in choosing empirical treatment in serious patients before the individual's laboratory results are analyzed in the microbiology laboratory.

Reveals the changing trends in the local isolates.

Help the local pattern of antibiotic prescribing.

Bacteria have the ability to develop resistance following repeated or subclinical doses, so more advanced antibiotics are continually required to overcome them which are revealed by sensitivity patterns.

Helps in learning the resistance pattern of the pathogen.

Provides the further information about the pathogen susceptibility.

Leads to the proper pharmacotherapy of the patients and reduce the chances of the antibiotic resistance in the population²⁰.

DISCUSSION

Urinary tract infections (UTI) are serious health problems affecting millions of people each year. They are the second most common type of infections in the body, accounting for about 8.3 million visits to the hospitals each year. UTIs are caused by the presence of bacteria in urine, although fungi and viruses could be involved. *E.coli* is the major etiological pathogen causing UTI which account for up to 90% cases. *E. coli* was sensitive to antibiotic gentamycin, nitrofurantoin. The sensitive antibiotic to *Klebsiella* isolates are gentamicin, piperacillin tazobactam *E. coli* and *Klebsiella pneumoniae* were resistance to ampicillin. *Enterococcus* was sensitive to vancomycin & linezolid. *Staphylococcus* was sensitive to vancomycin²² and was similar to the other studies. *Escherichia coli* isolated was resistant to cephalosporin (83%,71%), floquinolones (79%,73%)²³.

Nitrofurantoin is the mostly use drug for UTI and is mostly sensitive to all the pathogen. But nitrofurantoin is mostly not given to elderly patients due to renal impairment which leads to sub therapeutic effects. It is most effective against the *E. coli* which is responsible for 80- 90% of cases of UTI. Since it is the safest drug to use in UTI so is prescribed. If Nitrofurantoin is ineffective so the Amikacin is the second most effective drug used to treat urinary tract infection.

CONCLUSION

The major pathogens causing the urinary tract infection are *E.coli*, *Proteus sp.*, *Staphylo coccus sp.*, *Pseudomonas sp.*, *Klebsiella spp.* and *Candida spp.* The mostly found pathogen is *E.coli* and is susceptible to Amikacin, Nitrofurantoin and Gentamicin. *Klebsiella spp.* is susceptible to Gentamicin, Pipracilin and Tazobactum. *Enterococcus* is susceptible to Vancomycin and Linizolid. *Staphylococcus* is susceptible to Vancomycin. *Pseudomonas sp.* Are sensitive to Nitrofurantoin and Ciprofloxacin. *Candida spp.* are sensitive to Ketocanazole.

The use of antibiotic should be done through a proper regimen and it is important to check the antibiotic sensitivity before the prescription of the antibiotic for any pathogen. As it may lead to antibiotic resistance. So the antibiotics should be prescribed only after checking the sensitivity of antibiotic over a pathogen.



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