

RECENT TRENDS IN ANTIMICROBIAL SUSCEPTIBILITY PATTERN OF ESCHERICHIA COLI IN URINARY TRACT INFECTIONS

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Summary

Urinary tract infection is one of the most common reasons for patients to seek medical care. Escherichia coli are most frequently found in both community and hospital acquired Urinary tract infections. Antimicrobial resistance is a serious concern as it increases morbidity and mortality due to treatment failure and also escalates cost of therapy. Incomplete diagnosis and injudicious use of antibiotics is perhaps the main reason for this. The objective of the present study is to determine the antibiotic susceptibility pattern of Escherichia coli prevalent in community acquired urinary tract infections in view of the increasing antibiotic resistance and diversity of Escherichia coli sensitivity.

A total number of 800 patients diagnosed to be suffering from Urinary tract infection were enrolled. E. coli was the causative agent in 480 (60%) and identified by standard procedures. Antibiotic susceptibility pattern was performed by Kirby Bauer disc diffusion method.

Out of 800 urine samples, 480(60%) showed growth of Escherichia coli. Among the 480 Escherichia coli isolates, 390 were females (81.25%) and 90 were males (18.75%)... All strains were sensitive to Amikacin and Nitrofurantoin, resistant to Norfloxacin, Ciprofloxacin and Cefazolin.

One of the causative agents of Urinary tract infection is Escherichia coli, affecting mainly women. They were sensitive to Amikacin and Nitrofurantoin, resistant to fluoroquinolones and others due to various reasons. So indiscriminate use of antibiotics is avoided and always susceptibility testing should be performed.

Key words: *Urinary tract infection, Escherichia coli, Drug resistance.*

Introduction

Urinary tract infection (UTI) is one of the most common reasons for patients to seek medical care, accounting for more than 7 million patient visits each year in the United States¹. It is the most common bacterial infection in women and accounts for significant morbidity and health care costs.² Urinary tract infections are also the most common infections in acute and long term care hospital patients.^{3,4} India is a developing country where 40% of the population is below the poverty line. It is a general practice that up to 95% of cases of UTI

with severe symptoms are treated without proper bacteriological investigations. The emerging antibiotic resistance due to incomplete diagnosis, indecisive attitude of the physicians and injudicious use of antibiotics is a matter of serious concern. *Escherichia coli* (*E. coli*) is the most frequently found bacteria in both community acquired and hospitalized UTI patients^{5,6} so antibiotic resistance pattern is essential concerning the increasing use antibiotics and diversity of *Escherichia coli* sensitivity in the various parts of world.

Antimicrobial resistance in both out and in patients with UTI is increasing and can vary according to geographical and regional location^{7, 8}. This drug resistance complicates treatment and necessitates the appropriate use of drugs along with invention and synthesis of new drugs⁹.

Wide spread use of the drugs to treat UTI in adults and upper respiratory tract infection in children and to provide prophylaxis against *Pneumocystis carinii* pneumonia in patients with human immunodeficiency virus infections have created selective pressures that favor resistant strains in the fecal flora.¹⁰ Another risk factor is recent travel suggesting that exposure to water and food contaminated with *E. coli*. Urinary tract infection in small children attending at day care centers are other risk factors for infection with *E.coli*¹¹.

The aim of the present study was to investigate urine cultures and identify the specific pathogens and evaluate the antibiotic resistance and susceptibility pattern of *Escherichia coli* detected from urine culture prevalent in community acquired UTI.

Patients and methods:

The present study is a cross sectional, descriptive type of observational study undertaken by the Department of Microbiology, Mamata Medical College, Khammam, Andhra Pradesh. Due permission of the Institutional Ethical Committee was taken. The study group included patients attending Out Patient Department of various Disciplines of Mamata General Hospital, Khammam during January 2010 to June 2010 with symptoms suggestive of UTI. They entered the study when they were confirmed to be suffering from UTI due to *E. coli*.

Inclusion criteria

- Both males and females Aged 15 -75 years attending different Out Patients Department of Mamata General Hospital.
- Diagnosed clinically and microscopically to be suffering from uncomplicated UTI .
- Willing to give written informed consent.

Exclusion criteria

- Congenital malformations of the urinary tract.
- Any other major systemic illness like diabetes, renal hypertension, immune deficient states etc
- Patients who had taken a course of antibiotic within a period of 2 months due to diverse reasons.

Procedure:

A total number of 800 urine samples were collected. The midstream urine specimens were obtained by clean – catch method. The samples were collected in sterile containers under aseptic precautions and cultured within one hour of collection. The samples were plated out on MacConkey and Blood agar media using a calibrated loop, delivering 0.01ml of the sample and incubated aerobically overnight at 37°C¹². Samples that showed pure growth of isolate in a count of $\geq 10^5$ colony-forming units (CFU) per ml of urine after overnight incubation were considered to indicate significant bacteriuria¹³ and were considered as positive. The isolates were identified by their colony characters, microscopic morphology and appropriate biochemical reactions as per the standard procedures¹⁴. All *E. coli* isolates were subjected to Antimicrobial sensitivity tests by Kirby-

Bauer disc diffusion method using Muller Hinton Agar, *E. coli* ATCC strain 25922 susceptible to all the antibiotics was used as control. The Antibiotics used for susceptibility testing in our study were Amikacin(AK) (30µg), Gentamicin(G) (10µg), Nitrofurantoin(F) (30µg), Norfloxacin(NX)(10µg), Ciprofloxacin(CF)(5µg), Ofloxacin(OF)(5µg), Tetracycline(T)(5µg), cefazolin(CZ)(5µg), and ceftazidime(CA)(30µg). The sensitivity levels of the isolates to the antibiotics were examined using the CLSI, 2006 criteria¹⁵. The data was collected and analysed.

Results:

A total number of 800 urine samples were collected from out patients attending tertiary care hospital. Out of them 480 samples showed significant growth of *E. coli* (60%)(Table-1). Of them, 390 (81.25%) were females indicating that females are most frequently affected with UTI

Table 1: Percentage of Escherichia coli isolated from total no. of samples

Organisms isolated	No. of samples	Percentage
Escherichia coli	480	60%
other organisms	320	40%
Total	800	100%

Various antibiotics tested were Amikacin(AK), Gentamicin(G), Nitrofurantoin(F), Norfloxacin(NX), Ciprofloxacin(CF), Ofloxacin(OF), Tetracycline(T), Cefazolin(CZ), Ceftazidime(CA). All the samples were sensitive to Amikacin(100%), followed by Nitrofurantoin(90%), followed by Gentamicin(70%), Tetracycline(40%),Ceftazidime(5%), Ofloxacin(5%). All of them were resistant to Norfloxacin, Ciprofloxacin, Cefazolin(table-2).

Table 2: Antibiotic susceptibility patterns of E.coli

Antibiotics	AK	F	G	T	CA	OF	CZ	CF	NX
Sensitive percentage	480 100%	432 90%	336 70%	192 40%	24 5%	24 5%	Nil 0%	Nil 0%	Nil 0%
Resistant percentage	Nil 0%	48 10%	144 30%	288 60%	456 95%	456 95%	480 100%	480 100%	480 100%

Abb:- Amikacin(AK), Nitrofurantoin(F), Gentamicin(G), Tetracycline(T), Ceftazidime(CA), Ofloxacin(OF), Cefazolin(CZ), Ciprofloxacin(CF), Norfloxacin(NX),

Discussion

The emergence and spread of antimicrobial resistance in *E. coli* is an example of ongoing global problem. A multidisciplinary and worldwide approach to the problem outlined in recent recommendations from the World Health Organization and Centre for Disease Control and prevention needs to be followed. We must exercise considerable restraint in prescribing antimicrobials and restrict their use to only certain definite indications as their injudicious use has led to the emergence of antibiotic-resistant pathogens that is a serious challenge to the community. The prevalence and incidence of UTI is higher in women than in men, which is

likely the result of several clinical factors including anatomic differences, hormonal effects, and behavior patterns. UTIs also more commonly progress to bladder infections in females due to the much shorter length of the female urethra.

The antibiotic sensitivity pattern showed that the bacterium is resistant to most of the antibiotics and only showed maximum sensitivity to Amikacin (100%) next to Nitrofurantoin (90%). All the isolates were resistant to Norfloxacin Ciprofloxacin and Cefazolin.

In a study by Asad U Khan et al in 2006 from India showed that E.coli was isolated in 61% of infection and 17% were males and the rest of them were females. In that study 90% of isolates were resistant to Ampicillin, intermediate resistance to Norfloxacin. Maximum sensitivity was to Kanamycin and Streptomycin¹⁶ which indicates that they are sensitive to aminoglycosides which is correlating with our study.

In another study by Ronald et al in 2009 from North Carolina showed that resistance to Ciprofloxacin was 6.8% and maximum sensitivity to Nitrofurantoin¹⁷.

In another study carried out by Nakhjavani et al ,2007 in Tehran on the resistance of E. coli in UTI to Fluoroquinolones, the resistance rates of 49.3% to Nalidixic acid ,44.5% to Ofloxacin ,41.4% to Norfloxacin and 40.2% to Ciprofloxacin were reported¹⁸.

In another study by Mohsen et al in 2010 from Iran showed that maximum resistance to Ampicillin and Amoxicillin and more sensitive to Amikacin (93.3%) and Ciprofloxacin (91.5%), Nitrofurantoin (89.8%) and Nalidixic acid (78.7%)¹⁹.

Based on the present study and comparison with other studies it is evident that E. coli is the most important and prevalent bacterium isolated from urinary tract infections and its sensitivity and resistance pattern is varying from place to place. This may be due to different species of E.coli play roles in causing UTI. It also may be attributed to other factors like the prevalence of some species of E.coli epidemically in some parts of world, in addition to other factors such as age, gender, individual hygiene, hospital infections, irregular and inappropriate use of antibiotics. This may be one reason for Fluroquinolone resistance in our patients. Current resistance to some drugs such as Amikacin, Nitrofurantoin and Gentamicin is low; however we should be aware of the increasing resistance of these drugs in future.

Conclusion

The emergence and spread of resistance to various antibiotics in E.coli which cause UTI is an example of ongoing global problem of antimicrobial resistance. Ultimately control depend on a multidisciplinary and worldwide approach to the problem, including reduced and judicious use of antimicrobial agents in humans as well as in animals. The alarming reports of community acquired UTI caused by Fluoroquinolone resistant E.coli strains in some parts of the world suggests that we will see an evolution of resistance to these agents just as reported in literature with Sulfonamides, Ampicillin etc., unless we take a much more aggressive approach to the control of antimicrobial resistance. After Amikacin, Nitrofurantoin is highly active against E. coli followed by others. seven days therapy may be required to achieve reasonable cure rates with this drug. Thus nitrofurantoin can be considered as first line empirical treatment for uncomplicated UTI.^{20, 21,}

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