

Prevalence of Escherichia Coli in Urine Samples in a Tertiary Care Hospital

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1. Introduction

Urinary tract infection (UTI) is defined as the microbial invasion of genitourinary tract. It is a bacterial infection that affects any part of the urinary tract. UTI is the most prevalent infections worldwide with a high global burden¹. UTI is known to affect approximately 150 million people each year and is responsible for approximately seven million doctor visits per year^{2,3}.

UTI can be caused by Gram negative bacteria such as Escherichia coli, Klebsiella species, Enterobacter species, Proteus species and Gram positive bacteria like Enterococcus species and Staphylococcus saprophyticus.

Escherichia coli, the most prevalent facultative gram negative bacillus in the human fecal flora, usually inhabits the colon as an innocuous commensal. UTIs are the most common form of the extraintestinal Escherichia coli infections and Escherichia coli is the most common cause of UTIs.

At some point of their lives, at least 12% men and 10-20% women experience an acute symptomatic UTI and even greater numbers develop asymptomatic bacteriuria^{4,5}.

UTI is divided into two broad categories.

- 1) Lower UTI
- 2) Upper UTI.

The lower UTI is mainly due to the ascending infection caused by faecal coliforms and it causes Urethritis, cystitis and Prostatitis. Upper UTI involves the Kidney (Pyelitis & Pyelonephritis). Pyelonephritis is through hematogenous spread of infection. Incidence of UTI is more in females as compared to males due to shorter urethra and proximity to anus. In elderly males, UTI due to enlarged prostate is very common. Other causes of UTI includes pregnancy, prostatic hypertrophy, reflux of urine from bladder upto the ureters and into renal pelvis, neurogenic bladder dysfunction, multiple sclerosis etc⁶

E.coli cause about 90% of first episode of UTI in children⁷. Uropathogenic Escherichia coli (UPEC) has several virulence factors that enables it to colonize bladder mucosa and injure it leading to inflammatory changes.

Extended spectrum β lactamase (ESBL) producing bacilli from the family Enterobacteriaceae are increasingly identified as chief pathogens having become endemic in many healthcare settings. The prevalence of ESBL

producing strains among Gram Negative Bacilli varies widely depending upon the clinical setting and the geographic area. The increasing incidence of ESBL producing organisms are mainly seen in old age population, patients who are severely ill and urinary tract infections, patients with indwelling urinary catheter, malignancy, patients who have a long stay in hospital wards and intensive care units (ICU), patients who are functionally dependent. Infections due to ESBL producing organism increase the treatment cost and also mortality and morbidity.

In the current scenario, drug resistant pathogens carry higher morbidity and mortality and also they are difficult to identify by routine laboratory methods and hence the diagnosis is delayed and finally there is delay in administration of appropriate anti-microbial therapy. The major concern is the lack of new antibiotics for multi drug resistant strains of uropathogenic E.coli that produces ESBL. In June 2010 the Infectious Disease Society of America (IDSA) gave testimony before the house committee on energy and commerce subcommittee on health, on the critical need for antimicrobials and urgent necessity of research and development in newer therapy.

According to Rishi H.P, Dhillon et al, risk factors for acquiring community associated UTI include recurrent UTI, previous antibiotic usage, diabetes mellitus, prior instrumentation to urinary tract, female sex and age over 65 years⁸. Complications have increased because ESBL producing pathogens are resistant to most commonly prescribed empiric therapy antibiotics.

Despite widespread availability of antibiotics, UTI is considered to be the most common infectious disease in clinical practice in developing countries, with incidence of 250 million people are affected worldwide⁹. Long term UTI leading to immunological and inflammatory response causing renal injury and scarring, which leads to end stage renal failure. Obstructive uropathy, renal calculi, vesico urethral reflex disease and voiding disorders leads to stasis of urine and becomes a predisposing factor of recurrent UTI and its complications. It is estimated that nearly 10% of human population experience UTI in their lifetime¹⁰. Since antibiotics are empirically used before urine culture report an increasing antibiotic resistance in uropathogens are reported.

Liberal use of Fluoroquinolones and β lactams have triggered bacterial resistance worldwide. Due to rapidly evolving adaptive microorganisms the etiology of UTI and the antibiotic resistance profile of uropathogens has changed

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considerably over the past years, both in community and nosocomial infection .

ESBL

The first ESBL producing organism was detected in Europe in 1983. ESBL is primarily produced by Enterobacteriaceae family of Gram negative organism particularly E.coli and Klebsiella species.

ESBL's are defined as Beta lactamases capable of hydrolyzing oxyiminocephalosporins .ESBL are chromosomal or plasmid mediated β lactamases which have mutated from pre existing broad spectrum β lactamases (TEM-1,TEM-2,SHV-1) as a consequence of widespread use of 3rd generation Cephalosporins as well as Aztreonam^(11,12). ESBL's may be inhibited by β lactamase inhibitors such as Clavulanic acid or Sulbactam. However,several inhibitor-resistant ESBL producers are also encountered, by virtue of Amp-C lactamase hyper production or loss of porin¹³. Production of ESBL enzymes confers multiple drug resistance, making infections difficult to treat .Patients admitted to hospitals are more likely to serve as reservoirs for these resistant organisms and eventually, the patients in the community acquire ESBL-producing strains¹⁴.

Study of drug resistance among uropathogens has recently gained importance since the mechanism of resistance of ESBL production may vary. Moreover, the vast number of species included in the family enterobacteriaceae further adds to the diagnostic and clinical complications associated with UTI's. ESBL-producing genes are normally harbored on plasmids 80kb in size or larger and most often carry resistance determinants for Aminoglycosides, Fluoroquinolones, Tetracyclines, Chloramphenicol and even Cotrimoxazole, making the microorganisms resist a wide variety of drugs¹⁵. ESBL production confers resistance to all the beta-lactam antibiotics except Carbapenams and Cephamycins.

The effectiveness of an antibiotic administered to a patient depends on the site and severity of the infection, liver and renal function, presence of implants and local resistance patterns. It is also believed that the age and pregnancy in the patient determine the effectiveness of the antibiotic used ¹⁵.

Since β-lactam antibiotics are still widely used, emergence of β-lactamase produces has become a matter of serious concern. The various mechanisms of drug resistance in gram negative bacilli include production of β-lactamases, AmpC lactamases, Efflux mechanisms and Porin deficiency.

The present study is taken up to study the prevalence of Uropathogenic E.coli and its antibiotic susceptibility pattern with special reference to ESBL.

2. Observation and Results

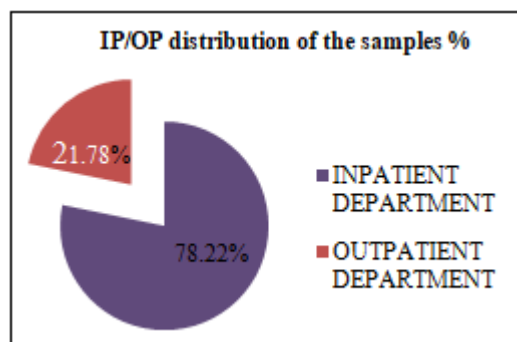
The study was carried out in the Central laboratory Department of Microbiology Sree Balaji Medical College and Hospital, Chrompet, Chennai for a period of one year from August 2017 to August 2018. A total of 3580 urine samples was received in Central lab during the study period

and the samples were analyzed for the prevalence of Escherichia coli and its antimicrobial susceptibility pattern.

Out of a total of 3580 urine samples received , majority of the samples were from inpatient departments (2800) while 780 samples were from outpatient.

Table 7: IP/OP distribution of the samples

S.NO	IP/OP	Total	Percentage %
1.	Inpatient Department	2800	78.22%
2.	Outpatient Department	780	21.78%
		3580	



Out of the total 3580 urine samples received in the Central lab, **987** samples (27.56%) showed No growth, **1786** (49.88%) showed growth of Gram negative bacilli and **807** (22.54%) showed Gram positive cocci.

S.No	Growth	Number of samples
01	No growth	987
02	Gram Positive cocci	807
03	Gram Negative bacilli	1786
	Total	3580

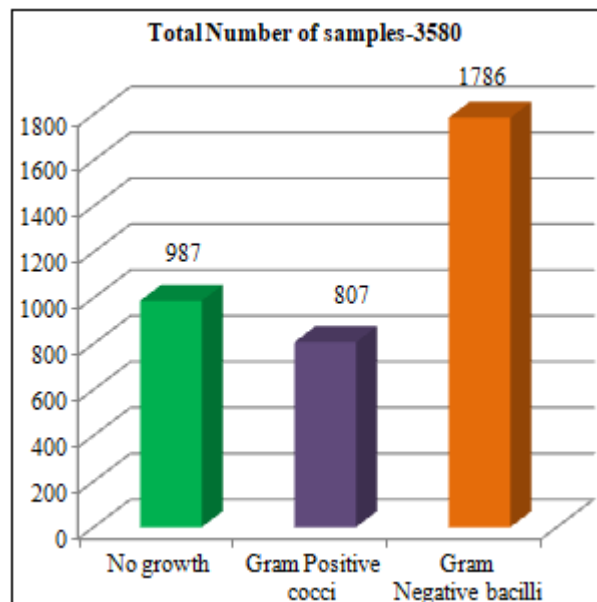


Table 8 : Distribution of Pathogens in UTI

S.No	Oraganism	Frequency (n=2593)	Percentage (%)
1.	Escherichia coli	1081	41.7%
2.	Klebsiella species	520	20%
3.	Pseudomonas aeruginosa	155	6%
4.	Proteus species	104	4%

5.	Citrobacter koseri	39	1.5%
6.	Enterobacter	33	1.3%
7.	Acinetobacter	52	2%
8.	Staphylococcus aureus	259	10%
9.	CoNS	311	12%
10.	Enterococcus species	39	1.5%
	Total	2593	100 %

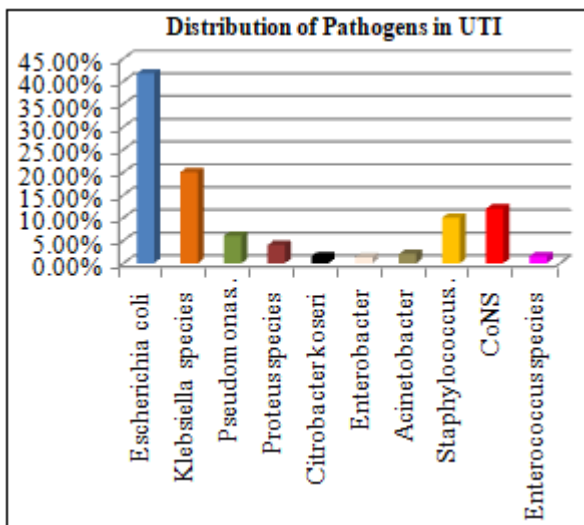


Table: Comparison of Common organisms causing UTI

Organisms	Latin America ¹⁶	India ²	Tamilnadu ¹⁸	Present study
E.coli	60.4%	61%	30.2%	41.7%
Klebsiella	11.1%	22%	22%	20%
Pseudomonas	8.3%	4%	12.35%	6%
Acinetobacter	10%	3%	8.3%	2%
Proteus	4.6%	-	6.7%	4%
Enterobacter	14%	-	35%	1.3%
Citrobacter	7%	2%	2.5%	1.5%
ConS	-	7%	5%	12%
Enterococcus	2.3%	1%	9.5%	1.5%

In the present study, E.coli (41.7%) was the commonest organism isolated from urine samples among UTI patients followed by Klebsiella (20%), Cons (12%) and the least isolated was Enterobacter, Citrobacter, Enterococcus and Acinetobacter with prevalence of 1.3%, 1.5%, 1.5% and 2% respectively. These results were in agreement with the results obtained from other studies conducted worldwide which approved that E.coli is the major pathogen that cause UTIs. As E.coli is a major normal flora in the gut and most of the times poor hygiene will lead to cross contamination and then urinary tract infection.

The study conducted in India by Akram et al² and in Latin America by Ana.C.Gales et al(1998)¹⁶ showed that E.coli was the commonest organism isolated followed by Klebsiella.

In the present Study, only 1.3% of Enterobacter was isolated, but the study conducted by Ana.C.Gales et al (1998)¹⁶ showed prevalence of 14% and Ramesh et al (2008)¹⁸ Tamil Nadu showed 35%.

Worldwide, E.coli was the predominant pathogen isolated from patients with community acquired UTI. The current study shows a prevalence of 41.7% of E.coli isolated from

urine samples of patients suffering from urinary tract infections. This result is in agreement with different studies conducted worldwide. Mohanthy et al 2005¹⁹ documented a prevalence rate of 46% E.coli in New Delhi among UTI patients while a study conducted by Baby Padmini and Appalaraju in Chennai in 2004 showed a prevalence similar to our present study (49.3%)²⁰.

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