

Original Research Article

<http://dx.doi.org/10.20546/ijcmas.2016.508.025>

Bacteria Associated with Urinary Tract Infection (UTI)

Neelam Tia^{1*} and Moti Lal²

¹Department of Medicine, Institute of Medical Science BHU, Varanasi, India

²School of Biochemical Engineering IIT- BHU Varanasi, India

*Corresponding author

ABSTRACT

Keywords

Bacterial agents,
Urinary Tract
Infection,
Antimicrobial
susceptibility.

Article Info

Accepted:
12 July 2016
Available Online:
10 August 2016

In the present study, approximately 300 patients (male and female) have been taken for observation; with clinical symptoms of UTI will require antimicrobial treatment. There were 197(50.7%) females and 103 (40.3%) males, with an age range of 28-60 years (mean, 43.7 years). *Escherichia coli* were observed to be the most common cause of UTIs patients. Most microorganisms occurring in UTIs are found to show maximum sensitivity against nitrofurantion and minimum sensitivity against norfloxacin.

Introduction

Urinary tract infection (UTI) is the second most common infectious presentation in community medical practice. Worldwide, about 150 million people are diagnosed with UTI each year, and UTI are classified as uncomplicated or complicated. A UTI is an infection in the urinary tract. Infections are caused by microbes-organisms too small to be seen without a microscope—including fungi, viruses, and bacteria. Bacteria are the most common cause of UTIs. Normally, bacteria that enter the urinary tract are rapidly removed by the body before they cause symptoms. However, sometimes bacteria overcome the body's natural defenses and cause infection. An infection in the urethra is called urethritis.

A bladder infection is called cystitis. Bacteria may travel up the ureters to multiply and infect the kidneys. A kidney infection is called pyelonephritis (Stamm and Norrby, 2001).

Urinary tract infection (UTI) is an extremely medical problem and about 80% UTI caused by *Escherichia coli*. In UTI bacteria that affects any part of the urinary tract. Urinary tract infection is caused by pathogenic invasion of the urinary tract, which leads to an inflammatory response of the urothelium. Since bacteria can enter the urinary tract through urethra (an ascending infection), poor toilet habits can predispose to infection.

UTIs are most common in sexually active women, increase in diabetic patients and people with sickle cell disease or anatomically malformation of urinary tract; other factors for UTI are an enlarged prostate gland in men, pregnancy in women raising the risk of infection. Patient with indwelling bladder catheter are predisposed to bacteriuria and UTIs. The most common type of UTI is bladder infection which is often called *cystitis* and another kind of UTI is a kidney infection, known as *pyelonephritis*, and is much more serious. Infection may be acute or chronic. Although they cause discomfort, UTIs can usually be quickly and easily treated with a short course of antibiotics. Women are more prone to UTIs than men because in females, the urethra is much shorter and closer to the anus in comparison to males and they lack bacteriostatic properties of prostatic secretion (Hooton 2000). Urinary tract infection may involve only the lower urinary tract or both the upper and the lower tracts. The term *cystitis* has been used to describe the syndrome involving dysuria, frequency, and occasionally suprapubic tenderness. Acute *pyelonephritis* describes the clinical syndrome characterized by flank pain or tenderness, or both, and fever, often associated with dysuria, urgency, and frequency (Mandell *et al.*, 2005). More than 95% of urinary tract infections are caused by a single bacterial species. *E. coli* is the most frequent infecting microorganism in delicate to the infection (Jellheden *et al.*, 1996, Ronld, 2005). *Klebsiella*, *Staphylococci*, *Enterobacter*, *Proteus*, *Pseudomonas*, and *Enterococci* species are more often isolated from inpatients, whereas there is a greater preponderance of *E. coli* in an outpatient population (Bronsema *et al.*, 1993). *Corynebacterium urealyticum* has been recognized as an important nosocomial pathogen (Soriano *et al.*, 1990). Anaerobic organisms are rarely pathogens in the

urinary tract (Jacob, 1996). Coagulase Negative *Staphylococci* are a common cause of urinary tract infection in some reports. *Staphylococci saprophyticus* tends to cause infection in young women of a sexually active age (Schneider and Riley, 1996).

Materials and Methods

Sampling

In total, 300 patients with clinical symptoms of UTI referred to Chhatrapati Shahuji Maharaj Medical University (CSMMU) Lucknow were studied. There were 197(50.7%) females and 103 (40.3%) males, with an age range of 28-60 years (mean, 43.7 years). Clean-Catch midstream urine of the Patients was collected in a sterile tube (5-10 ml) and immediately transported to the laboratory. Guidelines for proper specimen collection were given to all patients on a printed card (Forbes *et al.*, 2007).

Antimicrobial susceptibility testing

In the present study antimicrobial susceptibility testing was done on Mueller-Hinton agar (Merck, Germany) using disk diffusion (Kirby Bauer's) technique. This method was done according to Clinical and Laboratory Standards Institute (CLSI) guidelines to determine susceptibility of UTIs agents (MacFaddin, 2000) Disks diffusion method was used to check antimicrobial activity of tested antibiotics and different disks were loaded with varying concentration of Cefoperazone, Norfloxacin, Nitrofurantion, and gentamicin. Concentration of each antibiotic was kept at 100 µg (Foxman, 2002).

Bacterial colony count of bacteria in UTI

A calculated quantity of urine, using calibrated loop method was inoculated to

nutrient agar medium (Merck, Germany) for colony count. Equivalent or more than 10⁸ CFU/ml of a single potential pathogen or for each of two potential pathogens Interpreted as positive UTI and a result of 10⁰-10⁸ CFU/ml was continual. A less than 10⁰ CFU/ml was interpreted as negative UTI (Schneider and Riley, 1996) Urine specimens were cultured for isolation of the microbial agents of UTI on blood agar and MacConky agar media. All the bacteria isolated from urine in this study were identified using conventional biochemical tests (Mandell *et al.*, 2005; Forbes *et al.*, 2007; MacFaddin, 2007).

In this present study 46.60% (in female) sterile urine were found out of 300 patient and 42.77 % in case of male. And total 43.57 % patient urine was found in sterile condition, 5.82% urine was contaminated in case of female and 14.45% in male. *Candida* species was found only in female patient and not in male. 41.74% urine generally infected by bacteria in male and 38.15% bacterial infection was found in female urine.

In case of other experiment condition

27.90% pyuria have been found in urine of male patient, 24.24% in Female patient. Finally 25.68% pyuria found in out of 300 patients.

In this study, 140(48%) patients out of 300 were showed to be urine culture positive (their colony count was equal or more than 10⁴). There were 197(50.7) females and 103(49.3) males in in patients with urine positive culture gram negative bacilli isolated accounted for 522(94.4%) of the positive cultures, while Gram-positive cocci were 5.6%. The frequency of isolated microorganisms and their relation to sex is given in table 03. The most common isolated uropathogens in Gram-negative bacilli and Gram-positive cocci were *E. coli* (51.37%) and coagulated negative Staphylococci (13.63%) respectively. In this study, the incidence of UTI was ranged in patients between 15-60 (mean, 43.7) years old. The isolated bacterial showed wide differences in their susceptibility to the tested antimicrobial antibiotics. The relation between antimicrobial sensitivity patterns of the isolated bacteria in urine of the population studied is presented in Figure 2.

Table.1

Conditions	No. Isolated (%)		
	Male	Female	Total
Pyuria	27.90%	24.24%	25.68%

Table.2 Antibiotic sensitivity of *Pseudomonas* associated with UTI

Drugs	Concentration (µg)	Disc diffusion method	
		Sensitive %	Resistant %
Piperacillin/Tazobactam	110	99.8%	0.2%
Norfloxacin	10	0.2%	99.8%

Fig.1

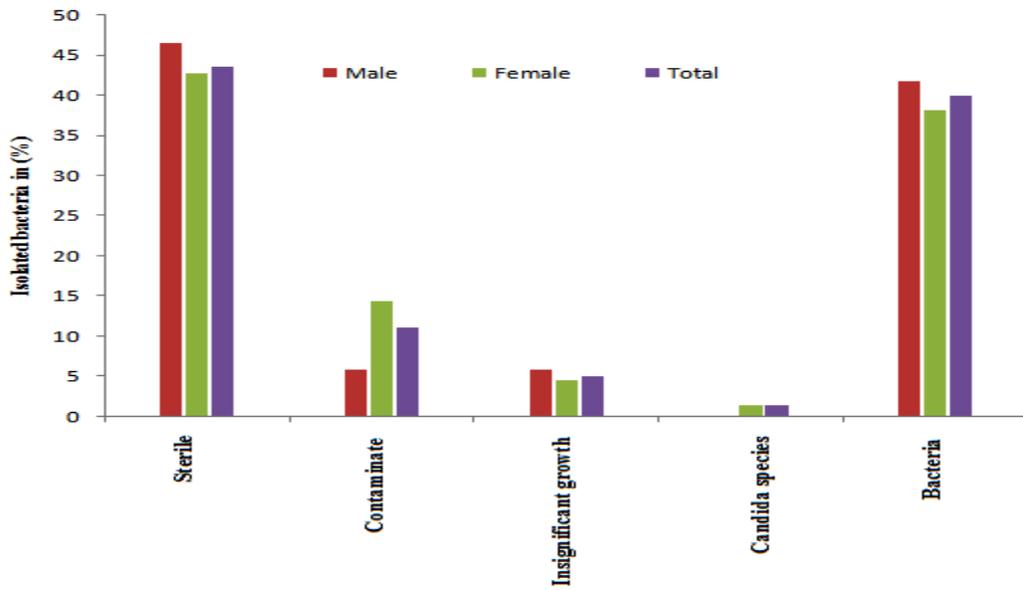


Fig.2 Percentage of different bacteria obtained in urine sample

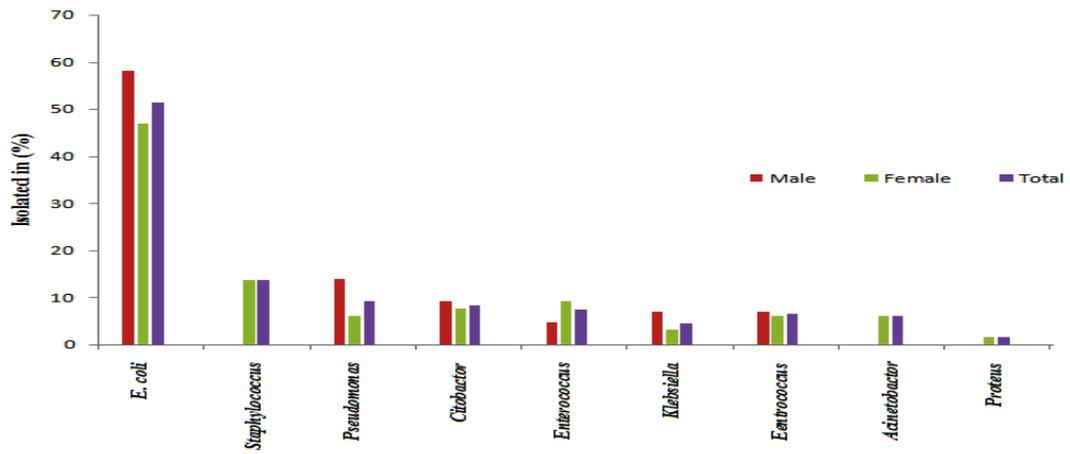


Fig.3 Antibiotic sensitivity of E. coli associated with UTI

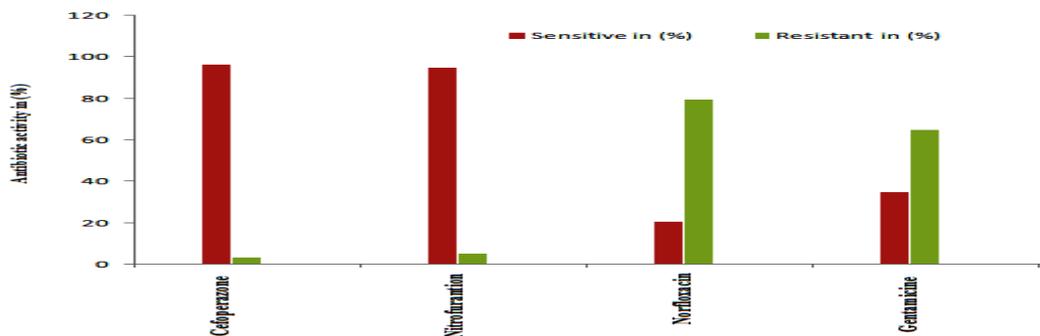


Fig.4 The percentage of UTI on the basis of Age in females and males

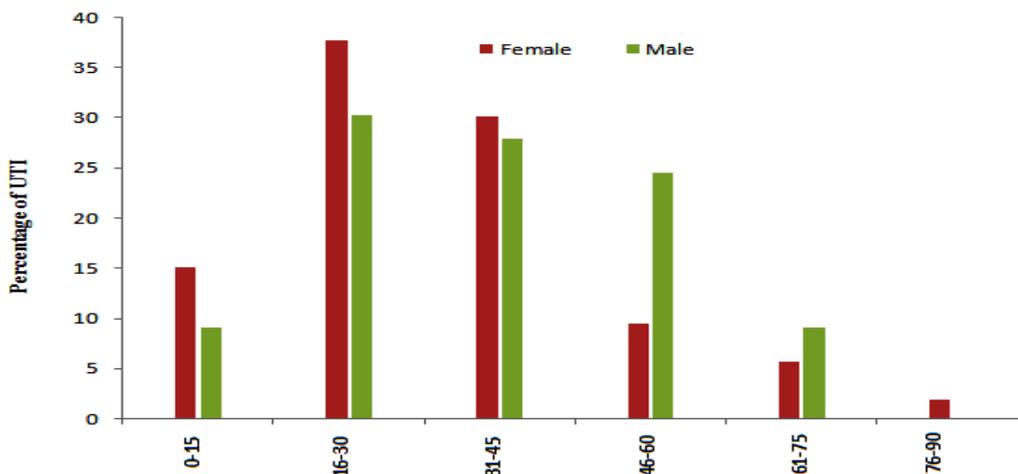
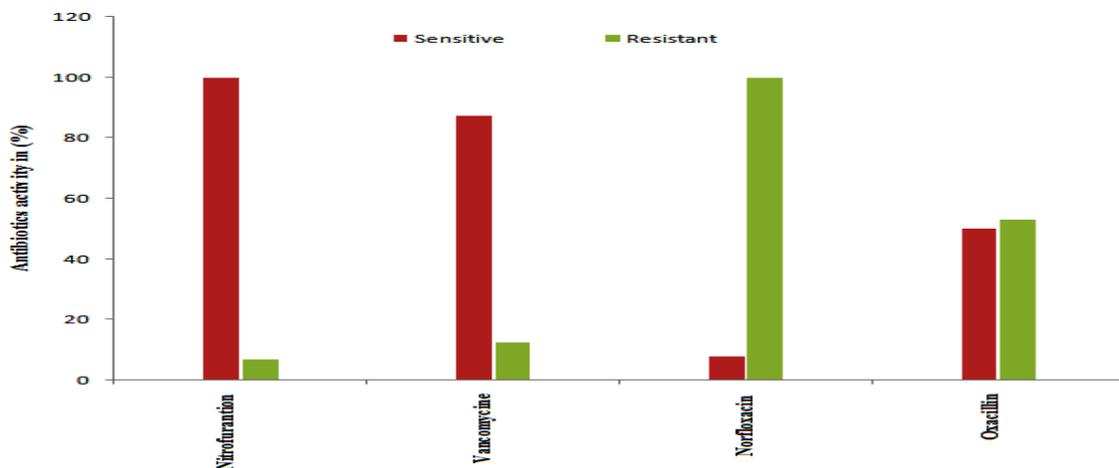


Fig.5 Antibiotic sensitivity of Staphylococcus associated with UTI



Antibiotic sensitivity of *E. coli* associated with UTI

Based on results obtained from susceptibility testing (Figure 4), all the bacteria recovered from UTI showed the highest degree of resistance to ampicillin, cephalothin. The Gram-negative bacilli isolated from UTI were sensitive to amikacin and, ciprofloxacin (83%- 100%), and Gram-positive cocci were sensitive to Cefoperazone and Sulbactam (near about 100%). The Piperacillin was more effective against *Pseudomonas* spp. And

Acinetobacter spp. isolated in present study. *E. coli* showed that this bacterium was sensitive to Nitrofurantoin, piperacillin, amikacin, (90.5%).

Most of the isolated bacteria in this study were resistant to norfloxacin (92.8%), oxacillin (50%), and vancomycin (12.5%). And most of isolate bacteria show the sensitivity against to the Nitrofurantoin drugs (99.8%), vancomycin (87.5%), and oxacillin (50%).

Result and Discussion

On the basis of graph, women between the ages of 15-45 years have UTI, (67.91%) because at this age females are sexually active, most of the females are community acquired (Kothari and Sagar, 2008). The other predisposing factors for UTI in women are diabetes, urethral catheterization, pre & post -menopausal, delay voiding, wiping pattern and having a mother with a history of previous UTI. In men, UTI increases (57.57%) between 30-60 years the percentage of UTI in males is higher and nearer to female's percentage because most of the male patients are hospital acquired (Zhanel *et al.*, 2005).

Although sexual intercourse doesn't seem to be common predisposing factor. Prostatic obstruction and instrumentation become major cause of infection among middle aged and older men. In older population, the role of sexual and contraceptive practice decrease and the other factor may become relatively more important (McIsaac *et al.*, 2004). Urinary tract infections are common conditions worldwide and the pattern of antimicrobial resistance varies in different regions. However, isolated Gram-positive cocci were fully sensitive to Oxacillin, Tazobactam and Norfloxacin. This study is comparable with the results reported by (Astal *et al.*, 2002; McIsaac *et al.*, 2004).

The high prevalence of resistance to the commonly used antibiotics such as ampicillin, cephalothin and tetracycline has caused considerable alarm (Nurullaev 2004, orrett and Davis, 2006). We describe the relationships between sex, isolated bacterial agents and antibiotic resistance of UTIs. The study was confined to UTIs in adults. In the United States, UTIs account for seven million office visits and 100,000 hospitalizations yearly, making them the

most common bacterial infections in outpatient settings.

In conclusion, the higher incidence of UTI in females reflects the shorter urethra and lack of prostate. The increased incidence of UTI in the teens represents urethral trauma due to sex ; the general increase with advancing old age reflects obstruction, cystocele etc. Below age 50, UTI is almost entirely a disease of females. The only afflicted male has abnormal anatomy.

Acknowledgement

The authors would like to thank Chhatrapati Shahuji Maharaj Medical University (CSMMU) Lucknow for providing necessary facility in this project.

References

- Astal, Z.Y., Sharif, F.A. 2002. Relationship between demographic characteristics and community-acquired urinary tract infection. *EMHJ*. 8(1): 164-71
- Bronsema, D.A., Adams, J.R., Pallares R. 1993. Secular trends in rates and etiology of nosocomial urinary tract infections at a university hospital. *J. Urol.*, 150: 414- 6.
- Foxman, B. 2002. Epidemiology of urinary tract infections: incidence, morbidity, and economic costs. *Am. J. Med.*, 113(suppl): 5S-13S.
- Foxman, B. 2003. Epidemiology of urinary tract infections: incidence, morbidity, and Economic costs. *Dis. Mon.*, 49: 53-70.
- Forbes, B.A., Sahm, D.F., Weissfeld, A.S. 2007. Bailey and Scott's Diagnostic microbiology, 12th edition, Mosby Elsevier. 842-55.
- Hooton, T.M. 2000. Pathogenesis of urinary tract infections: an update. *J. Antimicrob. Chemother.*, 46: 1- 7.
- Jellheden, B., Norrby, R.S., Sandberg, T.

- 1996 Symptomatic urinary tract primary health care: Bacteriological, clinical and diagnostic aspects in relation to host Response to infection. *Scand J. Prim. Health Care*, 14: 122-8.
- Jacobs, L.G. 1996 Fungal urinary tract infections in the elderly: Treatment guidelines. *Drugs Aging*, 8: 89-96.
- Kothari, A., Sagar, V. 2008. Antibiotic resistance in pathogens causing community-acquired urinary tract infections in India: a multi center study. *J. Infect. Developing Countries*, 2(5): 354-8.
- Mandell, G.L., Bennett, J.E., Dolin, R. 2005. Principles and practice of infectious diseases. *Churchill Livingstone*. 881-882.
- McIsaac, W.J., Mazzulli, T., Moineddin, R., Raboud, J., Ross, S. 2004. Uropathogen antibiotic resistance in adult women presenting to family physicians with acute uncomplicated cystitis. *Can. J. Infect. Dis. Med. Microbiol.*, 15: 266-70.
- MacFaddin, J.F. 2000. Biochemical tests for identification of medical bacteria. 3rd ed. Philadelphia: Lippincott Williams and Wilkins.
- McIsaac, W.J., Mazzulli, T., Moineddin, R., Raboud, J., Ross, S. 2004. Uropathogen Antibiotic resistance in adult women presenting to family physicians with acute uncomplicated cystitis. *Can. J. Infect. Dis. Med. Microbiol.*, 15: 266-70.
- Nurullaev, R.B. 2004. The role of Asymptomatic bacteriuria in epidemiologic study the urinary tract infection (UTI). *Lik Aprava*, 7: 23-5.
- Orrett, F.A., Davis, G.K. 1999 A comparison of antimicrobial susceptibility profile of urinary pathogens for the years. *West Indian Med. J.*, 55(2): 95-98.
- Ronald, A. 2002. The etiology of urinary tract infection: Traditional and emergin pathogens. *Am. J. Med.*, 113: Suppl 1A: 14S-9S.
- Soriano, F., Aguado, J.M., Ponte, C. 1990. Urinary tract infection caused by *Corynebacterium* group D2: Report of 82 cases and review. *Rev. Infect. Dis.*, 12: 1019-34.
- Stamm, W.E., Norrby, S.R. 2001. Urinary tract infections: disease panorama and Challenges. *J. Infect. Dis.*, 183.
- Schneider, P.F., Riley, T.V. 1996. *Staphylococcus saprophyticus* urinary tract infections: Epidemiological data from Western Australia. *Eur. J. Epidemiol.*, 12: 51-4.
- Zhanel, G.G. 2005. Antibiotic resistance in outpatient urinary isolates: final results from the North American urinary tract infection collaborative alliance (NAUTICA). *Int. J. Antimicrob. Agents*, 26: 380-8.

How to cite this article:

Neelam Tia and Moti Lal. 2016. Bacteria Associated with Urinary Tract Infection (UTI). *Int.J.Curr.Microbiol.App.Sci*. 5(8): 248-254. doi: <http://dx.doi.org/10.20546/ijcmas.2016.508.025>