



Original Research Article

Prevalence and Distribution of Bacterial Pathogens Causing Urinary Tract Infections in Humans: A Study from Tertiary Care Hospital in AP, India

Maria Sindhura John*, K.Meenakshi, P.Muni Lakshmi and P.Sreenivasulu Reddy

Department of Microbiology, Narayana Medical College, Nellore, A.P, India

*Corresponding author

ABSTRACT

Urinary tract infections are most common infection caused by bacterial pathogens seen mostly in developing countries. It is one of the common clinical conditions in the patients presenting to the hospitals. Causative agents vary from place to place. Studies are done to know the most common pathogen of urinary tract infections. This study is also done to give the complete bacteriological profile of pathogens causing urinary tract infection, which is helpful to the clinicians. A total of 200 mid-stream urine samples collected from the suspected UTI patients were tested microbiologically on CLED agar, a non-inhibitory growth medium used in the isolation and differentiation of urinary organisms. Clean catch midstream urine samples were collected from 200 patients of the age ranging from <20 to >80 years. The rate of culture positivity in females was 91.6% and in males was 40.3%. *E. coli* was the most frequently isolated urinary pathogen (42.8%), followed by *Klebsiella* (16.8%) and *Acinetobacter* (12.9%). Higher prevalence of UTI was seen in females. Gram negative organisms were the most commonly isolated in UTI than gram positive organisms. Among which *E. coli* is most commonly isolated organism followed by *Klebsiella* and *Acinetobacter*.

Keywords

Urinary tract infections,
Bacterial pathogens,
Midstream,
Prevalance,
CLED

Introduction

A urinary tract infection, or UTI, is an infection of the urinary tract. The infection can occur at different points in the urinary tract. An infection in the bladder is also called cystitis or a bladder infection. An infection of one or both kidneys is called pyelonephritis or a kidney infection. The tubes that take urine from each kidney to the bladder are only rarely the site of infection. An infection of the tube that empties urine from the bladder to the outside is called urethritis.

Urinary tract infections are the most common infections in clinical practice (Noor *et al.*, 2004) Urinary tract infection (UTI) is one of the most important causes of morbidity in the general population, and is the second most common cause of hospital visits (Ronald and Pattulo, 1991)

Uncomplicated UTIs typically occur in the healthy adult non-pregnant woman, while complicated UTIs (cUTIs) may occur in all sexes and age groups and are frequently

associated with either structural or functional urinary tract abnormalities. Examples include foreign bodies such as calculi (stones), indwelling catheters or other drainage devices, obstruction, immunosuppression, renal failure, renal transplantation and pregnancy (Lichtenberger and Hooton, 2008)

UTI is described as a bacteriuria with urinary symptoms (Zelikovic *et al.*, 1992). The lower UTI infection is characterized by symptoms such as dysuria, frequency, urgency, and suprapubic tenderness (Sobel and Kaye, 2010).

UTI is more common in females than in males as female urethra structurally found less effective for preventing the bacterial entry (Warren *et al.*, 1999). It may be due to the proximity of the genital tract and urethra (Schaeffer *et al.*, 2001) and adherence of urothelial mucosa to the mucopolysaccharide lining (Akortha and Ibadin, 2008). The other main factors which make females more prone to UTI are pregnancy and sexual activity (Salek, 1992). In pregnancy, the physiological increase in plasma volume and decrease in urine concentration develop glycosuria in up to 70% women which ultimately leads to bacterial growth in urine (Lucas and Cunningham, 1993). Also in the nonpregnant state the uterus is situated over the bladder whereas in the pregnant state the enlarged uterus affects the urinary tract (Warren *et al.*, 1982). Sexual activity in females also increases the risk of urethra contamination as the bacteria could be pushed into the urethra during sexual intercourse as well as bacteria being massaged up the urethra into the bladder during child birth (Ebie *et al.*, 2001; Kolawole *et al.*, 2009).

Using a diaphragm also causes UTI as it pushes against the urethra and makes the

urethra unable to empty the bladder completely and the small concentration of urine left in the bladder leads to the growth of bacteria which ultimately causes UTI (Okonko *et al.*, 2009).

UTI is frequently encountered in patients with diabetes and in those with structural and neurological abnormalities, which interfere with urinary flow. The prevalence in both out and hospital patients with UTI is increasing and can vary according to geographical and regional location (Arul *et al.*, 2012)

The aim of the study is to determine the prevalence of UTI in male and female patients as well as the effect of gender and age on its prevalence. The UTI-causing microorganisms, their distribution among different ages and genders, also be determined.

The quantitative criterion appropriate for the microbiological identification of significant bacteriuria is generally considered to be at least 10^8 cfu/L. In some specific groups it is less: for men $\geq 10^6$ cfu/L; and for women with symptoms of UTI it is $\geq 10^5$ cfu/L (Scottish Intercollegiate Guidelines Network, 2006).

The most common pathogenic organisms of UTI are *Escherichia coli*, *Staphylococcus saprophyticus* and less common organisms are *Proteus sp.*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Enterococci* and *Candida albicans* (Mathai *et al.*, 2001). Although a broad range of pathogens can cause UTI, *Escherichia coli* remains the most common; however, even this organism is becoming resistant to the agents that are normally prescribed.

Drugs commonly recommended for simple UTIs are Sulfamethoxazole-trimethoprim

(Bactrim, Septra, others) Amoxicillin
(Amoxil, Augmentin, others) Nitrofurantoin
(Furadantin, Macrochantin, others)
Ampicillin, Ciprofloxacin (Cipro),
Levofloxacin (Levaquin)

Usually, symptoms clear up within a few days of treatment. But you may need to continue antibiotics for a week or more. Take the entire course of antibiotics prescribed by your doctor to ensure that the infection is completely gone.

Material and Methods

This prospective study was conducted over a period of six months. During this period a total of 200 urine samples were collected in sterile containers from suspected urinary tract infected cases from different clinical departments in Narayana Super speciality Hospital, Nellore, A.P. Work is carried out in Department of Microbiology, Narayana Medical College, Nellore, AP.

Mid-stream urine samples from the suspected UTI patients referred by physicians are taken. The urine samples were collected into labelled 20ml calibrated sterile bottles distributed to the patients by the attending physicians suspected to have UTIs. In each container, boric acid (0.2 mg) was added to prevent the growth of bacteria in the urine. All patients were instructed on how to collect the urine samples aseptically and taken to the laboratory immediately for culture.

The collected urine samples were inoculated on CLED (cysteine lactose electrolyte deficient agar) agar plates and cultured media were incubated aerobically at 37°C. The urine culture plates were examined for pure growth determined by morphologically same type of colonies and colony counts for determination of significant and insignificant growth. A growth of $\geq 10^5$

colony forming units/ml was considered as significant bacteriuria.

Identification of bacterial pathogens was made on the basis of Gram reactions, morphology, biochemical characteristics and cultural characteristics. Gram staining was performed to differentiate the Gram positive and Gram negative organisms.

Results and Discussion

The study was done from January 2014 to June 2014 at the Department of Microbiology, Narayana Medical College, Nellore, AP, India. The name, age, sex and address of the patients was also recorded.

Pathogenic bacteria were isolated in 200 samples with a prevalence rate of 77%. The prevalence in females was 91.6% and the prevalence rate in males was 40.3%, the prevalence pattern in males and females were shown.(Table-1)

A total of 200 samples were collected in the study period. Among which 143 (91.6%) were from females and 57 (40.3%) samples were from males. 131 samples are positive among females and 23 samples are positive among males. Highest number of samples is collected from females (Table 1).

Based on age distribution maximum number of samples collected from 21 to 40 yrs age was 101 samples (50.5%). UTI was most commonly seen in the age group. Minimum number of samples collected from age group >80 were 9 samples (4.5%). Below age group 20 yrs the samples collected were 47 (23.5%) (Table 2).

Among the pathogenic bacteria isolated, *E. coli* was the most frequently isolated urinary pathogen (42.8%), followed by *Klebsiella* (16.8%), *Acinetobacter* (12.9%) and

Candida (11%). *Pseudomonas* and *Proteus* were isolated as 1.9%, 0.6% respectively (Table 3)

Age and gender wise distribution of pathogens causing urinary tract infection is clearly shown. Among the age group 21-40 yrs 87 (86.1%) samples were shown positive. Among them highest positivity is shown by females, 80 samples than males 7samples. Least no. of samples were collected from >80 yrs 3 samples. Among them females showed positivity of 2 samples, while men showed 1 sample (Table 4).

Our study findings are contrary to the belief. Therefore it is recommended that larger sample based studies may be taken up in which may throw better light on bacterial pathogens causing UTI. This prospective study was conducted over a period of six months from January 2010 to June 2012. During this period a total of 200 samples received from various clinical departments were tested for pathogenic bacteria.

In our study the total no. of samples collected was 200 samples. Prevalence rate of isolation of urinary pathogen in our study was 77%. It is similar to the study by (Das RN et al) isolation rate was 71.6% (Das *et al.*, 2006)

In our study UTI was more in females when compared to males. This was seen with other studies by Bashir *et al.* (2008) and Getenet *et al.* (2011) Women are more prone to UTIs than men because, in females, the urethra is much shorter and closer to the anus (Dielubanza and Schaeffer, 2011).

Several reports have indicated that females are more prone to having UTIs than males (Kolawale *et al.*, 2009).

Women's propensity to develop UTIs has also been explained on the basis of certain behavioral factors, including delays in micturation, sexual activity, the use of diaphragms and spermicides (both of which promote colonization of the periurethral area with bacteria). Also, the length of the urethra, the dried environment surrounding the meatus, and the antibacterial properties of prostatic fluid contribute to a lower rate of infection in males.

Higher proportions of patients were seen in the age group between 20–40 years followed by < 20 years age group. This was in consistent with a study by Beyene *et al.* (2011) in which 53.5% was in the age group between 19–39 years.

Susan (2005) who concluded that most uncomplicated urinary tract infections occur in women who are sexually active, with far fewer cases occurring in older women, those who are pregnant, and in men. The incidence of UTI increases in males as the age advances because probably because of prostate enlargement and other related problems of old age.

E. coli was the most common isolated organism in our study with percentage of (42.8%). This was in seen in other studies by Gupta *et al.* (1999), Moges *et al.* (2002), Sibi *et al.* (2011). The second most common isolated pathogen was *Klebsiella* in our study accounting for 16.8%. This was in agreement by Khameneh *et al.* (2009).

Our study provides a bacteriological profile of pathogens causing UTI. It is recommended that it should be included in the proper diagnosis of UTI, so that timely and adequate treatment may be given to patient as delay in treatment is associated complicated UTI.

Table.1 Sex wise distribution

S.No	Sex	No. of samples processed	No. of positive samples	Percentage %
1	MALE	57	23	40.3%
2	FEMALE	143	131	91.6%
	TOTAL	200	154	77%

Table.2 Age distribution

Age	Total samples collected	Percentage%
<20	47	23.5%
21-40	101	50.5%
41-60	27	13.5%
61-80	16	8%
>80	9	4.5%
TOTAL	200	100%

Table.3 Urinary pathogens isolated

Pathogens isolated	Total no. of pathogens	Percentage%
<i>E. coli</i>	66	42.8%
<i>Klebsiella</i>	26	16.8%
<i>Acinetobacter</i>	20	12.9%
<i>Candida</i>	17	11%
<i>Citrobacter</i>	10	6.4%
<i>CONS</i>	6	3.8%
<i>Staphylococcus</i>	5	3.2%
<i>Pseudomonas</i>	3	1.9%
<i>Proteus</i>	1	0.6%

Table.4 Age and gender wise distribution of urinary tract infection

Age	No. of positive samples		Total	Percentage%
	Male	Female		
<20	9	28	37/47	78.7%
21-40	7	80	87/101	86.1%
41-60	5	13	18/27	66.6%
61-80	1	8	9/16	56.2%
>80	1	2	3/9	33.3%
TOTAL	23	131	154/200	77%

References

- Akortha, E.E., Ibadin, O.K. 2008. Incidence and antibiotic susceptibility pattern of *Staphylococcus aureus* amongst patients with urinary tract infection (UTI) in UBTH Benin City, Nigeria. *Afr. J. Biotechnol.*, 7(11): 1637–1640.
- Arul, K.C., Prakasam, K.G., Kumar, D., Vijayan, M. 2012. A cross sectional study on distribution of urinary tract infection and their antibiotic utilization pattern in Kerala. *Int. J. Res. Pharm. Biomed. Sci.*, 3(3): 1125–1130.
- Bashir, M.F., Qazi, J.I., Ahmad, N., Riaz, S. 2008. Diversity of urinary tract pathogens and drug resistant isolates of *Escherichia coli* in different age and gender groups of Pakistanis. *Trop. J. Pharm. Res.*, 7(3): 1025–1031.
- Das, R.N., Chandrashekar, T.S., Joshi, H.S., Gurung, M., Shrestha, N., Shivananda, P.G. 2006. Frequency and susceptibility profile of pathogens causing urinary tract infections at a tertiary care hospital in western Nepal. *Singapore Med. J.*, 47(4): 281.
- Dielubanza, E.J., Schaeffer, A.J. 2011. Urinary tract infections in women. *Med. Clin. N. Am.*, 95(1): 27–41.
- Dielubanza, E.J., Schaeffer, A.J. 2011. Urinary tract infections in women. *Med. Clin. N. Am.*, 95(1): 27–41.
- Ebie, M.Y., Kandaki-Olukemi, Y.T., Ayanbadejo, J., Tanyigna, K.B. 2001. UTI infections in a Nigerian Military Hospital. *Nigerian J. Microbiol.*, 15(1): 31–37.
- Getenet, B., Wondewosen, T. 2011. Bacterial uropathogens in urinary tract infections and antibiotic susceptibility pattern in JIMMA University specialized hospital, Southwest Ethiopia. *Ethiop. J. Health Sci.*, 21(2): 141–146.
- Gupta, K.D., Scholes, W.E., Stamm, 1999. Increasing prevalence of antimicrobial resistance among uropathogens causing acute uncomplicated cystitis in women. *J. Am. Med. Assoc.*, 281: 736–738.
- Khameneh, Z.R., Afshar, A.T. 2009. Antimicrobial susceptibility pattern of urinary tract pathogens. *Saudi J. Kidney Dis. Transpl.*, 20: 251–253.
- Kolawale, A.S., Kolawale, O.M., Kandaki-Olukemi, Y.T., Babatunde, S.K., Durowade, K.A., Kplawale, C.F. 2009. Prevalence of urinary tract infections among patients attending Dalhatu Araf Specialist Hospital, Lafia, Nasarawa State, Nigeria. *Int. J. Med. Med. Sci.*, 1(5): 163–167.
- Kolawole, A.S., Kolawole, O.M., Kandaki-Olukemi, Y.T., Babatunde, S.K., Durowade, K.A., Kolawole, C.F. 2009. Prevalence of urinary tract infections (UTI) among patients attending Dalhatu Araf Specialist Hospital, Lafia, Nasarawa State, Nigeria. *Int. J. Med. Med. Sci.*, 1(5): 163–167.
- Lichtenberger, P., Hooton, T.M. 2008. Complicated urinary tract infections. *Curr. Infect. Dis. Rep.*, 10: 499–504.
- Lucas, M.J., Cunningham, F.G. 1993. Urinary infection in pregnancy. *Clin. Obstet. Gynecol.*, 36(4): 855–868.
- Mathai, D., Jones, R.N., Pfaller, M.A. 2001. Epidemiology and frequency of resistance among pathogens causing urinary tract infection in 1,510 hospitalized patients: a report from the SENTRY Antimicrobial Surveillance Program (North America). *Diag. Microbiol. Infect. Dis.*, 40: 129–136.

- Moges, A.F., Genetu, A., Mengistu, G. 2002. Antibiotic sensitivities of common bacterial pathogens in urinary tract infections at Gondar Hospital, Ethiopia. *East Afr. Med. J.*, 79: 140–142.
- Noor, N., Ajaz, M., Rasool, S.A., Pirzada, Z.A. 2004. Urinary tract infections associated with multidrug resistant enteric bacilli, characterization and genetical studies. *Pak. J. Pharm. Sci.*, 17: 115–123.
- Okonko, I.O., Ijandipe, L.A., Ilusanya, O.A., *et al.* 2009. Incidence of urinary tract infection (UTI) among pregnant women in Ibadan, South-Western Nigeria. *Afr. J. Biotechnol.*, 8(23): 6649–6657.
- Ronald, A.R., Pattulo, M.S. 1991. The natural history of urinary infection in adults. *Med. Clin. N. Am.*, 75: 299–312.
- Salek, S.B. 1992. Infective syndrome in medical microbiology, 4th edn, Pp. 740.
- Schaeffer, A.J., Rajan, N., Cao, Q., *et al.* 2001. Host pathogenesis in urinary tract infections. *Int. J. Antimicrob. Agents*, 17(4): 245–251.
- Scottish Intercollegiate Guidelines Network. 2006. Management of suspected bacterial urinary tract infection in adults. NHS Quality Improvement, Scotland.
- Sibi, G., Devi, A.P., Fouzia, K., Patil, B.R. 2011. Prevalence, microbiologic profile of urinary tract infection and its treatment with trimethoprim in diabetic patients. *Res. J. Microbiol.*, 6: 543–551.
- Sobel, J.D., Kaye, D. 2010. Urinary tract infections. In: Mandell, G.L., Bennett, J.E., Dolin, R. (Eds). *Mandell, Douglas and Bennett's principles and practice of infectious diseases*, 7th edn. Churchill Livingstone, Philadelphia, Pa, USA, Pp. 957–985.
- Susan, A.M.K. 2005. Diagnosis and management of uncomplicated urinary tract infections. *Am. Family Phys.*, 72(3): 451–456.
- Warren, J.W., Abrutyn, E., Richard Hebel, J., Johnson, J.R., Schaeffer, A.J., Stamm, W.E. 1999. Guidelines for antimicrobial treatment of uncomplicated acute bacterial cystitis and acute pyelonephritis in women. *Clin. Infect. Dis.*, 29(4): 745–758.
- Warren, J.W., Tenney, J.H., Hoopes, J.M. 1982. A prospective microbiologic study of bacteriuria in patients with chronic indwelling urethral catheters. *J. Infect. Dis.*, 146(6): 719–723.
- Zelikovic, I., Adelman, R.D., Nancarrow, P.A. 1992. Urinary tract infections in children—an update. *West. J. Med.*, 157(5): 554–561.