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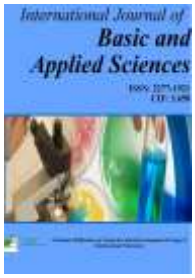

Full Length Research Paper

A Study about Urinary Tract Infection (UTI) Among Patients Attending Tertiary Care Hospital, Dewas, Madhya Pradesh

Rinku Padiyal Gehlot[1*], Dr. Sangeeta Gupta[2] and Dr. Munish Kumar Sharma[3]
[1]PhD Scholar, Department of Microbiology, OPJS University Churu, Rajasthan, India.
[2]Associate Professor, Department of Microbiology, OPJS University Churu, Rajasthan, India.
[3]Associate Professor, Department of Microbiology, Amaltas Institute of Medical Science, (AIMS), Dewas, Madhya Pradesh, India.

ARTICLE DETAILS

Corresponding Author:
Rinku Padiyal Gehlot

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ABSTRACT

Urinary tract infection (UTI) is one of the most prevalent diseases affecting people of all age groups i.e. from neonate to geriatric age group. Women are at greater risk of developing a UTI than are men. If an infection is limited to the bladder, it can be painful and annoying. But serious health problems can result if a UTI spreads to the kidney. The present study was done to study about urinary tract infection among patients attending tertiary care hospital, Dewas, Madhya Pradesh. In present study is a retrospective analysis of culture results of urine samples, was conducted at Microbiology department of tertiary health care hospital in Dewas, Madhya Pradesh. The age & sex of patients, the organism isolated and also the antimicrobial susceptibility profiles were collected from the laboratory registers using a standard data collection form. The overall prevalence of UTI was 73.02% of which 67.12% were females and 32.88% were from males. High prevalence was observed in females as compared to males (2:1). In females high prevalence was seen among middle-aged (31 to 45 years) patients and in male high prevalence was seen among old age (>45 years) patients. From total 739 uropathogens, *E.coli* (54.94%) was the commonest isolate causing UTI followed by *Klebsiella pneumoniae* (26.66%), *Proteus* spp (13.26%), *Psudomonas aeruginosa*(2.84%), *Staphylococcus aureus*(1.76%), *candida* spp and *Entrococcus* spp(0.27%) . In our study, the most effective antimicrobial agents were Nitrofurantoin , Cotrimoxazole , Gentamicin, and Meropenem. Apart from this, the higher resistance observed were Fluoroquinolones, Amoxicillin and third generation Cephalosporins, these are the drugs which is generally given for UTI. As drug resistance among bacterial pathogens is vary with time to time regular surveillance and monitoring is necessary for giving updated information to physician for most effective empirical treatment of urinary tract infection.

1.Introduction

The word Urinary Tract Infection (UTI) is a combined statement describing any form of infection that takes part in the urinary tract. This is usually associated with catheterization or instrumentation of urethra, bladder or kidneys. Urinary tract infection associated with catheterization is named as *catheter associated urinary tract infection* (CAUTI). Infection is caused by

* Author can be contacted at: *PhD Scholar in the Department of Microbiology, OPJS University Churu, Rajasthan (India)*

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E.coli,Klebsiella spp., *Proteus* spp., *Pseudomonas aeruginosa*,*Stapyloccousaureus* and *Candida* spp. Infection can be prevented by strict asepsis during catheterization[1].

E.coli is the commonest organism responsible for UTI. Most frequent O serotypes of *E.coli* causing UTI include 01, 02, 04, 06, 07, 018 and 075. These are also named as nephritogenic strains. Special nephron pathogenic potential of these strains appears to be due to following factors: Polysaccharides of O and K-antigens protect the organism from the bactericidal effects of complement and phagocytes. Strains possessing K1 or K5 antigen appear to be more virulent [1,2]. Fimbriae mediate the adherence of the organism to uro-epithelial cells. The receptor, to which it attaches, is believed to be a part of the P blood group antigen and therefore it is termed as *P fimbriae*[1,3]. E.coli that causes UTI often originates in the intestinal of the patient. Route of infection to reach urinary tract is either the ascending route or the haematogenous route. The ascending route is through faecal flora spreading to the perineum and from there they ascending into the bladder [4]. The other commonly encountered bacteria in UTI are *klebsiella, Proteus, Citrobacter* and those which rarely produce UIT are S*almonellae*, *Edwardsiellae and Enterobacter*. The gram positive organisms that can cause UTI include S*taphylococcus aureus*, coagulase negative staphylococci, *Str.faecalis, Str.pyogenes, Str.milleri, Str.agalactiae, other* streptococci and anaerobic streptococci. Rarely *Gardnerella vaginalis* may cause UTI in immune compromised patients. The hospital-associated infection following instrumentation, catheterization and other procedure, is mostly caused *by Pseudomonas* and *Proteus*[5].

Urinary tract infections (UTI) known as the propagation of active microorganisms within the urinary channel and its causes to the environment. UTI was more frequent in women and frequently present in the bladder or urethra, but extra serious infections engage the kidney. Back pain, nausea, vomiting and fever of symptoms indicates microbes causes UTI part kidney (upper urinary tract), likewise pelvic pain, greater than before urge to urinate, pain with urination and urine with blood are the symptoms signifying the infection of bladder (lower urinary tract)[2,6]. UTI can affect lower and sometimes both lower and upper urinary tracts. The term cystitis has been used to define the lower UTI infection and is characterized by symptoms such as dysuria, frequency, urgency, and suprapubic tenderness. The presence of the lower UTI symptoms doesn't exclude the upper UTI, which is often present in most of the complicated UTI cases [3,7]. The treatment of UTI can be classified into uncomplicated and complicated on the basis of their choice of treatment [8]. UTI is more common in females than in males, since the female urethra is structurally less effective for preventing the bacterial entry [9]. It may be due to the proximity of the genital tract and urethra [11] and adherence of urothelial mucosa to the mucopolysaccharide lining [12].

In the case of uncomplicated UTIs that majorly prevails in healthy persons, and those have no structural, or neurological abnormalities in the urinary tract [13,14]. These infections are further named as lower UTIs (cystitis) and upper UTI (pyelonephritis) [13,15]. In case of cystitis, it remains associated with several risks including sexual activity, female gender, a prior UTI and vaginal infection, diabetes, obesity and genetic susceptibility [15,16]. In case of complicated UTI, they are associated with factors such as compromised urinary tract or host defense, obstruction in urinary tract, neurological disease based urinary retention, renal failure, immunosuppression, pregnancy and installation of foreign material such as calculi, indwelling catheters or any drainage devices [17,18] In the majority of cases, 70- 80% of UTIs are linked with indwelling catheters that accounts for 1 million cases per year [16]. On the basis of symptoms there are two clinical features of UTI, symptomatic and asymptotic infection. Symptomatic infection is associated with significant bacteriuria ($>10^5$ CFU/ ml of urine) with symptoms of UTI(8). In the case of Asymptomatic bacteriuria (ABU), the patient did not represent renal disease or damage. As per studies, patients undergoing treatment of ABU increases their chances of subsequent symptomatic UTIs. Therefore, treatment not recommended except in diagnostic and therapeutic procedures such as entry to the urinary tract with a risk of mucosal damage, endoscopic urological surgery and transurethral resection of the prostate [10,19].The increasing antimicrobial resistance among Gram–negative organism including *E.coli* is a growing public health concern in our country. This indicates the need for continuous monitoring of antimicrobial resistance (AMR) to document any changing trends in our geographical region.

2.Material and Method:

Study was carried out for the detection and prevalence of urinary tract infection causing bacteria from specimens in the microbiology Department of Amaltas Institute of Medical Science(AIMS), Dewas, (M.P.) from December2019 to December 2021. Total 739 microorganisms were isolated for detection and prevalence of UTI in different types of specimens such as midstream urine samples, catheter samples and urine specimens from infants etc. The study design was approved by ethical committee and the protocol of study was reviewed and approved by the research cell of Amaltas Institute of Medical Science (AIMS),Dewas, (M.P.). Ethical committee also acquired the ethical approval.

2.1 Laboratory Diagnosis: Physical examination, Chemical examination, Microscopy andCulture of the urine is necessary for the identification of the organism and its antimicrobial susceptibility test.

2.2 Sample Collection:

2.2.1 Midstream Urine Sample (MUS)

For routine urine examination, the specimen is collected in dry and clean container. For microbiological examination, a midstream specimen is collected in a sterile container (to avoid debris and prostatic secretions). The sterile container can be prepared in the laboratory by sterilizing it in hot air oven at 1600C for 1 hour. The container should be made up of glass with a metal screw cap. It is better to collect the specimen by catheterization in case of culture. Usually the female patient is asked to clean the external genitalia before collection. The first portion of urine adequately flushes out the normal urethral flora. Urine should be examined within 2 hours and if it cannot be examined promptly, must be refrigerated.

2.2.1 Catheter sample:

Urine should be collected directly from catheter and not from the collection bag. The catheter should not touch the container. Although a catheter specimen yields excellent results but catheterization to obtain urine is not justified because of risk of introducing infection.

2.2.1 Urine Specimens from Infants:

A clean catch specimen after cleansing of genitalia is preferred. Another procedure of collecting specimen in infants is suprapubic aspiration. This procedure may also be used in adult women when uncontaminated specimen cannot be obtained by other methods.

2.2.1 Transport and preservation:

As urine is a good culture medium, specimens after collection should reach the laboratory with minimum delay, if this is not possible, the specimen is to be refrigerated at 4°C. It is better to examine fresh specimen because delay in testing may result in some undesirable changes, which affect the test results. If there is a delay in examination, the urine should be refrigerated because it provides bacteriostatic temperature (2-60C). When bacterial growth is not there, urea and glucose in urine are unaffected and thus no change in ph.Various chemicals are used to preserve the urine specimen and are known as preservatives, e.g. formalin, toluene, HCI, boric acid and thymol, etc. This preservation is very important to prevent growth of bacteria, preserving quantity of solutes, and preserving morphology of formed elements.

2.3 Laboratory Methods:

2.3.1 Physical Method:

In physical method, appearance of urine, volume, order, color, specific gravity, osmolality, pH are included.

2.3.2 Chemical method:

In chemical examination, different types of chemicals and reducing substances are checked or examined in patient's urine. These include proteins, glucose, reducing sugars, ketone bodies, bile pigments, calcium, melanin, chloride, homogentisic acid, and amino acid.

2.3.3 Microscopy:

The urine is microscopically examined for cells, casts and crystals. For the microscopic examination, urine is centrifuged at 2,000 rpm for 5 minutes. The supernatant is poured off and by flicking the end of tube with finger, re-suspend in a few drops of urine left. This is placed on the slide and examined. Staining of urine sediment can also be done. This makes possible the recognition of cells, particularly for the inexperienced technicians.

2.3.4 **Culture method:**

CLED agar is used as a single urine culture medium. Alternately, Blood agar and MacConkey agar may also be used. For sensitivity test, Muller Hinton agar is used. Uncentrifuged urine is inoculated on CLED agar alternately, on blood agar and MacConkey's agar. Culture plates are incubated at 37°C for 24 hours. Bacteria isolated on culture are identified. Most laboratories use a semi quantitative method (standard loop technique) for culture of urine specimens.

*2.3.5 Standard Loop Technique***:**

A standard calibrated loop is used to culture a fixed volume of uncentrifuged urine. CLED agar, Blood agar and MacConkey's agar are used and incubated at 37°C for 24 hours. Next day, the number of colonies obtained is counted and the total count per ml is calculated. The fixed volume loop is 4mm in diameter and can hold 0.005 ml urine(i.e.200loopfuls make one ml), the total bacterial count per ml will be number of colonies multiplied by 200. Single bacterium would form a single colony; therefore, the number of colonies shall be equal to number of bacteria present. Kass(1996) gave a criterion of active bacterial infection of urinary tract as follows:

- Count more than 10^5 bacteria of single species per ml: *significant bacteriuria* which indicates active UTI.
- Between 10^4 to 10^5 bacteria per ml is of *doubtful significance*, specimen should be repeated for culture.
- Less than 10^4 bacteria per ml: no *significant growth* but regarded as contaminant.Contamination is also considered when three or more bacteria are isolated.

2.3.6 Identification of the Organisms:
The organisms are identified by colony characteristics, motility, gram staining, biochemical reaction and serological tests.

3. Results:

Mostly of the 739 samples, 54.94% showed the growth of *E.coli.* Apart from this, growth of other microorganisms was seen in remaining 45.06%, like the growth of *Klebsiella* spp. 26.66%, growth of *Proteus* spp. 13.26%, growth of *Pseudomonas aeruginosa*2.84%, growth of *Staphylococcus aureus*is 1.76%, while the growth of *Candida* spp. 0.27% and *Enterococcus faecalis*growth 0.27% were also observed.

Table 1 : Distribution of Micro-organisms isolates from various clinical samples-midstream urine specimen, catheter specimen, urine specimens from infants,(n=739)

Name of Isolated Microorganisms	Number of Isolates	Percentage (%)
E.coli	406	54.94
Klebsiella spp.	197	26.66
Proteus spp. (*P.mirabilis)*	98	13.26
Pseudomonas aeruginosa	21	2.84
Staphylococcus aureus	13	1.76
Candida spp.	02	0.27
Enterococcus faecalis	02	0.27
Total	**739**	**100%**

Table 2 : Departments wise distribution of microbial growth. (n=739)

Departments	Total No. of Samples Received	No. of Specimen with Growth of Microorganisms
Obstetrics &Gynecology	623	467
Surgery	285	217
I.C.U.	61	32
Casualty	35	20
N.I.C.U.	05	02
Orthopedics	03	01
Total	**1012**	**739**

Table 3 : Gender wise distribution of microorganisms isolates. (n=739)

Gender	Total No. of Cases	Percentage (%)
Female	496	67.12
Male	243	32.88
Total	**739**	**100**

4. Discussion:

This study determined the detection and prevalence of urinary tract infection causing bacteria from specimens in tertiary care hospital. Our analysis demonstrated that the prevalence of bacterial urinary tract infection in patients attending amaltas hospital was 739/1012 (73.02%). Out of this bacterial UTI prevalence, symptomatic and asymptomatic patients contributed to 396/739 (53.5%) and 343/739 (46.4%), respectively. Almost half of the patients having significant bacteriuria were asymptomatic, and this situation is of utmost concern since asymptomatic bacteriuria is a strong predictor of ensuing symptomatic UTIs [22]. The higher prevalence of UTIs in our study could have been probably due to the inclusion of a number of risk groups like diabetes,[13,14] elderly, pregnant women, HIV,[10-12] infants[15,16], and a high number of inpatients who are usually prone to UTIs. Previous study in Mulago by Mwaka et al. [23] found a much higher prevalence of significant bacteriuria of 29/40 (72.5%) in asymptomatic patients. The higher proportion in the study carried out at Mulago is not surprising, since the study included only adult females who are always at high risk of developing asymptomatic bacteriuria [20].

Our study demonstrated *E.coli* as the most prevalent bacterial uropathogen with 406/739(54.94%). This finding is comparable with other studies elsewhere in Africa indicating 40–46% of isolation of *E. coli* [24–27]. The high prevalence of *E. coli* in the female gender could be due to the close proximity of the anus to the vagina. This high possibility of UTIs in females is due to the inherent virulence of *E. coli* for urinary tract colonization such as its abilities to adhere to the urinary tract and also association with other m.o. moving from the perineum areas contaminated with fecal microbes to the moist warmth environment of the female genitalia [19, 28].

This study demonstrated that age ≤19 years, female gender, married individuals, genitourinary tract abnormalities, diabetes, hospitalization, catheter, and increase in duration of catheter were found to bear statistically significant relationship with UTIs. Age and female gender were found to have statistically significant relationship with UTIs in similar study carried out by Kabugo et al. in 2016 [20]. The statistically significant association between UTIs and diabetes could be due to altered immunity in diabetic patients which includes depressed polymorphonuclear leukocyte functions, altered leukocyte adherence, chemotaxsis, phagocytosis, impaired bactericidal activity of the antioxidant system [29, 30], and neuropathic complications, such as impaired bladder emptying. In addition, a higher glucose concentration in the urine may create a culture medium for pathogenic microorganisms in diabetic patients that may result into UTIs. Generally, similar reports from elsewhere also indicated that age, female gender [20, 31], diabetes [21, 31, 32], genitourinary tract abnormalities [13, 14], married individuals [33], hospitalization [17], catheter, and duration of catheter [31] bear statistically significant relationship with UTIs.

5. Conclusion:

We know that, UTIs remain a major medical problem occurring frequently and worldwide, the rate of *E.coli*is rising very quickly and becoming most important problem in the part of UTI. *E.coli* is fastly increasing and now this is the important cause of trouble among the infectious diseases. Changing pattern of resistant bacterial infection in UTIs need to be detected as early a possible to prevent the spread of resistant bacteria and improve the strategies of treatments. In order to UTIs to emerge in a hospital/health care setup, various strategies such as applying strict infection control measures, judicious prescribing of antibiotics, implementation of antibiotics resistant cycling must be done. Regular monitoring and documentation of urinary tract infection(UTIs) should be done by all microbiology laboratories.

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7. References:

1. Baveja, C. P. (2015). Textbook of microbiology (vol. fifth edition). New delhi:arya publication.
2. Schaeffer AJ, Rajan N, Cao, Q, et al., (2001). Host pathogenesis in urinary tract infections. Int J Antimaicrob Agents, 17(4):245-251.
3. Wilks D, Farrington M, Rubenstein D. (1995). The infectious Diseases Manual. International ed. Black well Science Ltd, 58-64.
4. Foxman B.(2003). Epidemiology of urinary tract infection: Incidence, morbidity, economic costs. Disease a Month, 49:53-70.
5. L. E. Nicolle, "Uncomplicated urinary tract infection in adults including uncomplicated pyelonephritis," *Urologic Clinics of North America*, vol. 35, no. 1, pp. 1–12, 2008.
6. Mims CA, Playfair JHL, Roitt IM, et al., (1995). Medical Microbiology. Mosbey, Urinary tract infections, 231-38.
7. Inglis TJ.(1996). Churchil's Mastery of Medicine. Microbiology and Infection 1st ed. Churchill Livingstone. 90-3.
8. Kloos WE, Balows A, Sussmas M. (1998). Topley and Wilson„s Microbiology and Microbial infections. Systematic Bacteriology. Arnold oxford University Press: 2:601-621.
9. Nagoba BS, Pichre A. (2007). Prep manual of undergraduates; Medical Microbiology, 1st edition, Elsevier, 648-54.
10. A. Banu and R. Jyothi, "Asymptomatic bacteriuria in HIV positive individuals in a tertiary care hospital," *Journal of HIV and Human Reproduction*, vol. 1, no. 2, p. 54, 2013.
11. Schaeffer AJ, Rajan N, Cao, Q, et al., (2001). Host pathogenesis in urinary tract infections. Int J Antimaicrob Agents, 17(4):245-251.
12. Andreu A, Planells I (2008). Etiology of community acquired lower urinary tract infections and antimicrobial resistance of Escherichia coli: a national surveillance study. Med clin (Barc),130(13):481-86.
13. Hooton, T. M. (2012). Uncomplicated urinary tract infection. New England Journal of Medicine, 366(11), 1028-1037.
14. Nielubowicz, G. R., and Mobley, H. L. (2010). Host–pathogen interactions in urinary tract infection. Nature Reviews Urology, 7(8), 430.

15. Hannan, T. J., Totsika, M., Mansfield, K. J., Moore, K. H., Schembri, M. A., and Hultgren, S. J. (2012). Host–pathogen checkpoints and population bottlenecks in persistent and intracellular uropathogenic Escherichia coli bladder infection. FEMS microbiology reviews, 36(3), 616-648.
16. Foxman, B. (2014). Urinary tract infection syndromes: occurrence, recurrence, bacteriology, risk factors, and disease burden. Infectious disease clinics of North America, 28(1), 1-13.
17. Lichtenberger, P., and Hooton, T. M. (2008). Complicated urinary tract infections. Current infectious disease reports, 10(6), 499-504.
18. Levison, M. E., and Kaye, D. (2013). Treatment of complicated urinary tract infections with an emphasis on drug-resistant gram-negative uropathogens. Current infectious disease reports, 15(2), 109-115.
19. Nicolle, L. E., Bradley, S., Colgan, R., Rice, J. C., Schaeffer, A., and Hooton, T. M. (2005). Infectious Diseases Society of America guidelines for the diagnosis and treatment of asymptomatic bacteriuria in adults. Clinical infectious diseases, 643-654.
20. D. Kabugo, S. Kizito, D. D. Ashok et al., "Factors associated with community-acquired urinary tract infections among adults attending assessment centre, Mulago Hospital Uganda," *African Health Sciences*, vol. 16, no. 4, 2016.
21. M. Odoki, J. Bazira, M. L. Moazam, and E. Agwu, "Health-point survey of bacteria urinary tract infections among suspected diabetic patients attending clinics in Bushenyi district of Uganda," *Special Bacterial Pathogens Journal (SBPJ)*, vol. 1, no. 1, pp. 0005–0009, 2015.
22. T. M. Hooton, D. Scholes, A. E. Stapleton et al., "A prospective study of asymptomatic bacteriuria in sexually active young women," *New England Journal of Medicine*, vol. 343, no. 14, pp. 992–997, 2000.
23. A. D. Mwaka, H. Mayanja-Kizza, E. Kigonya, and D. Kaddu-Mulindwa, "Bacteriuria among adult non-pregnant women attending Mulago hospital assessment centre in Uganda," *African Health Sciences*, vol. 11, no. 2, pp. 182–189, 2011.
24. J. K. Kayima, L. S. Otieno, A. Twahir et al., "Asymptomatic bacteriuria among diabetics attending Kenyatta National Hospital," *East Afr. Med. J.*, vol. 73, no. 8, pp. 524–526, 1996.
25. A. F. Moges, A. Genetu, and G. Mengistu, "Antibiotic sensitivities of common bacterial pathogens in urinary tract infections in Gondar Hospital, Ethiopia," *East African Medical Journal*, vol. 79, no. 3, pp. 140–142, 2002.
26. Wanyama, "Prevalence, bacteriology and microbial sensitivity patterns among pregnant women with clinically diagnosed urinary tract infections in Mulago Hospital Labour Ward," Makerere University, Kampala, Uganda, 2003, M.Ed. dissertation of Wanyama.
27. R. Mayanja, C. Kiggundu, D. Kaddu-Mulindwa et al., "The prevalence of asymptomatic bacteriruria and associated factors among women attending antenatal clinics in lower Mulago Hospital," Makerere University, Kampala, Uganda, 2005, M.Ed. dissertation of Mayanja.
28. S. P. McLaughlin and C. C. Carson, "Urinary tract infections in women," *Medical Clinics of North America*, vol. 88, no. 2, pp. 417–429, 2004.
29. A. Stapleton, "Urinary tract infections in patients with diabetes," *American Journal of Medicine*, vol. 113, no. 1, pp. 805–845, 2002.
30. E. Hopps, A. Camera, and G. Caimi, "Polymorphonuclear leukocytes and diabetes mellitus," *Minerva Medica*, vol. 99, pp. 197–202, 2008.
31. S. A. Ally, R. A. Tawfeek, and I. S. Mohamed, "Bacterial catheter-associated urinary tract infection in the intensive care unit of assiut university hospital," *Al-AzharAssiut Medical Journal*, vol. 14, no. 2, pp. 52–58, 2016.
32. R. Simkhada, "Urinary tract infection and antibiotic sensitivity among diabetics," *Nepal Medical College Journal*, vol. 15, no. 1, pp. 1–4, 2013.
33. N. O. Angus, B. A. Vivian, E. E. Chijioke et al., "Bacteriology and antibiogram of urinary tract infection among female patients in a tertiary health facility in south eastern Nigeria," *Open Microbiology Journal*, vol. 11, pp. 292–300, 2017.