Original Research Article

# Antiboitic susceptibility pattern of common uropathogens isolated at a tertiary care hospital of Bihar

**Vandana Kumari[1], Prem Prakash Mandal[2*], Prakash Kumar Mishra[3]**

*[1]Tutor, Department of Microbiology, Jan Nayak Karpuri Thakur Medical College, Madhephura, Bihar, India*
*[2]Tutor, Department of Microbiology, Jan Nayak Karpuri Thakur Medical College, Madhephura, Bihar, India*
*[3]Assistant Professor, Department of Microbiology, Jan Nayak Karpuri Thakur Medical College, Madhephura, Bihar, India*

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## Abstract

**Introduction:** Urinary tract infections (UTIs) are amongst the most common infections encountered in clinical practice. The present study was undertaken to assess the current antibiotic resistance pattern in the common uropathogens isolated in a tertiary care hospital in south India. **Material & Methods:** A secondary data analysis was carried out in the department of Microbiology, Jan Nayak Karpuri Thakur Medical College, Madhephura, Bihar, India, for the samples collected during January 2019 to December 2019. Samples received included mid-stream clean catch urine, suprapubic aspirate, urine collected from Foley's catheter and from the nephrostomy tube under sterile precautions, in patients who had undergone percutaneous nephrostomy. Samples were processed and isolates were identified as per standard methods. The chi-square test or Fisher's exact test was used to compare different groups. Statistical software SPSS 16.0 (SPSS Inc, Chicago, Illinois, USA) was used to analyse the data. **Results:** Data from a total of 1000 consecutive urine samples received in the dept during the period of data collection were included in the study. Of these, 680 (68%) were sterile, 180 (18%) showed significant growth, 20 (2%) showed insignificant growth and 120 (12%) were found contaminated. Of the 180 culture positives, E. coli was the most common isolate. The percentage of Klebsiella pneumoniae, Acinetobacter spp, Pseudomonas spp, Staphylococcus spp, Enterococcus faecalis was higher in patient females and patients with history of prior treatment with antibiotics, compared to the rest. Almost three-fourth of all E.coli isolates were found to be resistant to ciprofloxacin. Ciprofloxacin resistance was comparatively less among the other Gram-negative uropathogens like Pseudomonas spp, Proteus spp and K. pneumoniae as mentioned. Resistance to the aminoglycosides, amikacin and gentamicin was also considerable especially among isolates of Acinetobacter. **Conclusion:** The present results in increasing antibiotic resistance trends in UTI patients indicate that it is imperative to rationalize the use of antimicrobials and to use these conservatively.

**Key Words**: Antiboitic Susceptibility, Uropathogens



## Introduction

Urinary tract infections (UTIs) are amongst the most common infections encountered in clinical practice[1]. The commonest bacterial agent involved in causation of UTIs is *Escherichia coli*, being the principal pathogen both in the community as well as in the hospital[2, 3].

The treatment of UTIs varies according to the age of the patient, sex, underlying disease, infecting agent and whether there is lower or upper urinary tract involvement. Trimethoprim/sulphamethoxazole is the recommended drug for the treatment of UTIs in settings where the prevalence of resistance is <10-20 per cent and ciprofloxacin is recommended where this resistance is >20 per cent, according to the Infectious Diseases Society of America (IDSA) guidelines[4, 5]. The other agents used in the treatment of UTI include fluoroquinolones, cephalosporins and other β-lactams with or without β-lactamase inhibitors, nitrofurantoin[4, 5]. Recently, several studies have revealed increasing trends of resistance to many antimicrobials including the fluoroquinolones[6-8]. The increase in bacterial resistance to fluoroquinolone is multifactorial[9-13]. With the increasing trend of antibiotic-resistance in *E. coli*, the management of urinary tract infections is likely to become complicated with limited therapeutic options.

The present study was undertaken to assess the current antibiotic resistance pattern in the common uropathogens isolated in a tertiary care hospital in south India.

*Correspondence
**Dr. Prem Prakash Mandal**
Tutor, Department of Microbiology, Jan Nayak Karpuri Thakur Medical College, Madhephura, Bihar, India.
**E-mail:** drpremprakash3012@gmail.com

## Material & Methods

A secondary data analysis was carried out in the department of Microbiology, Jan Nayak Karpuri Thakur Medical College, Madhephura, Bihar, India, for the samples collected during January 2019 to December 2019. This was an analysis of data generated from the records of consecutive urine samples received in the laboratory during the study period. Only the initial sample of an individual received was included to avoid duplication. Analysis of the data was carried out focusing on the age, gender, whether admitted or not, whether received prior antibiotic therapy, any surgical or gynecological intervention performed in the recent past, and any history of urinary tract infection in the past. The antibiotic susceptibility data of all isolates were also reviewed and analyzed.

Samples received included mid-stream clean catch urine, suprapubic aspirate, urine collected from Foley's catheter and from the nephrostomy tube under sterile precautions, in patients who had undergone percutaneous nephrostomy. Samples were processed and isolates were identified as per standard methods[14]. All urine samples were inoculated onto cysteine lactose electrolyte deficient (CLED) medium (Himedia, Mumbai, India) using a calibrated loop (volume-0.005 ml) and were incubated for 18-24 h at 37°C.Wet mount preparations were also made from all urine samples to look for pus cells and epithelial cells. Depending upon the number of the colonies grown on the CLED medium, the interpretations of urine culture were made as insignificant (<50 colonies), doubtful significance (>50 - <500 colonies) and significant (≥500 colonies) with due clinical correlation as per recommendations[14, 15]. The

antibiotic susceptibility testing of the isolated bacteria was carried out by the Kirby Bauer method[15, 16].

**Statistical analysis**

The chi-square test or Fisher's exact test was used to compare different groups. Statistical software SPSS 16.0 (SPSS Inc, Chicago, Illinois, USA) was used to analyse the data.

**Results**

Data from a total of 1000 consecutive urine samples received in the dept during the period of data collection were included in the study. Of these, 680 (68%) were sterile, 180 (18%) showed significant growth, 20 (2%) showed insignificant growth and 120 (12%) were found contaminated.

Of the 180 culture positives, E. coli was the most common isolate. The percentage of Klebsiella pneumoniae, Acinetobacter spp, Pseudomonas spp, Staphylococcus spp, Enterococcus faecalis was higher in patient females and patients with history of prior treatment with antibiotics, compared to the rest. In addition to these isolates, the percentage of Proteus spp was more in males, especially in cases with prior history of antibiotics administration. [Figure 1]

Almost three-fourth of all E.coli isolates were found to be resistant to ciprofloxacin. Ciprofloxacin resistance was comparatively less among the other Gram-negative uropathogens like Pseudomonas spp, Proteus spp and K. pneumoniae as mentioned. Resistance to the aminoglycosides, amikacin and gentamicin was also considerable especially among isolates of Acinetobacter. [Table 1] Substantial number of Staphylococcus isolates were resistant to ciprofloxacin. Resistance to nitrofurantoin was comparatively more amongst the Enterococcus spp. [Table 1]

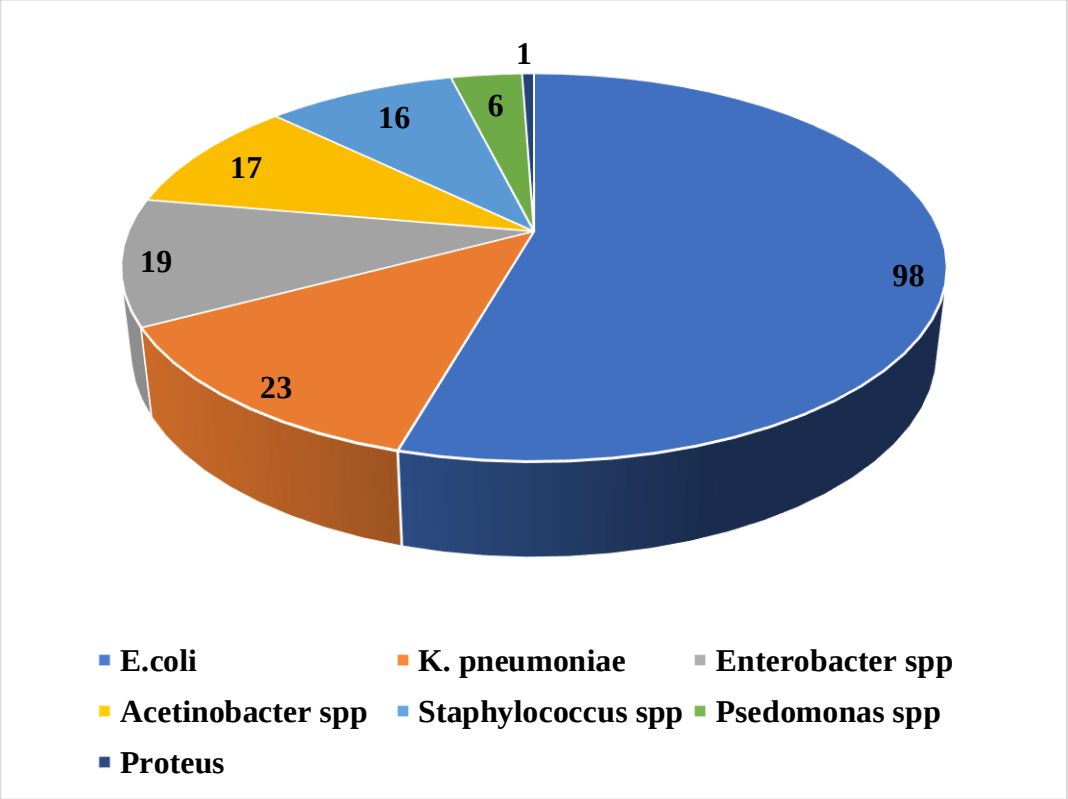


**Figure 1: Pie distribution of samples based on isolated organism**

**Table 1: Antiboitic susceptibility pattern of isolated organism**

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|---|---|---|---|---|---|---|
| | **E.coli** | **K.pneumoniae** | **Pseudomonas** | **Enterobacter** | **Acitenobacter** | **Staphylococcus** |
| Ceftriaxone | 57/98 | 15/23 | - | 16/19 | - | - |
| Ceftazidime | 52/98 | 14/23 | 2/6 | 8/19 | 11/17 | - |
| Gentamycin | 56/98 | 17/23 | 3/6 | 11/19 | 13/17 | - |
| Nitrofurantoin | 25/98 | 16/23 | - | 10/19 | - | 7/16 |
| Meropenam | 8/98 | 5/23 | 3/6 | 6/19 | 2/17 | - |
| Ciprofloxacin | 76/98 | 13/23 | 4/6 | 9/19 | 11/17 | 12/16 |
| Amikacin | 19/98 | 7/23 | 2/6 | 5/19 | 10/17 | - |
| Ampicillin | 82/98 | - | - | 17/19 | - | 8/16 |
| Vancomycin | - | - | - | - | - | 1/16 |
| Penicillin | - | - | - | - | - | 14/16 |

**Discussion**

This study showed that E. coli was the commonest pathogen causing complicated and uncomplicated UTI as described previously[1–3]. There are several organisms known to cause UTIs, including P. aeruginosa, S. saprophyticus, S.epidermidis, Enterococcus spp, P. mirabilis, Klebsiella spp., Citrobacter spp, etc. as reported by earlier

workers[17,18]. This study also demonstrates that Pseudomonas spp as major uropathogens especially in the patients admitted in the hospitals, more so in the intensive care units. Such findings have been documented elsewhere[5–16, 19–22]. The percentage of isolates of E.coli resistant to ampicillin was found to be as much as 80 per cent in our set up. Such high levels of resistance to ampicillin have been quoted by many other studies from different parts of India. Gupta et al[23] in a study from the northern part of the country reported 76 per cent resistance to E.coli isolates for ampicillin. A more recent study from Karnataka reported a resistance rate of 80.6 per cent for ampicillin[24].

The emergence of resistance for fluoroquinolones is multifactorial[7,17,19,20]. Resistance to ciprofloxacin has emerged in a variety of genera of the family Enterobacteriaceae[25, 26]. Apart from the notable resistance of E. coli to ciprofloxacin, other organisms were also found to be resistant to ciprofloxacin especially K. pneumoniae, Citrobacter spp, Pseudomonas spp, Acinetobacter spp, Proteus spp and Enterobacter spp, Staphylococcus spp, and E. faecalis. Also, fluoroquinolone resistance in E. coli has emerged particularly in patients with urinary tract infections who have received fluoroquinolone prophylaxis[5–12]. An association between the increase in quinolone prescriptions and an increase in bacterial resistance has been reported from several countries[5–8, 12]. Usually, the prevalence of fluoroquinolone resistance is related to the intensity of antibiotic use[5], Resistance rates for ciprofloxacin against uncomplicated UTI pathogens were reported as 0-14.7 per cent in the ECO-SENS Project, 2.5 per cent in the USA and 1.2 per cent in outpatients in Canada[27, 28].

**Conclusion**

The present results in increasing antibiotic resistance trends in UTI patients indicate that it is imperative to rationalize the use of antimicrobials and to use these conservatively. [29]

**References**


1. Gatermann SGBorriello P, Murray PR, Funke G. Bacterial infections of the urinary tract Topley ' Wilson's microbiology & microbial infections. 200710th ed London Hodder Arnold Publishers:671–83.
2. Karlowsky JA, Jones ME, Thornsberry C, Critchley I, Kelly LJ, Sahm DF. Prevalence of anti microbial resistance among urinary tract pathogens isolated from female outpatients across the US in 1999 Int J Antimicrob Agents. 2001;18:121–7.
3. Gorbach SL, Bartlett JG, Balcklow NRGorbach SL, Bartlett JG, Balcklow NR. Urinary tract Infectious diseases. 2004 Philadelphia Lippincott Williams & Wilkins Publisher:861–81
4. Warren JV, Abrutyn E, Hebel R, Johnson JR, Schaeffer AJ, Stamm WE. Guidelines for the treatment of uncomplicated acute bacterial cystitis and acute pyelonephritis in women Clin Infect Dis. 1999;29:745–58
5. Zervos MJ, Hershberger E, Nicolau DP, Ritchie DJ, Blackner LK, Coyle EA, et al Relationship between fluoroquinolone use and changes in susceptibility to fluoroquinolones of selected pathogens in 10 United States teaching hospitals, 1991-2000 Clin Infect Dis. 2003;37:1643–8
6. Arslan H, Azap OK, Ergönül O, Timurkaynak F. Risk factors for ciprofloxacin resistance among Escherichia coli strains isolated from community-acquired urinary tract infections in Turkey J Antimicrob Chemother. 2005;56:914–8
7. Karlowsky JA, Kelly LJ, Thornsberry C, Jones ME, Sahm DF. Trends in antimicrobial resistance among urinary tract infection isolates of Escherichia coli from female outpatients in the United States Antimicrob Agents Chemother. 2002;46:2540–5
8. Kahlmeter G. An international survey of the antimicrobial susceptibility of pathogens from uncomplicated urinary tract infections: the ECO·SENS Project J Antimicrob Chemother. 2003;51:69–76
9. Anjum F, Kadri SM, Ahmad I, Ahmad S. A study of recurrent urinary tract infection in women attending the outpatient department of SMHS hospital, Srinagar, Kashmir, India JK - Practitioner. 2004;11:272–3
10. Kauser Y, Chunchanur SK, Nadagir SD, Halesh LH, Chandrashekhar MR. Virulence factors, serotypes and antimicrobial susceptibility patterns of Escherichia coli in urinary tract infections AJMS. 2009;2:47–51
11. Pais P, Khurana R, George J. Urinary tract infections: A retrospective survey of causative organisms and antibiotics prescribed in a tertiary setting Indian J Pharmacol. 2002;34:278–80
12. Ena J, Amador C, Martinez C, Ortiz de la Tabla V. Risk factors for acquisition of urinary tract infections caused by ciprofloxacin-resistant Escherichia coli J Urol. 1995;153:117–20
13. Tabibian JH, Gornbein J, Heidari A, Dien SL, Lau VH, Chahal P, et al Uropathogens and host characteristics J Clin Microbiol. 2008;46:3980–6
14. Collee JG, Duguid JP, Fraser AG, Marmion BP, Simmons ACollee JG, Duguid JP, Fraser AG, Marmion BP, Simmons A. Laboratory strategy in the diagnosis of infective syndromes Mackie & McCartney practical medical microbiology. 199914th ed New York Churchill Livingstone:84–90
15. James HJ, John DTMurray PR, Baron EJ, Jorensen JH, Landry ML, Michael AP. Susceptibility Test Methods: Dilution and Disk Diffusion methods Manual of clinical microbiology. 200710th ed Washington, D.C American Society for Microbiology Press:1152–72
16. Clinical Laboratories Standards Institute (CLSI) Performance of standards for antimicrobial disk susceptibility tests;approved standards. 2009;2910th ed Wayne, PA CLSI M02-A10
17. Hooper DC. Emerging mechanisms of fluoroquinolone resistance Emerg Infect Dis. 2001;2:338–41
18. Canbaz S, Peksen Y, Tevfik SA, Leblebicioglu H, Sunbul M. Antibiotic prescribing and urinary tract infection Int J Antimicrob Agents. 2002;20:407–11
19. Boyd LB, Atmar RL, Randall GL, Hamill RJ, Steffen D, Zechiedrich L. Increased fluoroquinolone resistance with time in Escherichia coli from >17,000 patients at a large county hospital as a function of culture site, age, sex, and location BMC Infect Dis. 2008;8:4–10
20. Hooton TM. Fluoroquinolones and resistance in the treatment of uncomplicated urinary tract infection Int J Antimicrob Agents. 2003;22:S65–S72
21. Arjunan M, Al-Salamah AA, Amuthan M. Prevalence and antibiotics susceptibility of uropathogens in patients from a rural environment, Tamil Nadu Am J Infect Dis. 2010;6:29–33
22. Bhargavi PS, Gopala Rao TV, Mukkanti K, Dinesh Kumar B, Krishna TP. Increasing emergence of antibacterial resistance mainly in uropathogens:southeast part of India Intl J Microbiol Res. 2010;2:1–6
23. Gupta N, Kundra S, Sharma A, Gautam V, Arora DR. Antimicrobial susceptibility of uropathogens in India J Infect Dis Antimicrob Agents. 2007;24:13–8
24. Manjunath GN, Prakash R, Annam V, Shetty K. Changing trends in the spectrum of antimicrobial drug resistance pattern of uropathogens isolated from hospitals and community patients with urinary tract infections in Tumkur and Bangalore Int J Biol Med Res. 2011;2:504–7
25. Hummers-Pradier E, Koc M, Ohse AM, Heizman WR, Kochen MM. Antibiotic resistance of urinary pathogens in female general practice patients Scand J Infect Dis. 2020;37:256–61
26. Alos JI, Serrano MG, Gomez-Garces JL, Perianes J. Antibiotic resistance of Escherichia coli from community-acquired urinary tract infections in relation to demographic and clinical data Clin Microbial Infect. 2021;11:199–203
27. Naber CK, Steghafner M, Kinzig-Schippers M, Sauber C, Sorgel F, Stahlberg HJ, et al Concentrations of gatifloxacin in plasma and urine and penetration into prostatic and seminal fluid, ejaculate, and sperm cells after single oral administrations

of 400 milligrams to volunteers Antimicrob Agents Chemother. 2022;45:293–7
28. Wagenlehner FM, Naber KG. Fluoroquinolone antimicrobial agents in the treatment of prostatitis and recurrent urinary tract infections in men Curr Infect Dis Rep. 2005;7:9–16
29. Licata L, Smith CE, Goldschmidt RM, Barrett JF, Frosco M. Comparison of the postantibiotic and postantibiotic sub-MIC effects of levofloxacin and ciprofloxacin on Staphylococcus aureus and Streptococcus pneumoniae Antimicrob Agents Chemother. 1997;41:950–5.

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