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# Resistance Rates to Commonly Used Antimicrobials among Pathogens Causing Urinary Tract Infection.

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## Abstract
Antimicrobial resistance among pathogens causing Urinary Tract Infection (UTI) is increasing worldwide. Researchers have concluded that empirical antimicrobial therapy is associated with significantly increased risk of resistant uropathogens. Accurate bacteriologic records of urine culture results may provide guidance for empiric therapy before resistant patterns are available. The currently available data on antimicrobial resistance of uropathogens in India are still incomplete. Retrospective study was carried out with the objective to determine prevalence of resistance amongst uropathogens against antimicrobials used to treat UTI. 436 urine culture reports with significant bacteriuria were studied, irrespective of underlying disease or pre-treatment, diagnosed by qualified pathologists of five registered district pathological laboratories from March 2007 to October 2010. Data of the uropathogens and resistance rates of antimicrobials were statistically interpreted. *E.coli* (83.02%) was the principal pathogen isolated from urine culture samples. Mean resistance for antimicrobials was: Cephalosporin: Cefaclor (88.57%), cefuroxime (86.32%), cephalexin (74.97%), ceftriaxone (63.61%), cefotaxime (59.77%), ceftazidime (56.83%), cefoperazone (34.43%), Aminoglycosides: Gentamicin (44.51%), amikacin (6.87%), netilmicin (4.61%), Quinolones: Norfloxacin (63.03%), gatifloxacin (34.83%), ofloxacin (34.54%), ciprofloxacin (33.13%), Others: Clindamycin (86.21%), nitrofurantoin (35.43%), cotrimoxazole (20%). On comparing the present data with various studies from India and other countries it was found that norfloxacin, cefalexin, cefotaxime, gentamicin, nalidixic acid and nitrofurantoin comparatively showed high rate of resistance to uropathogens in Nashik. Greatest concern arising from results of this study is increasing resistance of isolates to commonly used antimicrobials. Continued surveillance of resistance rates among uropathogens is needed while prescribing empirical antimicrobial therapy.

## Key Words
Urinary tract infection, antimicrobial agents, drug resistance.

## Introduction
The term Urinary Tract Infection (UTI) is used to describe either an infection of part of the urinary system or the presence of large numbers of microbes in urine. UTI represents one of the most common diseases encountered in the medical practice today and occurring from the neonate to the geriatric age group. It can affect both lower urinary tract (cystitis) as well as upper urinary tract (pyelonephritis) [9, 10]. Symptoms vary from painful urination to frequent urination along with fever and abdominal pain especially seen in case of pyelonephritis. The main causative agent is Escherichia coli. Diagnosis can often be difficult as the bacteria may be present without showing symptoms of infection[6].

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Despite the widespread availability of antimicrobials, UTI remains the most common bacterial infection in the human population. Antimicrobial resistance may develop in urinary pathogen due to frequent misuse of antibiotics. Area-specific monitoring studies aimed to gain knowledge about the type of pathogens responsible for UTIs and their resistance pattern may help the physician to choose the correct empirical treatment. Recent reports have shown increasing resistance to commonly used antimicrobials[1, 2,3,4,5]. We aimed to study the antimicrobial resistance pattern of the urinary pathogens isolated from the urine culture reports of the patients. Retrospective study was carried out with the objective to determine prevalence of resistance amongst urinary pathogens against antimicrobials used to treat UTI.

## Materials and Methods

Study Design

The retrospective study was carried out at the Nashik district of Maharashtra. Urine culture reports diagnosed by qualified pathologists of registered pathological laboratories of Nashik from March 2007 to October 2010 were selected for the study. 712 culture reports of urine diagnosed by qualified pathologists of registered pathological laboratories of Nashik were collected and analyzed. In many cases, two or more than two episodes of UTI were observed in many patients. However, each episode was considered as a separate case for UTI.

**Culture sensitivity test**

Identification of bacterial pathogens by pathological laboratories was made on the basis of gram reactions, morphology and biochemical characteristics. The pathological laboratories tested isolates for antimicrobial susceptibility by disc diffusion technique on Mueller Hinton agar using ready-made antimicrobial discs (Table 1).

**Data Analysis**

All of the collected data were analyzed statistically. The results were expressed in percentage and the mean resistance was calculated for antimicrobial agents for each organism isolated by culture**.**

## Results and Discussion

A total of 712 urine culture reports collected by registered pathological laboratories of Nashik were analyzed. Out of which 436 (61.24%) urine culture reports were found to be significant bacteriuria which were included in the final study; irrespective of underlying disease or pre-treatment and remaining 276 (38.76%) reports were either non-significant bacteriuria or very low bacterial count or sterile urine samples which were excluded from the study. Symptomatic patients with lower colony counts (but not less than $10^4$ CFU/ml) were also considered as having UTI. Gram-negative organisms constituted 90.59%, followed by gram-positive organism (8.94%) and 0.47% reports showed presence of more than one organism. E.coli (83.02%) was the principal pathogen isolated, followed by Staphylococci spp. (8.94%), pseudomonas spp. (3.90%) and klebsiella spp. (3.67%) (Table 2). Females (52.98%) were found to be more susceptible to UTI than males (47.02%) (Table 3). A review of the antimicrobial resistance rates of pathogens causing UTI amongst the various countries and India highlighted the seriousness of the resistance situation in Nashik. On comparison, it was found that antimicrobials like cephalexin (74.97%), Norfloxacin (63.03%) and cefotaxime (59.77%) comparatively showed high rate of resistance to pathogens causing UTI in Nashik (Table 5). However, amikacin (6.87%), cotrimoxazole (20%) showed less resistance to uropathogens in our study compared to other studies. On comparing with the studies from India, antimicrobials like ceftazidime (56.83%), gentamicin (44.51%), nitrofurantoin (35.43%), and ciprofloxacin (33.13%) comparatively showed less resistance to pathogens causing UTI in Nashik. Repeated treatment with antibiotics must encourage the emergence of drug resistant pathogens in Nashik. Environmental factors or variation in pathogens gene may also be responsible for the developing resistance. As resistance to antibiotics continues to increase, surveillance has become a well-recognized necessity, and should combine local, national, and international efforts. Multicenter surveillance program monitoring at the hospital, or even at ward level, is also critical in understanding the relative importance of risk factors, the evolution of resistance over time, as well as for the development and assessment of preventive measures. The present study data gives idea about the common trend of increasing antimicrobial resistance in Nashik. It may be due to repetitive exposure of organism to antimicrobials. This data will not only help in proper treatment of UTI patients but also reduce the indiscriminate use of antimicrobials and will help to prevent further development of bacterial drug resistance. By providing such data to physicians will help them to give proper treatment and prescription of most sensitive antimicrobials to the patient and avoid use of resistant antimicrobials.

## Conclusion

The greatest concern arising from this study is the increasing resistance of isolates to empirical antimicrobial agents. Since this was a cross-sectional study, further studies are required to establish reliable information about resistance pattern of uropathogens for optimal empirical therapy of patients with UTI.

## References


1. Kader AA, Kumar A, Dass SM. Antimicrobial resistance patterns of gram negative bacteria isolated from urine cultures at a general hospital, Alkhobar, Saudi Arabia. Saudi J Kidney Dis Transplant 2004; 15(2):135-139.
2. Das RN, Chandrashekhar TS, Joshi HS, Gurumg M, Shrestha N, Shivananda PG. Frequency and susceptibility profile of pathogens causing UTI at a tertiary care hospital in western Nepal. Singapore Med J 2006; 47(4):281.
3. Hasan AS, Nair D, Kaur J, Baweja G, Deb M, Aggarwal P. Resistance pattern of urinary isolates in a tertiary Indian hospital, New Delhi. J Ayub Med Coll Abbottabad 2007; 19(1).
4. Tankhiwale SS, Jalgaonkar SV, Ahamad S, Hassani U. Evaluation of extended spectrum beta lactamase in urinary isolates, Nagpur, India. Indian J Med Res, Dec 2004; 553-556.
5. Tambekar DH, Dhanorkar DV, Gulhane SR, Khandelwal VK, Dudhane MN. Antibacterial susceptibility of some urinary tract pathogens to commonly used antibiotics, Amravati, India. African Journal of Biotechnology 2006; 5(17): 1562-1565.
6. RW Schrier; Manual of Nephrology-diagnosis and therapy; II edition; Little Brown and Company, Boston medical sciences International, Ltd. Tokyo; 97-111.
7. Collins, Lyne's; Microbiological Methods; VII edition; Butter worth Heinemann, K M Varghese Company; 178-205.
8. Mims C, Dockrell HM, Goering RV, Roitt I, Wakelin D, Zuckerman M. Medical Microbiology; III edition; Mosby Elsevier Ltd; 241-245,473-496,510.
9. Lane, DR; Takhar, SS (2011 Aug). "Diagnosis and management of urinary tract infection and pyelonephritis." Emergency medicine clinics of North America 29 (3): 539-52.
10. Colgan, R; Williams, M (2011 Oct 1). "Diagnosis and treatment of acute uncomplicated cystitis." American family physician 84 (7): 771-6.


**Figure 1:** Mean antimicrobial response of uropathogens.

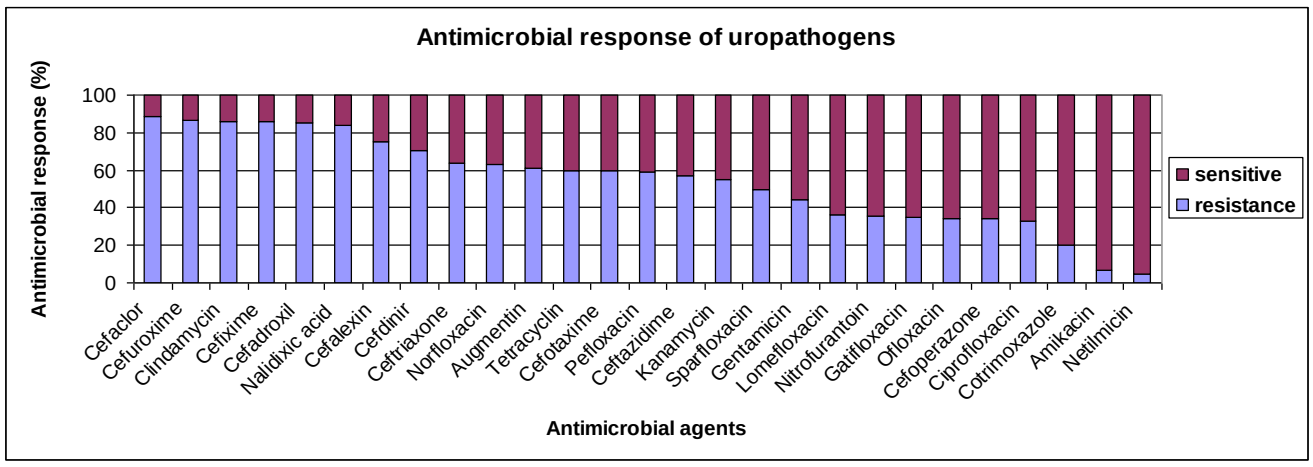


**Table 1:** Antimicrobial discs used by registered pathological laboratories.

| Name | Strength (μg) | Name | Strength (μg) |
|---|---|---|---|
| Amikacin | 30 | Clindamycin | 2 |
| Augmentin | 30 | Cotrimoxazole | 23.75 |
| Cefdinir | 5 | Gentamicin | 10 |
| Cefixime | 30 | Kanamycin | 30 |
| Cefoperazone | 75 | Lomefloxacin | 30 |
| Cefotaxime | 30 | Nalidixic Acid | 30 |
| Ceftazidime | 30 | Netilmicin | 30 |
| Ceftriaxone | 30 | Nitrofurantoin | 300 |
| Cefuroxime | 30 | Norfloxacin | 10 |
| Cephalexin | 30 | Ofloxacin | 5 |
| Ciprofloxacin | 5 | Pefloxacin | 5 |

**Table 2:** Isolation rate of uropathogens in collected urine culture reports.

| Sr. no. | Organism Isolated | N | Percentage (%) |
|---|---|---|---|
| **1** | *E.coli* | 362 | 83.02% |
| **2** | *Staphylococci spp*. | 39 | 8.94% |
| **3** | *Pseudomonas spp.* | 17 | 3.90% |
| **4** | *Klebsiella spp.* | 16 | 3.67% |
| **5** | Others | 2 | O.47% |
| | Total | 436 | 100% |

**Table 3:** Sex distribution for organisms isolated from urine culture reports.

| Organisms Isolated | Total N = 436 | Male n = 205 (47.02%) | Female n = 231 (52.98%) |
|---|---|---|---|
| **Gram-negative organisms** | | | |
| *E.coli* | 362 | 178 ( 86.83% ) | 184 ( 79.65% ) |
| *Pseudomonas spp.* | 17 | 9 ( 4.39% ) | 8 ( 3.46% ) |
| *Klebsiella spp.* | 16 | 4 ( 1.95% ) | 12 ( 5.19% ) |
| **Gram-positive organism** | | | |
| *Staphylococci spp*. | 39 | 14 ( 6.83% ) | 25 ( 10.82% ) |
| **More than one organism** | | | |
| *E.coli + Staphylococci* | 1 | 0 ( 0% ) | 1 ( 0.44% ) |
| *Klebsiella + Enterobacter* | 1 | 0 ( 0% ) | 1 ( 0.44% ) |

**Table 4:** Distribution showing resistance pattern of antimicrobial agents to the organisms isolated from collected urine culture reports.

| Antimicrobial Agents | *E.coli* (%) | *Pseudomonas Spp.* (%) | *Klebsiella Spp.* (%) | *Staphylococci Spp.* (%) | Mean (%) |
|---|---|---|---|---|---|
| **Cephalosporins** | | | | | |
| Cefadroxil | 85.33 | - | - | - | 85.33 |
| Cephalexin | 83.34 | 88.89 | 60.00 | 67.65 | 74.97 |
| Cefaclor | 88.57 | - | - | - | 88.57 |
| Cefuroxime | 68.06 | 100 | 90.91 | - | 86.32 |
| Cefdinir | 70.73 | - | - | - | 70.73 |
| Cefoperazone | 42.16 | 37.50 | 30.77 | 27.27 | 34.43 |
| Cefotaxime | 54.33 | 71.43 | 80.00 | 33.33 | 59.77 |
| Ceftazidime | 48.00 | 62.50 | 60.00 | - | 56.83 |
| Ceftriaxone | 51.92 | 75.00 | - | 63.89 | 63.61 |
| Cefixime | 79.26 | 90.00 | - | 87.88 | 85.71 |
| **Aminoglycosides** | | | | | |
| Gentamicin | 62.45 | 64.71 | 23.07 | 27.78 | 44.51 |
| Kanamycin | 50.91 | 66.67 | - | 48.49 | 55.36 |
| Amikacin | 03.44 | 05.88 | 0 | 18.18 | 06.87 |
| Netilmicin | 09.21 | - | 0 | - | 04.61 |
| **Quinolones** | | | | | |
| Nalidixic acid | 88.08 | 78.57 | - | 84.85 | 83.83 |
| Ciprofloxacin | 53.35 | 37.50 | 25.00 | 16.67 | 33.13 |
| Lomefloxacin | 53.91 | 30.78 | 08.33 | 52.94 | 36.49 |
| Norfloxacin | 72.03 | 61.54 | 50.00 | 68.57 | 63.03 |
| Ofloxacin | 31.36 | 17.65 | 31.25 | 57.90 | 34.54 |
| Gatifloxacin | 38.09 | - | - | 31.58 | 34.83 |
| Sparfloxacin | 50.00 | - | - | - | 50.00 |
| Pefloxacin | 72.29 | 37.50 | 66.67 | - | 58.82 |
| **Others** | | | | | |
| Tetracyclin | 60.00 | - | - | - | 60.00 |
| Clindamycin | 86.21 | - | - | - | 86.21 |
| Nitrofurantoin | 22.06 | 62.50 | 0 | 57.13 | 35.43 |
| Augmentin | 88.51 | - | 88.89 | 66.67 | 61.02 |
| Cotrimoxzole | 20.00 | - | - | - | 20.00 |

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