# Prevalence of UTI in Different Age Groups in a Tertiary Care Hospital and their Antibiogram

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## ABSTRACT

**Introduction**: Urinary tract infection is a common problem despite age and sex worldwide. Recent study was done to determine prevalence of urinary tract infection (UTI) among patients admitted in a tertiary care hospital in order identify the microorganisms responsible for UTI. Further, the antibiotic resistance pattern of different microorganisms were also studied.

**Material and methods:** Mid stream urine samples were collected from subjects with clinically suspected acute UTI during one year period from 2016 to 2017 Urine samples were aseptically collected in sterile containers and plated onto blood agar and Mac Conkey agar plates by using standard loop. Organisms were identified and antibiotic sensitivity tests were performed using standard methods. Only culture proven cases, were included in this study.

**Result**: Total 1530 samples were collected from both females and males of age groups 5 to 55. Among the total, 502 [34.6%] samples were positive [significant bacteriuria]. Gram positive bacteria caused 12.9% of UTI. Gram negative bacteria caused 87.1% of UTI. *E. coli* were the most commonly found bacteria causing UTI (37.4%).

**Conclusion**: In this study, antibiotic susceptibility of various uropathogens were studied. Most of the gram negative organism wre sensitive to imipenem. In gram positive bacteria, they were highly sensitive to vancomycin, teicoplanin and linezolid.


**Key words**: Urinary Tract Infections, Antimicrobial Resistance, Significant Bacteriuria

## INDRODUCTION

Urinary tract infection (UTI) remains the most common infection world wide, which can occur in any time in the life of an individual. UTI can affect both lower and upper urinary tract. It may be acquired from community or hospital. In children, the most commonly found symptom of UTI was fever. While in infants it may be appeared as poor feeding, vomiting, or show signs of jaundice. *E.coli,* in the case of community acquired UTI, bacteria typically enter the bladder through the urethraand attach to bladder wall to form biofilm, that can resist the body immune response.[1,2,3] The infection was considered as complicated in pregnant women,[4] and immunocompromised subjects. American academy of Peadiatrics recommends the renal ultrasonogram and voiding cystourethrogram in all age groups.[5,6] Common clinical symptoms of UTI include burning sensation during urination, pain above pubic bone, cloudy urine, foul smell of urine, fever, urgency and frequency of urination increased back pain, vomit, etc. The selection of antibiotics against UTI is done by performing antibiotic sensitivity tests. Antimicrobial resistance remains the major problem in the therapy for UTI throughout the world.

Fundamental mechanism of antibiotic resistance may be due to enzymatic degradation of antibiotics, alteration of bacterial proteins or changes in the membrane permeability to antibiotics. Antibiotic resistance can appear spontaneous because of random mutation or more commonly following gradual build up over time.[7,8] A region wise variation in the prevalence of UTI emphasizes the need for the study. Hence, this study was aimed to evaluate the prevalence of UTI and the antibiotic sensitivity of bacteria among the samples collected from subjects with clinically suspected infection.

## MATERIAL AND METHODS

This prospective study was conducted in a tertiary care hospital over a period of 14 months, from 2016 October to 2017 November after ethical commitee approval. Total 1530 samples were collected from both male and female patients of age 5 – 55 years. Patient present at the departments of Urology, General Medicine, Gynecology, Paediatrics were included in this study. Patients with recurrent UTI, autoimmune disease, structural anomally in the urinary tract, patient admitted for surgery, in- patient with urinary catheter were excluded from the study. The study was conducted according to the guidelines and approval from the Institutional Research Ethics Committee.

All patients were instructed to collect clean catch mid-stream urine specimen into a wide mouthed sterile screw-capped container. Urine samples were immediately taken to bacteriology lab and processed.

Each of the specimens was subjected to culture by the semi-quantitative standard loop technique on blood agar and MacConkey agar. The plates were incubated aerobically at 37°C for overnight. Culture plates without visible colonies were re-incubated overnight for visible growth, before being discarded. Since, we are using 4 mm internal diameter loop, which collects 0.01 ml of the sample, colony counts of 100

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and above which is equivalent to or greater than one lakh cfu/mlwas considered as significant bacteriuria. Further, this significant isolates were identified by standard bacteriological tests[9]. The standard Kirby-Bauer disc diffusion test as per clinical laboratory Standards institute (CLSI) guidelines were done for antibiotic sensitivity[10]. All culture media and antibiotic discs were purchased of Hi Media laboratories, Mumbai, India. For quality control of the gram positive and gram negative panel of antibiotics, the discs were tested with ATCC 25923 *Staphyllococcus aureus* and ATCC 25922 *E. coli* respectively.

## STATISTICAL ANALYSIS

Descriptive statistical analysis such as mean and percentages were used. Mean and percentages were used to interpret the data.

## RESULT

In this study, among the total, 502 [34.6%] samples were positive [significant bacteriuria] (Table 1). *E. coli* was the common organism causing UTI in all the age groups. Sensitivity of Proteus to antibiotics were observed this include imipenem [98.2%], amikacin [98.3%], piperacillin+tazobactum [85.3%], gentamycin [99.6%], ciprofloxacin [98%], norfloxacin [91.4%] and piperacillin [82.9%]. So sensitivity of Proteus to all these antibiotics was above 80%. Sensitivity of Proteus to amoxyclav [35.2%], cefotaxime [39.0%], naldixic acid [26.2%] was below 50%. Sensitivity of Klebsiella to imipenem [99.6%], amikacin [96.2%], was found to highest. Sensitivity of Klebsiella to cotrimoxazole [38.5%] and amoxyclav [26.3%], was below 50%. In table 3, the sensitivity of gram negative organism to different antibiotics were depicted All the 4 gram negative organism were highly sensitive to imipenem than others. All the antibiotics chosen for study were sensitive to all gram negative bacteria, but to amoxyclav it was less than 50.0%. Sensitivity of *E. coli* to imipenem, nitrofurantoin, amikacin

| Age in years | Males with UTI | | Females with UTI | | Total | |
|---|---|---|---|---|---|---|
| | Number | Percentage | Number | Percentage | Number | Percentage |
| 5 - 15 | 30 | 15.2% | 20 | 6.6% | 50 | 9.9% |
| 16-25 | 20 | 10.1% | 45 | 14.8% | 65 | 12.9% |
| 26-35 | 40 | 20.2% | 65 | 21.4% | 105 | 20.9% |
| 36-45 | 23 | 11.7% | 70 | 23.0% | 93 | 18.5% |
| 46-55 | 35 | 17.7% | 55 | 18.1% | 90 | 17.9% |
| Above 55 | 50 | 25.3% | 49 | 16.1% | 99 | 19.7% |
| Total | 198 | | 304 | | 502 | |

**Table-1:** Distribution of UTI as per gender and age

| Age Group [years] | *E. coli* | | Proteus[sp] | | *S.aureu* | | Klebsiella sp | | Pseudomonas sp | | Enterococcus sp | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No | % | No | % | No | % | No | % | No | % | No | % | No | % |
| 5-15 | 33 | 17.6 | 05 | 8.1 | 02 | 8.3 | 05 | 4.5 | 03 | 4.0 | 02 | 4.9 | 50 | 9.9 |
| 16-25 | 31 | 16.5 | 06 | 9.6 | 03 | 12.5 | 12 | 10.7 | 09 | 12.0 | 04 | 9.8 | 65 | 12.9 |
| 26-35 | 35 | 18.6 | 19 | 30.6 | 10 | 41.7 | 21 | 18.8 | 12 | 16.0 | 08 | 19.5 | 105 | 20.9 |
| 36-45 | 29 | 15.4 | 13 | 20.9 | 03 | 12.5 | 25 | 22.3 | 17 | 22.7 | 06 | 14.63 | 93 | 18.5 |
| 46-55 | 32 | 17.0 | 09 | 14.5 | 04 | 16.7 | 20 | 17.9 | 15 | 20.0 | 10 | 24.4 | 90 | 17.9 |
| Above 55 | 28 | 14.9 | 10 | 16.1 | 02 | 8.3 | 29 | 25.9 | 19 | 25.3 | 11 | 26.8 | 99 | 19.7 |
| Total | 188 | | 62 | | 24 | | 112 | | 75 | | 41 | | 502 | |

**Table-2:** UTI prevalence among different age group with infecting agent percentage

| Organism | Imp[%] | Nit | Ak | Pit | Gen | cfs | Cot | Ctx | Cip | Nx | Pi | Na | Amc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| E.coli | 98.2 | 82.3 | 81.1 | 75.2 | 63.5 | 52.4 | 50.8 | 32.3 | 31.9 | 28.2 | 27.5 | 15.5 | 18.4 |
| Proteus | 99.8 | 48.2 | 98.3 | 85.3 | 99.6 | 80.5 | 68.5 | 39.0 | 98.0 | 91.4 | 82.9 | 26.2 | 35.2 |
| Klebsiella | 99.6 | 53.4 | 96.2 | 78.3 | 78.0 | 50.1 | 38.5 | 62.1 | 79.1 | 74.2 | 23.5 | 51.1 | 26.3 |
| Pseudomonas | 99.8 | 45.0 | 88.3 | 87.6 | 89.1 | 51.0 | 54.9 | 56.6 | 69.7 | 82.0 | 74.1 | 25.3 | 28.5 |

Imp- imipenem, Nit- nitrofurantoin, Ak –amikacin, Gen – gentamycin, Pit – piperacillin+tazobactum, Cfs – cefaperazone+sulbactum, Cot – cotrimoxazole, Ctx – cefotaxime, Cip – cipofloxacin, Nx – norfloxacin, Pi – piperacillin,Na – naldixicacid, Amc – amoxyclav.

**Table-3:** Antibiotic sensitivity percentage of gram negative bacilli uropathogens

| | P [%] | E | T | AK | GEN | CIP | COT | AMC | LZ | VA | TEI |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Enterococcus | 09.9 | 23.1 | 30.0 | 22.2 | 35.6 | 51.3 | 35.7 | 20.0 | 86.7 | 82.2 | 88.5 |
| Staphyllococcus[sp] | 02.1 | 01.8 | 93.9 | 90.5 | 12.3 | 32.3 | 35.1 | 09.9 | 99.1 | 100 | 87.3 |

P – penicillin, E – erythromycin, T – tetracycline, AK – amikacin, GEN – gentamycin, CIP – ciprofloxacin, COT – cotrimoxazole, AMC – amoxyclav, LZ- linezolid, VA – vancomycin, TEI–teicoplanin

**Table-4:** Antibiotic sensitivity percentage of gram positive cocci uropathogens

was above 80%. Sensitivity of *E. coli* to ciprofloxacin [31.9%], norfloxacin [28.2%], piperacillin [27.5%], naldixic acid [15.5%], cefaperazone [12.3%], amoxyclav [18.4%]. This indicated that the sensitivity of *E.coli* to the above mentioned antibiotic was below 50%.

In table 4 sensitivity of Enterococcus to vancomycin [82.2%], teicoplanin [88.5%], and linezolid[86.7%] was depicted,. Sensitivity of penicillinwas [09.9%]. Sensitivity of *S.aureus* to penicillin and erythromycin was 02.1% and 01.8%, respectively. Sensitivity of *S.aureus* to tetracycline [93.9%], amikacin[90.5%], linezolid[99.1%] was above 90%.Sensitivity of *S.aureus* to vancomycin was 100%.

## DISCUSSION

UTI is a common problem despite age and sex worldwide. Our study in 1530 clinically diagnosed male and female patients showed positive UTI incidence in 502 samples32.8%. A study from Karnataka state reported that 26.01% prevalence of UTI.[(11)]

In this study, *E.coli* was the most common organism causing UTI in all age groups which was consistent to the previous report [12.] Presently many multidrug resistant strains of *E.coli* are emerging. Even though our most common isolate was *E. coli*, the rate of incidence is less than the report from to the Western studies, where the corresponding rate were ranges from 80 – 85%.[13-16] Klebsiella was the second most common organism (22.31%) in this study. A study done by Somshekhara et al and Hassan et al.[17,18] were also found a similar conclusion. Sensitivity of *E. coli* to imipenem was 98.2% followed by nitrofurantoin (82.3%), amikacin (81.1%), piperacillin tazobactum (75.2%) and cefotaxime 32.2%. But *E. coli* was least sensitive to naldixic acid (15.5%).

Iregbu et al [19] showed 89% sensitivity of *E.coli* to imipenem(98%) amikacin (79%), nitrofurantoin (67%), and ceftriazone. Gentamycin and amoxyclave showed 57% and 73% resistance, respectively. Ampicillin was 99% resistant. Biswas et al [20] found 100% sensitivity of *E. coli* to imipenem, meropenem, amikacin and nitrofurantoin followed by gentamycin [94.1%]. Furthermore, they reported 88.2% sensitivity to third generation cephalosporin ceftriaxone. In the present study, Proteus isolates were 99.8% sensitive to imipenem followed by gentamycin [99.6%], amikacin [98.3%],ciprofloxacin [98%], norfloxacin [91.4%], amoxyclave [35.2%]. A study by vinodrai et al [21] demonstrated that Proteus sp. isolates were 100% sensitive to imipenem, netilmycin and amikacin. Barate et al[22],in their study demonstrated that high resistance of Proteus sp to amoxyclav [65%]. Biswas et al. [20] found 100% sensitivity of proteus sp to gentamycin, imipenem, meropenem, followed by amikacin [80%], ciprofloxacin [70%] with 100% resistance to nitrofurantoin.

In the present study, resistance shown by gram positive isolates to vancomycin is very low. All the isolates of *Staphyllococcus* was sensitive to vancomycin. Study conducted by Reshmi Gopalakrishnan et al. [23] none of the *Staphyllococcus* isolates and *Enterococcus* sp were vancomycin resistant. In the present study, 82.2% of *Enterococcus* sp. was sensitive to vancomycin. Majority of the isolates showed resistance to drugs commonly used to treat UTI. Variations in sensitivity may be due to the inappropriate exposure of different localities as to antibiotics which can drive the development of resistance.[24] From the results of this study, it is certain that choosing drugs for empiric treatment will be challenging as no single common drug can conveniently be recommended for UTI.

## CONCLUSION

*E. coli* is the leading agent of UTI in all the age groups studied. Among them, the multidrug resistsnt *E. coli* is becoming very common. This study is also pointed out towards the increasing prevalence of multidrug resistant pathogens. Most of the gram negative organism were sensitive to imipenem. In gram positive bacteria, they were highly sensitive to vancomycin, teicoplanin and linezolid. It is necessary to stop the misuse of antibiotics and continue the surveillance of multidrug resistant strain in order to overcome the antibiotic resistance over time.

**Ethical approval**

The study was approved by the Institutional Ethics Committee

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