A STUDY OF THE ANTIBIOTIC SUSCEPTIBILITY PATTERN OF UROPATHOGENS ISOLATED FROM URINE CULTURES IN A TERTIARY CARE HOSPITAL IN TAMILNADU

SUGIRDA
Department of Pharmacology,
MADRAS MEDICAL COLLEGE AND GOVERNMENT GENERAL HOSPITAL

Abstract:
BACKGROUND - Urinary tract infection (UTI) is one of the most common infections affecting men and women of all ages. The chronicity and complications of UTI are important public health problems. Since antibiotic resistance is on the rise among uropathogens, it is important to have local hospital based knowledge of the organisms causing UTI and their antibiotic sensitivity patterns to guide antibiotic policy for rational and successful treatment. OBJECTIVES - To retrospectively study the growth pattern of uropathogens isolated from urine culture samples and their antibiotic susceptibility pattern for a period of one month in a tertiary care hospital. METHODS - This retrospective study was conducted at the Institute of Microbiology, Madras Medical College, Rajiv Gandhi Govt. General Hospital, Chennai. In this study, laboratory records of patients showing positive urine culture over one month period were collected. The age and sex of the patients and the type of urinary isolates and their antibiotic susceptibility pattern were noted and analyzed. RESULTS - Of the 540 samples collected for the study (Males-42.2 percent, Females-57.8 percent), the isolates found were E. coli- 45.9 percent, Klebsiella- 23.7 percent, others - 30.4 percent (Citrobacter, Proteus, Pseudomonas, Staphylococci, Acinetobacter, Enterococci). Amikacin, Cefotaxime, Norfloxacin, Gentamicin, Nitrofurantoin, Cotrimoxazole were the most commonly tested drugs. Most of the isolates showed sensitivity to Amikacin (70.3 percent) and Nitrofurantoin (54.9 percent). E. coli showed sensitivity to Cefaperazone-sulbactum (78.4 percent), Amikacin (78 percent), Nitrofurantoin (60.9 percent) and for Klebsiella it was 93.3 percent, 62 percent and 50.8 percent respectively. Overall, the organisms showing resistance to Norfloxacin were 81.6 percent, Cotrimoxazole-71.5 percent, Cefotaxime-66.4 percent and Gentamicin-60.2 percent. Staphylococci and Proteus showed resistance to all antibiotics except to Amikacin. Enterococcus was sensitive only to amoxicillin. CONCLUSION - High level of
resistance by the common uropathogens is a matter of concern as evidenced by this study. This mandates periodic evaluation of the culture pattern and their antibiograms to guide the antibiotic policy to prevent emergence of drug resistance.

**Keyword :** UTI, uropathogens, antibiotic resistance, susceptibility pattern, antibiotic policy.

**INTRODUCTION:**
Urinary tract infection (UTI) is one of the most common infectious diseases encountered by physicians. UTI refers to the presence of microbial pathogens within the urinary tract. It is an inflammatory response of the urothelium to bacterial invasion that is usually associated with bacteriuria and pyuria. It remains a worldwide therapeutic problem as it poses a significant health risk that can lead to progressive kidney damage with associated high morbidity and mortality. It is estimated that around 150 million people are diagnosed with UTI each year globally.1 Early diagnosis and prompt antimicrobial treatment are required to reduce the burden of the disease and minimize the complications. Although several different microorganisms can cause UTI, including fungi and viruses, bacteria are the major causative organisms and are responsible for more than 95% of UTI cases.2 Presumptive diagnosis of UTI is made by direct or indirect analysis of the urine and is confirmed by urine culture. Antibiogram is essential to find out the sensitivity of an isolated bacterial strain to different antibiotics. The etiology of UTI and the antibiotic susceptibility pattern of uropathogens have been changing, and in recent years the essence of antibiotic resistance has posed a global threat4. Therefore, knowledge of the causative uropathogens and their antibiotic susceptibility is mandatory to ensure appropriate treatment. Empirical therapy urine culture is often used in majority of the cases. Even such practice should be initiated based on the knowledge of the local prevalence of uropathogens and their sensitivity pattern rather than based on the universal guidelines.5 Only then it can be considered as a rational therapeutics. As increasing numbers of urinary isolates are gaining resistance to commonly used antimicrobials, antibiotic policy should evolve for each hospital based on the sensitivity pattern exhibited by the organisms prevalent in the setup. This has led to reconsideration of traditional treatment recommendations in many hospitals.6 Clearly, the susceptibility patterns of uropathogens are changing, reducing the safety and effectiveness of empirical therapy for the affected patients. To complicate matters, this change is not uniform from region to region or within different patient groups. Knowledge of antibiotic sensitivity helps to determine the choice of antimicrobials, till the culture and sensitivity report is available.7 As drug resistance among pathogens is an evolving process, regular and routine surveillance should be conducted by each hospital. Such area-specific monitoring studies help to guide the antibiotic policy regarding the effective and rational empirical treatment of UTI. They are also useful in indicating presence or the emergence of the hospital-acquired (nosocomial) infections.8 With this background, this study was undertaken to evaluate bacterial growth trends and their antibiotic susceptibility pattern in our hospital.

**OBJECTIVES**
To study the pattern of bacterial growth of the urine cultures for a period of one month.
To study the sensitivity and resistance patterns of these microbes to the antibiotics.

**MATERIALS AND METHODS**

**STUDY DESIGN:**
Retrospective descriptive study.

**STUDY CENTRE:**
Institute of Microbiology, Madras Medical College, Rajiv Gandhi Govt. General Hospital, Chennai-3.

**STUDY MATERIALS:**
Laboratory record of urine culture reports and their antibiograms for a duration of one month (1.8.2011 to 31.8.2011).

**Inclusion criteria:**
- Positive urine culture reports
- Age: 13 years and above
- Sex: both genders.

**Exclusion criteria:**
- Age: below 13 years.
- The samples reported before and after the study period.
- Repeat sample of the same patient.
- Culture reports with mixed infections.
- Reports with incomplete information.
- The urine samples which were considered to be contaminated as per the records.

**STUDY PROCEDURE:**
The study was commenced after obtaining approval from the Institutional Ethics Committee. Informed consent waiver was obtained since this was a retrospective, data analysis from laboratory records. The laboratory data of urine culture samples for the month of August 2011 was taken. The sample reports were selected after exercising the inclusion and exclusion criteria. The urine culture results that included the type of bacterial isolates and their antibiotic susceptibility pattern were noted along with age and sex of the patients. All the data were collected and analysed statistically using SPSS version15.0 software.

**RESULTS:**
A total of 540 samples were collected from the laboratory records. Of which 312 (57.80%) were female samples and 228 (42.20%) were males.

**SEX DISTRIBUTION**

![Figure 1](image1)

Figure 1
Figure-1 shows the sex distribution of UTI. The samples were divided into six age groups with a span of ten each. The proportion of patients in each age group is shown in table-1 and represented graphically in figure-2.

**AGE DISTRIBUTION**

![Figure 2](image2)

Figure 2 Table -1
### Table 1: Age Distribution

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Age Group (Years)</th>
<th>No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>13-24</td>
<td>70 (13%)</td>
</tr>
<tr>
<td>2.</td>
<td>25-54</td>
<td>122 (22.6%)</td>
</tr>
<tr>
<td>3.</td>
<td>35-44</td>
<td>74 (13.7%)</td>
</tr>
<tr>
<td>4.</td>
<td>45-54</td>
<td>96 (18.3%)</td>
</tr>
<tr>
<td>5.</td>
<td>55-64</td>
<td>104 (19.3%)</td>
</tr>
<tr>
<td>6.</td>
<td>&gt;65</td>
<td>94 (16.8%)</td>
</tr>
</tbody>
</table>

### Table 2: List of Bacterial Isolates

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>Bacterial Isolates</th>
<th>No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Escherichia coli</td>
<td>245 (45.9%)</td>
</tr>
<tr>
<td>2.</td>
<td>Klebsiella</td>
<td>126 (23.7%)</td>
</tr>
<tr>
<td>3.</td>
<td>Citrobacter</td>
<td>58 (10.7%)</td>
</tr>
<tr>
<td>4.</td>
<td>Proteus</td>
<td>32 (5.8%)</td>
</tr>
<tr>
<td>5.</td>
<td>Pseudomonas</td>
<td>36 (6.6%)</td>
</tr>
<tr>
<td>6.</td>
<td>Staphylococcus</td>
<td>28 (5.2%)</td>
</tr>
<tr>
<td>7.</td>
<td>Acinetobacter</td>
<td>26 (4.8%)</td>
</tr>
<tr>
<td>8.</td>
<td>Enterococcus</td>
<td>10 (1.9%)</td>
</tr>
</tbody>
</table>

### Table 3: Antibiotic Sensitivity Pattern of E. coli and Klebsiella

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>Drugs</th>
<th>E. coli</th>
<th>Klebsiella</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Cefotaxime</td>
<td>27.1%</td>
<td>31.7%</td>
</tr>
<tr>
<td>2.</td>
<td>Norfloxacin</td>
<td>3%</td>
<td>19%</td>
</tr>
<tr>
<td>3.</td>
<td>Nitrofurantoin</td>
<td>50.9%</td>
<td>50.9%</td>
</tr>
<tr>
<td>4.</td>
<td>Gentamicin</td>
<td>39.8%</td>
<td>33.8%</td>
</tr>
<tr>
<td>5.</td>
<td>Amikacin</td>
<td>78%</td>
<td>62%</td>
</tr>
<tr>
<td>6.</td>
<td>Cotrimoxazole</td>
<td>23.1%</td>
<td>26.4%</td>
</tr>
<tr>
<td>7.</td>
<td>Cefoperazone-sulbactum</td>
<td>76.4%</td>
<td>93.3%</td>
</tr>
</tbody>
</table>

### Table 4: Antibiotic Sensitivity Pattern of Pseudomonas and Citrobacter

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>Drugs</th>
<th>Pseudomonas</th>
<th>Citrobacter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Cefotaxime</td>
<td>40%</td>
<td>47%</td>
</tr>
<tr>
<td>2.</td>
<td>Norfloxacin</td>
<td>13.3%</td>
<td>47.4%</td>
</tr>
<tr>
<td>3.</td>
<td>Nitrofurantoin</td>
<td>20%</td>
<td>55.5%</td>
</tr>
<tr>
<td>4.</td>
<td>Gentamicin</td>
<td>20%</td>
<td>52.6%</td>
</tr>
<tr>
<td>5.</td>
<td>Amikacin</td>
<td>21%</td>
<td>73.6%</td>
</tr>
<tr>
<td>6.</td>
<td>Cotrimoxazole</td>
<td>18%</td>
<td>37.5%</td>
</tr>
<tr>
<td>7.</td>
<td>Cefoperazone-sulbactum</td>
<td>60%</td>
<td>80%</td>
</tr>
</tbody>
</table>
Totally, 8 different bacterial isolates were found from these samples. E.coli was the most common pathogen isolated (45.9%) followed by Klebsiella (23.7%). Table-2 shows the list of bacteria found in the samples and their distribution which is represented graphically in figure-3.

**Figure 3**

Totally, 17 antimicrobial drugs were used for testing antibiotic sensitivity in these samples. They were amikacin, cefotaxime, gentamicin, norfloxacin, nitrofurantoin, cotrimoxazole, cefoperazone-sulbactum, imipenem, ciprofloxacin, ofloxacin, piperacillin-tazobactum, tetracycline, chloramphenicol, penicillin, amoxicillin, erythromycin, vancomycin.

Among these drugs, six were most commonly used for testing. Amikacin was the most common drug used in 97.4% of the samples followed by cefotaxime (93.7%) and norfloxacin (92.6%).

**ANTIBIOTIC SENSITIVITY PATTERN:**

E.coli, the major causative pathogen was highly sensitive to cefoperazone-sulbactum (78.4%), amikacin (78%) and nitrofurantoin (60.90%). The second leading one, Klebsiella was also highly sensitive to these drugs with a sensitivity of 93.3%, 62%, 50.8% respectively. Figure-4 shows the sensitivity pattern of both E.coli and Klebsiella to the commonly tested drugs which is tabulated in Table-3. (CEFO-SUL—Cefoperazone- Sulbactum)

Proteus was found to be more sensitive to amikacin (75%) and cefotaxime (71.4%). Staphylococcus was also more sensitive to amikacin (66.6%). Acinetobacter showed good sensitivity against amikacin (83.3%) and nitrofurantoin (66.6%). Enterococcus was found to be sensitive only to amoxicillin (75.0%).

When considering the less common pathogens, Citrobacter was highly sensitive to cefoperazone-sulbactum (80%) and amikacin (73.6%); Pseudomonas was found to be highly sensitive to cefoperazone-sulbactum (90%). Figure-5 depicts the antibiotic sensitivity pattern of Pseudomonas and Citrobacter to the commonly tested drugs which is tabulated in Table-4. (CEFO-SUL—Cefoperazone- Sulbactum)
ANTIBIOTIC RESISTANCE PATTERN:
Norfloxacin exhibited maximum resistance as 81.6% of the isolates were found to be resistant to it followed by cotrimoxazole (71.5%), cefotaxime (66.40%) and gentamicin (60.20%). Table-5 shows the over all percentage of resistance to the commonly tested drugs which is shown graphically in Figure-6.

DISCUSSION:
Urinary tract infection (UTI) is a leading cause of morbidity that poses huge health care expenditure in persons of all ages. Antibiotic surveillance studies can provide crucial information to guide empirical therapy that can encourage the prudent use of antibiotics which will play a key role in controlling the emergence and spread of resistance. Many studies were conducted globally regarding the emerging trend in antibiotic resistance. Our study highlights the prevalence of uropathogens and their susceptibility pattern in our hospital setup.

In this study, female: male ratio was 1.4:1 which shows that females are slightly vulnerable towards the development of UTI. It was more prevalent in the age group of 25-34 years in our study. Escherichia coli was the leading cause of UTI, irrespective of age and sex, with a distribution of 45.9%. Klebsiella was the second most common pathogen with 23.70%.

Our study shows that nitrofurantoin can be an effective drug for UTI as 54.9% of the isolates were sensitive to the drug. A multicentre study conducted by Atul Kothari et al., found out that 65.7% of isolates were sensitive to nitrofurantoin which is in accordance with our study. Also, most of the isolates showed good sensitivity of 84.3% to the less commonly tested drug, cefoperazone-sulbactum making it an alternative option for the treatment of UTI.

High level of resistance (71.5%) for cotrimoxazole would favor its exclusion from the first line drug list in the empirical treatment of UTI. Similar trend has been observed in a retrospective study conducted by M.J.Saffar et al., in Iran in which the resistance of cotrimoxazole ranged from 50% to 90%. A study conducted in Andhra Pradesh also found out that cotrimoxazole had resistance of 77.3%.

From this study, it can be concluded that norfloxacin is not effective against uropathogens as 81.6% of the isolates were resistant to that drug. This may be due to the indiscriminate and widespread use of norfloxacin in the empirical treatment of UTI. This data positively correlates with findings from the study conducted in Andhra Pradesh in which norfloxacin had resistance percentage ranging from 70% to 90%. But, Azra S.Hasan et al in New Delhi found out that norfloxacin was effective for many isolates. It is obvious from our study that the incidence of resistance has increased for commonly used parenteral antibiotics like cefotaxime (66.4%) and gentamicin (60.20%). Manjunath G N et al., who assessed the changing
trends in the spectrum of antimicrobial drug resistance in Karnataka, found out 40-53% resistance for gentamicin and also for some cephalosporins like ceftriaxone, cefuroxime, ceftazidine.\textsuperscript{14} This contradicts with the finding from a study conducted by Kalpana Gupta et al. in which gentamicin had overall resistance of less than 10%.\textsuperscript{15} Most of the isolates showed high sensitivity to amikacin with an overall sensitivity of 70.3%. But Pseudomonas was least sensitive to amikacin. In contrast, a study on the prevalence of antimicrobial resistance in uropathogens done at Salem in Tamil Nadu found out that 60% of isolates including Pseudomonas were sensitive to amikacin.\textsuperscript{16} These findings demonstrate the regional variation in the antibiotic susceptibility pattern that highlights the need for periodic evaluation of the same in each hospital.

**CONCLUSION:**
Our study demonstrated the prevalence of bacterial isolates causing urinary tract infections and their susceptibility pattern to commonly used antimicrobial drugs. High level of resistance exhibited by the uropathogens to the commonly used drugs is a matter of concern as evidenced by this study. This mandates regular and periodic evaluation of the culture pattern and their antibiograms to guide the antibiotic policy to prevent the emergence of drug resistance.

**REFERENCES:**


