



ANTIBIOTIC SUSCEPTIBILITY PATTERN OF BACTERIA AMONG PATIENTS WITH URINARY TRACT INFECTIONS IN A TERTIARY CARE CENTRE, TAMIL NADU, SOUTH INDIA.

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ABSTRACT

Background:-Urinary tract infections (UTI) are the inflammatory disorder of the urinary system caused by pathogenic organisms. UTI form diseases of serious health concern. **Aim:-** 1.To study the antibiotic susceptibility pattern, among UTI patients, attending Sree Mookambika Institute of Medical Sciences, Kulasekharam. 2.To find the organisms responsible for the causation of UTI among patients attending Sree Mookambika Institute of Medical Sciences, Kulasekharam. **Material & Methods:-** A Descriptive analytical study was conducted among 290 UTI patients attending Sree Mookambika Institute Of Medical Sciences (SMIMS). The antibiotic susceptibility was done by Kirby Bauer diffusion test. **Results:-** Of the 290 urine samples processed, Majority of them with gram negative organism (86.6%). The most commonly isolated Gram negative organism was E.Coli (49.3%) and it showed high level of resistance to Cephalosporins like Cefotaxime (72.1%). The commonly isolated Gram positive organism was Enterococcus (8.3%) and it showed high level of resistance to Norfloxacin (46.2%). **Conclusion:-** This study concludes that E.Coli is the most commonly isolated organism sensitive to Amikacin and showing resistance to Cephalosporins. Gram positive - Enterococcus sensitive to Vancomycin, also showed high level of resistance to Norfloxacin, Amikacin, Penicillin and Cefuroxime.

KEYWORDS

Urinary tract infections, Antibiotic, Organism, Resistance, Sensitivity, Isolated

INTRODUCTION

Urinary tract infections are the inflammatory disorders of the urinary tract caused by the abnormal growth of the pathogens [1,2]. Urinary tract infection is known to cause short term morbidity in terms of fever, dysuria and lower abdominal pain and may result in permanent scarring of the kidney [4,5]. Urinary tract infections can be community acquired or nosocomial.

The symptoms of UTIs such as fever, burning sensation while urinating, lower abdominal pain, itching, formation of blisters and ulcers in the genital area, genital and suprapubic pain and pyuria generally depend on the age of the person infected and the location of the urinary tract infection [4].

UTI are a serious health problem and it has been estimated that about six million patients visit outpatient department and about 3,00,000 are treated in the ward every year for UTI worldwide [3] with the constantly shifting trends in drug resistance, antibiotic options and pharmaco-economic consideration, UTI continue to be one of the most frequently diagnosed cases having an estimated figure of 150 million per annum worldwide [3].

Microorganisms that cause urinary tract infections almost come from the skin at or near the opening of the urethra. Uropathogens differ in terms of virulence factor and pathogenic mechanism that allow them to colonize and infect the urinary tract. The incidence of UTI is greater in women (20%) as compared to men; this may be either due to anatomical predisposition or urethral mucosa adherence to the mucopolysaccharide lining or other host factor [3].

The World Health Organization (WHO) has called antibiotic resistance an emergency disease [3]. Bacteria may be initially resistant or may acquire resistance to antibiotics [3]. The rapid spread of bacterial resistance to antimicrobial agents has led to the search for newer and more potent drugs. However, as soon as the new drug appears, rational use of antibiotics can effectively overcome the problem of bacterial resistance [3].

In the past decade, many kinds of resistant strains have been discovered, for example MRSA, multidrug-resistant *Pseudomonas aeruginosa*, Vancomycin-resistant *Enterococcus*, Extended spectrum beta lactamase-resistant *Enterococcus* [6]. Drug resistance of pathogens is a serious problem, because of very fast arising and spread of mutant strains that are insusceptible to medical treatment.

Aim

This study aimed at gaining knowledge about the type of pathogens

responsible for UTI and their susceptibility pattern. This may help the clinician to choose the right empirical therapy and to ascertain the current situation of antimicrobial-resistant UTIs caused by human pathogens.

Objectives

To estimate the distribution and antibiotic susceptibility pattern of bacteria among patients with urinary tract infections attending Sree Mookambika Institute of Medical Sciences, Kulasekharam, Tamil Nadu.

METHODOLOGY

A total of 290 midstream urine samples were collected from patients having symptoms of UTI, visiting SMIMS Hospital, OPD, during the period from February 2019 to July 2019.

Each sample was inoculated on blood agar (with 5% sheep blood) and Mac-Conkey agar plates and incubated at 37°C for 24 – 48 hrs. Significant growth was identified biochemically and serologically in the systematic way according to the standard methods.

Antimicrobial sensitivity testing of all isolates was performed on diagnostic sensitivity test plates by Kirby Bauer method (1996) following the definition of the National Committee of Clinical Laboratory Standards (NCCLS 1999). Bacterial inoculums were prepared by suspending the freshly grown bacteria in 25ml sterile nutrient broth. A sterile cotton swab was used to streak the surface of Muller Hinton agar plates. Filter paper disks containing designated amount of the antimicrobial drugs, commercial supply firms and the results are noted by measuring the inhibition zone in millimeter (mm).

Study Design: Cross sectional study.

Approximate Total Duration of the Study: Two months

Number of Groups to be Studied: One

Detailed Description of the Groups: One group of 350 patients with urinary tract infection attending Sree Mookambika Institute of Medical Sciences, Kulasekharam, Kanyakumari District, Tamil Nadu

Sample Size of Each Group: NA

Total Sample Size of the Study: 290

Scientific Basis of Sample Size Used in the Study: Based on the study done by Kulkarni SR, Peerapur BV, Sailesh KS et al [7] showing the prevalence of 82.53%

Sampling Technique Used in the Study: Random sampling

Study Setting: Outpatient department and Dept of Microbiology of Sree Mookambika Institute of Medical Sciences, Kanyakumari district.

Sample Size Calculation: ≥

Formula for sample size calculation $Z\alpha^2Pq/d^2$

$P=82.53\%$ [1]

$Q=100-p=100-82.53=17.47$

$d=5.5\%$ of p

Therefore, sample size = $3.84 \times 82.53 \times 17.47 / 20.6$

= 268.7

Sample size approximated to 290

Inclusion Criteria

1. Patients with symptoms of UTI
2. Bacterial culture should be positive
3. Culture containing colony forming unit (cfu) $>10^5$ was considered

Exclusion criteria

1. Bacterial culture negative (no growth in agar)
2. Culture containing colony forming unit (cfu) $<10^5$ colony was excluded.

RESULTS

Of the 290 urine samples processed 290 yielded significant growth of pathogens. The patients were between age 01 to 95 years of age. More cases were recorded among the young and middle aged patients (41 -60 years of age 43%) as shown in Table 1. More organisms were isolated from women (42.7%) than from men (57.3%) as shown in Table 2. Of the 290 significant samples isolates, gram negative organisms accounts for 86.6% while gram positive organism accounted for remaining 13.4% of the pathogens as shown in Table 3.

Tab.1 Percentage And Frequency Of Incidence Among Different Age Groups

Age	Frequency	Percentage
1 - 20	12	4.1%
21 - 40	43	14.8%
41 – 60	125	43%
61 - 80	97	33.4%
81 - 95	13	4.5%

Tab.2 Percentage And Frequency Of Incidence Among Different Sex

Sex	Frequency	Percentage
Male	114	42.7%
Female	153	57.3%

Tab.3 Gram Staining Of The Given Organism

Organism grown in culture	Percentage
E.coli	49.3%
Klebsiella pneumoniae	12.4%
Proteus mirabilis	1.4%
Citrobacter koseri	3.8%
Citrobacter ferundii	3.1%
Providencia species	1.0%
Pseudomonas argenousum	8.3%
Klebsiella oxytoca	1.7%
Acinitobacter	4.8%
Proteus vulgaris	0.7%
Enterococcus	8.3%
MSSA	2.8%
MRSA	2.1%
MRS epidermidis	0.3%

From the Tab.4 it infers that the E.Coli (49.3%) is the most common organism causing the UTI and followed by the Klebsiella pneumonia which accounts for 12.4% of the infection the most common gram positive organism causing UTI are Enterococcus accounts for 8.35 of the total infection and followed by the MSSA which accounts for 2.85% of infections.

Tab.4 Organism Isolated In The Culture

Gram satining	Percentages
Gram negative	86.6%
Gram positive	13.4%

The antibiotic susceptibility rates of gram negative organism are presented in Tab.5. Among the Aminoglycosides antibiotics, Amikacin had the widest coverage against gram negative isolates (77.7%), Gentamycin (59.8%). and then Nitrofurantoin derivatives, Nitrofurantoin (64.1%). This was followed by Beta lactamase antibiotics Piperacillin (69.3%), Sulbactam (17.5%), Aztreonam (17.5%), Cefotaxime (19.5%), Cefoperazone (23.1%), Cefipime (27.9%), Ceftriaxone (21.9%), Cefoxitin (17.1%). This was followed by Fluroquinolones,

Norfloxacin(30.3%), Ofloxacin(34.3%). Cotrimoxazole(35.5%). The antibiotic susceptibility rates of gram positive organism are presented in Tab.6. Among the Glycopeptide antibiotics Vancomycin(82.1%) has the widest coverage against gram positive organism followed by Nitrofurantoin derivative antibiotics, Nitrofurantoin(74.4%) and then cotrimoxazole(61.5%). The antibiotic susceptibility rates of gram negative organism are presented in Tab.7. Among the cephalosporin antibiotics cefotaxime (72.1%) has the highest range of resistance against gram negative organism followed by ceftriaxone (70.5%) Cefuroxime (70.5%) , Azetronam and Cefoxitin (68.9%). The antibiotic resistance rates of gram positive organism are presented in Tab.8. Among the fluroquinolones – Norfloxacin (48.2%) has the highest range of resistance against gram positive organism followed by Amikacin (43.6%), Penicillin (38.5%), Cefuroxime (35.90%)

Tab5. Sensitivity Pattern Among Gram Negative Organism

Antibiotics	Percentage
Cefotaxime	18.7%
Cefotaxime	19.5%
Azetronam	17.5%
Sulbactum	17.5%
Cefoperazone	23%
Cefipime	27.9%
Ceftriaxone	21.9%
Ertapenem	34.7%
Cefoxitin	17.0%
Gentamycin	59.8%
Amikacin	77.7%
Cotrimoxazole	35.5%
Piperacillin	69.3%
Norfloxacin	30.3%
Nitrofurantoin	64%
Ofloxacin	34.3%

Tab.6 Sensitivity Pattern Among Gram Positive Organisms

Antibiotics	Percentages
Cefotaxime	25.6%
Ceftriaxone	59.0%
Cefoxitin	23.1%
Gentamycin	30.8%
Amikacin	48.7%
Cotrimoxazole	61.5%
Piperacillin	17.9%
Norfloxacin	38.5%
Nitrofurantoin	74.4%
Ofloxacin	51.3%
Vancomycin	82.1%
Penicillin	48.7%
Cefuroxime	15.4%
Erythromycin	12.8%
Clindamycin	23.1%
Tetracyclin	30.8%
Teicoplanin	30.8%
Chloramphenicol	33.3%
Novobiocin	35.9%

Tab.7 Resistance Pattern Among Gram Negative Organisms

Antibiotics	Percentage
Cefotaxime	72.10%
Ceftriaxone	70.50%
Cefuroxime	70.10%
Azetronam	68.90%
Cefoxitin	68.90%
Sulbactum	68.50%
Cefoperazone	67.70%
Norfloxacin	58.20%
Cefepime	55.80%
Ofloxacin	54.20%
Ertapenem	53.00%
Cotrimoxazole	52.20%
Nitrofurantoin	28.30%
Gentamycin	26.70%
Piperacillin	23.50%
Amikacin	20.30%

Tab.8 Resistance Pattern Among Gram Positive Organisms

Antibiotics	Percentage
Norfloxacin	48.20%
Amikacin	43.60%
Penicillin	38.50%
Cefuroxime	35.90%
Ceftriaxone	28.20%
Cefotaxime	25.60%
Cotrimoxazole	23.10%
Erythromycin	23.10%
Ofloxacin	20.50%
Nitrofurantoin	15.40%
Cefoxitin	12.80%
Clindamycin	10.30%
Vancomycin	7.70%
Teicoplanin	5.10%
Chloramphenicol	2.60%

DISCUSSION

Devanand Prakash and Ramchandran Sahai Saxena[1] studied the Distribution and Susceptibility of UTI causing pathogens change according to time and place. This study was conducted to determine the distribution and antimicrobial susceptibility of uropathogens in the Indian community as well as to determine the effects of gender and age on the etiology of bacterial uropathogens. The UTI prevalence was 53.82% among the urine samples collected from the patients; however, the prevalence was significantly higher in females than in males (females:73.57%; males:35.14%; $P=0.000$). Gram negative bacteria (90.32%) were found in higher prevalence than gram positive (9.68%). *Escherichia coli* (42.58%) was the most prevalent gram negative isolate. Nitrofurantoin (78.71%) was found the most resistant drug among all uropathogens.

In a study on comparative prevalence of antimicrobials resistance in community-acquired urinary tract infection cases from representative states of Northern and Southern India by Gupta S et al [4], *Escherichia coli* (55.1%) were the most prevalent isolates followed by *Enterococcus faecalis* (15.8%). Amikacin was the most active antimicrobials agents which showed low resistance rate of 14%. The present study revealed the geographical difference in prevalence of uropathogens with *Klebsiella pneumoniae* being the second most common uropathogens followed by *E.faecalis* in the states from northern India while no *K.pneumoniae* was seen in samples from southern India but *E.faecalis* was the second most prevalent organism.

Akram M et al [5] found that majority (66.66%) of the isolates were from females.

Sabir S et al [6] found urine samples with highest prevalence of *E. coli* (321, 80%) followed by *Staphylococcus aureus* (9.4%), *Proteus* species (5.4%) and *Pseudomonas* species (5.2%).

Study by Kolawole AS et al [7] found that common organism causing UTI were Gram negative-*E.COLI*- 30.56% and Gram positive -*Staph.Aureus*-15%

Patel HB et al found that. Isolates rate from male and female urine samples was 45.29% and 46.32% respectively. The most commonly isolated organism was *Escherichia coli* (36.11%), followed by *Candida* spp (18.56%), and *Klebsiella* spp (18.06%). *E.coli* was most susceptible to Meropenem (91.89%) and Imipenem (91.69%). *Klebsiella* spp was most susceptible to Imipenem (75.89%) and Meropenem (75.49%). Susceptibility of *E.coli* and *Klebsiella* spp to Nitrofurantoin, Cotrimoxazole and Ciprofloxacin was 72.33%, 32.02% and 18.97% and 51.77%, 27.27% and 22.13% respectively. [8]

As per the study by Rajendran V et al, the commonest organism isolated overall was extended spectrum beta lactamase positive *E.coli* (36.5%) followed by extended spectrum beta lactamase negative *E.coli* and *Enterococcus*. Females (68.63%) were mostly affected than males in our study. The people in the age group of 41-60 years are found to be more (48.46%) affected than the people of other age groups. The most sensitive oral antibiotics to almost all organism in our study is Nitrofurantoin followed by Cotrimoxazole and Norfloxacin and among parenteral antibiotics Amikacin stands first followed by Piperacillin-Tazobactam and Gentamycin [9]

A study by Saha, S., Rahman, et al (2015) on antimicrobial resistance in

uropathogen from patients with urinary tract infections, comparative prevalence of *E.coli* was detected in 69 of the 100 samples (69%), while *Staphylococcus* spp was found in 18 samples (18%), *Pseudomonas aeruginosa* in 8 samples (8%) and *Klebsiella pneumoniae* in 6 samples (6%), respectively [10].

LIMITATION

As the study was conducted among UTI patients attending a tertiary care hospital in Kulasekharam, SMIMS, so the results cannot be generalized to all the UTI patients across the country.

CONCLUSION

The susceptibility and resistance profile of all isolates in this study have shown that Nitrofurantoin, Vancomycin, Amikacin, Piperacillin possess the higher efficacy while Cephalosporins possess lower efficacy. Despite this efficacy, there was a general increase in the resistance pattern of isolates to all the antibiotics used in this study. The present study conforms that bacterial resistance would be a greatest problem in the country. The findings of the present study confirms that still some bacteria are resistant to antibiotics especially Cephalosporins frequently used drugs in many parts of the world.

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