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Original Research Article

Retrospective study on susceptibility and resistance pattern of urinary pathogens in a tertiary care hospital

Sudha Ramu*

Department of Pharmacology, K.A.P.V. Govt. Medical College, Tiruchirapalli, Tamil Nadu, India

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***Correspondence to:**
Dr. Sudha Ramu,
Email: sudhapharm71@gmail.com

ABSTRACT

Background: Indiscriminate and inappropriate use of antimicrobial agents (AMA) resulted in rapid emergence of antimicrobial resistance. Institutional level surveillance program to be carried out to track AMA use. The study was conducted to evaluate the prevalence of uropathogens and their susceptibility and resistance pattern in a tertiary care hospital to revise empirical therapy.
Methods: Urine samples received from the inpatients and outpatients Departments of Mahatma Gandhi memorial hospital for culture sensitivity between January 2018 to December 2018 were included in this study. Data collected from the Department of Microbiology register by using WHONET software. After identification, isolates were tested for antimicrobial susceptibility by the standard Kirby Bauers diffusion method. Descriptive analysis done and results were expressed as percentage.
Results: Out of 3425 samples 68.5% showed no growth, 15.5% normal flora and only 15.9% reported as culture positive. In this study the highest isolate was *Escherichia coli* (59%) followed by *Klebsiella pneumoniae* (10.6%), *Enterococcus sp.* (7%), *Staphylococcus aureus* (5%), *Candid* (3.6%), *Acinetobactor* (3%) and *Pseudomonas* (2.9%). Uropathogens developed resistance against penicillins, cephalosporins, macrolides and cotrimaxazole.
Conclusions: This study confirms, the frequently prescribed empirical therapy drugs were less susceptible and developed resistance than less frequently prescribed and costly drugs. The current antimicrobial resistance pattern alarms the irrational and excessive use of antimicrobial agents. Hence the treating physicians should revise empirical therapy periodically based on the institutional antibiogram and resistance pattern reported from the laboratory to preserve antimicrobial source for the future generation.

Keywords: Urinary tract infection, Susceptibility and resistance pattern, Antimicrobial agents

INTRODUCTION

Urinary tract infections (UTI) are one of the most common infections that affect all age groups. Every year about 150million people are diagnosed with urinary tract infection worldwide.[1,2] Prevalence of UTI is more common in females than males. Due to the anatomical structure, most of the women approximately 40% to 50% will suffer at least one episode of UTI during their lifetime.[3] High risk factors for UTI are paediatric age groups, elderly patients, patients with spinal cord injuries or catheters, immunocompromised individuals especially HIV, diabetics and congenital urinary tract malformations.[4]

The causative organisms for urinary tract infections are bacteria, predominantly gram negative than gram positive organisms and candida. The prevalence of commonest isolates were *Escherichia coli*, *Klebsiella*, *Pseudomonas*, *Staphylococcous* and *Proteus.*[5] *E. coli* is the most common causative bacteria being responsible for about 80 percent of infections in acute uncomplicated urinary tract infections.[6]

Antibiotics are the first line of treatment for urinary tract infections, usually patients with symptoms of dysuria and increased frequency of urine are immediately started on empirical therapy. The selection of antibiotic in empirical therapy should be based on information determined from

the antimicrobial resistance pattern of the urinary pathogens.[7] The commonly prescribed antimicrobial agents are levofloxacin, ciprofloxacin, nitrofurantoin, cotrimaxazole, nalidixic acid and gentamicin.[8] Irrational and extensive use of antimicrobial agents has resulted in the development of antimicrobial resistance, which has become a major problem all over the world.[9,10] UTI increases the morbidity and economical burden of the society. Emergence of multidrug resistance against uropathogens also an important and threatening challenge being faced by the world.[10,11]

The aim of the study was to evaluate the prevalence of uropathogens and their susceptibility and resistance pattern in a tertiary care hospital to guide the clinicians to plan and revise empirical therapy.

METHODS

This was a retrospective study and the data was collected from the Department of Microbiology laboratory register by using WHONET software. Urine samples received from in patients and outpatients departments of Mahatma Gandhi Memorial hospital attached to K.A.P.V. Government medical college, between January 2018 to December 2018 were included in this study. Samples were processed as per CLSI methodology 2015 guidelines. Smears for Grams staining, bacterial isolates identification and biochemical tests for identifying the species of the pathogens were done. After identification, isolates were tested for antimicrobial susceptibility testing by the standard Kirby Bauers diffusion method. Quality control procedures were incorporated to assure the quality of the media, biochemical and antibiotic discs.

The following standard antibiotic discs were used for the isolates, amikacin (AMK), amoxicillin (AMX), ampicillin (AMP), azithromycin (AZM), cefotaxime (CTX), ceftazidime (CAZ), ceftriaxone (CRO), cephalexin (CEP), chloramphenicol (CHL), ciprofloxacin (CIP), erythromycin (ERY), gentamycin (GEN), gentamycin high (GEH), meropenem (MEM), oxacillin (OXA), penicillin (PEN), piperacillin (PIP), tazobactum (TZP), tigycycline (TCY), tobramycin (TOB), cotrimaxazole (SXT), vancomycin (VAN), doxycycline (DOX), teicoplanin (TEC), cloxacillin (CLO), levofloxacin (LEX), cefoxitin (FOX), cefipime (FEP), ertapenem (ETP), minocycline (MNO), colistin (COL), linezolid (LNX), clindamycin (CLI), imepenam (IPM), cefaperazone sulbactum (CSL), nalidixic acid (NAL), norfloxacin (NOR) and nitrofurantoin (NIT).

Results were entered in Microsoft excel. Descriptive analysis done and results were expressed as percentage.

RESULTS

Between January 2018 to December 2018, 3425 urine samples were received for culture sensitivity. No growth was reported in 2348 samples and normal flora grown in 531 samples. Numbers of organisms isolated were 546 (Figure 1).

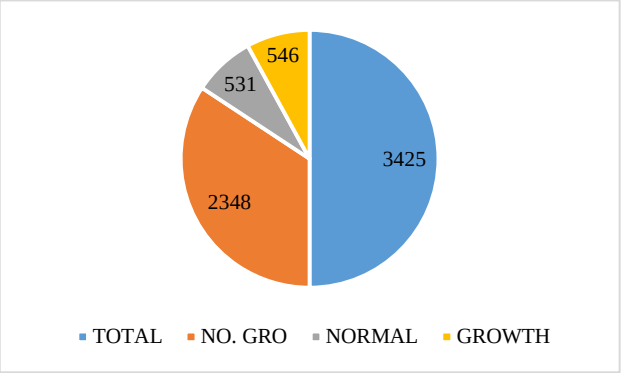

Figure 1: Distribution of urine samples.

Table 1 shows the prevalence of organisms and the number of isolates.

Table 1: Distribution of bacterial isolates.

Organism	No. of isolates
***Acinetobacter* sp.**	17
***Candida* sp.**	20
***Citrobacter* sp.**	5
E. coli	324
***Enterobacter* sp.**	9
***Enterococcus* sp.**	40
***Klebsiella* sp.**	3
Klebsiella oxytoca	9
Klebsiella pneumoniae	58
Pseudomonas aeruginosa	16
Proteus mirabilis	7
***Pseudomonas* sp.**	7
Proteus vulgaris	2
S. aureus	29

Highest isolates were *E. coli* (59%), *Klebsiella Pneumoniae* (10.6%), *Enterococcus* sp. (7%), *S. Aureus* (5%), *Candid* (3.6%), *Acinetobactor* (3%) and *Pseudomonas* (2.9%).

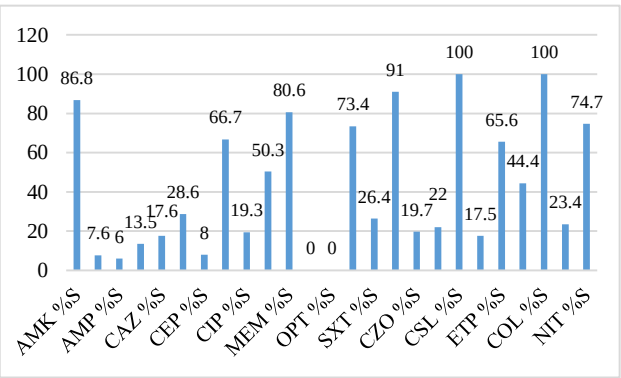

Figure 2: *E. coli* susceptibility pattern.

E. coli was highly susceptible to (100%) colistin and cefaperazone sulbactum (CSL), Amikacin (87%), levofloxacin (91%), meropenam (81%), tezobactum (73%) and nitrofurantoin (75%).

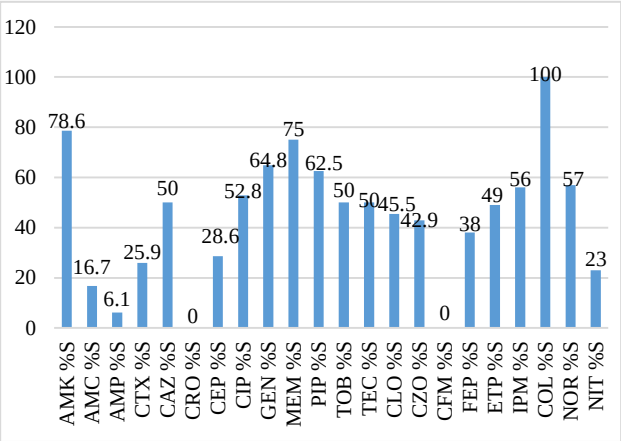

Figure 3: Antimicrobial susceptibility for *Klebsiella pneumoniae.*

Klebsiella pneumoniae found to have a high susceptiblity to colistin (100%), amikacin (79%) and meropenam (75%).

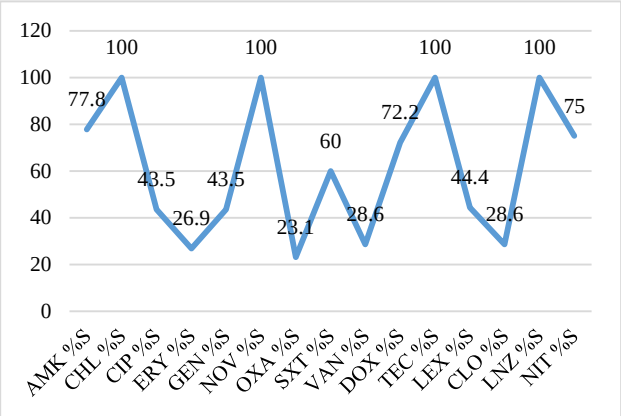

Figure 4: *S. aureus* susceptibility pattern.

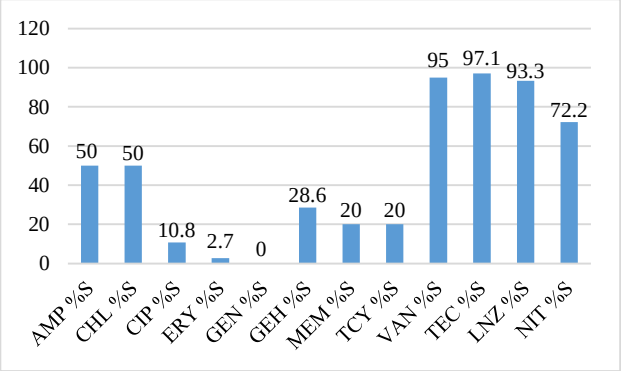

Figure 5: Antimicrobial susceptibility for *Enterococcus sp.*

S. aureus showed high susceptiblility to chloramphenicol, novobiocin, teicoplanin and linezolid (100%).

Vancomycin (95%), teicoplanin (97%), linezolid (93%) and nitrofurantoin (72%) were sensitive against *Enterococcus* species.

DISCUSSION

In our study the most common uropathogen reported was *E. coli* followed by *Klebsiella pneumoniae*, *Enterococcus* species, *S. Aureus*, *Candid*, *Acinetobacter* and *Pseudomonas*. Out of 3425 samples 68.5% no growth, 15.5% normal flora and only 15.9% reported as culture positive.

Various studies from India and other countries also confirms the similar distribution pattern of urinary pathogen.[5,6,12,13] Obiofu et al study reported *S. aureus* was the commonest uropathogen in Nigeria.[14]

E. coli was highly susceptible to colistin, cefaperazone sulbactum combination, amikacin, meropenam and levofloxacin. It developed resistance (>80%) against penicillins (amoxacillin and ampicillin) and all four generations of cephalosporins (cephalexin, cefotaxime, ceftazidime, cefazolin, cefixime and cefipime). Quinolones (nalidixic acid, norfloxacin and ciprofloxacin) and cotrimaxazole (>70%) also developed resistance. Gentamicin showed low susceptibility (50%) to E.coli. Penicillin, cephalosporins, ciprofloxacin and cotrimaxazole resistance to *E. coli* was similar in various studies conducted worldwide.[15-18]

Colistin, amikacin and meropenam were sensitive against *Klebsiella* and total resistance was seen against penicillins, cephalosporins, quinolones, cotrimaxazole and nitrofurantoin. This findings were coincide with many studies and it was explained, due to the production of extended spectrum beta lactamase (ESBL) by the bacteria its naturally resistant to beta lactam antibiotics. Inappropriate use of AMAs results in emergence of resistance against quinolones, cotrimaxazole and nitrofurantoin. Colistin is not prescribed regularly for its side effects. Amikacin and meropenem are costly drugs. The cost factor of Amikacin and Meropenem restricted the frequent prescription of these drugs and exhibits the high susceptibility. These may be kept as reserve drugs for complications.[19,20]

Enterococcus susceptibility pattern showed vancomycin, teicoplanin, linezolid and nitrofurantoin were highly sensitive. The frequently prescribed drugs penicillins (50%), quinolones (73%), erythromycin (84%) and aminoglycosides (100%) were developed resistance. This pattern also comparable to other studies reported in India.[21] Vancomycin resistance was not seen in our study which is reported in North India.[22]

S. aureus was highly susceptible to chloramphenicol, teicoplanin, novobiocin and linezolid. Amikacin, nitrofurantoin and doxycycline were moderately susceptible and total resistance seen against ampicillin and azithromycin. Our study revealed, *S. aureus* resistance against penicillins, macrolides and low susceptibility to flouroquinolones and aminoglycosides. Onangua et al study also confirms ampicillin resistance, but flouroquinolones are still sensitive in their region.[23] In contrast to Laksminarayana et al study, *S. aureus* was highly sensitive to linezolid.[24] This study also coincides with Toner et al study, which emphasized development of resistance against fluoroquinolone over decade.[25]

CONCLUSION

Increased availability of antimicrobial agents lead to irrational prescription, excessive use of drugs, rapid development of resistance and depletion of antimicrobial source. Commonly used empirical drugs penicillin, cephalosporins, fluroquinolones and cotrimaxazole were developed resistance, no longer they can be used as empirical therapy. This study showed that colistin, imepenam, amikacin, linezolid and vancomycin continue to the first line of drugs for complications. The current antimicrobial resistance pattern seems to be increase the economical burden of the family and society. Awareness to be created among treating physicians and empirical therapy choice should be revised periodically based on the institutional antibiogram and resistance pattern reported from the laboratory. Our study alarms strict protocol and follow up for antimicrobial use to preserve antimicrobial resource for the future generation.

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