Print ISSN: 2319-2003 | Online ISSN: 2279-0780

IJBCP International Journal of Basic & Clinical Pharmacology

DOI: http://dx.doi.org/10.18203/2319-2003.ijbcp20192188

Original Research Article

A retrospective analysis of antibiogram on urinary isolates in a tertiary care hospital, Trivandrum, India

Pramodh K.[1], Thansila L. T.[2]*, Pushpajan K. S.[2], Lallu Mariam Jacob[3]

[1]Department of General Medicine, SK Hospital, Edappazhanji, Trivandrum, Kerala, India
[2]Intern, [3]Department of Pharmacy Practice, The Dale View College of Pharmacy and Research Centre, Punalal, Trivandrum, Kerala, India

Received: 18 March 2019
Revised: 05 April 2019
Accepted: 03 May 2019

***Correspondence to:**
Dr. Thansila LT,
Email: 9037685401thansi@gmail.com

ABSTRACT

Background: Antimicrobial resistance among bacterial strains is an emerging problem. Urinary tract infections are one of the most common bacterial infections in humans both in the hospital and the community settings. Gram-negative bacilli are the common pathogens isolated in urine. These uropathogens have developed resistance to commonly prescribed antimicrobial agents. This severely limits the effective empirical treatment options. Objective of this study was to determine the prevalence and antibiotic susceptibility patterns of bacterial uropathogens isolated from patients attending a tertiary care hospital Trivandrum.
Methods: Urine samples received for culture in the laboratory between 6 month periods was cultured in MacConkey agar and blood agar plates. The growth from urine cultures was processed for identification and antibiotic susceptibility as per standard methods. The details of urinary pathogens grown from urine samples and their Antibiogram profile were collected from the records.
Results: Out of 924 specimens investigated for significant bacteriuria, 226 shows positive cultures. *E.coli* and *Klebsiella* were the predominant pathogens isolated. Antibiotics like 3rd generation cephalosporins, fluoroquinolones, and cotrimoxazole are the usual empirical treatment options, these organisms have developed resistance towards the latter which might make the empirical therapy less effective.
Conclusions: Gram-negative bacilli were the predominant pathogens isolated and many were resistant to the commonly prescribed antibiotics. Routine surveillance and monitoring studies need to be constantly conducted to update clinicians on the prevalent pathogens for the rational and empirical treatment of bacteriuria. Beta-lactam beta-lactamase inhibitors, aminoglycosides, carbapenem, and nitrofurantoin showed low resistance so they should be considered as empirical treatment options.

Keywords: Antibiogram, Antibiotics, Bacteriuria, Resistance, Uropathogens

INTRODUCTION

Bacteriuria is the presence of bacteria in urine. Based on the presence and absence of clinical manifestations, bacteriuria may be classified as symptomatic or asymptomatic bacteriuria. Presence of organisms like *E. Coli*, *Klebsiella* etc. may cause urinary tract infections which can be regarded as symptomatic bacteriuria. And if there are no symptoms, it's regarded as asymptomatic bacteriuria.[1]

Hospital antibiogram provides a region-wide report of culture and susceptibility data. Antimicrobial sensitivity studies are conducted to determine the sensitivity of organisms towards antibiotics. These studies are important because of the increased rate of antibiotic resistance. Antibiotic resistance makes it difficult to treat infections

caused by bacteria. It makes the surveillance of antimicrobial sensitivity essential. Additionally, trends in the appropriateness of antibiotic prescribing were also assessed.[2]

The aim of this study is to determine the prevalence and antimicrobial sensitivity patterns of uropathogens in a tertiary care hospital because these are two factors which can help in improving the efficacy of empirical therapy.

Aim and objectives

- To study the prevalence of various bacterial isolates present in the urinary culture samples.
- To study the changing trends in the susceptibility patterns of uropathogens isolated over a 6 months period.
- To assess the prevalence of multidrug resistance among the urinary isolates.

METHODS

Inclusion criteria

- Patients admitted for more than 3 days
- Both genders
- Age >18 years

Exclusion criteria

- Pregnant women
- Nursing mothers
- Mentally retarded
- Paediatrics
- OP patients

Study Period

The study has been carried out for 6 months from September 2018 to February 2019.

Study population

The study population consists of 924 urine specimens. The patients were selected on the basis of inclusion-exclusion criteria.

A retrospective observational study was carried out for a 6 month period in 924 urine specimens to determine the susceptibility and resistance of gram negative organisms towards the existing empirical treatment options.

Statistical analysis

For the evaluation of the study data descriptive quantitative type statistical analysis was used. Data from laboratory investigation was entered into the Microsoft Excel Spreadsheet.

Study design

A retrospective analysis of urine culture was performed at a microbiology laboratory in a tertiary care hospital, Trivandrum. The age, gender, urine culture reports, and their antibiogram profile were collected from the registration records using a standard data collection form. Data analysis was done using Excel.

Identification of isolate

According to standard operating procedures, urine samples were cultured on to MacConkey agar and blood agar plates, then incubated at 37°C for 24 hours and the colonies were identified based on the bacterial morphology.

Anti-microbial susceptibility tests

Urine isolates were selected to determine their susceptibility patterns against the first line antimicrobial agents by the disc diffusion method. The antimicrobial agents used were amoxiclav (30 µg), gentamicin (120 µg), amikacin (30 µg), cefuroxime (30 µg), cefixime (5 µg), ceftriaxone (30 µg), ceftazidime (30 µg), cefepime (30 µg), cefoperazone sulbactam (75/30 µg), doxycycline (30 µg), tigecycline (15 µg), levofloxacin (5 µg), ciprofloxacin (5 µg), piperacillin-tazobactam (100/10 µg), imipenem (10 µg), nitrofurantoin (100 µg), cotrimoxazole (25 µg), nalidixic acid (30 µg), linezolid (10 µg), tetracycline (30µg), vancomycin (30µg),clindamycin (2 µg), Teicoplanin(30 µg), Tigecycline(15 µg), and Penicillin (1 unit).

RESULTS

Out of 924 urine specimens screened for significant bacteriuria, a total of 226 showed positive culture. In 226 bacterial isolates, 57% were from female patients and 43% from male patients. Among 226 urine isolates, gram-negative constitutes 221 (97.78%) and gram-positive constitutes 5 (2.21%). Figure 1 shows the distribution of bacteria among urine isolates (n=226).

The prevalence of bacterial isolate from urine culture was *E. coli* (47.3%), followed by *Klebsiella* (27.8%), *Pseudomonas* (7.96%), *Enterobacter* (6.19%), *Citrobacter* (5.75%), *Acinetobacter spp.* (2.65%), *β streptococcus* (1.76%) and *S. aureus* (0.44%) is shown in Figure 1. Antibiogram of *E. coli* and *Klebsiella* are shown in Figure 2 and Figure 3 respectively.

Antibiogram of *E. coli* showed higher resistance towards nalidixic acid (78.5%) followed by cefuroxime (75.7%), cefixime (71.9%), ceftriaxone and amoxyclav (68.2%) levofloxacin (62.6%), ciprofloxacin (59.8%), cefepime (56%) doxycycline (51.4%). Piperacillin tazobactam (82.2%) showed higher susceptibility followed by cefperazone sulbactam (79.4%), nitrofurantoin (72.8%), and imipenem (60.7%) and gentamicin (53.2%).

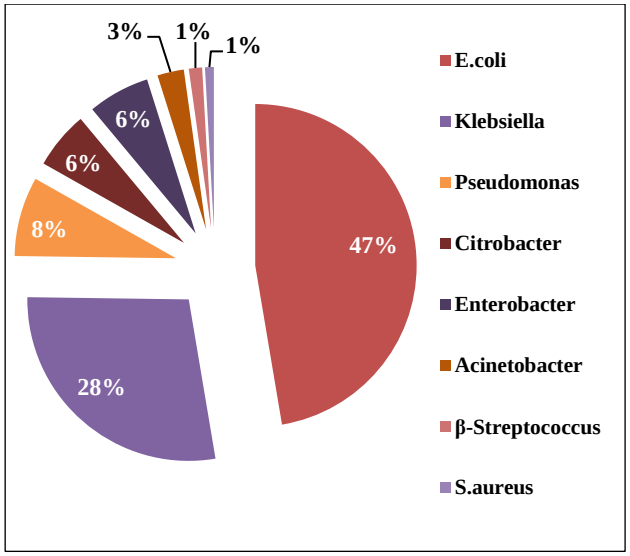

Figure 1: Distribution of bacteria among urine isolates (n=226).

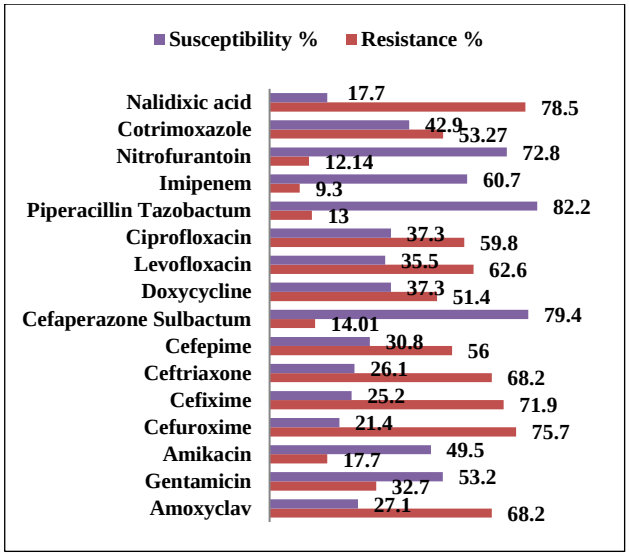

Figure 2: Antibiogram of *E. coli*.

Table 1: Antimicrobial resistance patterns of other urinary isolates.

Antibiotics	Pseudomonas (18)*	Citrobacter (13)*	Enterococci (14)*	Acinetobacter (6)*	βstreptococci (4)*	S. aureus (1)*
Amoxyclav		7 (53.8%)	3 (21.4%)	3 (50%)		
Gentamicin	7 (38.8%)	4 (22.2%)	7 (50%)	2 (33.3%)	1 (25%)	
Amikacin	6 (33.3%)	1 (7.6%)	6 (42.8%)	2 (33.3%)	1 (25%)	
Cefuroxime	1 (5.5%)	10 (76.9%)	6 (42.8%)	4 (66.6%)		
Cefipime		10 (76.9%)	6 (42.8%)	4 (66.6%)		
Ceftriaxone		9 (69.23%)	5 (35.7%)	3 (50%)		
Cefepime	3 (16.6%)	6 (46.1%)	3 (21.4%)	3 (50%)		
Cefperaxone Sulbactum	2 (11.1%)	1 (7.6%)	1 (7.14%)			
Doxycycline	5 (27.7%)	5 (38.4%)	2 (14.28%)	3 (50%)		
Levofloxacin	4(22.2%)	4(22.2%)	5(35.7%)	3(50%)	3(75%)	1
Ciprofloxacin	3(16.6%)	4(22.2%)	5(35.7%)	3(50%)	3(75%)	1
Piperacillin Tazobactum		1(7.6%)	1(7.14%)	1(16.6%)		
Imipinem	6(33.3%)					
Nitrofurantoin	1(5.5%)	2(15.3%)	3(21.4%)	5(83.3%)		
Cotrimoxazole		4(22.2%)	5(35.7%)	2(33.3%)	1(25%)	
Nalidixic acid		11(84.6%)	7(50%)	3(50%)	1(25%)	1
Tetracycline					2(50%)	
Clindamycin					3(75%)	
Cefazolin	1(5.5%)					

*Indicate total number of organism

Klebsiella antibiogram showed greater susceptibility towards imipenem (60.3%), gentamicin (55.5%), piperacillin sulbactam (53.9%), cefperazone sulbactam (52.3%) amikacin (50.7%), cefepime (38.0%), ciprofloxacin (36.5%), levofloxacin (31.7%). Resistance pattern shows higher resistance to cefuroxime (71.4%), cefexime (68.2%), levofloxacin (61.9%), ciprofloxacin and nalidixic acid (60.3%), doxycycline (58.7%) cotrimozaxole and amoxyclav (57.1%), nitrofurantoin (53.9%).

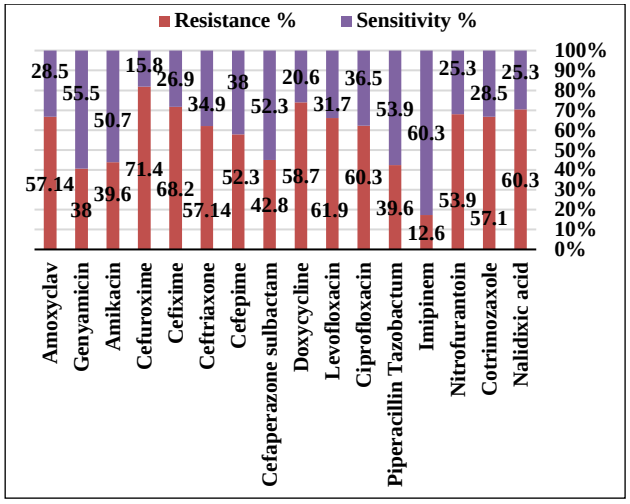

Figure 3: Antibiogram of *Klebsiella.*

Pseudomonas and *Citrobacter* contributed 7.96% and 5.75% of the total urinary isolates. Pseudomonas showed 38.8% resistance towards gentamicin, 33.3% resistance to amikacin and imipenem. *Citrobacter* showed 84.6% resistance towards nalidixic acid, 76.9% resistance towards cefuroxime and cefepime, 69.23% resistance towards ceftriaxone. *Enterobacter* showed 50% resistance towards gentamicin and nalidixic acid, 42.8% resistance towards amikacin, cefuroxime and cefepime. These isolates showed more sensitivity towards Cefoperazone sulbactam followed by piperacillin-tazobactam. *Enterococci* showed more sensitivity towards Gentamicin. The antimicrobial resistance pattern of organisms other than *E. coli* and *Klebsiella* is shown in Table 1.

DISCUSSION

Antibiotic susceptibility or resistance pattern of uropathogens have been changing over the years. One of the important factors contributing to the high resistance rates may be due to the increasing use of antibiotics without knowing the causative organism and its susceptibility pattern towards the antibiotics.

A total of 226 positive culture and sensitivity report during a 6 month period were analysed in this study. In this study, significant bacteriuria accounted for 25%. It was lower to the isolation rate reported by some other studies.[3-5] The prevalence was more in females 129(57%) as compared to males 97 (43%), this was in agreement with other studies by Razak SK et al, and Bency JAT.[3,6] In the present study, *E. coli* and *Klebsiella* were the frequently isolated uropathogens as similar to other studies.[3,7,8]

In our study, *E. coli* was most resistant to Nalidixic acid followed by cefuroxime, cefixime, and amoxiclav. It was most sensitive to Piperacillin tazobactam, followed by cefoperazone sulbactam, nitrofurantoin, and imipenem. Present antibiogram shows E.coli sensitivity towards Piperacillin tazobactam in 83% cases, while sensitivity to Cefoperazone Sulbactam is 80%, nitrofurantoin is 73% and imipenem is 61%, which was in accordance to study conducted by Jha A et al.[9] Sensitivity towards cephalosporins is very low as compared to other studies.[10,11] This difference occurs due to the indiscriminate use of cephalosporins. As a result, present antibiogram results favor the use of piperacillin-tazobactam or cefoperazone sulbactam as the drug of choice.

Isolates of *K. Pneumonia* were sensitive to Imipenem, Gentamicin, followed by piperacillin-tazobactam, Cefoperazone sulbactam, Amikacin, and some second-generation cephalosporins.[3,6,7]

The *Pseudomonas* and *Enterococci* were resistant to gentamicin and amikacin. Isolates of *Acinetobacter* and *Citrobacter* were sensitive to Cefoperazone sulbactam and Imipenem.[12]

Antimicrobial resistance may be inherent and it may be due to the natural biological response of microbes to the antimicrobial drugs.[13]

CONCLUSION

This study provides information on the antibiotic resistance pattern of urinary isolates which may be a helpful guide for physicians to initiate empiric therapy and in the formulation of hospital antibiotic policy. *E.coli* was the most prevalent urinary isolate followed by *Klebsiella*, *Pseudomonas*, *Citrobacter*, and other species.

Third generation cephalosporins, fluoroquinolones, and cotrimoxazole are the most common empirical treatment options against gram-negative bacilli. Over the years these uropathogens have developed resistance towards the usual empirical treatment options. Further advanced research studies are required to formulate cautionary guidelines to prevent the development of antibiotic resistance otherwise development of multi-drug resistant bacteria will become a major threat to the health care system and the usual empirical treatment options will no longer be effective.

ACKNOWLEDGEMENTS

Authors would like to extend their heartfelt thanks to the staffs in the Microbiology Department of SK Hospital and our batch mates who extended their support.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

REFERENCES

1. Chander A, Shrestha CD. Prevalence of extended-spectrum beta-lactamase producing *Escherichia coli* and *Klebsiella pneumoniae* urinary isolates in a tertiary care hospital in Kathmandu, Nepal. BMC Res Notes 2013;6:487.

2. Sarasu VP, Rani SR. Bacteriological profile and antibiogram of urinary tract infections at a tertiary care hospital. Int J Med Microbiol Trop Dis. 2017;3(3):106-12.
3. Razak SK, Gurushantappa V. Bacteriology of urinary tract infection and antibiotic susceptibility pattern in a tertiary care hospital in South India. Int J Med Sci Public Health. 2012;1(2):109-12.
4. Das RN, Chandrashekhar TS, Joshi HS, Gurung M, Shrestha N, Shivananda PG. Frequency and susceptibility profile of pathogens causing urinary tract infections at a tertiary care hospital in western Nepal. Singapore Med J. 2006 Apr;47(4):281-5.
5. Shah LJ, Vaghela GM, Mahida H. Urinary tract infection: Bacteriological profile and its antibiotic susceptibility in Western India. Nat J Med Res. 2015;5(1):71-4.
6. Priyanka R, Jose P. A study on the bacteriological profile of urinary tract infection in adults and their antibiotic sensitivity pattern in a tertiary care hospital in central Kerala, India. Int J Res Med Sci. 2017 Jan 23;5:666-9.
7. Prakasam AK, Kumar KD, Vijayan M. A cross sectional study on distribution of urinary tract infection and their antibiotic utilisation pattern in Kerala. Int J PharmTech Res. 2012;4(3):1310-6.
8. Sood S, Gupta R. Antibiotic resistance pattern of community acquired uropathogens at a tertiary care hospital in Jaipur, Rajasthan. Indian J Community Med. 2012;37(1):39-44.
9. Jha A, Agrawal M, Neral A, Hishikar R, Mahesh B. *Escherichia coli* as uropathogen: antibiotic susceptibility profiling. Int J Basic Clin Pharmacol. 2018;7(2):433-8.
10. Fluit AC, Jones ME, Schmitz FJ, Acar J, Gupta R, Verhoef J. Antimicrobial resistance among urinary tract infection (UTI) isolates in Europe: results from the SENTRY Antimicrobial Surveillance Program 1997. Antonie Van Leeuwenhoek. 2000;77(2):147-52.
11. Akhtar N, Rahman R, Sultana S. Antimicrobial sensitivity pattern of Escherichia coli causing urinary tract infection in Bangladeshi patients. Am J Microbiol Res. 2016;4(4):122-5.
12. 12. Magdaline J. Changing trends in the Antibiotic susceptibility pattern of Acinetobacter species isolated from clinical specimens over a period of five years from a tertiary care hospital. J Med Scie Cli Resea. 2017;05(06):24144-7.
13. Khalil A. Prevalence and antibiogram of uncomplicated lower urinary tract infections in human population of Gilgit, Northern Areas of Pakistan. Pak J Zool. 2008 Aug 1;40(4):295-301.

Cite this article as: Pramodh K, Thansila LT, Pushpajan KS, Lallu JM. A retrospective analysis of antibiogram on urinary isolates in a tertiary care hospital, Trivandrum, India. Int J Basic Clin Pharmacol 2019;8:1273-7.