Section: Microbiology

Original Research Article

URINE CULTURE ISOLATES FROM A TERTIARY CARE HOSPITAL MICROBIOLOGY LAB

Jugal Kishor Agrawal[1], Tulika Choudhary[2], Shweta Sachan[3], Muzaffari Yasmeen[4]

[1]Associate Professor, Department of Microbiology, Rama Medical College Hospital and Research Centre, Hapur, Uttar Pradesh, India
[2]Assistant Professor, Department of Microbiology, Rama Medical College Hospital and Research Centre, Hapur, Uttar Pradesh, India
[3]Department of Microbiology, Rama Medical College Hospital and Research Centre, Hapur, Uttar Pradesh, India
[4]Professor and Head, Department of Microbiology, Rama Medical College Hospital and Research Centre, Hapur, Uttar Pradesh, India

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Corresponding Author:
Dr. Jugal Kishor Agrawal,
Email: drjugalkishore9@gmail.com

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ABSTRACT

Background: Samples of urine accounts for majority of the samples seen in any microbiology lab of India. Also, UTI (urinary tract infection) is most commonly acquired infection from the hospital. Studying the pattern of antibiotics resistance is vital to decide empirical treatment modalities at hospital level. The present study was aimed to assess the isolates of urine culture from microbiology lab in an Indian institution. **Materials and Methods:** The study assessed all the urine culture isolates received at Microbiology laboratory of the Institute within the defined study period. The study assessed isolates from urine samples in subjects that were non-catheterized and had colony count of >105 CFU/mL were assessed. WHONET 5.6 software was used to assess the distribution of species and antibiotic sensitivity pattern. **Result:** Among 320 isolates assessed from 1602 samples with 19.98% positivity rate, most common pathogen was coliforms followed by pseudomonas spp., and candida spp. in 71.8%, 8.75%, and 8.75% subjects respectively. Higher rate of UTI was seen in females compared to males with 28.21% and 11.73% subjects respectively. Most resistant among isolates was Enterobacteriaceae group. Most sensitive antibiotics were imipenem and amikacin in 82% and 85% sensitivity in Enterobacteriaceae group and aztreonam and polymyxin-B showed sensitivity for 93% and 100% in pseudomonas spp. **Conclusion:** The present study concludes that leading cause of UTI (urinary tract infection) in India was Enterobacteriaceae which also shows maximum resistance among all the isolates. Smart and appropriate use of AMAs (antimicrobial agents) is needed to decrease the burden of increased drug resistance in urinary tract infection.

INTRODUCTION

Urine samples form majority of samples collected in the Microbiology laboratories globally including in India. Urinary tract infections are also most common hospital acquired infections. Studying the resistance pattern of antibiotics is vital in deciding the empirical treatment regimens at tertiary healthcare level. These studies also help in forming guidelines and policies for antibiotic stewardship program. Being a part of antibiotic policy making at the hospital, data concerning urinary isolates is gathered and analyzed utilizing the WHONET software.[1]

WHONET software is a software developed by WHO in collaboration with the Centre for Surveillance of Antimicrobial Resistance at Brigham & Women's Hospital, Boston, USA. It was developed to analyze, report, and record different isolates and their susceptibility data.[2] The present study was aimed to assess different species of microorganisms that cause urinary tract infection and to analyze the antimicrobial sensitivity patterns in these isolates.

MATERIALS AND METHODS

The present clinic microbiological study was aimed to assess different species of microorganisms that cause urinary tract infection and to analyze the antimicrobial sensitivity patterns in these isolates. The study was done at, Department of microbiology, Rama medical College hospital and research centre, Hapur, UP, after the clearance was taken by the concerned Institutional Ethical committee. The study subjects were from the Outpatient Department, Department of Microbiology of the Institute. Verbal

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and written informed consent were taken from all the subjects before study participation.

The study assessed the urine samples collected as a part of routine diagnostic assessment from subjects that presented with the symptoms and signs of urinary tract infection. Subjects were guided concerning mid-stream urine sample collection and were given sterile containers to collect the urine. After collection of the samples, these samples were immediately transported to the laboratory for assessment.

In the laboratory, the samples were processed following the standard microbiological protocols where samples were first inoculated on nutrient agar, CLED agar, and MacConkey agar and were kept under aerobic incubation at 37°C. Microscopy was done on samples utilizing gram stain and we mount techniques. Sample isolates having colony count of > 105 CFU/mL were considered for further analysis. Different biochemical tests were utilized for identification of the microorganisms.[3] These samples were tested further for antimicrobial susceptibility testing according to CLSI guideline.[4,5] Susceptibility testing was done utilizing the Kirby-Bauer disc diffusion method. Antimicrobial susceptibility data and testing of the isolates was saved and assessed using WHONET 5.6 software.

The data gathered were statistically analyzed using the chi-square test, Fisher's exact test, Mann Whitney U test, and SPSS (Statistical Package for the Social Sciences) software version 24.0 (IBM Corp., Armonk. NY, USA) using ANOVA, chi-square test, and student's t-test. The significance level was considered at a p-value of <0.05.

RESULTS

The present clinicomicrobiological study was aimed to assess different species of microorganisms that cause urinary tract infection and to analyze the antimicrobial sensitivity patterns in these isolates. During the study period, a total of 320 isolates were assessed in 1602 samples depicting a positivity rate of 19.98%. Among 320 isolates, most common were the gram-negative isolates seen in 80.63% (n=258) isolates. Other isolates assessed from the samples of the subjects were Candida spp., Staphylococcus aureus, and Enterococcus spp. [Table 1].

It was seen that higher rates of urinary tract infection were seen in female patients compared to male subjects with 28.21% (n=226/801) females compared to 11.73% (n=94/801) males. This higher rate in females was attributed to anal orifice proximity and shorter urethral length. Most common cause of urinary tract infection in patients was Coliforms irrespective of the gender. It was noted that infection rate by Pseudomonas spp. was higher in males compared to females with 14.86% (n=22/148) and 3.49% (n=6/172) respectively. Infections caused by other isolates were more commonly seen in female subjects compared to males.

The study results showed that concerning antibiotic susceptibility pattern among gram negative organisms, more resistance to antimicrobials was seen in Enterobacteriaceae tribe compared to Pseudomonas spp. Highest antimicrobial susceptibility was seen in enterobacteriaceae group for amikacin, imipenem, aztreonam, and piperacillin-tazobactam with susceptibility of 85%, 82%, 81%, and 79% respectively. In pseudomonas spp., most sensitive antimicrobials were polymyxin-B, aztreonam, imipenem, and piperacillin-tazobactam with sensitivity of 100%, 93%, 86%, and 86% respectively. More resistant in pseudomonas were Fluoroquinolone group (ciprofloxacin, levofloxacin & lomefloxacin) [Table 2 and 3].

It was also seen that for gram positive bacteria, teicoplanin and vancomycin had 100% sensitivity to enterococcus isolates. Other antibiotics that presented sensitivity were nitrofurantoin and linezolid with 92% sensitivity each. Tetracyclines, fluoroquinolones, and penicillins showed relative resistance in enterococcus spp. All the Staphylococcus aureus isolates were MSSA (methicillin sensitive staphylococcus aureus). Owing to non-availability of novobiocin disc to differentiate Staphylococcus saprophyticus from other coagulase negative staphylococci, CoNS were not included in the study [Table 4 and 5].

Table 1: Species of organisms from urine culture in study subjects

S. No	Organism	Number (n)	Percentage (%)
1	Gram positive	34	10.63
A	Staphylococcus aureus	8	2.50
B	Enterococcus spp.	26	8.13
2	Gram negative	258	80.63
A	E. coli	170	53.13
B	Pseudomonas spp.	28	8.75
C	Klebsiella spp.	58	18.13
D	Others	2	0.63
3	Others	28	8.75
A	Candida spp.	28	8.75

Table 2: Enterobacteriaceae percentage sensitivity

S. No	Organism	Percentage (%) sensitivity
1.	Amikacin	85
2.	Gentamicin	66
3.	Nitrofurantoin	66

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4.	Sulfamethoxazole/Trimethoprim	39
5.	Lomefloxacin	29
6.	Levofloxacin	74
7.	Ciprofloxacin	27
8.	Azetreonam	81
9.	Imipenem	82
10.	Cefepime	58
11.	Cefotaxime	40
12.	Cefuroxime	27
13.	Piperacillin/Tazobactam	79
14.	Amoxicillin/Clavulanic acid	38
15.	Ampicillin/Sulbactam	56
16.	Ampicillin	17

Table 3: Pseudomonas spp. percentage sensitivity

S. No	Organism	Percentage (%) sensitivity
1.	Polymyxin B	100
2.	Lomefloxacin	64
3.	Levofloxacin	64
4.	Ciprofloxacin	57
5.	Amikacin	71
6.	Gentamicin	64
7.	Aztreonam	93
8.	Meropenem	86
9.	Imipenem	79
10.	Cefepime	71
11.	Ceftazidime	64
12.	Piperacillin/Tazobactam	86
13.	Ticarcillin	71
14.	Piperacillin	79

Table 4: Enterococcus spp. percentage sensitivity

S. No	Organism	Percentage (%) sensitivity
1.	Teicoplanin	100
2.	Vancomycin	100
3.	Linezolid	92
4.	Tetracycline	31
5.	Nitrofurantoin	92
6.	Levofloxacin	38
7.	Ciprofloxacin	31
8.	Ampicillin	31
9.	Penicillin G	15

Table 5: Staphylococcus spp. percentage sensitivity

S. No	Organism	Percentage (%) sensitivity
1	Teicoplanin	90
2	Linezolid	90
3	Nitrofurantoin	70
4	Tetracycline	75
5	Vancomycin	100
6	Gentamicin	75
7	Moxifloxacin	80
8	Levofloxacin	80
9	Ciprofloxacin	75
10	Trimethoprim/sulfamethoxazole	75
11	Cefoxitin	95
12	Penicillin	60

DISCUSSION

During the study period, a total of 320 isolates were assessed in 1602 samples depicting a positivity rate of 19.98%. Among 320 isolates, most common were the gram-negative isolates seen in 80.63% (n=258) isolates. Other isolates assessed from the samples of the subjects were Candida spp., Staphylococcus aureus, and Enterococcus spp. These data were consistent with the previous studies of Olson RP et al,[6] in 2009 and Niranjan V et al,[7] in 2014 where authors assessed urine samples with characteristics similar to the present study in their respective studies. The study results showed that higher rates of urinary tract infection were seen in female patients compared to male subjects with28.21% (n=310/801) females compared to 11.73% (n=94/801) males. This higher rate in females was attributed to anal orifice proximity and shorter urethral length. Most common cause of urinary tract infection in patients was Coliforms irrespective of the gender. It was noted that infection rate by Pseudomonas spp. was higher in males compared to females with 14.86% (n=22/148)

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and 3.49% (n=6/172) respectively. Infections caused by other isolates were more commonly seen in female subjects compared to males. These results were in agreement with the findings of Saha S et al,[8] in 2014 and C. Wijekoon et al,[9] in 2014 where authors also reported higher rates of urinary tract infection were seen in female patients compared to male subjects similar to the present study.

It was seen that concerning antibiotic susceptibility pattern among gram negative organisms, more resistance to antimicrobials was seen in Enterobacteriaceae tribe compared to Pseudomonas spp. Highest antimicrobial susceptibility was seen in enterobacteriaceae group for amikacin, imipenem, aztreonam, and piperacillin-tazobactam with susceptibility of 85%, 82%, 81%, and 79% respectively. In pseudomonas spp., most sensitive antimicrobials were polymyxin-B, aztreonam, imipenem, and piperacillin-tazobactam with sensitivity of 100%, 93%, 86%, and 86% respectively. More resistant in pseudomonas were Fluoroquinolone group (ciprofloxacin, levofloxacin & lomefloxacin). These findings correlated with the results of Prakash D et al,[10] in 2013 and Beyene G et al,[11] in 2011 where antibiotic susceptibility pattern among gram negative organisms similar to the presents study was also reported by the authors in their respective studies.

The study results also showed that for gram positive bacteria, teicoplanin and vancomycin had 100% sensitivity to enterococcus isolates. Other antibiotics that presented sensitivity were nitrofurantoin and linezolid with 92% sensitivity each. Tetracyclines, fluoroquinolones, and penicillins showed relative resistance in enterococcus spp. All the Staphylococcus aureus isolates were MSSA (methicillin sensitive staphylococcus aureus). Owing to non-availability of novobiocin disc to differentiate Staphylococcus saprophyticus from other coagulase negative staphylococci, CoNS were not included in the study. These results were in line with the findings of Vuotto C et al,[12] in 2014 and Akram et al,[13] in 2007 where for gram positive bacteria, teicoplanin and vancomycin had 100% sensitivity to enterococcus isolates was reported by the authors in their studies which was comparable to the present study.

CONCLUSION

The present study, within its limitations, concludes that leading cause of UTI (urinary tract infection) in India was Enterobacteriaceae which also shows maximum resistance among all the isolates. Smart and appropriate use of AMAs (antimicrobial agents) is needed to decrease the burden of increased drug resistance in urinary tract infection.

REFERENCES

1. Forbes B A, Sahm D F and Weissfeld A S. 2007. Bailey & Scott's Diagnostic Microbiology.
2. Paniker C K Jayaram and R Ananthanarayan. 2009. Ananthanarayan and Paniker's Textbook of Microbiology.
3. Koneman EW. Koneman's Color Atlas and Textbook of Diagnostic Microbiology. 6th ed. Lippincott Williams & Wilkins; 2006. p. 624-671.
4. Performance standards for antimicrobial disk susceptibility tests; approved standard-twelfth edition, M02-A12. January 2015.
5. Clinical and Laboratory Standards Institute, Performance standards for antimicrobial susceptibility testing: twenty-fifth informational supplement M100-S25, no. January. CLSI, 2015.
6. R. P. Olson, L. J. Harrell, and K. S. Kaye. Antibiotic resistance in urinary isolates of Escherichia coli from college women with urinary tract infections. Antimicrob Agents Chemother 2009;53:1285–6.
7. V. Niranjan and A. Malini. Antimicrobial resistance pattern in Escherichia coli causing urinary tract infection among inpatients. Indian J Med Res 2014;139:945–8.
8. S. Saha, S. Nayak, I. Bhattacharyya, S. Saha, A. K. Mandal, S. et al. Understanding the patterns of antibiotic susceptibility of bacteria causing urinary tract infection in West Bengal, India. Front Microbiol 2014;5:1–7.
9. C. Wijekoon, K. Dassanayake, A Pathmeswaran, Antimicrobial susceptibility patterns and empirical prescribing practices in adult in patients with urinary tract infection: is there a need for changing clinical practices? Sri Lankan J Infect Dis 2014;4:9–21.
10. Prakash D., Saxena R. S. Distribution and antimicrobial susceptibility pattern of bacterial pathogens causing urinary tract infection in urban community of Meerut city, India. International scholarly research notices . 2013;2013.
11. Beyene G, Tsegaye W. Bacterial uropathogens in urinary tract infection and antibiotic susceptibility pattern in JIMMA university specialized hospital, Southwest Ethiopia. Ethiopian Journal of Health Sciences. 2011;21:141-6
12. Vuotto C, Longo, F, Balice MP, Donelli G, Varaldo, PE. Antibiotic Resistance Related to Biofilm Formation in Klebsiella pneumoniae. Pathogens. 2014;3:743-58.
13. Akram M, Shahid M, Khan Au. Etiology and antibiotic resistance patterns Of Community- acquired urinary tract infections in JNMC Hospital Aligarh, India. Ann Clin Microbiol Antimicrob. 2007;23:6-4.

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