

Analysis of urine culture isolates from microbiology laboratory of a tertiary care Hospital

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Abstract

The study of urine culture isolates was conducted on samples received to microbiology laboratory of GMERS Medical College attached General Hospital, Gandhinagar during the period of December 2015 to November 2016.

Only isolates from urine samples of non catheterized patients having colony count of $>10^5$ CFU/mL were included for analysis. Analysis of the species distribution and antibiotic sensitivity pattern was done with the help of WHONET 5.6 software.

Out of 160 isolates identified from 801 urine samples (positivity rate of 19.98%), most common were coliforms (71.88%) followed by pseudomonas spp. (8.75%), candida spp. (8.75%) etc. Female patients (22.81%) had higher rate of urinary tract infection as compared to males (17.45%). Enterobacteriaceae group was most resistant among all isolates. Amikacin (85%) and imipenem (82%) were most sensitive antibiotics in Enterobacteriaceae group while polymyxin-B (100%) and aztreonam (93%) were most sensitive in pseudomonas spp. Antimicrobial susceptibility testing and analysis was done for gram positive cocci also.

Enterobacteriaceae are the leading cause of urinary tract infection worldwide and also most resistant among all isolates. Cautious usage of antimicrobial agents is required to reduce the burden of increasing drug resistance in UTI.

Keywords: Urinary tract infection, Antimicrobial sensitivity, Coliform, Gender difference.

Introduction

Urine samples form major part of sample load of any microbiology laboratory. Also, urinary tract infection is most common hospital acquired infection. Study of antibiotic resistance pattern is important to decide empirical treatment regimens at hospital level. The data also helps to form policies and guidelines of antibiotic stewardship program. As a part of making antibiotic policy of the hospital, data regarding urinary isolates was collected and analyzed using WHONET software. WHONET is software developed by WHO Collaborating Centre for Surveillance of Antimicrobial Resistance at Brigham & Women's Hospital, Boston, USA. It is developed with aim of recording, reporting and analyzing various isolates and its susceptibility data.

Objectives

1. To determine various species of organisms causing urinary tract infection.
2. To analyze antimicrobial sensitivity patterns of those isolates.

Materials and Methods

The study was conducted at a tertiary care hospital, Gandhinagar. Urine samples were collected as part of routine diagnostic procedures from patients showing sign & symptoms of urinary tract infection. Patients were instructed regarding collection of mid-stream urine samples and provided sterile containers. After collection, samples were transported immediately to the laboratory. These samples were processed according to standard microbiological protocols.¹ Samples were first inoculated on nutrient agar, MacConkey agar and CLED agar and kept under aerobic incubation at 37°C. Microscopy was performed on samples

using wet mount and gram stain techniques. Isolates from samples having colony count of $>10^5$ CFU/mL were considered for further analysis.² Various biochemical tests were used to identify microorganisms.³ They were also further tested for antimicrobial susceptibility testing according to CLSI 2015 guideline.^{4,5} The Kirby-Bauer disc diffusion method was utilized for the susceptibility testing. The isolates and its antimicrobial susceptibility data was saved and analyzed with WHONET 5.6 software.⁶ Statistical analysis was performed to determine significance of findings.

Results

The study was conducted from December 2015 to November 2016 for the duration of one year. Total 160 isolates were identified from 801 samples (positivity rate 19.98%) during the defined study period. Out of total 160 isolates, gram negative isolates were the most common (n=129, 80.63%). The other isolates identified from the patient's samples were Enterococcus spp., Staphylococcus aureus and candida spp. (Table 1)

Table 1: Species distribution of organism from urine culture

Organism	N	%
Gram Negative	129	80.63%
E. coli	85	53.13%
Klebsiella spp.	29	18.13%
Pseudomonas spp.	14	8.75%
Others	1	0.63%
Gram Positive	17	10.63%
Enterococcus spp.	13	8.13%
Staphylococcus aureus	4	2.50%
Other	14	8.75%
Candida spp.	14	8.75%

The study shows that female patients had higher rate (86 out of 377, 22.81%) of urinary tract infection as compared to male patients (74 out of 424, 17.45%). This higher rate of urinary tract infection in female patients is due to shorter urethral length and proximity to anal orifice. Coliforms are leading cause of urinary tract infection in patients irrespective of their gender. In this study, rate of infection by *Pseudomonas* spp. was higher (11 out of 74, 14.86%) in male patients as compared to female patients (3 out of 86, 3.49%). While infection by all other isolates was more common among female patients. (Fig. 1)

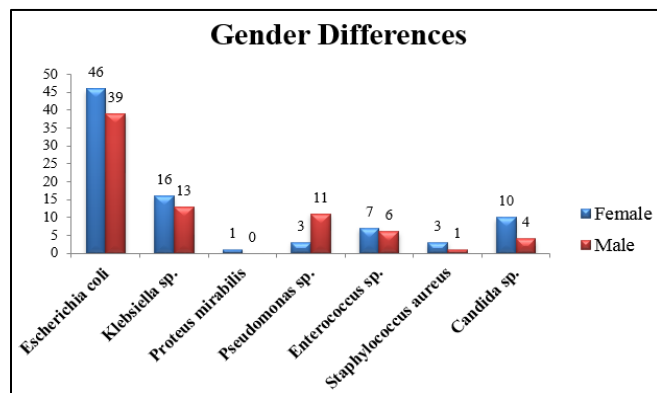


Fig. 1: Gender differences among isolated organisms

Looking at antibiotic susceptibility pattern among gram negative organisms, Enterobacteriaceae tribe appears more resistant to antimicrobials as compared to *Pseudomonas* spp. Highest susceptibility to antimicrobial agents among enterobacteriaceae group was found for amikacin (85%) followed by imipenem (82%), aztreonam (81%) and piperacillin-tazobactam (79%). Most sensitive antimicrobial in *pseudomonas* spp. was polymyxin-B (100%) followed by aztreonam (93%), imipenem (86%) and piperacillin-tazobactam (86%). Fluoroquinolone group (ciprofloxacin, levofloxacin & lomefloxacin) was more resistant in *pseudomonas* spp. (Table 2 & 3)

Table 2: Percentage sensitivity of tribe Enterobacteriaceae

Antibiotic	% Sensitivity
Ampicillin	17%
Ampicillin/Sulbactam	56%
Amoxicillin/Clavulanic acid	38%
Piperacillin/Tazobactam	79%
Cefuroxime	27%
Cefotaxime	40%
Cefepime	58%
Imipenem	82%
Aztreonam	81%
Ciprofloxacin	27%
Levofloxacin	74%
Lomefloxacin	29%
Trimethoprim/Sulfamethoxazole	39%
Nitrofurantoin	66%
Gentamicin	66%
Amikacin	85%

Table 3: Percentage sensitivity of *Pseudomonas* spp

Antibiotic	% Sensitivity
Piperacillin	79%
Ticarillin	71%
Piperacillin/Tazobactam	86%
Ceftazidime	64%
Cefepime	71%
Imipenem	79%
Meropenem	86%
Aztreonam	93%
Gentamicin	64%
Amikacin	71%
Ciprofloxacin	57%
Levofloxacin	64%
Lomefloxacin	64%
Polymixin B	100%

In gram positive bacteria, vancomycin and teicoplanin had 100% sensitivity in enterococcus isolates. Other antibiotics in descending order of sensitivity were linezolid (92%) & nitrofurantoin (92%). Penicillins, fluoroquinolones and tetracyclines were relatively resistant in enterococcus spp. All *Staphylococcus aureus* isolates were methicillin sensitive *Staphylococcus aureus* (MSSA). Due to non availability of novobiocin disc to differentiate *Staphylococcus saprophyticus* from other coagulase negative staphylococci, CoNS were excluded from this study. (Table 4 & 5)

Table 4: Percentage sensitivity of *Enterococcus* spp

Antibiotic	% Sensitivity
Penicillin G	15%
Ampicillin	31%
Ciprofloxacin	31%
Levofloxacin	38%
Nitrofurantoin	92%
Tetracycline	31%
Linezolid	92%
Vancomycin	100%
Teicoplanin	100%

Table 5: Percentage sensitivity of *Staphylococcus* spp

Antibiotic	% Sensitivity
Penicillin	75%
Cefoxitin	100%
Trimethoprim/Sulfamethoxazole	100%
Ciprofloxacin	75%
Levofloxacin	100%
Moxifloxacin	100%
Gentamicin	100%
Amikacin	100%
Tetracycline	75%
Nitrofurantoin	100%
Linezolid	100%
Teicoplanin	100%

Discussion

In the current study, positivity rate was 19.98% (160 out of 801) in suspected cases of urinary tract infections. Out of 160 isolated organisms most common were coliforms (71.88%, 115 out of 160). Various studies from world as well as India show varying positivity from urine culture e.g. Wijekoon CN et al.⁷ Saha S et al.⁸ Most common organism causing urinary tract infection in this study was *Escherichia coli* (53.13%) followed by *Klebsiella* spp. (18.13%) and *Pseudomonas* spp. (8.75%) which was similar pattern in findings of Niranjana V et al.⁹

Female patients had higher rate of urinary tract infection in this study which is similar to study done by Wijekoon CN et al.⁷ Most of the isolated organisms from urine were common in female patients. Although *Pseudomonas* spp. was found at significantly higher rate in male patients (p-value = 0.011).⁷

Lower susceptibility in coliforms was observed for orally available antibiotics like ampicillin, amoxicillin-clavulanic acid, ciprofloxacin, cefuroxime, co-trimoxazole etc. This is suggestive of substantial and uncontrolled use of oral antimicrobials in the community. The resistance rate in this study was found to be much higher as compared to similar studies done in developed countries.⁹ Amikacin, imipenem, piperacillin-tazobactam and levofloxacin showed high sensitivity in coliforms.

Pseudomonas spp. isolates in this study were more susceptible to antimicrobials as compared to coliforms. All drugs tested in *Pseudomonas* spp. showed susceptibility of more than 55%. Most sensitive antimicrobial in *Pseudomonas* spp. was polymyxin-B (100%) followed by aztreonam (93%), imipenem (86%) and piperacillin-tazobactam (86%). Gentamicin and ciprofloxacin were least sensitive antibiotics in our study which coincides with results of Wijekoon CN et al.⁷

Among gram positive isolates of our study, enterococci were most susceptible to vancomycin (100%), teicoplanin (100%), linezolid (92%) and nitrofurantoin (92%). No vancomycin resistant enterococcus was found in our study. All *Staphylococcus aureus* isolates in our study were methicillin sensitive (MSSA).

Conclusion

Enterobacteriaceae are the leading cause of urinary tract infection worldwide. Levofloxacin appears most promising orally available agent for first line treatment of UTI in outdoor patients caused by coliforms. Nitrofurantoin should be preferred drug for empirical treatment as it shows better sensitivity among orally available antimicrobial agents in wide spectrum of bacteria. Carbapenems and piperacillin-tazobactam can be used for parenteral therapy in indoor patients. Considering the extensive nature of the problem of resistance, antimicrobial therapy of UTI in all patients should preferably be guided by culture and sensitivity testing.

To optimize the use of antimicrobial therapy and to reduce burden of increasing drug resistance, antibiotic

policy should be formulated based on local surveillance data and needs to be incorporated into routine clinical practice.

Conflict of Interest: None.

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