

Study of Urine Culture Isolates Analysis from Microbiology Laboratory of a Tertiary Care Hospital

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Abstract:

Background: A significant portion of each microbiology laboratory's sample load consists of urine samples. Additionally, the most frequent hospital acquired illness is a urinary tract infection. To determine empirical treatment plans at the hospital level, it is crucial to investigate patterns of antibiotic resistance.

Methods: The study of urine culture isolates was conducted on samples received to microbiology laboratory of Radha Devi Jageshwari Memorial Medical College & Hospital, Turki, Muzaffarpur, Bihar, from May 2023 to October 2023. For analysis, only isolates from urine samples of individuals who were not catheterized and had a colony count more than 105 CFU/mL were included. WHONET 5.6 software was used to analyze the antibiotic sensitivity pattern and species distribution.

Results: After 801 urine samples were analyzed, 160 isolates were found (positive rate of 19.98%), with coliforms accounting for the majority (71.88%), followed by pseudomonas spp. (8.75%), candida spp. (8.75%), and so on. Urinary tract infections were more common in female patients (22.81%) than in male patients (17.45%). Of all the isolates, Enterobacteriaceae exhibited the highest level of resistance. The most sensitive antibiotics in the Enterobacteriaceae group were amikacin (85%) and imipenem (82%), while the most sensitive antibiotics in the pseudomonas spp. group were polymyxin-B (100%) and aztreonam (93%). Gram positive cocci were also subjected to testing and investigation of their antimicrobial susceptibility.

Conclusion: Of all the isolates, Enterobacteriaceae are the most resistant and the primary cause of urinary tract infections worldwide. Antimicrobial agent use must be done with caution in order to lessen the burden of rising drug resistance in UTIs.

Keywords: Urinary Tract Infection, Antimicrobial Sensitivity, Coliform, Gender Difference.

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Introduction

A significant portion of each microbiology laboratory's sample load consists of urine samples. Additionally, the most frequent hospital acquired illness is a urinary tract infection. To determine empirical treatment plans at the hospital level, it is crucial to investigate patterns of antibiotic resistance.

The information is also used to develop the antibiotic stewardship program's rules and regulations. WHONET software was used to gather and evaluate data on urine isolates in order to inform the hospital's antibiotic policy.

The WHO Collaborating Centre for Surveillance of Antimicrobial Resistance at Brigham & Women's Hospital in Boston, USA, is the developer of WHONET software. Its development aims to record, report, and analyze data on susceptibility to different isolates. The purpose of this study is to

identify different kinds of microbes that cause UTIs and examine the isolates' patterns of antibiotic sensitivity.

Materials and Methods

The study was conducted at microbiology laboratory of Radha Devi Jageshwari Memorial Medical College & Hospital, Turki, Muzaffarpur, Bihar, from May 2023 to October 2023. As part of standard diagnostic procedures, individuals exhibiting signs and symptoms of a urinary tract infection had their urine samples taken. Patients were given sterile containers and instructions on how to collect urine samples midstream. Samples were taken and sent straight to the lab after collection. Standard microbiological procedures were followed in the processing of these materials. Initially, the samples were cultured on nutritional agar, MacConkey agar,

and CLED agar and incubated aerobically at 37°C. Samples were subjected to microscopy utilizing gram stain and wet mount methods. Sample isolates with a colony count more than 105 CFU/mL were taken into consideration for additional examination.[2] Microorganisms were identified using a variety of biochemical tests.[3] In accordance with the CLSI 2015 standard, they underwent additional testing for antimicrobial susceptibility. [4,5] Disc diffusion method of Kirby-Bauer was applied for the susceptibility testing. Using WHONET 5.6 software, the isolates' antibiotic susceptibility data

were stored and examined. [6] The findings were statistically analyzed to assess their relevance.

Results

During the specified study period, a total of 160 isolates (with a positive rate of 19.98%) were detected from 801 samples. Gram negative isolates (n=129, 80.63%) were the most prevalent type of isolates out of 160 total isolates. Other isolates found in the patient's samples were candida spp., Enterococcus spp., and Staphylococcus aureus. (Table 1)

Table 1: Species distribution of organism from urine culture

Organism	No. of samples	Percentage
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%

According to the study, the prevalence of urinary tract infections was greater in female patients (86 out of 377, 22.81%) than in male patients (74 out of 424, 17.45%).

Due to their shorter urethral length and closer closeness to the anal orifice, female patients have a higher incidence of urinary tract infections.

Regardless of gender, coliforms are the primary cause of urinary tract infections in patients.

In this study, male patients had a greater rate of Pseudomonas spp. infection (11 out of 74, 14.86%) than female patients (3 out of 86, 3.49%). Female patients were more likely to be infected by all other isolates.

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%
Ticarcillin	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%

When comparing *Pseudomonas* spp. to Enterobacteriaceae, the latter group of gram-negative organisms seems to be more resistant to antibiotics. Among the Enterobacteriaceae group, amikacin had the highest susceptibility to antimicrobial drugs (85%), followed by imipenem (82%), aztreonam (81%), and piperacillin-

tazobactam (79%). In *pseudomonas* spp., polymyxin-B (100%) was the most sensitive antibiotic, followed by aztreonam (93%), imipenem (86%), and piperacillin-tazobactam (86%). *Pseudomonas* species showed greater resistance to the fluoroquinolone group (ciprofloxacin, levofloxacin, and lomefloxacin) (Table 2 & 3).

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%

Enterococcus isolates showed 100% susceptibility to vancomycin and teicoplanin in gram-positive bacteria. Linezolid (92%) and nitrofurantoin (92%), two other antibiotics, were listed in decreasing order of sensitivity.

In enterococcus species, penicillins, fluoroquinolones, and tetracyclines showed comparatively high resistance. Every isolate of *Staphylococcus aureus* that was obtained was methicillin-sensitive (MSSA). CoNS were not included in this investigation since novobiocin disc was not available to distinguish *Staphylococcus saprophyticus* from other coagulase-negative staphylococci. (Tables 4 and 5)

Discussion

In the current study, the positive rate for suspected UTI cases was 19.98% (160 out of 801). Coliforms accounted for the majority of the 160 isolated organisms (71.88%, or 115 out of 160).

Urine culture positivity varies according to several international and Indian research (Wijekoon CN et al., [7] Saha S et al.). [8] In this investigation, *Escherichia coli* (53.13%) was the most common bacterium causing urinary tract infections, followed by *Klebsiella* spp. (18.13%) and *pseudomonas* spp. (8.75%), which followed a similar trend to the findings of Niranjana V et al. [9] Similar to a study by Wijekoon CN et al., a greater rate of urinary tract

infections was seen in female patients in this investigation. [7] The majority of the identified organisms from urine were typical of patients who were female. Despite the fact that male patients had a noticeably greater rate of pseudomonas spp. (p-value = 0.011). [7] Orally administered antibiotics such as ampicillin, amoxicillin-clavulanic acid, ciprofloxacin, cefuroxime, co-trimoxazole, etc. were found to have a lower susceptibility in coliforms. This suggests that oral antimicrobials are widely and uncontrollably used in the community. In comparison to research of a comparable nature conducted in wealthy nations, the resistance rate in this study was shown to be significantly greater. [9] In coliforms, amikacin, imipenem, piperacillin-tazobactam, and levofloxacin all demonstrated good sensitivity.

Compared to coliforms, the isolates of pseudomonas spp. in this investigation were more sensitive to antibiotics. Pseudomonas species tested positively for every medication, with susceptibility exceeding 55%. In pseudomonas spp., polymyxin-B (100%) was the most sensitive antibiotic, followed by aztreonam (93%), imipenem (86%), and piperacillin-tazobactam (86%). The least sensitive antibiotics in our investigation were gentamicin and ciprofloxacin, which is consistent with Wijekoon CN et al. findings. [7] Enterococci were the most susceptible gram positive isolates in our investigation to vancomycin (100%), teicoplanin (100%), linezolid (92%) and nitrofurantoin (92%). In our investigation, no vancomycin-resistant enterococcus was discovered. In our investigation, every isolate of Staphylococcus aureus was methicillin-sensitive (MSSA).

Conclusion

Globally, enterobacteriaceae are the most common cause of urinary tract infections. The most promising oral medication for treating coliform-induced UTIs in people who are outside seems to be levofloxacin. Given its greater sensitivity to oral antimicrobial medicines against a wider range of bacteria than other current drugs, nitrofurantoin ought to be the drug of choice for empirical treatment. Parenteral therapy for patients receiving care indoors can use carbapenems and piperacillin-tazobactam. Antimicrobial therapy for UTIs in all patients should ideally be guided by culture and

sensitivity testing due to the widespread nature of the resistance issue.

Antibiotic policy needs to be developed based on local surveillance data and integrated into standard clinical practice in order to maximize the use of antimicrobial therapy and lessen the burden of rising drug resistance.

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