https://doi.org/10.29309/TPMJ/2024.31.09.8095

The Professional Medical Journal
www.theprofesional.com
2024, Volume, 31 Issue, 09

ORIGINAL ARTICLE

Urine culture Isolates and their sensitivity patterns.

Mahvesh Mahmud[1], Maryam Anwar[2], Hassan Mansoor[3], Muhammad Farrukh Abbas Awan[4], Muddassar Pervaiz[5], Khurram Baqai[6]

Article Citation: Mahmud M, Anwar M, Mansoor H, Awan MFA, Pervaiz M, Baqai K. Urine culture Isolates and their sensitivity patterns. Professional Med J 2024; 31(09):1351-1355. https://doi.org/10.29309/TPMJ/2024.31.09.8095

ABSTRACT… Objective: To make an assessment of the susceptibility pattern to antimicrobials of various isolates, which would be helpful in deciding about further empirical treatment with antibiotics and would lead to improved patient outcomes. **Study Design:** Cross-sectional study. **Setting:** Watim Medical & Dental College, Rawalpindi. **Period:** Jun 1, 2023 – Nov 30, 2023. **Methods:** 300 urine samples of patients suspected clinically to have urinary tract infection were directly collected directly from the microbiology laboratory, out of which 60 were culture positive. The positive samples comprised 44 females and 16 males. **Results:** The organism with the highest prevalence was *Escherichia coli (E.coli)*, followed by Klebsiella species. *Escherichia coli* showed 100% sensitivity to tazobactam whereas Klebsiella species showed sensitivity to several different antibiotics. **Conclusion:** E.coli species was noted to be the most common organism causing UTIs. Antimicrobial resistance has been noted to be emerging against some antibiotics, and the current susceptibility patterns may be used in this area for achieving optimum therapeutic outcomes, and for preventing antibiotic misuse.

Key words: Antimicrobial Susceptibility, Urine Culture Isolates.

INTRODUCTION

Urinary tract infection (UTI) is the most frequently acquired bacterial infection which affects approximately 150 million people worldwide every year. It has a high risk of mortality, morbidity, and significant costs of health care. It can occur anywhere in the urinary tract, including the ureter, kidney, urethra and bladder.[1] It is more common in women because the organisms' ascent into the bladder due to the relatively shorter urethra is easier, bactericidal prostatic secretions are not present, and fecal flora can easily contaminate the urinary tract.[1,2]

Various gram-positive and gram-negative organisms contribute to the development of UTI, and a facultative, gram-negative, anaerobic bacterium known as Escherichia (E.) coli is the most common cause of UTIs, and in greater than 80% of female UTI cases between 18 and 39 years of age, it is the most common cause. In approximately 15%-20% of the cases, Staphylococcus (S.) saprophyticus is the cause of UTI. Other organisms which cause UTI less frequently are Enterobacter, Enterococci, Pseudomonas, Klebsiella, and Proteus.[2]

Treatment of UTIs empirically has led to the organisms becoming antibiotic resistant.[2,3] Thus, treatment should be as per the organisms' sensitivity patterns, and targeted as per the local available data. The development of newer antibiotics has led to a change in the antibiotic sensitivity of microorganisms, as well as the abuse of antibiotics, which has also caused a change in sensitivity patterns. The antibiotic sensitivity patterns of the microbes isolated from recent urine cultures can guide us in choosing the most suited antibiotics for the prophylaxis and treatment of UTIs. A quick diagnosis and timely treatment of complicated UTIs with targeted antimicrobial therapy can prevent permanent renal damage from developing.[2]

This study was therefore conducted to review current sensitivity and resistance patterns of

1. DABIM Int Med/Nephro, Associate Professor Nephro, Watim Medical College, Rawalpindi.
2. MBBS, Resident Medical Officer Medicine, Ziauddin University, Karachi, Pakistan.
3. MBBS, FCPS, Senior Registrar Urology, Watim Medical College, Rawalpindi.
4. MBBS, FCPS, Senior Registrar Urology, Watim Medical College, Rawalpindi.
5. MBBS, MPH, Associate Professor Community Medicine, Al-Nafees Medical College, Islamabad.
6. MBBS, FCPS, Assistant Professor Medicine, Ziauddin University, Karachi, Pakistan.

Correspondence Address:
Dr. Mahvesh Mahmud
Department of Nephro
Watim Medical College, Rawalpindi.
mahveshkm@gmail.com

Article received on: 10/01/2024
Accepted for publication: 11/06/2024

urinary tract microbes in different aged groups, thus leading to the prevention of antibiotic misuse and therapeutic failures in UTI patients.

METHODS

This was a cross-sectional study that was done at a hospital Watim Medical & Dental College, Rawalpindi. which caters to patients from surrounding urban and rural areas and from other neighbouring towns. Ethical Approval was obtained (Approval Number WMDC/ R&D (ERB)/2023/87) from the Ethical Review Board. The study included patients' urine samples from the outpatient setting collected over a period of 6 months from Jun 1, 2023 – Nov 30, 2023. All patients had clinically evident UTI as per the physician's notes. The reports of culture and susceptibility were directly procured from the microbiology laboratory.

The study included the urine culture specimens of 300 patients consisting of 220 females and 80 male patients were. 300 samples were processed, out of which 60 (20%) showed bacterial growth, 18 (6%) depicted mixed flora, and the remaining 222 (74%) samples were sterile.

The outdoor patients were specifically instructed to collect midstream urine specimens in a small plastic container given to them, and to return it to the laboratory for subsequent processing. In The organisms were isolated in the laboratory, and each organism's colony count was measured. According to the standard criteria, urine culture results were interpreted as being significant and insignificant, and a growth of $>10^5$ colony forming units/mL was deemed as 'significant bacteriuria'.

Thirteen antibiotics were tested as part of this study and these included amikacin, amoxicillin-clavulanic acid, ampicillin, aztreonam, cefoperazone/sulbactam, cefixime, ceftriaxone, colistin, co-trimoxazole, imipenem/meropenem, nitrofurantoin, ofloxacin/ciprofloxacin and tazobactam/piperacillin/ tazobactam. Authorized laboratory technicians performed all the microscopic examinations involving identification of bacterial strains. The results of the antimicrobial discs were validated using appropriate quality control strains. The collected data was then entered into Microsoft Excel and analyzed with the help of a statistician. Mean susceptibility was calculated for the antibiotics for each organism, and the results were expressed as proportions.

RESULTS

Age (Years)	Gender		Total
	Female	Male	
0 – 20	5	3	8 (13.3%)
21 – 40	17	1	18 (30%)
41 – 60	11	1	12 (20%)
61 – 80	8	8	16 (26.6%)
81 – 100	3	3	6 (10%)
Total	44 (72.1%)	16 (27.8%)	60

Table-I. Gender and age-wise distribution of urine specimen results

The total prevalence of UTI was seen to be 72.1% in females and 27.8% in males as noted in Table-I, thereby showing a greater prevalence in female patients. The age group of patients highly susceptible to UTIs, irrespective of gender was found to be 21-40 years (30%) followed by 61-80 years (26.6%), and then between 41-60 years (20%). The least prevalence of UTI was seen in the age groups of 81-100 years (10%), followed by 0-20 years (13.3%), not respective of gender.

The prevalence of UTI was different in males and females according to age groups. The greatest prevalence was found in the age group of 21-40 years in females, whereas the age bracket of older 61-80 years males were more commonly affected. On the other hand, the group least affected by UTI were elderly females (81-100 years).

Among all the isolated bacterial uropathogens as seen in Table-II, *Escherichia coli* was seen to be the dominant bacterium with the greatest prevalence, not respective of gender. Klebsiella sp. was the second most prevalent isolate, followed by *Pseudomonas.*

Bacterial Isolates	Gender				Total
	Female		Male		
	N	%	N	%	
Enterobacter Species	1	33.3%	2	66.7%	3
Enterococcus Species	2	100.0%	0	0.0%	2
Escherichia Coli	28	75.6%	9	24.3%	37
Klebsiella Species	8	66.6%	4	33.3%	12
Pseudomonas aeruginosa	3	60%	2	40%	5
Staphylococcal species	1	100.0%	0	0.0%	1
Streptococcus Species	1	100.0%	0	0.0%	1

Table-II. Gender-wise bacterial isolates.

There were some variations in the prevalence rates for the occurrence of different uropathogens among females and males. Enterococcus species, for example, was not isolated in males, and seen only seen in females (100%).

On the contrary, some organisms had a greater prevalence in females as compared to males, like E. coli with a prevalence of 75.6% in females and 24.3% in males.

The only organism which had which had a higher prevalence in males (66.7%) than in females (33.3%) was Enterobacter species.

	Enterobacter	Enterococcus	E.coli	Klebsiella	P.aeroginosa	Staph spp.	Strep spp.
Amikacin	85%	100%	90%	90%	100%	100%	100%
Amox-clav	85%	100%	75%	83%	100%	0%	100%
Ampicillin	85%	85%	30%	90%	100%	100%	100%
Aztreonam	50%	100%	40%	65%	100%	100%	100%
Cef-Sul	100%	100%	90%	83%	100%	100%	100%
Cefixime	40%	100%	38%	65%	100%	100%	100%
Ceftriaxone	40%	100%	40%	40%	100%	100%	100%
Colistin	90%	100%	87%	87%	100%	100%	100%
Cotrimoxazole	85%	85%	55%	53%	100%	0%	100%
Imip/Mero	85%	100%	98%	98%	100%	100%	100%
Nitrofurantoin	85%	85%	98%	97%	100%	100%	100%
Oflox/Cipro	65%	100%	70%	50%	70%	0%	100%
Tazo/Pipera	100%	100%	100%	82%	100%	100%	100%

Table-III. Bacterial isolates from the urine specimens and their antibiotic susceptibility patterns

	Enterobacter	Enterococcus	E.coli	Klebsiella	P.aeroginosa	Staph spp.	Strep spp.
Amikacin	15%	0%	10%	10%	0%	0%	0%
Amox-clav	15%	0%	25%	17%	0%	100%	0%
Ampicillin	15%	15%	70%	10%	0%	0%	0%
Aztreonam	50%	0%	60%	35%	0%	0%	0%
Cef-Sul	0%	0%	10%	17%	0%	0%	0%
Cefixime	60%	0%	62%	35%	0%	0%	0%
Ceftriaxone	60%	0%	60%	60%	0%	0%	0%
Colistin	10%	0%	13%	13%	0%	0%	0%
Cotrimoxazole	15%	15%	45%	47%	0%	100%	0%
Imip/Mero	15%	0%	2%	2%	0%	0%	0%
Nitrofurantoin	15%	15%	2%	3%	0%	0%	0%
Oflox/Cipro	35%	0%	30%	50%	30%	100%	0%
Tazo/Pipera	0%	0%	0%	18%	0%	0%	0%

Table-IV. Bacterial isolates from the urine specimens and their antibiotic resistance patterns

The organisms' susceptibility and resistance patterns to the 13 antibiotics that were included in the study are seen in Tables-III and IV.

E.coli was 100% susceptible to tazobactam/ piperacillin, followed by imipenem and nitrofurantoin. Klebsiella had the highest sensitivity to imipenem, followed by nitrofurantoin.

Pseudomonas was among the organisms which were fully sensitive to most of the antibiotics, and was resistant to a single antibiotic, namely ofloxacin/ciprofloxacin.

DISCUSSION

The distribution of the age and gender patterns of the patients diagnosed with UTIs was similar to the natural epidemiological pattern of UTIs, with the most affected group being young females. The current scenario of UTIs is highlighted in this study, with the antimicrobial sensitivity and resistance patterns. As seen in other studies, *E. coli* is the most commonly isolated uropathogen.[1,4] Two other studies conducted in ethopia and Nigeria also concluded as E. coli being the highest implicated in UTIs.[5,6] One possible reason could be the significant abundance of E. coli in the rectal area, leading to this high isolation rate of E. coli, as it ascends to the urinary tract through external contamination. It may also be due to the fact that E. coli has various enhanced virulence factors which are specific for the invasion and colonization of the urinary epithelium, like the S-fimbriae and P-fimbriae adherence factors, through which the attachment of E. coli to vaginal and uroepithelial cells is mediated.[1,7]

In our study E. coli showed the highest resistance to ampicillin (70%) which is similar to another study conducted in Ethopia which showed 88% resistance to ampicillin.[1] The explanation may be due to the fact that this drug has been used continuously for many years. This study also showed 96% sensitivity to meropenem which is similar to our study.[1] Another study conducted in Addis Ababa, Ethiopia showed E. coli's 81% sensitivity to nitrofurantoin.[8] This is also consistent with our study. E. coli is followed by Klebsiella sp. which is the organism isolated in the second place in various other studies. For instance, in another study comprising 48 positive urine cultures, E. coli was seen in 67% of the cases, followed by Klebsiella (21%); and nearly 90% of these cases showed sensitivity to amikacin which is also similar to our study.[9]

The high resistance rates in multiple studies are to be worried about, as it may be due to the extensive misuse and use of antibiotics by patients, and healthcare workers, as many antibiotics are also available over the counter, and used extensively in general practice.[10,11] Negligible surveillance of susceptibility patterns and starting antibiotics before specimens are obtained for culture, are among one of the many factors that lead to the inappropriate and injudicious use of antibiotics, thereby leading to the quick development of resistance.[12,13]

CONCLUSION

The leading cause of therapeutic failures globally is resistance to antibiotics. This study was therefore aimed at improving patient outcomes, by studying the local antimicrobial resistance trends, and thereby guiding clinicians in deciding on appropriate empirical treatment. Guidelines can be updated to aid on preventing antibiotic misuse in UTI patients. A unified antibiotic protocol is mandatory in order to restrict antibiotic injudicious use, so as to prevent resistance and to mitigate the complications of UTI from the use of resistant antimicrobials. Further regular monitoring by microbiological laboratories, and a continuous review of antibiograms is also important to track variations in etiological agents and antimicrobial patterns to guide empirical treatment in the future.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

SOURCE OF FUNDING

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

REFERENCES

1. Teferi S, Sahlemariam Z, Mekonnen M, Tamrat R, Bekana T, Adisu Y, Darge T. **Uropathogenic bacterial profile and antibiotic susceptibility pattern of isolates among gynecological cases admitted to Jimma Medical Center, South West Ethiopia.** Scientific Reports. 2023 May 1; 13(1):7078.

2. Muzammil M, Adnan M, Sikandar SM, Waheed MU, Javed N, Ur Rehman MF. **Study of culture and sensitivity patterns of urinary tract infections in patients presenting with urinary symptoms in a Tertiary Care Hospital.** Cureus. 2020 Feb 16; 12(2):e7013. doi: 10.7759/cureus.7013.

3. Konca C, Tekin M, Uckardes F, Akgun S, Almis H, Bucak IH, Genc Y, Turgut M. **Antibacterial resistance patterns of pediatric community-acquired urinary infection: Overview.** Pediatr Int. 2017 Mar; 59(3):309-15. doi: 10.1111/ped.13139

4. Hazarika J, Baruah K, Urine culture isolates and their antibiotic sensitivity pattern in a Tertiary Care Hospital of North East India. Paripex Indian Journal of Research. 2018; 7(7):17-18. https://www.doi.org/10.36106/paripex

5. Ejerssa AW, Gadisa DA, Orjino TA. **Prevalence of bacterial uropathogens and their antimicrobial susceptibility patterns among pregnant women in Eastern Ethiopia: Hospital-based cross-sectional study.** BMC Women's Health. 2021; 21(291)1-15.

6. Ekwedigwe KC, Adeoye IS, Eliboh MO, Isikhuemen ME, Chukwu HU, Ezeonu P, et al. **Prevalence and antimicrobial susceptibility of asymptomatic bacteriuria among women with pelvic organ prolapse in Abakaliki, South-East Nigeria.** BMC Womens Health. 2018; 18(1):1-5.

7. Kot, B. **Virulence factors and innovative strategies for the treatment and control of uropathogenic Escherichia coli. In Book Escherichia coli-Recent Advances on Physiology.** Pathogenesis and Biotechnological Applications. 2017. DOI: 10.5772/67778

8. Wabe YA, Reda DY, Abreham ET, Gobene DB, Ali MM. **Prevalence of asymptomatic bacteriuria, associated factors and antimicrobial susceptibility profile of bacteria among pregnant women attending Saint Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia.** Therapeutics and Clinical Risk Management. 2020 Sep 29; 16:923-32. doi: 10.2147/TCRM.S267101.

9. Amatya P, Joshi S, Shrestha S. **Culture and sensitivity pattern of urinary tract infection in hospitalized children in Patan Hospital.** J Nepal Paediatric Society. 2016; 36(1):28-33. https://doi.org/10.3126/jnps.v36i1.14629

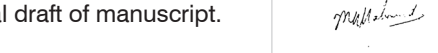
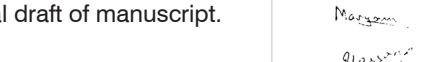
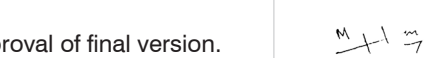
10. Hallsworth M, Chadborn T, Sallis A, Sanders M, Berry D, Greaves F, et al. **Provision of social norm feedback to high prescribers of antibiotics in general practice: A pragmatic national randomised controlled trial.** Lancet. 2016; 387(10029):1743-52. https://doi.org/10.1016/s0140-6736(16)00215-4

11. Almeida SR, Lourenço JS, Ciriolo E. **This paper was commissioned European monitoring centre for drugs and drug addiction;** 2017.

12. World Health Organization. The World Health Report 1996. Geneva, Switzerland: World HealthOrganization; 1996. Availablefrom: http://www.who.int/whr/1996/media_centre/en/whr96_presskit_en.pdf. [Last accessed on 2018 Aug 01].

13. **World Health Organisation. National Action Plan on Antimicrobial Resistance (NAP-AMR) 2017-2021.** New Delhi, India: World Health Organisation Country Office for India; 2017.http://www.searo.who.int/india/topics/antimicrobial_resistance/nap_amr.pdf.

AUTHORSHIP AND CONTRIBUTION DECLARATION

No.	Author(s) Full Name	Contribution to the paper	Author(s) Signature
1	Mahvesh Mahmud	Final draft of manuscript.	
2	Maryam Anwar	Final draft of manuscript.	
3	Hassan Mansoor	Data acquisition.	
4	Muhammad Farrukh Abbas Awan	Data entry.	
5	Muddassar Pervaiz	Approval of final version.	
6	Khurram Baqai	Data analysis.