Prevalence of Uropathogens and Antimicrobial Resistance Patterns among Suspected UTI Patients Attending a Diagnostic Centre in Imphal

Chingakham Miranda Devi, and Pratibha Huidrom

Department of Microbiology, Manipur International University, Manipur- 795104, India

DOI: https://doi.org/10.51584/IJRIAS.2025.11SP140003

Received: 20 May 2026; Accepted: 25 May 2026; Published: 12 June 2026

ABSTRACT

Globally, urinary tract infections (UTIs) are a common health problem in both community and hospital settings. It results from microbial invasion and proliferation within the urinary tract, leading to infection. UTIs affect both males and females; however, females are more commonly affected due to the close proximity of the urethra and anus, a shorter urethra, as well as hormonal fluctuations. UTIs are more often accompanied by vaginal infection and frequently caused by pathogens originating in the digestive tract. UTIs and antimicrobial resistance continue to pose major global health challenges, particularly in developing and underdeveloped countries, due to their significant medical and socio-economic impact. The present study aimed to identify bacterial pathogens causing UTI and determine their antimicrobial resistance patterns among patients attending Kangla Diagnostic Centre, Imphal West. A total of 300 urine samples were collected from UTI suspected individuals which were inoculated onto the recommended media, and identifications were performed using a microbiological protocol. Antibiotic susceptibility testing was also done following CLSI guidelines. Among 300 samples, 33.3% showed significant bacterial growth. Klebsiella spp., Escherichia coli and Proteus spp. were the most frequently isolated bacterial pathogens exhibiting increased antimicrobial resistance. Most susceptible age group to UTI was 21-40 years (44%) followed by 41-60years (32%).

Keywords: Urinary tract infections, Uropathogens, Antimicrobial resistance, Identification and Age groups.

INTRODUCTION

Urinary tract infections (UTIs) are among the most common microbial diseases encountered in medical practice, affecting people of all age groups. UTIs may involve different parts of the urinary system and are classified as pyelonephritis (kidney infections) or cystitis (bladder infection). Infections of the kidney, ureter, bladder, urethra or prostate are termed pyelonephritis, cystitis, urethritis and prostatitis. Clinical symptoms such as dysuria, frequency, urgency, suprapubic tenderness, fever, chills, nausea, and vomiting are observed. It may sometimes be asymptomatic as well (Beyene & Tsegaye, 2011). UTIs are one of the most frequently presented complaints in outpatient clinics, where most of the patients are of reproductive age. Acute bacterial prostatitis is generally present with urinary tract pain in the pelvic and genital region that may lead to chronic bacterial prostatitis if the symptoms persist for more than 3 months. If UTIs are not properly treated, then other complications may develop, such as bacteraemia, acute and chronic prostatitis, vaginitis, bladder cancer, and in severe cases may lead to death. UTI is the most common hospital-acquired infection, followed by nosocomial infections (AS et al., 2009).

The prevalence of UTIs is higher in females than males due to biological factors such as the short urethra, anal-genital proximity, and urethral trauma, during intercourse, and use of contraceptives or spermicides. Furthermost, the anatomical relationship of the female's urethra and the vagina make it liable to bacteria being passed up the urethra into the bladder during pregnancy or child birth. (AS et al., 2009). Pregnant women are also more prone to urinary tract infections because of dilation of the ureters, and renal pelvis, urinary stasis, incompetence of the vesico-urethral valves and hormonal changes. Escherichia coli is the most predominant

facultative anaerobic bacterium found in the gastrointestinal tract and remain the most common causative agents of UTIs. Complicated UTIs have a more diverse aetiology than uncomplicated UTIs. Microorganisms that, rarely causes disease in healthy people can cause significant disease in hosts with anatomic, metabolic, or immunologic underlying disease. The majority of community-acquired symptomatic UTIs in elderly women are caused by E. coli (Ronald, 2002). In complicated urinary tract infections and hospitalised patient, organisms such as Enterococcus faecalis and highly resistant Gram-negative rod, including Pseudomonas spp., which are comparatively more common. The relative frequency of the pathogens varies depending upon age, sex, catheterization, and hospitalisation status (Sefton, 2000). Inappropriate and non-judicious usage of antibiotics has contributed in the development of worldwide antibiotic resistance in bacteria, leading to the emergence of multidrug-resistant strains of bacterial pathogens (Spellberg et al.,2013).

While UTIs are typically considered extracellular infections, it has been recently demonstrated that UPEC (Uropathogenic Escherichia coli) invades and replicates within the murine bladder urothelium to form intracellular bacterial communities (IBCs). These IBCs dissociate, and bacteria flux out of bladder facet cells, some with filamentous morphology, and ultimately establishing quiescent intracellular reservoirs, which may have important implication for recurrent UTI infections (Rosen et al., 2007).

Individual susceptibility to UTIs is complex, depending on their genetic, biological, and behavioural factors. The interaction between bacterial virulence and host defence factors can ultimately result in UTI. Each bacterial species has certain distinct mechanisms to facilitate UTI. Colonization is determined by the specific bacterial adhesive characteristics, the receptor present on the epithelial surface and the surrounding fluids. Vaginal colonization of uropathogens frequently causes UTIs (Ronald, 2002). The most common bacterial cause of urinary tract infection includes Escherichia coli, Klebsiella pneumoniae, Citrobacter spp., Enterobacter spp., Pseudomonas aeruginosa and Staphylococcus aureus. However, Enterobacteriaceae species, including Escherichia coli, Proteus mirabilis, Enterobacter agglomerans, Citrobacter freundii and Klebsiella pneumoniae, account for over 70% of cases between the ages of 2-5yrs since etiological agent of UTI are variable and usually depend on the geographical area, seasons and ages of the patients (Yousefi Mashouf et al., 2009).

The pathogens traditionally associated with UTIs are changing many of their characteristics, particularly because of antimicrobial resistances. The aetiology of UTI is also affected by underlying host factors that complicate UTI, such as age, diabetes, spinal cord injury, or catheterization (Ronald, 2002). Antimicrobial resistance is a global medical problem in which microorganisms use various resistance mechanisms such as gene mutation, genetic recombination, and gene transfer. Also, misuse and self-medication hastens resistivity, which leads to prolonged illness and increases healthcare costs. Drugs that are usually administered against the uropathogens include ampicillin, aminoglycosides, cephalosporins, nalidixic acid and nitrofurantoin, based on microbial sensitivity testing (Yousefi Mashouf et al., 2009).

Biofilm formation may be considered another pathogenic determinant for the increasing antimicrobial resistance, which allows the strains to persist for a long time in the genitourinary tract and interfere with bacterial eradication, thus infection persists despite appropriate antibiotic therapy (Soto et al., 2007). Microbial biofilms pose a serious threat to the patients they resist antibiotics, which lengthen the duration of treatment and increase the costs of treatment as well. Biofilm may be responsible for a wide variety of nosocomial infections. Bacteria present in biofilm experience an increase in antibiotic efficacy and escape from predators. The degree of resistivity depends on the type of community formed and its morphology (Johnson, 2008). Sources of biofilm-related infection can include the surface of catheters, medical implants, wounds dressing or other types of medical devices.

For the last many years, there has been a tremendous rise in the frequency and spectrum of drug resistance by microorganisms in hospitals as well as the community. This increase in frequency has contributed to a combination of selective pressure of antibiotic use and technological changes that enhance the transmission of drug-resistances strain or species. Antimicrobial resistances result in increasing morbidity and health care costs, so prevention and control may require a new antimicrobial agent, a new vaccine, or reduce transmission. Unless there is decrease in antibiotics resistances, we can expect for substantial rise in untreatable diseases.

ISSN No. 2454-6194 | DOI: 10.51584/IJRIAS |Volume XI Issue XIV June 2026 | Special Issue on Microbiology

MATERIALS AND METHODS

This study was conducted from the month of January to March, 2025. The clinically suspected outpatients with UTIs who visited the Kangla Diagnostic Center, Nagamapal, RIMS Road, provided a midstream urine sample in a sterile wide-mouth container. Participants in the study ranged in all age groups both male and female. Three hundred (300) urine samples were collected from people who were suspected of having a urinary tract infection. These samples were then inoculated onto the suggested media, and established microbiological techniques were used for identification. Testing for antibiotic susceptibility was done in compliance with CLSI recommendations. Urine samples that proved positive were used for the study.

Sample Processing

Samples for urine culture were tested within an hour of sampling. All samples were inoculated on Blood agar, CLED, as well as MacConkey agar and incubated at 37°C for 24hours, and for 48hours in negative cases. A specimen was considered positive for UTI if a single organism was cultured at a concentration of $\geq 10^5$cfu/ml, or when a single organism was cultured at a concentration of 10^4cfu/ml and ≥5 leukocytes per high-power field were observed on microscopic examination of the urine.

Isolation And Identification of the Organism

Microbial colony identification was done using conventional methods, including cultural characteristics, Gram staining methods and biochemical tests (M. Bonadio et al., 2001, NCCLS, 2000). After identification, it is further processed with antimicrobial susceptibility testing by the Kirby-Bauer disk diffusion method on the MullerHinton Agar Plates (MHA) in accordance to the Clinical and Laboratory Standards Institute protocol (Patel & Clinical and Laboratory Standards Institute, 2015). Ampicillin, Gentamicin, Meropenem, Ceftazidime, Co-trimoxazole, Nitrofuratoin, Oxacilin, Norfloxacin and Imipenem were used in the study. For the routine Quality Control of antibiotic susceptibility test, Staphylococcus aureus ATCC 25923, E. coli ATCC 25922 and Pseudomonas aeruginosa ATCC 27853 were used.

RESULTS

Out of 300 urine samples of clinically suspected out-patient received in Kangla Diagnostics centre, Nagamapal, RIMS Road, about 100 samples (33.3%) showed positive microbial growth with significant colony count. Klebsiella spp. (56%) is most implicated bacterial pathogens followed by Escherichia coli (34%) and Proteus spp. (9%). Most of the isolated bacterial strains showed resistance to co-trimaxazole (24%), Oxacillin (21%) and ceftaxidime (19%) Higher frequency of UTIs were observed in female (63%) as compared to male (37%) and most susceptibility age group to UTIs was 20-40yr (44%) followed by 41-60yr (32%), 60 above (15%), and 1-20yr (9%). Males above 60yrs of age showed a higher prevalence of UTIs whereas females showed higher prevalence in remaining of the age groups.



Fig 1: Growth of a lactose-fermenting organism on Mac-Conkey agar



Fig 2: Escherichia coli on CLED Agar



Fig 3: Escherichia coli on Blood Agar Plate



Fig 4: Biochemical reaction, Indole test, Citrate utilization test, TSI agar slants

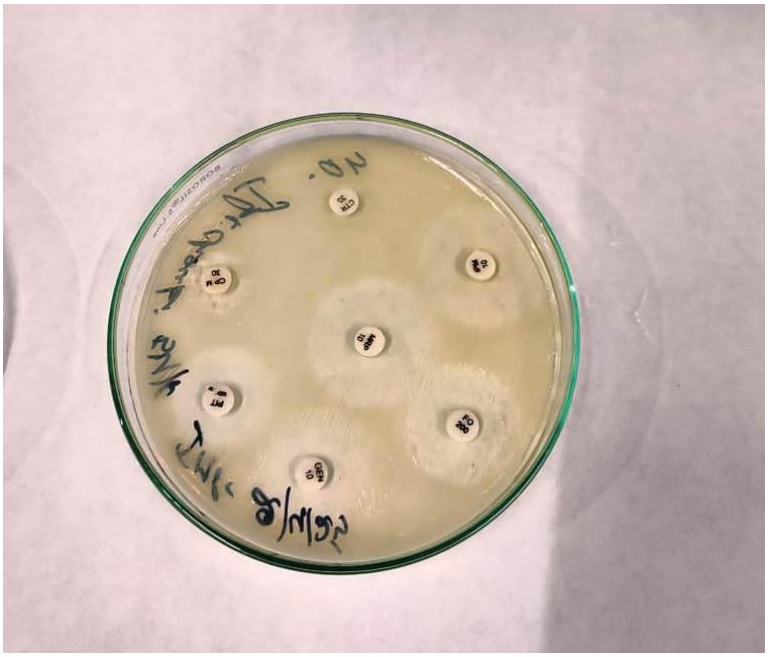

Fig 5: Antibiotic sensitivity testing

Table1: Number of uropathogens causing UTI in the study

SL. NO	PATHOGENS ISOLATED	NUMBER OF POSITIVE SAMPLES
1	Klebsiella spp.	56
2	Escherichia coli	34
3	Proteus spp.	9
4	Yeast	1

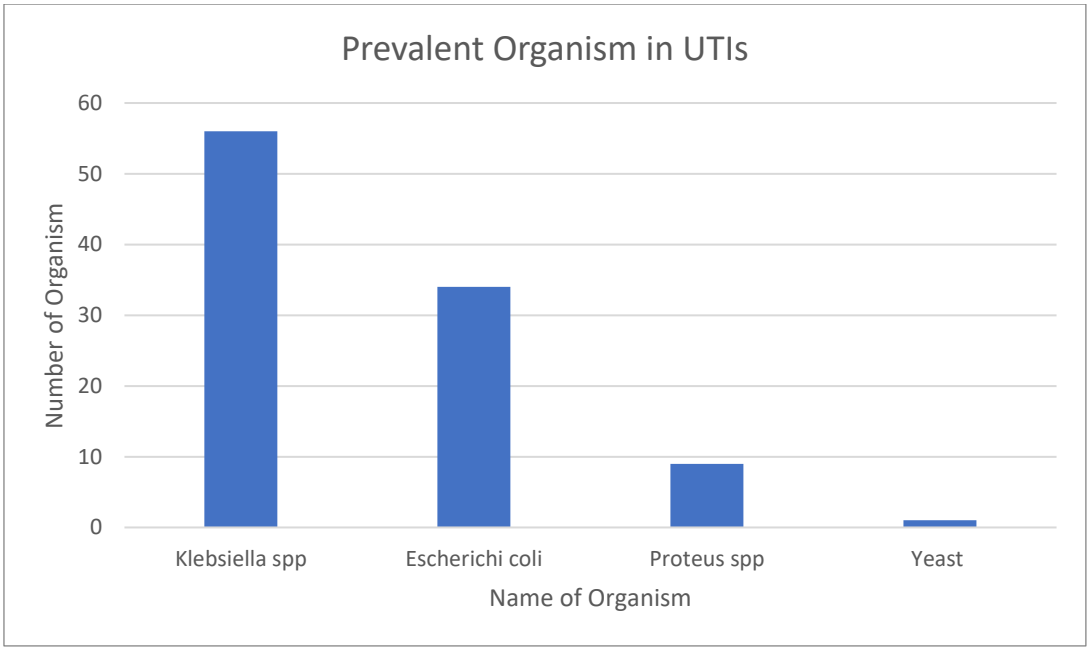

Fig 6: Distribution of Pathogenic organisms

Table 2: Distribution of UTI Patients with Respect to Age Group:

SL. NO.	Age Group	Number of Patients	Male	Female
1	1-20 Yrs	9	5	4
2	21-40 Yrs	44	10	34
3	41-60Yrs	32	13	19
4	60 Above	15	9	6

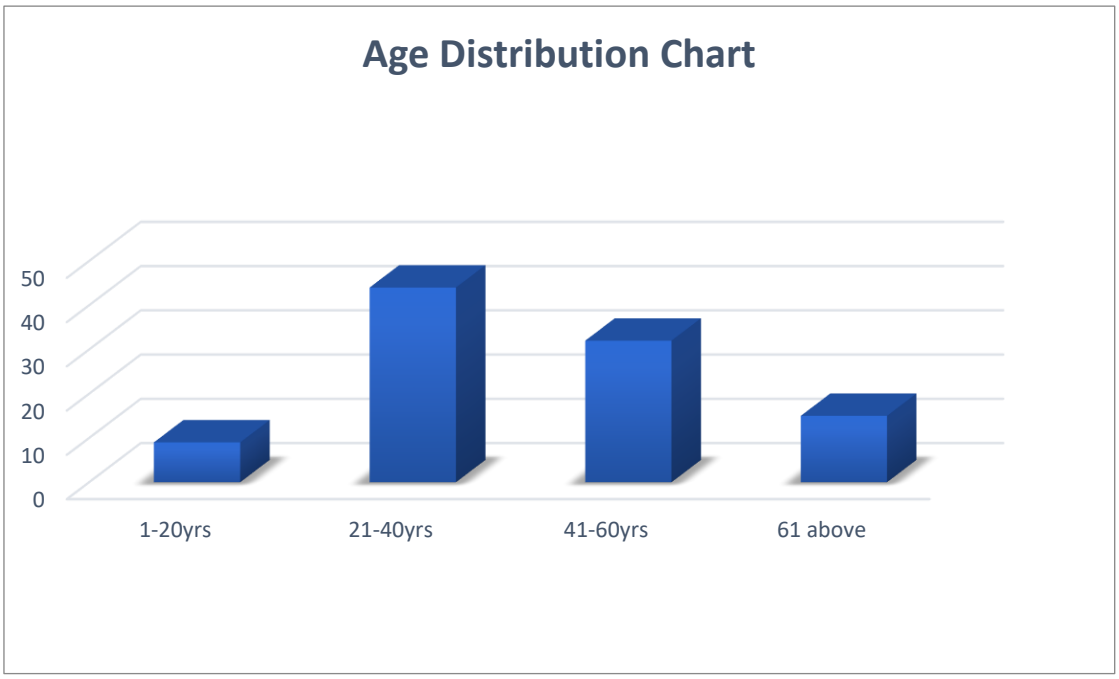

Fig. 7: Age distribution with respect to the positive culture urine sample

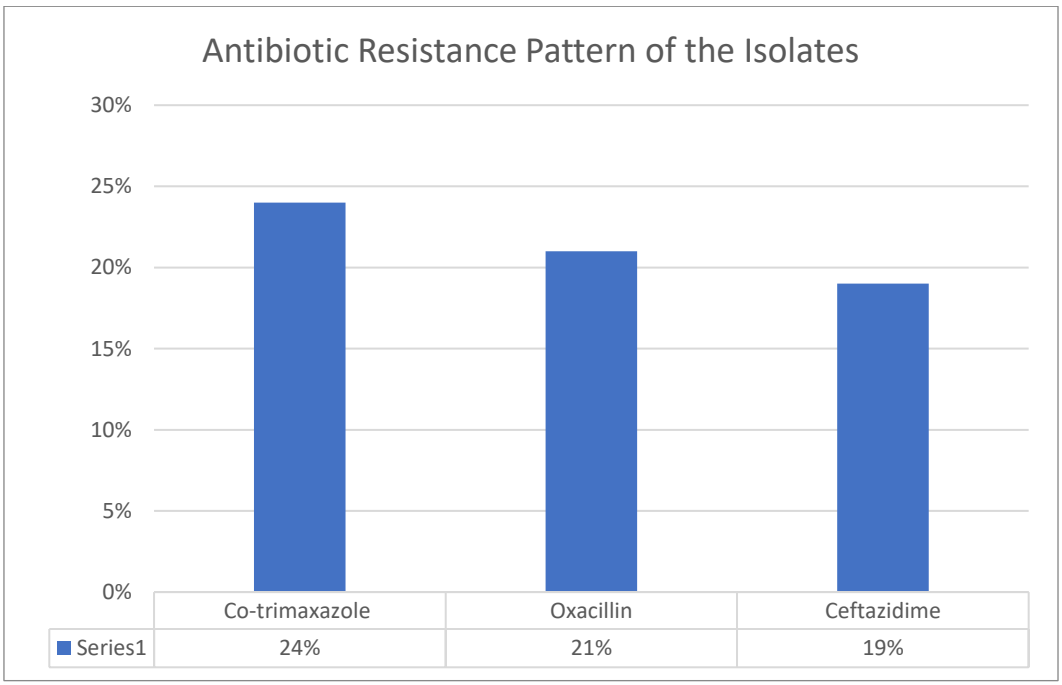

Fig. 8: Graphical Presentation of the Antibiotic Resistance Pattern

DISCUSSION & CONCLUSION

The study revealed a high prevalence of bacterial isolates and multidrug resistance. Therefore, continuous monitoring of microbiological and antimicrobial surveillance of UTIs is crucial for appropriate treatment and for preventing the development of antibiotic resistances of urinary pathogens. Klebsiella spp. and Escherichia coli are the predominant pathogens isolated in the study and showed resistance to commonly prescribed antibiotics. Antibiotic resistance remains a major global health concern, emphasizing the need for stronger control measures and enhanced public health interventions. Maintaining antibiotic stewardship is essential since abuse, misuse, and self-medication have all contributed to the rise in drug resistance.

The distribution of bacterial isolates causing UTIs and their antimicrobial resistance patterns differs among geographical regions. In this study, Klebsiella spp. was identified as the predominant isolate, followed by Escherichia coli. The predominance of Klebsiella spp. observed in the study may be attributed to several factors. Firstly, the relatively short duration of the study might have limited the diversity of the uropathogens identified. Secondly, the study's focus on antimicrobial resistance may have influenced patient selection, potentially favouring cases of community-acquired urinary tract infections (UTIs)

Females are more prone to UTIs in comparison to males because of the close proximity of urethra and anus, shorter urethra as well as hormonal fluctuations. But, the higher incidences of UTIs in elderly males may be attributed to the greater prevalence of benign prostatic enlargement and neurogenic bladder disorders (Dash et al.2013).

Furthermore, hygienic living, health education, and good infection-controlled measures can help in reducing the incidences of urinary tract infections (UTIs).

ACKNOWLEDGEMENT

The authors express sincere gratitude to Kangla Diagnostics Centre, Nagamapal RIMS Road Imphal-West, for their kind support and co-operation through the research work.

Conflicts Of Interest: None

Financial Disclosure: None

Ethical Statements:

Ethical permission has been taken by the Institute Ethical Committee.

Informed consent was obtained from each participant.

REFERENCES

1. AS, K., Kolawole, O., YT, K.-O., Babatunde, S., Durowade, K., & CF, K. (2009). Kolawole AS, Kolawole OM, Kandaki-Olukemi YT, Babatunde SK, Durowade KA and Kolawole CF. Prevalence of Urinary Tract Infections (UTI) among patients attending Dalhatu Araf Specialist Hospital, Lafia, Nasarawa State, Nigeria. International Journal of Medicine and Medical Sciences, 1, 163–
2. Beyene, G., & Tsegaye, W. (2011). Bacterial Uropathogens in Urinary Tract Infection and Antibiotic Susceptibility Pattern in Jimma University Specialised Hospital, Southwest Ethiopia. Ethiopian Journal of Health Sciences, 21(2), 141–146.
3. Cepas, V., López, Y., Muñoz, E., Rolo, D., Ardanuy, C., Martí, S., Xercavins, M., Horcajada, J. P., Bosch, J., & Soto, S. M. (2019a). Relationship Between Biofilm Formation and Antimicrobial Resistance in Gram-Negative Bacteria. Microbial Drug Resistance, 25(1), 72–79. https://doi.org/10.1089/mdr.2018.0027

4. Chongtham, U., Yengkokpam, C., & Lokhendro, H. (2013). Bacterial uropathogens inurinary tract infection and antibiotic susceptibility pattern of patients attending JNIMS Hospital, Imphal. Journal of Evolution of Medical and Dental Sciences, 2(50), 9769–9775.
5. C. W. Washington Jr., D. A. Stephen, M. J. William et al., Koneman's Color Atlas andTextbook of Diagnostic Microbiology, Lippincott Williams & Wilkins, Philadelphia, Pa, USA, 6th edition, 2006.
6. Dash, M., Padhi, S., Mohanty, I., et al. (2013). Antimicrobial resistance in pathogens causing urinary tract infections in a rural community of Odisha, India. Journal of Family and Community Medicine, 20(1), 20–26.
7. E.Morales,F.Cots,M.Salaetal.,"Hospitalcostsofnosocomial multi-drug resistant Pseudomonas aeruginosa acquisition," BMC Health Services Research,vol.12,no.1,article122,2012.
8. Foxman B. Epidemiology of urinary tract infections: incidence, morbidity, andeconomic costs.Am J Med.2002;113:5–11S.[PubMed][Google Scholar
9. Hooton TM, Stamm WE. Urinary tract infections and asymptomatic bacteriuria in pregnancy.UpToDate.2007. From:http://obgyndo.com/resources/Rotating-Residents/intern-Uptodate-UTI-and-asymptomatic-bacteriuria-in-pregnancy.pdfAccessed: Dec 2012.
10. Johnson, L. R. (2008). Microcolony and biofilm formation as a survival strategy for bacteria. Journal of Theoretical Biology, 251(1), 24–34. https://doi.org/10.1016/j.jtbi.2007.10.039
11. Kamei, J., & Yamamoto, S. (2021). Complicated urinary tract infections with diabetes mellitus. Journal of Infection and Chemotherapy, 27(8), 1131–1136. https://doi.org/10.1016/j.jiac.2021.05.012
12. M.Bonadio,M.Meini,P.Spetaleri,C.Gilgi Current microbiological and clinical aspects of urinary tract infections Eur J Urol,40(2001), pp.439-445
13. National Committee for Clinical Laboratory Standards Performance standards for antimicrobial disc susceptibility tests (7th ed.),NCCLS,Wayne, Pennsylvania, USA(2000) M2–A7
14. Nguyen HT.Smith's General Urology.16th ed. New York (USA): Mcgraw-Hill Medical; 2004. Bacterial Infections of the Genitourinary Tract; p. 220.[Google Scholar
15. Patel, J. B., & Clinical and Laboratory Standards Institute (Eds.). (2015). Performance standards for antimicrobial disk susceptibility test; approved standards (12. ed). Committee for Clinical Laboratory Standards.
16. Rahn DD. Urinary tract infections: contemporary management.Urol Nurs.2008;28:333–41.[PubMed][Google Scholar]
17. Ronald, A. (2002). The etiology of urinary tract infection: Traditional and emerging pathogens. The American Journal of Medicine, 113(1, Supplement 1), 14–19. https://doi.org/10.1016/S0002-9343(02)01055-0
18. Rosen, D. A., Hooton, T. M., Stamm, W. E., Humphrey, P. A., & Hultgren, S. J. (2007). Detection of Intracellular Bacterial Communities in Human Urinary Tract Infection. PLOS Medicine, 4(12), e329. https://doi.org/10.1371/journal.pmed.0040329
19. Schaeffer AJ, Stuppy BA. Efficacy and safety of self-start therapy in women with recurrent urinary tract infections.J Urol.1999;161:207–11. [PubMed][Google Scholar]
20. Schnarr J, Smaill F. Asymptomatic bacteriuria and symptomatic urinary tract infections in pregnancy.Eur J Clin Invest.2008;38(Suppl 2):50–7. [PubMed][Google Scholar]
21. Sefton, A. M. (2000). The impact of resistance on the management of urinary tract infections. International Journal of Antimicrobial Agents, 16(4), 489–491. https://doi.org/10.1016/s0924-8579(00)00282-x
22. Shadkam, S., Goli, H. R., Mirzaei, B., Gholami, M., & Ahanjan, M. (2021). Correlation between antimicrobial resistance and biofilm formation capability among Klebsiella pneumoniae strains isolated from hospitalized patients in Iran. Annals of Clinical Microbiology and Antimicrobials, 20(1), 13. https://doi.org/10.1186/s12941-021-00418-x
23. Soto, S. M., Smithson, A., Martinez, J. A., Horcajada, J. P., Mensa, J., & Vila, J. (2007). Biofilm Formation in Uropathogenic Escherichia coli Strains: Relationship With Prostatitis, Urovirulence Factors and Antimicrobial Resistance. Journal of Urology, 177(1), 365–368. https://doi.org/10.1016/j.juro.2006.08.081
24. Spellberg B, Bartlett JG, Gilbert DN. The future of antibiotics and resistance.N EnglJ Med.2013;368:299–302.

25. Stamm, W. E., & Norrby, S. R. (2001). Urinary Tract Infections: Disease Panoramaand Challenges. The Journal of Infectious Diseases, 183(s1), S1–S4. https://doi.org/10.1086/318850
26. Yousefi Mashouf, R., Babalhavaeji, H., & Yousef, J. (2009). Urinary Tract Infections: Bacteriology and Antibiotic Resistance Patterns. Indian Pediatrics, 46, 617–620.