Content available at: https://www.ipinnovative.com/open-access-journals

IP International Journal of Medical Microbiology and Tropical Diseases

Journal homepage: https://www.ijmmtd.org/

Original Research Article

Bacterial urinary tract infection in diabetes patients and evaluation for multidrug resistant organisms

Reenu S.P[1], Girish Narayanaswamy[1,*], Ramesh Kumar Kushwaha[2]

[1]*Dept. of Microbiology, Vydehi Institute of Medical Sciences and Research Centre, Bangalore, Karnataka, India*
[2]*School of Allied Health Sciences, Reva University, Bengaluru, Karnataka, India*

ARTICLE INFO

Article history:
Received 17-08-2022
Accepted 30-10-2022
Available online 28-12-2022

Keywords:
E.coli
Klebsiella pneumoniae was the most familiar isolated microorganisms

ABSTRACT

Background: Bladder infection exists as frequently occurring infectious disease in diabetic mellitus of all distinct age groups. Acute cystitis is recognised as higher frequency in person with diabetes. Urinary Tract infection is most familiar and widespread infection in world-wide. The frequency of urinary tract infection is at peak in patients with diabetic mellitus. Diabetic mellitus (DM) is a group of metabolic impairment characterised by hyperglycaemia resulting from defects in insulin secretion, insulin action or both. It's a common disease that affects health in many ways and relevant problems one of the leading illness world-wide. Urinary tract infection medical aid experimental is less execution of urine culture and sensitivity. In the present study designed to find out occurrence of bacterial urinary tract infection, Multidrug resistant organisms, health risk and antimicrobial drug medication for UTI's.

Objective: To hypothesize the spectrum of uropathogens and the profile of antibiotic resistance pattern in both diabetic and non-diabetic patient with asymptomatic urinary tract infection.

Materials and Methods : The research study was performed for the duration of 6 Months (April-September 2022) in Vydehi Institute of medical science and research centre (VIMS & RC) Whitefield Bangalore. Diabetic as well as non-diabetic patients above 18 years of age, from OPD and also admitted in General medicine department of VIMS & RC was considered. A total of 247 diabetic and non-diabetic urine samples from outpatients and inpatients was collected and processed in the microbiology laboratory. In accordance to principle of Clinical and Laboratory Standards Institute, the urine samples was collected and analysed. VITEK 2 Automated system analyser was used to determine Antimicrobial Sensitivity.

Results : Bacterial Multidrug Resistant Organism isolates in diabetes mellitus with bacteriuria is 48 (53%). Bacterial isolates in non-diabetic mellitus with bacteriuria is 29 (17%). *E.coli* and *Klebsiella pnueumoniae* is frequently isolated. Gram-negative bacteria are highly resistant to multiple drugs like, Amikacin, Nitrofurantoin, Ceftriaxone, Clavulanic acid, Cefpirome, etc moreover increasingly resistant accessible antibiotics.

Conclusion: *E.coli* and *Klebsiella pneumoniae* was the most familiar isolated microorganisms.

1. Introduction

The most common and ubiquitous disease-causing agent recognized in clinical practice among all age groups is bacterial urinary tract infections (BUTIs). Urinary tract infection is the epidemic routine and repeated infectious disease involved in the urinary tract, kidneys, cystitis. Urinary tract infection affect 150 million people world-wide annually.[1] Diabetic mellitus is the universal endocrine disorder. Diabetes is constantly increasing metabolic syndrome based on high blood sugar arising from imperfection or deficiency in insulin secretion, action or

* *Corresponding author*.
E-mail address: girishdasanur@yahoo.co.in (G. Narayanaswamy).

https://doi.org/10.18231/j.ijmmtd.2022.062

both.[2] Diabetic mellitus endures for an extended period. It is distinguished by Type 1 and Type 2. Type 1 diabetes is also known as Juvenile diabetes or Insulin dependent diabetes. Type 2 diabetes is also called as diabetes mellitus and adult-onset diabetes. Type 1 diabetes results from the pancreas inability to generate insulin. Insulin resistance in the body's cells causes type 2 diabetes results when the body's cells resist the normal effect of insulin.[3] Diabetic Mellitus is the highest barrier causing UTI, because of diabetic mellitus there would be weakness or break in cell-mediated immune response, which results in illness microbial infection. Thus person with diabetes are vulnerable to UTI. Various fungi are too in charge for the cause of UTI in diabetic patients.[4] The up-to-date study predict from the global burden of diseases survey rate 462 million single person appeared to be afflicted with diabetic mellitus. Person with diabetes enlarge unhealthy and risky by UTI being the ultimate infection site.[5] Most people visiting health care with diabetes, The physician must enlighten and train the disorder of UTI in diabetic patients could possibly be asymptomatic bacteriuria inflammation of lining the bladder, Kidney infection, Pyelonephritis, Urosepsis, Abdominal pain, recurrent UTI, Perirenal or kidney abscess.[6] Patients with diabetes experience more UTIs than people without diabetes.[7] with more serious UTIs that result in consequences like dysuria which leads to total organ failure can result to trauma, because of complicated UTI.[8] The most regular microorganism isolated in UTI diabetes patients were gram-negative microorganisms like *E.coli, Klebsiella pneumonia, Proteus species, Enterobacter, E.faecalis*.[9] Diabetes patients are exposed and remain competing resistant pathogens in crisis of UTI[10] incorporate with ESBL positive enteric bacteria, fluroquinolones, proof against resistant pathogens, Carbapenem-resistant Enterobacterales.[11] The scope is to invent and illustrate Antimicrobial resistant connected to medical centre related to infections.[12] The appearance and increase of MDRO's is comprehensive and far-reaching community health threat.[13]MDRO has more prevalent in antimicrobial resistant infection in addition to nosocomial infection/health care-associated infections, However common occurrence may alter by region.[14] Uropathogens show a wide difference in them of varying levels of resistance to their antimicrobial medicines with time and space.[15] According to reports, diabetic persons who take antibiotics experience more severe UTI than those who don't.[16] This is due to the resistance posed by the medications' unchecked usage, which exposes individuals to more severe infection. The purpose of this study is to compare diabetes patients with non-diabetic patients to ascertain the prevalence, risk factors, and antibiotic sensitivity pattern of the organisms causing UTI.

2. Materials and Methods

This research is a hospital based investigation and analysis experimentation in adult-diabetic patients and non-diabetic people present at Vydehi research hospital, Whitefield Bangalore.

Ethical permission has been issued from Vydehi Institutional Ethical Committee (VIEC). The analysis is done in VIMS and RC.

2.1. Study design

The research design is a prospective study consisting for the duration of 6months (April-September 2022). Ethical approval certificate is issued by VIEC. Informed consent were obtained from all participants. After getting permission from the institution patients the process started for urinalysis. Both male and female patients above 18 years with diabetic and non-diabetic who attended Vydehi hospital were compared in this study, disregarding the presence or absence of urinary tract infection symptoms.

2.1.1. Experimental study design

Urine assessment and culture sensitivity test

Clean-voided midstream urine specimen was obtained from outpatients and inpatients in particular aseptic container for the purpose of microscopic examination of routine urine test and antibiotic susceptibility test for 6months. After giving informed consent form to the person who participates in research subject were enlightened on how to collect sample and be germ free and avoid contaminating. The collected samples was inoculated into a culture media (Agar-media).

2.2. Sample size

Calculation of sample size was done using the formula.

$$n = \frac{Z2(1-\alpha/2)P(1-P)}{d2}$$

Where n=required sample size, Z=Z value (from standard normal distribution) that corresponds to the desired confidence level or level of significance is 5% for 95%

confidence level, P=expected proportion of resistance in the target population, which is =0.04, d=absolute precision, which is =2%.

Diabetic – 247, Non- diabetic - 201

2.3. Inclusion standards

Studies that looked at the prevalence of UTIs in diabetes and non-diabetic patients as well as descriptive, cross-sectional, and observational studies were all considered. Patients above 18 years with diabetes and UTI was included. Patients with and without diabetes at all gender above 18 years of age, from OPD and also admitted in General medicine department of VIMS & RC, was included.

2.4. Exclusion criteria

Patients with pregnancy, known underlying renal pathology, chronic renal disease, and use of antibiotic medication during the previous month was excluded.

2.5. Objectives of research work

To screen and identify bacteria from samples of patients with UTI who are diabetes. To evaluate multidrug resistance in the bacterial isolates.

2.6. Methodology

2.6.1. Sample size

A total of 247 diabetic & 201 non diabetic urine samples from out patients and in patients was collected for processing in the microbiology laboratory.

Specimen collection & processing

Informed written consent was taken from case. Patient details was collected in data collection form. Patients. and requested a midstream urine sample. Samples taken with a sterile instrument holder that was delivered to bacteriology lab. Plates was inoculated to 24 hours by 37^{o}C and result is considered based on significant or non-significant growth progress. The presence of 10^5 CFC of bacteria in pure urine culture is notable and considered by standard calibrated units or colony-forming units.

Bacteria resisting treatment more than one or three antimicrobial classes of antibiotics is called Multidrug Resistant Organisms. Identification of bacteria was done as per CLSI guidelines.

2.7. Bacterial culture

According to CLSI guidelines, bacterial isolation and antibiotic susceptibility testing was performed. Vitek2 (Bio-Mereuix) was used. Bacterial identification and susceptibility testing. Bacteria was identified Gram's stain is used in fast tests using VITEK 2 system. VITEK 2 C is an automated analyser that identifies the Gram negative and Gram-positive bacteria in 4-6 hrs and sensitivity in 6-8 hours. VITEK 2 C system work as Advanced Colorimetry, diagnose technique that assist and equip high discrimination between strain and average of different and misidentified or mixed-up species.

2.8. Multidrug resistant organism

Resistant to all agents tested within at least three antimicrobial classes, including β-lactams, carbapenems, aminoglycosides, & fluroquinolones. New approaches and techniques applied by scientist to sketch microorganisms as Multidrug resistant organisms according to In-Vitro Antibiotic resistant process finding show three or more antimicrobial categories along with Extended Spectrum Beta Lactamase (ESBL), Methicillin Resistant Staphylococcus Aureus (MRSA), and Vancomycin Resistant Enterococcus (VRE), Carbapenems (CRE).[13]

3. Results

Significant bacteria was isolated in 90/247 (36%) & 157(63%) of symptomatic & asymptomatic diabetic patients respectively (Table 2). Prevalence of bacteria isolated among the symptomatic patients: *E.coli* (55) (61%) is the most common (Table 3). The Prevalence of Multi drug organisms (MDRO) isolated among the symptomatic patients: *E.coli* (43) (75%) (Table 4). Sensitivity to antibiotics patterns of gram negative & gram-positive bacteria segregates showed that *E.coli* is resistant to I-group (β-lactams), II–group (Carbapenems), III-group (Aminoglycosides), IV-group (Quinolones), SXT. Pseudomonas aeruginosa is resistant to I-group (β-lactams), III–group (Aminoglycosides), IV- group (Quinolones). *Klebsiella pneumoniae* is resistant to I-group (β-lactams), III - group (Aminoglycosides), IV- group (Quinolones). Enterococcus faecium is resistant to I - group (β-lactams), II – group (Carbapenems), IV- group (Quinolones). Klebsiella aerogenes I - group (β-lactams), IV- group (Quinolones), SXT, NIT (Table 5).

Significant bacteria was isolated in 29/201 (14%) & 114(56%) of symptomatic & asymptomatic non-diabetic patients respectively (Table 6). Prevalence of bacteria isolated among the symptomatic patients: *E.coli* (20) (64%) (Table 7). The Prevalence of Multi drug organisms (MDRO) isolated among the symptomatic patients: *E.coli*(2) (66%) *klebsiella pneumoniae* (1) (Table 8). The prevalence of Antibiotic sensitivity profile of MDRO bacterial isolates in non-diabetic patients: *E.coli* is resistant to I - group (β-lactams)

II – group (Carbapenems), Trimethoprim/sulfamethoxazole. *Klebsiella pneumoniae* is resistant to I - group (β-lactams), II – group (Carbapenems), III - group (Aminoglycosides), IV- group (Quinolones) (Table 9).

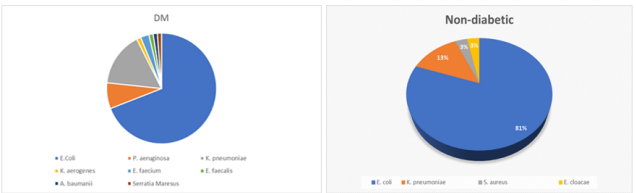

Fig. 1: Percentage of bacterial isolates in diabetic and non-diabetic patients

4. Discussion

The research outcome and findings depicted that many patients encountered Urinary Tract Infection(UTI) long-suffering and short period diabetic cases was considered

Table 1: Organisms identified from urine cultures of diabetic and non-diabetic patients

Isolates	Diabetic	Non-diabetic	Total
	No(%)	No(%)	
Escherichia coli	55(61%)	23(79%)	78
P. aeruginosa	6(6.67%)	-	6
K. pneumoniae	13(14%)	1(12.9%)	14
K. aerogenes	1(1.1%)	-	1
E. faecium	2(2.2%)	-	2
E. faecalis	1(1.1%)	-	1
A. baumanii	1(1.1%)	-	1
Serratia Maresus	1(1.1%)	-	1
S. aureus	-	1(3.2%)	1
Enterobacter cloacae	-	2(3.2%)	2

Table 2: Diabetic patients with UTI (n=247)

Total No. of patients	Total No. of organisms isolated (%)	No growth (%)
247	90(36%)	157(63%)

Table 3: Bacterial isolates from Diabetic patients with UTI (n=90)

Name of the bacteria	Total No. of isolate (%)
Escherichia coli	55 (61%)
Pseudomonas aeruginosa	6 (6.67%)
Klebsiella pneumoniae	13(14%)
Klebsiella aerogenes	1(1.1%)
Enterococcus faecium	2(2.2%)
Enterococci faecalis	1(1.1%)
Acinetobacter baumanii	1(1.1%)
Serratia Maresus	1(1.1%)
Total	90

Table 4: MDRO bacterial isolates in diabetic patients with UTI

Name of the bacteria	No. of MDRO isolates
Escherichia coli	43(75%)
Pseudomonas aeruginosa	1 (6.2%)
Klebsiella pneumoniae	1 (6.2%)
Klebsiella aerogenes	1(6.2%)
Enterococcus faecium	1(6.2%)
Total	48(53%)

int his study. Significant bacteria was isolated in 90/247 (36%) & 157(63%) of symptomatic & asymptomatic diabetic patients respectively. The most common cause of UTI is asymptomatic bacteriuria because, in favourable circumstances, colonised bacteria in the urinary system may climb towards the bladder and cause cystitis, which is typically accompanied by the classic UTI symptoms. If an untreated UTI spreads via the ureters to the kidneys, it may result in pyelonephritis, which can cause fatal renal failure and irreparable kidney damage.[17]

The distinctive outcome were described in advance research prevailed no significant variation with recurrence showing up of bacteria in urine considering male and females. In comparison, Geerling's et al[9] suggested with the purpose that UTI is increased in women.

Comparative research agreement of UTI in people with and without diabetes women unregulated and connected with increasing severity of infectious pathogen. The most commonly isolated pathogen is *E.coli*.[18] The most prevalent strains of Gram-negative isolate were *Klebsiella pnueumoniae, Pseudomonas aeruginosa*.

Escherichia coli was the most frequently isolated bacterium, according to several investigations. In this study, individuals with poor glycaemic control accounted for the majority of the 16 UTI cases (84.21%). In patients with adequate glycaemic control, only 3 (15.79%) incidences of UTI were discovered.[9,19] Among gram positive, Enterococcus represented 6.2% of isolated pathogens further more Staphylococcus aureus 3.2% was found in few cases at most 1% specimens exist to Candida species.

Table 5: Antibiotic sensitivity profile of MDRO bacterial isolates in diabetic patients with UTI

Name of the organism	MDRO antibiotic resistance	Sensitive antibiotics
1. *E.coli*	I - group (β-lactams) III - group (Aminoglycosides) IV- group (Quinolones), SXT	Fosfomycin
2. *E.coli*	I - group (β-lactams) IV- group (Quinolones), Trimethoprim/sulfamethoxazole	III - group (Aminoglycosides) Fosfomycin, Ertapenem, Nitrofurantoin
3. *E.coli*	I - group (β-lactams) IV- group (Quinolones), Trimethoprim/sulfamethoxazole	Fosfomycin, Gentamicin, Nitrofurantoin
4. *E.coli*	I - group (β-lactams) IV- group (Quinolones), Trimethoprim/sulfamethoxazole	Fosfomycin, Ertapenem, Nitrofurantoin, Piperacillin-tazobactam
5. *E.coli*	I - group (β-lactams) II – group (Carbapenems) Trimethoprim/sulfamethoxazole	III - group (Aminoglycosides) Fosfomycin, Ertapenem, Nitrofurantoin
6. *E.coli*	I - group (β-lactams) II – group (Carbapenems) IV- group (Quinolones)	SXT, Fosfomycin
7. *E.coli*	I - group (β-lactams) IV- group (Quinolones), Trimethoprim/sulfamethoxazole	I - group (β-lactams) III - group (Aminoglycosides) Nitrofurantoin
8. *E.coli*	I - group (β-lactams) III - group (Aminoglycosides) IV- group (Quinolones)	Fosfomycin, Nitrofurantoin, Trimethoprim/sulfamethoxazole
9. *E.coli*	I - group (β-lactams) II – group (Carbapenems) III - group (Aminoglycosides) IV- group (Quinolones)	Fosfomycin
10. *E.coli*	I - group (β-lactams) Nitrofurantoin, Trimethoprim/sulfamethoxazole	Amikacin, Fosfomycin, Ertapenem
11. *E.coli*	I - group (β-lactams) III - group (Aminoglycosides) IV- group (Quinolones)	III - group (Aminoglycosides) Piperacillin-tazobactam
12. *E.coli*	I - group (β-lactams) Nitrofurantoin, Trimethoprim/sulfamethoxazole	
13. Pseudomonas Aeruginosa	I - group (β-lactams) III - group (Aminoglycosides) IV- group (Quinolones)	Cefoxitin, Polymyxin B
14. *Klebsiella pneumoniae*	I - group (β-lactams) III - group (Aminoglycosides) IV- group (Quinolones)	Fosfomycin, Nitrofurantoin
15. Enterococcus faecium	I - group (β-lactams) II – group (Carbapenems) IV- group (Quinolones)	Trimethoprim/sulfamethoxazole Nitrofurantoin Piperacillin-tazobactam
16. Klebsiella aerogenes	I - group (β-lactams) IV- group (Quinolones), SXT, NIT	Amikacin, Fosfomycin

Table 6: Non-diabetic UTI patients (n=201)

Number of patients overall	Number of Isolates Overall	No growth (%)
201	29(14%)	114(56%)

Table 7: Bacterial isolates from non-diabetic patients with UTI (n=29)

Name of organisms	Total No. of isolated (%)
E.coli	23(79%)
Enterococcus faecium	2 (6%)
Klebsiella pneumoniae	1 (12.9%)
Staphylococcus aureus	1(3.2%)
Enterobacter cloacae	2(3.2%)
Total	29(17%)

Table 8: MDRO bacterial isolates in Non-diabetic patients with UTI

Name of the MDRO organisms	No. of organisms
E.coli	2 (66%)
Klebsiella pneumoniae	1 (33%)
Total	3

Table 9: Antibiotic sensitivity profile of MDRO bacterial isolates in diabetic patients with UTI

Name of the organism	MDRO antibiotic resistance	Sensitive antibiotics
E.coli	I - group (β-lactams) II – group (Carbapenems) Trimethoprim/sulfamethoxazole	Amikacin, Fosfomycin
E.coli	I - group (β-lactams) IV- group (Quinolones) Trimethoprim/sulfamethoxazole	Ertapenem, Fosfomycin, amikacin, Nitrofurantoin
Klebsiella pneumoniae	I - group (β-lactams) II – group (Carbapenems) III - group (Aminoglycosides) IV- group (Quinolones)	Trimethoprim/sulfamethoxazole

Gram-negative infections reveal disturbing resistant to first and second-line agents Ampicillin, Fluroquinolones, Trimethoprim/sulfamethoxazole, Amoxicillin, in this investigation.

In comparison analysis by Bhargava et al[20] exposed remarkably amikacin, gentamycin, cefepime, cefalotin The best treatments for GNB were and imipenem. Vancomycin, chloramphenicol, and nitrofurantoin, on the other hand, were the highest effectual medicine in opposition to Gram negative and Gram-positive bacteria. Various studies published resistant to the β-lactam group of antibiotic drug comparable with investigation of sensitivity pattern is observed.[21] The purpose of the study Daniel, Betty et al estimate the frequency of urethral infections with hose with and without diabetes[22] Whereas our study is to isolate and identify bacteria from samples of people with UTI who are diabetes. To evaluate multidrug resistance in the isolates of bacteria.

5. Conclusion

Infection of the urinary tract are frequent along with diabetic symptoms. UTI is an enhancing factor which give rise to infection in diabetic patients. The habitual utilize of common antibiotics created particular bacteria resistant's reaching consequences of antibiotics.

The prolonged case assuming that UTI endures in diabetic patients, later can have dangerous complications. Diabetic people remain on increased risk of infections, with UTI amongst the most chronic situation. Urinary tract infection in diabetic mellitus act as a common intention of mortality and will result in mortality. *E.coli* is the major recurrent and regular infectious agent in charge between diabetics and non-diabetics of UTI, accompanied by Klebsiella. Examination of bacteriuria (UTI) is high in both diabetes and non-diabetic people. Significant remedy in medical care.

6. Source of Funding

None.

7. Conflicts of Interest

There is no conflict of interest.

References

1. Barahim OH, AL-Kadassy AM, Pyar H, Dahman LSB. Prevalence of bacterial urinary tract infections amongst diabetes mellitus patients attending Ibn-Sina General Hospital in Mukalla, Yemen. *J Med Sci*. 2022;22:107–12. doi:10.3923/jms.2022.107.112.
2. Jagadeesan S, Tripathi BK, Patel P, Muthathal S. Urinary tract infection and Diabetes Mellitus-Etio-clinical profile and antibiogram: A North Indian perspective. *J Family Med Prim Care*. 2022;11(5):1902–6. doi:10.4103/jfmpc.jfmpc_2017_21.

3. Nitzan O, Elias M, Chazan B, Saliba W. Urinary tract infections in patients with type 2 diabetes mellitus: review of prevalence, diagnosis, and management. *Diabetes Metab Syndr Obes*. 2015;8:129–36. doi:10.2147/DMSO.S51792.
4. Sahu M, Bhagat Z. Pervasiveness of urinary tract infection in diabetic patients and their causative organisms with antibiotic sensitivity pattern. *Apollo Med*. 2020;17(1):26–30. doi:10.4103/am.am_2_20.
5. Khan MAB, Hashim MJ, King JK, Govender RD, Mustafa H, Kaabi JA, et al. Epidemiology of Type 2 Diabetes - Global Burden of Disease and Forecasted Trends. *J Epidemiol Glob Health*. 2020;10(1):107–11. doi:10.2991/jegh.k.191028.001.
6. Brown JS, Wessells H, Chancellor MB, Howards SS, Stamm WE, Stapleton AE, et al. Urologic complications of diabetes. *Diabetes Care*. 2005;28(1):177–85. doi:10.2337/diacare.28.1.177.
7. De Lastours V, Foxman B. Urinary tract infection in diabetes: epidemiologic considerations. *Curr Infect Dis Rep*. 2014;16(1):389. doi:10.1007/s11908-013-0389-2..
8. Saleem M, Daniel B. Prevalence of urinary tract infection among patients with diabetes in Bangalore City. *Int J Emerg Sci*. 2011;1(2):133.
9. Meiland R, Geerlings SE, Langermann S, Brouwer EC, Coenjaerts FEJ, Hoepelman AIM, et al. Fimch antiserum inhibits the adherence of Escherichia coli to cells collected by voided urine specimens of diabetic women. *J Urol*. 2004;171(4):1589–93. doi:10.1097/01.ju.0000118402.01034.fb.
10. Inns T, Millership S, Teare L, Rice W, Reacher M. Service evaluation of selected risk factors for extended-spectrum beta-lactamase Escherichia coli urinary tract infections: a case-control study. *J Hosp Infect*. 2014;88(2):116–9.
11. Colodner R, Rock W, Chazan B, Keller N, Guy N, Sakran W, et al. Risk factors for the development of extended-spectrum beta-lactamase-producing bacteria in nonhospitalized patients. *Eur J Clin Microbiol*. 2004;23(3):163–7.
12. Tapsall JW, Ndowa F, Lewis DA, Unemo M. Meeting the public health challenge of multidrug- and extensively drug-resistant Neisseria gonorrhoeae. *Expert Rev Anti Infect Ther*. 2009;7(7):821–34.
13. Magiorakos AP, Srinivasan A, Carey RB, Carmeli Y, Falagas ME, Giske CG, et al. Multidrug-resistant, extensively drug-resistant and pandrug-resistant bacteria: an international expert proposal for interim standard definitions for acquired resistance. *Clin Microbiol Infect*. 2012;18(3):268–81.
14. Dayan N, Dabbah H, Weissman I, Aga I, Even L, Glikman D, et al. Urinary tract infections caused by community-acquired extended-spectrum β-lactamase-producing and nonproducing bacteria: A comparative study. *J Pediatr* . 2013;163(5):1417–21.
15. Kotgire S, Siddiqui S. Prevalence and Antibiogram of Uropathogens from Patients Attending Tertiary Care Hospital. *Int J Med Microbiol Trop Dis*. 2017;3(1):20–3. doi:10.18231/2455-6807.2017.0005.
16. Chukwuocha UM, Emerole CO, Njokuobi TN, Nwawume IC. Urinary Tract Infections (UTIs) Associated with Diabetic Patients in the Federal Medical Center owerri, Nigeria. *Global Adv Res J Microbiol*. 2012;1(5):62–6.
17. Ngwai YB, Iliyasu H, Young E, Owuna G. Bacteriuria and Antimicrobial Susceptibility of Escherichia coli Isolated From urine of Asymptomatic University Students in Keffi, Nigeria. *Jundishapur J Microbiol*. 2012;5(1):323–7.
18. Garg V, Bose A, Jindal J, Goyal A. Comparison of Clinical Presentation and Risk Factors in Diabetic and Non-Diabetic Females with Urinary Tract Infection Assessed as Per the European Association of Urology Classification. *J Clin Diagn Res*. 2015;9(6):12–4. doi:10.7860/JCDR/2015/14177.6029.
19. Aamir AH, Raja UY, Asghar A. Asymptomatic urinary tract infections and associated risk factors in Pakistani Muslim type 2 diabetic patients. *BMC Infect Dis*. 2021;21(1):388. doi:10.1186/s12879-021-06106-7.
20. Bhargava K, Nath G, Bhargava A, Kumari R, Aseri GK, Jain N, et al. Bacterial profile and antibiotic susceptibility pattern of uropathogens causing urinary tract infection in the eastern part of Northern India. *Front Microbiol*. 2022;13:965053. doi:10.3389/fmicb.2022.965053.
21. Sood S, Gupta R. Antibiotic Resistance Pattern of Community Acquired Uropathogens at a Tertiary Care Hospital in Jaipur, Rajasthan. *Indian J Community Med*. 2012;37(1):39–44. doi:10.4103/0970-0218.94023.
22. Saleem M, Daniel B. Prevalence of Urinary Tract Infection among Patients with Diabetes in Bangalore City. *Int J Emerg Sci*. 2011;1(2):133–42.

Author biography

Reenu S.P, PhD. Scholar

Girish Narayanaswamy, Professor of Microbiology
https://orcid.org/0000-0001-8832-9078

Ramesh Kumar Kushwaha, Associate Professor
https://orcid.org/0000-0003-0098-0398

Cite this article: Reenu S.P, Narayanaswamy G, Kushwaha RK. Bacterial urinary tract infection in diabetes patients and evaluation for multidrug resistant organisms. *IP Int J Med Microbiol Trop Dis* 2022;8(4):317-323.