

Pattern of Microorganisms of Urinary Tract Infection (UTI) and its Outcomes in Diabetic Patients of Tertiary Intensive Care Unit (ICU)

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Abstract

Background: To assess pattern of microorganism of urinary tract infection (UTI) & its outcomes in diabetic patients admitted in intensive care unit (ICU). **Subjects & Methods:** One hundred twenty type II diabetes patients admitted in intensive care unit (ICU) of Himalayan Institute of Medical Sciences, Dehradun, Uttarakhand comprising of 78 males and 42 females were studied for UTI. **Results:** 70 patients had UTI. It was seen in 50 (71.4%) catheterized and 20 (28.6%) non- catheterized, 22 (31.4%) controlled diabetics and 48 (68.6%) uncontrolled diabetics and 38 (54.2%) on insulin and 32 (45.8%) on OHA. Most common gram- negative organism seen in UTI was E coli seen in 42%, gram positive organism was Staphylococcus sciuri in 7% and yeast was Candida albicans in 1% and Candida glabrata in 1.3%. Septic shock occurred in 18 (25%), re- infection in 7 (10%) and death in 4 (5.7%) patients **Conclusion:** Most commonly occurring gram negative pathogens among diabetic ICU patients was E coli and gram- positive pathogen was Staphylococcus sciuri. UTI was commonly seen among catheterized, uncontrolled diabetics.

Keywords: E. Coli

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Introduction

Diabetes mellitus is considered to be the commonly occurring endocrinal systemic disease worldwide. It is of two types such as insulin dependent or juvenile DM and non- insulin dependent or adult- onset DM.^[1] It is characterized by variable degrees of insulin resistance, impaired insulin secretion, and increased glucose production. Type II diabetes mellitus patients more susceptible to various infections such as respiratory tract, urinary tract and digestive tract etc. Among all, urinary tract infection (UTI) is the most frequent infection seen in DM patients.^[2]

Diabetic patients have weak immune system, hence urinary tract infections (UTI) are of great concern. It is evident that alterations of host defence mechanisms such as leukocyte adherence, chemotaxis, and phagocytosis increase the chances of UTI type II diabetes mellitus patients.^[3] The UTI ranges from asymptomatic bacteriuria (ASB) to lower UTI (cystitis) and severe urosepsis. Pyelonephritis, renal abscess, renal

papillary necrosis, emphysematous cystitis and renal papillary necrosis are complications of UTIs resulting from resistant uropathogens. Type II diabetes is not only a risk factor for community-acquired UTI but also for health care-associated UTI, catheter-associated UTI, and post-renal transplant-recurrent UTI.^[4]

The main causative organism causing urinary tract infection (UTI) is gram-negative bacteria such as Escherichia coli, Enterobacter species, Citrobacter species, Klebsiella species, Pseudomonas species, Proteus species and gram-positive bacteria like enterococcus species, streptococci, Candida albicans and staphylococcus saprophyticus.^[5] Diabetic patients are more prone to have bacteriuria as compared to non-diabetics because of combination of host and local risk factors. The chances of UTI in diabetic patients is even more in ICU patients. A study by Richards and colleagues found that UTI was responsible for 20– 30% of nosocomial infections in medical/surgical ICUs.^[6] The present study aimed to assess

pattern of microorganism of urinary tract infection (UTI) & its outcomes in diabetic patients admitted in intensive care unit (ICU).

Subjects and Methods

One hundred twenty type II diabetes patients admitted in intensive care unit (ICU) of Himalayan Institute of Medical Sciences, Dehradun, Uttarakhand comprising of 78 males and 42 females were included in the study. All patients agreed to participated in the study.

A case history proforma was developed and parameters related to them were recorded. Patients had random blood glucose >200 mg/dl or fasting blood sugar >126 mg/dl. 2-hour post prandial glucose level was >200 mg/dl during an OGTT. From all patients, clean catch midstream urine specimens was collected in mouthed container which was cultured on cystin-lactose-electrolyte deficient agar (CLED) agar and plate was incubated aerobically overnight at 37°C.

A 50 µl of well mixed uncentrifuged urine was examined under a high-power direct microscopy. A significant pyuria was considered with the presence of one pus cell/7HPF. Plate showing any significant growth was recognized based on colony morphology, gram staining and appropriate standard biochemical tests. The presence of fungi was established by colony morphology and gram stain. Results of the present study was tabulated and studied using Mann Whitney U test. The software IBM SPSS version 21.0 was used for analysis. Level of significance was below 0.05.

Results

Table 1: Age and gender distribution of patients in ICU

Age group (Years)	Males	Females	Total
0-25	14	8	22
25-50	38	24	62
>50	26	10	36
Total	78	42	120

Maximum patients in ICU were seen in age group 25- 50 years (males- 38, females- 24) and least were in age group 0-25 years (males- 14, females- 8) [Table 1].

It was found that 70 patients had UTI. It was seen in 50 (71.4%) catheterized and 20 (28.6%) non- catheterized, 22 (31.4%) controlled diabetics and 48 (68.6%) uncontrolled diabetics and 38 (54.2%) on insulin and 32 (45.8%) on OHA. A significant difference was seen in variables (P< 0.05) [Table 2].

Most common gram- negative organism seen in UTI was E coli seen in 42% followed by K. pneumoniae in 14%, P.

Table 2: Occurrence of urinary tract infection among patients in ICU

Variables	Parameters	Total	P-value
Catheterization	Catheterized	50 (71.4%)	Significant <0.05
	Non-catheterized	20 (28.6%)	
Diabetes status	Controlled	22 (31.4%)	Significant <0.05
	Uncontrolled	48 (68.6%)	
Drug	Insulin	38 (54.2%)	Non- significant >0.05
	OHA	32 (45.8%)	

mirabilis in 8%, Citrobacter koseri in 5%, P. aeruginosa in 6% and Citrobacter koseri in 3%. Gram positive organism was Staphylococcus sciuri in 7%, Streptococcus agalactiae in 3%, Staphylococcus epidermidis in 1%, Staphylococcus warneri in 1.5% and Enterococcus faecalis in 1.2% and yeast was Candida albicans in 1% and Candida glabrata in 1.3%. Mann Whitney U test was applied which showed a significant difference (P< 0.05) [Table 3, Figure 1-3].

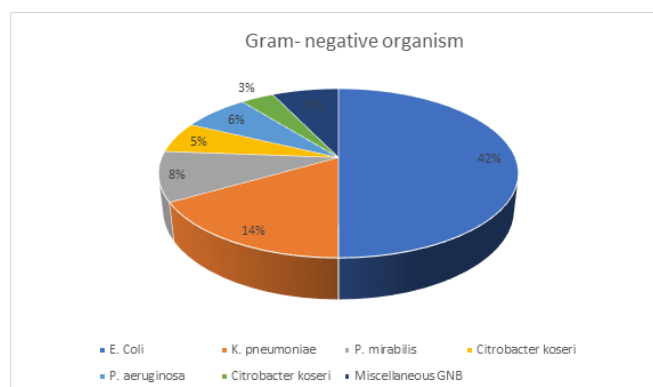


Figure 1: Gram- negative organism

Table 4: Outcome

Outcome	Number	P-value
Septic shock	18	Significant <0.05
Re- infection	7	
Death	4	

Septic shock occurred in 18 (25%), re- infection in 7 (10%) and death in 4 (5.7%) patients. A significant difference was found (P< 0.05) [Table 4].

Table 3: Microbial uropathogens isolated from urine of diabetic ICU patients

UTI pathogens	Variables	Percentage	P-value
Gram negative	E coli	42%	Significant <0.05
	K. pneumoniae	14%	
	P. mirabilis	8%	
	Citrobacter koseri	5%	
	P. aeruginosa	6%	
	Citrobacter koseri	3%	
	Miscellaneous GNB	6%	
Gram positive	Staphylococcus sciuri	7%	
	Streptococcus agalactiae	3%	
	Staphylococcus epidermidis	1%	
	Staphylococcus warneri	1.5%	
	Enterococcus faecalis	1.2%	
Yeast	Candida albicans	1%	
	Candida glabrata	1.3%	

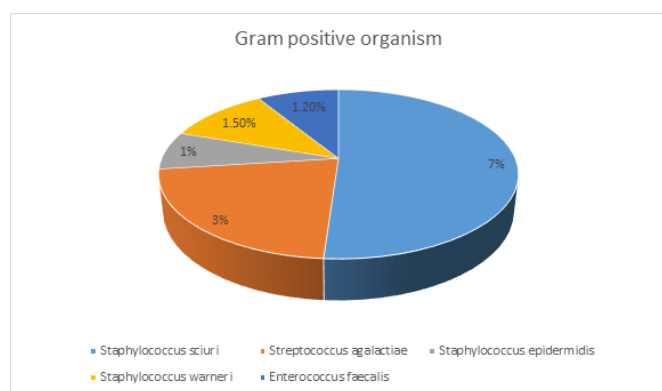


Figure 2: Gram- positive organism

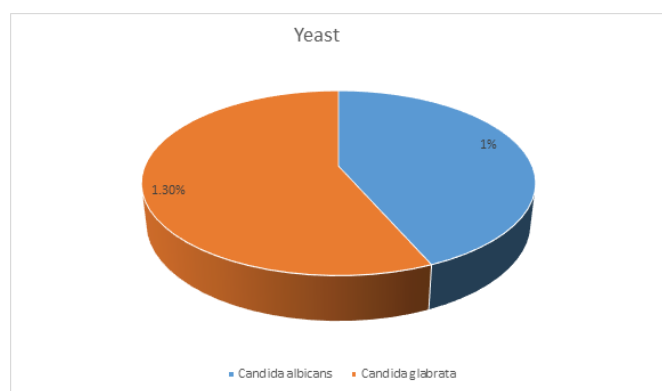


Figure 3: Yeast

Discussion

Infection of the urinary tract (UTI) is the most common hospital- acquired infection among critical ill patients and is frequently encountered in diabetics. Nosocomial UTIs have been associated with a 3-fold increased risk for mortality with approximately >50,000 deaths occurring every year in the USA as a result of these infections.^[7] Other risk factors such as increased length of hospital stay and cost is lined with nosocomial UTIs. Length of catheterization, age, status of diabetes and gender are other predisposing factors.^[8]

It is seen that Escherichia coli, Klebsiella spp., Proteus spp., Enterobacter spp., and Enterococci are the most common pathogens isolated from urine of diabetic patients.^[9] Patients with diabetes are more prone to have resistant pathogens as the cause of their UTI, including extended-spectrum β -lactamase-positive Enterobacteriaceae, fluoroquinolone-resistant uropathogens, carbapenem resistant Enterobacteriaceae and vancomycin-resistant Enterococci. The reason behind this could be multiple courses of antibiotic therapy, increased incidence of hospital acquired and catheter-associated UTI, which are both associated with resistant pathogens. Type II diabetes is also a risk factor for fungal UTI.^[10] The present study aimed to assess pattern of microorganism of urinary tract infection (UTI) & its outcomes in diabetic patients admitted in intensive care unit (ICU).

It was seen that maximum patients in ICU were seen in age group 25- 50 years (males- 38, females- 24) and least were in age group 0-25 years (males- 14, females- 8). Otta et al,^[11] in their study studied the common organisms implicated in the UTI in diabetic patients and their sensitivity pattern and

revealed that E coli was the most common organism isolated from 68 cases and 85 controls. 46 (67.7 %) diabetics had uncontrolled blood sugar level. Diabetics are more prone for catheter associated UTI (CAUTI) and fungal UTI. Most of the E coli and Atypical E coli isolated were ESBL positive for the diabetic patients (60.5%) than that for the non-diabetics (40.4%). Antimicrobial resistance pattern was similar in both the groups with maximum patients' sensitivity to tigecycline, colistin, fosfomycin and least susceptibility to cefixime. Both E coli and Klebsiella also showed high resistance to the fluoroquinolones.

It was observed that 70 ICU patients had UTI. It was seen in 50 (71.4%) catheterized and 20 (28.6%) non-catheterized, 22 (31.4%) controlled diabetics and 48 (68.6%) uncontrolled diabetics and 38 (54.2%) on insulin and 32 (45.8%) on OHA. Laupland et al,^[12] in their 3 years prospective study on 4465 patients found that a total of 356 ICU-acquired UTIs yielding an overall incidence density of ICU-acquired UTIs of 9.6 per 1000 ICU days. Four bacteremic/fungemic ICU-acquired UTIs occurred (0.1 per 1000 ICU days). Development of an ICU-acquired UTI was more common in women and in medical (9%) compared with non-cardiac surgical (6%), and cardiac surgical patients (2%). The most common organisms isolated were Escherichia coli (23%), Candida albicans (20%), and Enterococcus species (15%). Antibiotic-resistant organisms were identified among 14% isolates. Although development of an ICU-acquired UTI was associated with significantly higher crude in-hospital mortality and an ICU-acquired UTI was not an independent predictor for death.

In present study we observed that Most common gram-negative organism seen in UTI was E coli seen in 42% followed by K. pneumoniae in 14%, P. mirabilis in 8%, Citrobacter koseri in 5%, P. aeruginosa in 6% and Citrobacter koseri in 3%. Gram positive organism was Staphylococcus sciuri in 7%, Streptococcus agalactiae in 3%, Staphylococcus epidermidis in 1%, Staphylococcus warneri in 1.5% and Enterococcus faecalis in 1.2% and yeast was Candida albicans in 1% and Candida glabrata in 1.3%. Vignesh et al,^[13] in their study identified 126 subjects and found a prevalence of UTI was around 25% higher in women with type II diabetes than in men. UTI was found to be significantly associated with age, creatinine (p<0.05) and Escherichia coli was the commonly isolated micro-organism. The gram-negative pathogens were highly sensitive to cefoperazone-sulbactam and amikacin was found to be the most sensitive antibiotic for both gram positive and gram-negative pathogens.

Conclusion

Most commonly occurring gram negative pathogens among diabetic ICU patients was E coli and gram-positive pathogen was Staphylococcus Sciuri. UTI was commonly seen among

catheterized, uncontrolled diabetics.

References

1. Patterson JE, Andriole VT. Bacterial urinary tract infections in diabetes. *Infect Dis Clin North Am.* 1997;11(3):735–750. Available from: [https://dx.doi.org/10.1016/s0891-5520\(05\)70383-4](https://dx.doi.org/10.1016/s0891-5520(05)70383-4).
2. Geerlings SE. Consequences of asymptomatic bacteriuria in women with diabetes mellitus. *Arch Intern Med.* 2001;161(11):1421–1428. Available from: <https://doi.org/10.1001/archinte.161.11.1421>.
3. Geerlings SE, Stolk RP, Camps MJ. Asymptomatic bacteriuria can be considered a diabetic complication in women with diabetes mellitus. *Adv Exp Med Biol.* 2000;485:309–314. Available from: <https://doi.org/10.2337/diacare.23.6.744>.
4. Fünfstück R, Nicolle LE, Hanefeld M, Naber KG. Urinary tract infection in patients with diabetes mellitus. *Clinical Nephrol.* 2012;77(01):40–48. Available from: <https://dx.doi.org/10.5414/cn107216>.
5. Zhanel GG, Harding GKM, Nicolle LE. Asymptomatic Bacteriuria in Patients with Diabetes Mellitus. *Clin Infect Dis.* 1991;13(1):150–154. Available from: <https://dx.doi.org/10.1093/clinids/12.5.150>.
6. Boyko EJ, Fihn SD, Scholes D, Chen CL, Normand EH, Yarbro P. Diabetes and the Risk of Acute Urinary Tract Infection Among Postmenopausal Women. *Diabetes Care.* 2002;25(10):1778–1783. Available from: <https://dx.doi.org/10.2337/diacare.25.10.1778>.
7. Scholes D, Hooton TM, Roberts PL, Gupta K, Stapleton AE, Stamm WE. Risk Factors Associated with Acute Pyelonephritis in Healthy Women. *Ann Intern Med.* 2005;142(1):20. Available from: <https://dx.doi.org/10.7326/0003-4819-142-1-200501040-00008>.
8. Walsh C, Collyns T. The pathophysiology of urinary tract infections. *Surgery (Oxford).* 2017;35(6):293–298. Available from: <https://dx.doi.org/10.1016/j.mpsur.2017.03.007>.
9. Mareddy AS, Kudru CU, Nagiri SK, BC P. Clinical profile of urinary tract infections in diabetics and non-diabetics. *Med J Aust.* 2014;7(1):29–34. Available from: <https://dx.doi.org/10.21767/amj.2014.1906>.
10. Simkhada R. Urinary tract infection and antibiotic sensitivity pattern among diabetics. *Nepal Med Coll J.* 2013;15(1):1–4.
11. Otta S, Swain B, Bhoi P. Microbiological analysis of urinary tract infection in diabetic patients. *J Res Med Sci.* 2020;8(12):4410. Available from: <https://dx.doi.org/10.18203/2320-6012.ijrms20205315>.
12. Laupland KB, Bagshaw SM, Gregson DB, Kirkpatrick AW, Ross T, Church DL. Intensive care unit-acquired urinary tract infections in a regional critical care system. *Critical care.* 2005;9(2):1–6. Available from: <https://dx.doi.org/10.1186/cc3023>.
13. Vignesh PS, Gopinath TT, Sriram DK. Urinary tract Infection among type 2 diabetic patients admitted in a multispecialty hospital in South Chennai, Tamil Nadu. *Int J Community Med Public Health.* 2019;6(3):1295. Available from: <https://dx.doi.org/10.18203/2394-6040.ijcmph20190628>.

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