

**Original Research Article****Clinical and Bacteriological Profile of Urinary Tract Infection in Diabetes Mellitus Patients: An Evaluative Study**

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Dr. PDMMC, Amravati, Maharashtra, India**Abstract**

Background: *Diabetes Mellitus (DM) is a metabolic disease of modern civilization. It is associated with reduced life expectancy, significant morbidity due to specific diabetes related microvascular complications, increased risk of macrovascular complications and diminished quality of life. Urinary tract infection (UTI) is a common infection observed in diabetic patients. DM alters the genitourinary system where UTI can cause severe complications ranging from dysuria, organ damage and even death due to complicated UTI. Current study was carried out to evaluate UTI pathogens its association with clinical profile and susceptibility patterns to antimicrobials among diabetic patients.*

Materials and Method: *A one-year cross sectional, descriptive study was carried out in tertiary care hospital. Total 60 patients of DM with UTI were included based on inclusion criteria. Research tool consisted of questionnaire, clinical examination and investigations. Pus cells grading into categories were taken as dependent variables and clinical parameters (duration of DM, glycosylated hemoglobin levels, past episodes of UTI, past catheterization) as independent variables.*

Results: *Incidence of UTI in D.M. was mostly seen in women and above 50 years of age. Fever was the commonest symptom, UTI most common in patients with past history of diabetes of less than 10 years duration. Most common organism isolated in UTI was E. coli. Gram negative bacilli were sensitive to imipenem, gentamycin, nitrofurantoin, and Gram-positive cocci were sensitive to vancomycin, linezolid, tetracycline in most of the patients. Poor Glycemic control was significantly associated with more pus cells in urine.*

Keywords: *Diabetes Mellitus, Urinary tract infection, Bacteriology, Antimicrobial sensitivity.*

Introduction

Diabetes Mellitus (DM) is a metabolic disease of modern civilization. Diabetes is a condition primarily defined by the level of hyperglycaemia giving rise to risk of microvascular damage (retinopathy, nephropathy and neuropathy). It is

associated with reduced life expectancy, significant morbidity due to specific diabetes related microvascular complications, increased risk of macrovascular complications and diminished quality of life.

Urinary tract infection (UTI) is a common infection observed in diabetic patients. UTIs are the frequent infections observed in clinical practice and results in a significant morbidity and high medical costs. Asymptomatic bacteriuria, acute pyelonephritis and the complications of UTI are reported to be more common in patients with diabetes. DM alters the genitourinary system where UTI can be a cause of severe complications ranging from dysuria, organ damage and death due to complicated UTI (pyelonephritis).

During the course of a lifetime with diabetes, UTI ranked among the top ten concurrent or complicating illnesses. There is huge clinical and economic significance of UTI in diabetes. Also emergence of multi-drug-resistant (MDR) strains is escalating; hence, determining the prevalence of UTI among diabetic patients and investigating the sensitivity of bacterial isolates to antimicrobial agents is important for the epidemiologist, scientist, health planner, and clinician.^(1,2,3,4) Hence current study was carried out to know UTI pathogens among diabetic patients, its association with clinical profile and susceptibility patterns to antimicrobials.

Objectives

- 1) To study the clinical features in patients of diabetes mellitus with UTI admitted to tertiary care hospital
- 2) To evaluate the bacteriological aspect i.e. type of organisms (bacteria) isolated and their antibiotic sensitivity
- 3) To find association between important clinical features and bacteriological variables

Materials and Method

Study Design: Cross sectional, Descriptive-Observational study

Study participants, setting and period: The study included diabetic patients with UTI admitted to the medical wards of a Tertiary Care Hospital. Study period was 1 year.

Sample size: All diabetic patients with UTI admitted to medical wards of tertiary care hospital during the study period based on inclusion criteria were included.⁽⁵⁾

Selection of Participants

Inclusion Criteria

- 1) Diabetes mellitus patients admitted in hospital and having significant pyuria (More than 10 pus cells per high power field in a centrifuged fresh urine specimen) or significant bacteriuria (More than 10⁵ microorganisms per ml of urine).
- 2) Patients more than 18 years of age and giving written informed valid consent.

Exclusion Criteria

- 1) Pregnant patients, Patients with urinary tract infection of tubercular etiology
- 2) Patient with known anatomical abnormalities (Genito-urinary system)
- 3) Use of following drug in the preceding year- antiretroviral treatment for HIV; immune suppressive drugs; chemotherapy; and medication for renal insufficiency, such as calcium binding agents
- 4) Patients receiving an antibiotic prescription within duration of last 14 days of enrolment in study

Research Tool

Consisted of interviewer based pre-designed, semi-structured and pretested questionnaire which included socio-demographic data, presenting complaints, past history, personal history, family history. General physical examination and systemic examination was carried out on all participants as part of the study. All participants were also subjected to various investigations.

Statistical Analysis

-Data was entered into the computer using Statistical Package for the Social Sciences software for Windows version 20.0 (SPSS Inc., Chicago, IL, USA) and double-checked before analysis.

-Percentages were calculated and Chi-square analysis was done for qualitative data.

-Pus cells grading into three categories was taken as dependent variables, and clinical parameters (duration of DM, glycosylated hemoglobin levels, past episodes of UTI, past catheterization and urinary obstruction history) as independent variables.

-P value of <0.05 was termed as significant, value of <0.001 was termed as highly significant and value <0.0001 was termed as very highly significant, Fischer's Exact test was calculated when expected count in a cell was less than 5.

Operational Definitions

Diabetes Mellitus:⁽⁶⁾

Fasting plasma glucose	≥ 7.0 mmol/l (126mg/dl)
2- hour plasma glucose	≥ 11.1 mmol/l (200mg/dl)

Significant pyuria- Presence of more than 10 pus cells per high power field in a centrifuged fresh urine specimen. **Significant bacteriuria-** More than 10^5 microorganisms per ml of urine. **Asymptomatic bacteriuria (ASB)-** The presence of at least 10^5 colony-forming units of the same urinary tract pathogen per ml in two consecutive clean voided midstream urine cultures without symptoms of UTI⁽⁷⁾ **GlycosylatedHb:-** DM patients were categorized into two categories based on glycosylated Hb levels of $\leq 7\%$ and $> 7\%$ ⁽¹⁾

UTI estimation, culture and sensitivity

UTI was assessed in all the diabetic patients by clean catch method i.e midstream sample was collected in sterile container after thorough cleaning of peri-meatal area. This method was followed to collect urine for bacteriological study. In certain cases 24 hour total samples were collected to know the excretory and concentration power of kidneys.

Microscopic examination of a wet film of uncentrifuged urine was carried out to detect the presence of pus cells, erythrocytes, microorganisms, casts etc. The samples were processed using standard microbiological

procedures. The Mac Conkey's Agar plate was used for culturing the organisms. The identification of bacteria was made by colour of colonies and by fermentation of different sugars like glucose, sucrose, lactose, maltose, mannitol and xylose. Gram-stained and species confirmed by in-house biochemical testing. Gram-negative organisms, e.g. E. coli, Klebsiella pneumonia, and Proteus mirabilis, were distinguished by microscopy. E. coli was identified as medium, pink-to-red colonies and confirmed by positive indole test, whereas K. pneumonia were large, pink-to-mauve colonies, which were confirmed by negative oxidase and indole tests. P. mirabilis was assessed as small pale-to-colorless colonies testing positive to indole and urease but negative to oxidase. Enterococcus faecalis was the only Gram-positive microorganism that was isolated and was identified by the presence of small, turquoise colonies with coccoid morphology, which tested negative for catalase and positive for bile esculin.

The disc diffusion method was used to determine the antimicrobial susceptibility of isolates. Colonies were suspended in normal saline to 0.5 McFarland standard, and using disposable sterile swabs, the suspensions were inoculated on Muller-Hinton agar and incubated for 18–24 h, according to Clinical and Laboratory Standards Institute (CLSI) guidelines. E. coli ATCC® 25922 and E. faecalis ATCC® 29212 were used as control strains. Antimicrobial susceptibility and resistance was determined by isolate growth zone diameter according to CLSI guidelines. Gram negative isolates were tested against amikacin, ampicillin, ampicillin/ sulbactam, piperacillin, piperacillin-tazobactam, cefotaxime, ceftazidime, cefoxitin, norfloxacin, nitrofurantoin, gentamicin, ciprofloxacin, levofloxacin and imipenem. Gram positive isolates were tested with oxacillin, cefoxitin, erythromycin, linezolid, vancomycin, teicoplanin, rifampin, chloramphenicol, cotrimoxazole, ciprofloxacin, gentamicin, amikacin and tetracycline. The degree of sensitivity to the given antibiotics was indicated in

the report as R = Resistant, I= Intermediate, S= Sensitive^(8,9)

Results

Total 60 patients were included in study, urinary tract infection was seen in 46(77%) females patients of D.M. as compared to males D.M. patients 14 (23%). The incidence of urinary tract infection was more in the age group above 50 years (32%), 28% in 41-50 years age group, 23 % in 31- 40 years age group and 17% in age group of 30 years and less. Twenty three patients (38%) had a family history of hypertension, 15 (25%) had family history of both diabetes and hypertension, 12(20%) had family history of

diabetes only and 10(17%) had no family history of systemic diseases.

Out of 60 patients, 49(82%) patients were having normal BMI, 7(12%) were overweight and 02(03%) were obese. Also 41(68%) were hypertensive and 19(32%) were normotensive.

Symptom analysis for urinary tract infection showed fever as the commonest symptom in 90% patients. Next common symptom was dysuria (70%). Pain in abdomen was present in 25% patients suggesting pyelonephritis. Pain in lower abdomen (cystitis) was seen in 15%. Renal colic was seen in only 15% of cases. Numbness and tingling of extremities was found in 30% cases.

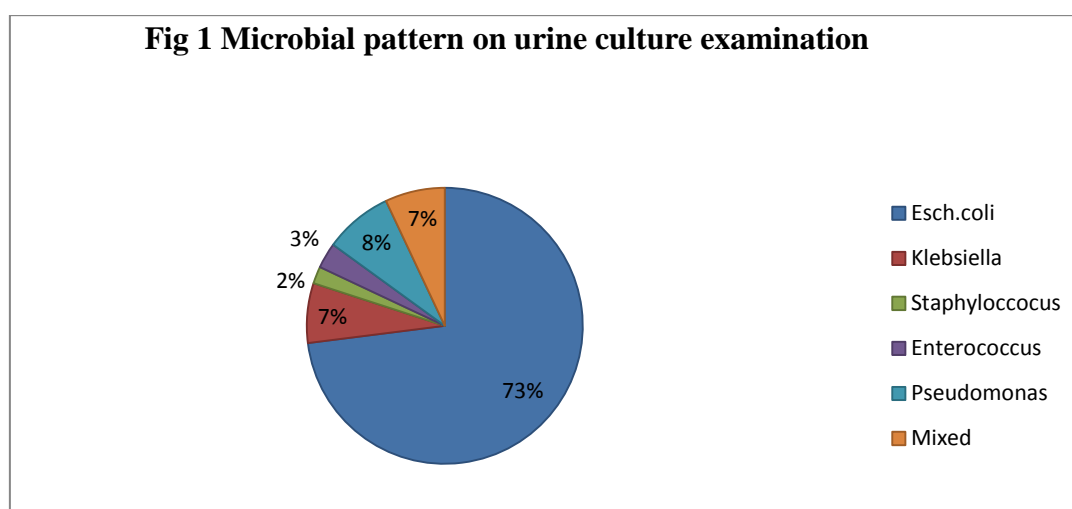


Figure 1 indicates that maximum number of urinary tract infections was caused by Esch. coli group of organisms i.e. 44(73%) patients. Five (8%) patients showed infection due to

pseudomonas and 4(7%) patients each showed mixed infections and klebsiella infections 3% and 2% were due to enterococcus and staphylococcus infections respectively.

Table 1: Antibiotic sensitivity pattern

Organism isolated	In Most Patients Sensitive to	In Most Patients Resistance to
Esch.coli	Imipenem, Gentamycin, Amikacin, Tazobactam with Piperacillin, Cefoperazone with Sulbactam, Ticarcillin with Clavullinic acid, Nitrofurantoin, Cefotaxime	Nalidixic acid, Norfloxacin, Ciprofloxacin, Amoxclav, Lomefloxacin, Cotrimazole, Cephalexin
Klebsiella	Imipenem, Tazobactam with Piperacillin, Cefoperazone with Sulbactam, Gentamycin, Amikacin, ceftoxitin, Nitrofurantoin, Cefotaxime	Nalidixic acid, Norfloxacin, Ciprofloxacin, Amoxclav, Lomefloxacin, Cotrimazole, Cephalexin
Staphylococcus	Vancomycin, Linezolid, tetracycline, Nitrofurantoin, Norfloxacin	Chloramphenicol and Ofloxacin
Enterococcus	Vancomycin Linezolid, tetracycline, Nitrofurantoin, Norfloxacin	Chloramphenicol and Ofloxacin
Pseudomonas	Imipenem, Gentamycin, Amikacin, Tazobactam with Piperacillin, Cefoperazone with Sulbactam, Ticarcillin with Clavullinic acid, Nitrofurantoin.	Nalidixic acid, Norfloxacin, Ciprofloxacin, Amoxclav, Lomefloxacin, Cotrimazole, Cephalexin

Table 1 depicts :Gram Negative Bacilli (GNB) were sensitive to imipenem, gentamycin, nitrofurantoin, tazobactam with piperacillin, cefoperazone with sulbactam, cefotaxime and

Gram Positive Cocci (GPC) were sensitive to vancomycin, linezolid, tetracycline, nitrofurantoin and norfloxacin in most of the patients.

Table 2: Association of variables with pus cells on microscopy

Variables	Number (n=60)	Grading of pus cells on urine microscopy			Chi Square/ Exact value	P value
		11-20	21-30	>=31		
Duration of Diabetes	<= 10 years	34(63)	11(20)	9(17)	3.8	p=0.175
	>10 years	2(33)	1(17)	3(50)		
Glycemic control HbA1c	<=7%	35(100)	0(0)	0(0)	56	p<0.0001
	>7%	1(4)	12(48)	12(48)		
Past Urethral obstruction	Yes	4(36)	3(28)	4(36)	3.414	p=0.189
	No	32(65)	9(19)	8(16)		
Past Urethral instrumentation	Yes	1(33)	0(0)	2(67)	4.444	p=0.198
	No	35(61)	12(21)	10(18)		
Past Urinary infections	Yes	4(44)	1(12)	4(44)	4.009	p=0.167
	No	32(63)	11(21)	8(16)		
Past urethral catheterization	Yes	1(33)	0(0)	2(67)	4.444	p=0.198
	No	35(61)	12(21)	10(18)		

Table 2 depicts association of variables with pus cell on microscopy. Glycemic control (HbA1c) was significantly associated with increasing number of pus cells on microscopy.

Discussion

Current study showed incidence of UTI in D.M. was mostly seen in women and above age of 50 years. Janifer J. et al (2009) found that the prevalence of lower UTI was significantly higher in female diabetic patients.⁽¹⁰⁾ Our study showed fever as the commonest symptom seen in majority of cases followed by dysuria. Hoepelman A. (2003) discussed that presentation of a lower urinary tract UTI can be accompanied by classical symptoms of dysuria, frequency, urgency, haematuria, and/or abdominal discomfort. Upper tract involvement as in acute pyelonephritis is characterized by fever and chills, flank pain, costovertebral angle tenderness, and other general symptoms, such as nausea and vomiting.⁽⁷⁾ Our study showed UTI most common in patients with past history of diabetes of less than 10 years duration. Gorter K. et al (2010) in a retrospective study from Netherlands found women with diabetes with a duration of diabetes >5 years were at risk of recurrent UTI (crude OR 3.6; 95% CI 2.5–5.1) compared with women without diabetes. (11). Glycemic control (HbA1c) was significantly

associated with pus cells on microscopy (p<0.0001) in current study. Patterson J. et al (1997) in study on diabetic patients with UTI found older age, duration of DM, and level of DM control are risk factors for UTI among diabetic patients.⁽¹²⁾ Our study showed predisposing cause for UTI was present in nearly half of the patients. Corson C. et al (2004) found that patients with long-term catheterization have UTIs typically caused by organisms that produce biofilms making eradication even more difficult.⁽¹³⁾

Most common organism isolated in UTI cases was E. coli in current study. Baqai R. et al (2008) studied 100 diabetic patients (64 males and 36 females). Major isolates were E.coli 50% followed by S.aureus 20%, S.saprophyticus 20% Proteus spp. 20% and E.fecalis 17%. Candida was isolated in 10.2% of cases.⁽¹⁴⁾

In current study it was found that gram negative bacilli were sensitive to imipenem, gentamycin, nitrofurantoin, tazobactam with piperacillin, cefoperazone with sulbactam, cefotaxime and gram positivecocci were sensitive to vancomycin, linezolid, tetracycline, nitrofurantoin and norfloxacin in most of the patients. Geerlings S. (2008) concluded that no higher percentage of resistance was seen to the most commonly prescribed antimicrobials such as amoxicillin, nitrofurantoin, trimethoprim/sulfamethoxazole

(TMP/SMX) and ciprofloxacin in isolates from diabetic patients.⁽¹⁵⁾ Janifer J. et al (2009) found gram negative bacilli to be more sensitive than gram positive cocci to aminoglycosides such as amikacin and tobramycin. Gram negative bacilli were found to be highly sensitive to ciprofloxacin (62%) than to Ofloxacin (28%). Gram positive cocci (63%) were found to be more sensitive to cefotaxime than gram negative bacilli (51%). Ceftriaxone, cefizoxime and cefotaxime had excellent activity against streptococci.⁽¹⁰⁾

Conclusions

Incidence of UTI in D.M. was mostly seen in women and above age of 50 years, fever was the commonest symptom seen in majority of cases followed by dysuria. UTI was common in patients with past history of diabetes of less than 10 years duration. Predisposing cause for UTI was present in nearly half of the patients. Majority of patients had pus cells in the range from 11-20/HPF in urine analysis. Most common organism isolated in UTI cases was E. coli. Gram negative bacilli were sensitive to imipenem, gentamycin, nitrofurantoin, tazobactam with piperacillin, cefoperazone with sulbactam, cefotaxime and gram positive cocci were sensitive to vancomycin, linezolid, tetracycline, nitrofurantoin and norfloxacin in most of the patients. Poor glycemic control was significantly associated with more number of pus cells in urine.

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