Urinary Tract Infection among Diabetic Women in Kirkuk City

Dilshad Sabir Mohammed

Department of Medicine/ College of Medicine/ Kirkuk University

Abstract:

Background: Urinary tract infection (UTI) is the most common of all bacterial infections in diabetes mellitus; it affects persons throughout their life spans. The term UTI encompasses a variety of clinical entities ranging from asymptomatic bacteriuria to cystitis, prostatitis and pyelonephritis.

Patients and methods: In the present study, 200 diabetic women,100 of them were at active age group(AAG) their ages range from (25-35)years with mean age of 31 years. Another 100 women were post-menopausal (PM) their ages range from (55-75) years with mean age of 64 years. Two hundred non diabetic women were taken as control group and were divided into 100 at AAG and 100 PM. The patients and control groups were attendant of Kirkuk general hospital.

Results: UTI was found to be present in 28 out of 100 cases of AAG diabetic women (*p* value =0.02) while it presents in 25 out of 100 PM diabetic women (p value =0.04). Also this study shows that 13 out of 25 PM diabetic women received insulin for treatment while 7 out of 25 PM diabetic women received oral antidiabetic drugs, and only 5 out of 25 PM diabetic women didn't receive any treatment (*p* value=0.03). The present findings shows that 14 out of 28 AAG diabetic women received insulin for treatment, while 8 out of 28 of them received oral antidiabetic drugs and only 6 out of 28 AAG diabetic women didn't receive any treatment (*p* value =0.043)

Conclusion: The prevalence of UTI is higher among diabetic patient compared to non-diabetic patient regardless of age .Diabetes treated with insulin is related to substantial increases in the risk of UTI among both age groups included in the present study.

Keywords: UTI, Diabetic, Bacteriuria.

Introduction:

Diabetes and its attendant acute and chronic complications continue to carry a major health problem worldwide [(1)]. There is evidence that diabetics are more prone to skin and chest infection than non-diabetic [(2)]. There is also view that urinary tract infections (UTI) are more common in diabetic patients [(3)].Urinary tract infection is an important clinical problem for people with diabetes.

This observation is most apparent in the increased severity of infection that may occur in diabetic patients [(4)].Serious complications of UTI, such as emphysematous cystitis, pyelonephritis virtually more prone in diabetic patients. On a population basis, diabetic women, depending on age, are 6–24 times more likely than non-diabetic women to be admitted for acute pyelonephritis, and diabetic men are 3.4–17 times more likely than their non-diabetic counterparts to be admitted for the same condition[(5)].

Despite the frequency and importance of this problem, it has received relatively little attention, and many important scientific and clinical questions remain unanswered.

In hospitalized diabetic patient, particularly those with multiple organ

complication the incidence of infection and true pyelonephritis also appear to be increased, partly because of poor bladder function and partly because of urinary catheterization. Other clinical conditions that causing obstruction in urinary flow or incomplete voiding also predispose diabetic patient to infection. In addition, impaired cytokine secretion may contribute to asymptomatic bacteriuria in diabetic women [6].

Urinary tract infection accounts for considerable morbidity among adult women, Diabetes causes several abnormalities of the host defense system that might result in a higher risk of certain infections, including UTI .These include immunologic impairments, such as impaired migration, intracellular killing, phagocytosis, and chemotaxis of polymorphonuclear leukocytes and abnormal T lymphocyte function in diabetic patients and neuropathic complications, such as impaired bladder emptying [6].

In addition, a higher glucose concentration in the urine may create a culture medium for pathogenic microorganisms. Other important unanswered questions include the association between glycemic control risk and the role of asymptomatic bacteriuria as a precursor to UTI in diabetic women [7].

There are three types of diabetes:

- **Type 1 diabetes** is usually diagnosed in childhood. The body makes little or no insulin, and daily injections of insulin are required to sustain life. Without proper daily management, medical emergencies can arise.
- **Type 2 diabetes** is far more common than type 1 and makes up 90% or more of all cases of diabetes. It usually occurs in adulthood. Here, the pancreas does not make enough insulin to keep blood glucose levels normal, often because the body does not respond well to the insulin. Many people with type 2 diabetes are asymptomatic, although it is a serious condition. Type 2 diabetes is becoming more common due to the growing number of older population was increasing obesity, and failure to exercise.
- **Gestational diabetes** is high blood glucose that develops at any time during pregnancy in a person who does not have diabetes.

Over the years, evidence from many epidemiological studies have suggested that asymptomatic bacteriuria (ASB) and symptomatic UTIs occur more commonly in women with diabetes than in those without diabetes[8]. Most of these studies, however, were not prospective cohort designs and are thus subject to multiple biases characteristically associated with case-control, retrospective, or cross-sectional studies. Further, the majority of the data has been collected in patients with type 2 diabetes and in women; therefore, data regarding these relationships in type 1diabetes and in men are less available.

Recent studies have focused on the relationship of ASB to diabetes [9-11]. In women without diabetes, ASB is relatively uncommon and increases risk of UTI but does not lead to serious sequale [12]. Diabetic women have a (2-3) folds higher prevalence of ASB and are at risk for developing more serious consequences [9, 10]. Women with type 2 diabetes and are ASB have an increased risk for development of a symptomatic UTI [13], and women with type 1 diabetes are at an increased risk for pyelonephritis and subsequent impairment of renal function [11].

Patients and Methods:

Patients group:

This case –control study was carried out in outpatient clinic of Kirkuk general hospital from March 2005 to September 2005. The study includes 200 women divided into 2 groups, first group includes 100 diabetic active age group, their ages range from (25-35) years and the second group includes100 diabetic postmenopausal women, their ages range from (55-75) years. The entire patients included in the study have been proved to be diabetic by clinical examination and laboratory investigations.

Patient's clinical history was investigated by Medical specialist. Microscopic and culture methods were done for patients urine samples and antibiotic sensitivity test were done for the isolated microorganisms, the microorganisms were identified according to Mackie and McCartney [14], and antimicrobial susceptibility test was done according to Bauer et al, [15].

Control group:

Two hundred non-diabetic women were chosen as a healthy control, 100 women of them were at active age and the other 100 were postmenopausal women, Isolation, identification and antibiotic sensitivity of the microorganisms were done for their urine samples as with that of patients group.

Results:

(Table 1) summarizes the number and percentages of the positive urine cultures among both active age group and postmenopausal diabetic women and their related normal control. From 100 active age group diabetic women 28 (28%) show positive urine culture while from 100 active age group non diabetic control only 7 (7%) show positive urine culture also the table demonstrate that among 100 postmenopausal diabetic women 25 (25%) of urine sample gave positive result while from 100 postmenopausal non diabetic normal control only 9 (9%) gave positive results.

(Table 2) summarizes the numbers and percentages of positive urine cultures among both treated and non-treated diabetic postmenopausal and active age group women.

According to the types of treatment received by the diabetic women which was either oral antidiabetic agents, insulin or the patient doesn't receive any treatment seven (28%) of positive urine cultures were postmenopausal diabetic women whom they received oral antidiabetic agents while 13 (52%) 0f positive urine cultures were postmenopausal diabetic women received insulin and 5 (20%) 0f positive urine cultures were postmenopausal diabetic women whom they didn't receive any treatment.

Among active age diabetic women 8 (28.57%) of positive urine cultures were they received oral antidiabetic drugs, 14 (50%) of positive urine cultures were they received insulin while only 6(21.42%) of positive urine cultures were didn't received any treatment.

(Table 3) shows the type of microorganisms isolated from positive urine cultures of postmenopausal diabetic and non-diabetic women. *Escherichia coli* were the most microorganisms isolated among diabetic and control group followed by *klebsiellaspp*, *staph.aureas* and *proteus* spp. respectively.

(Table 4) demonstrates microorganisms isolated from positive urine cultures of (treated and non-treated) active age

group diabetic and non-diabetic women. *Escherichia coli* is the most microorganism isolated among diabetic and control group followed respectively by *klebssiella spp., staph. aureas, pseudomonas spp. and proteus spp.*

Table (1): The percentages of positive urine cultures among both patient and control groups.

Age groups	positive urine cultures among diabetic patients no. of cases=200	positive urine cultures among control group no. of cases=200	*P* value
Post-menopausal group	25 (25%)	9 (9%)	0.04
Active age group	28 (28%)	7 (7%)	0.02

Table (2): The No. of positive urine cultures among both treated and non-treated diabetic women.

Diabetic women groups	positive urine cultures among diabetic women treated with antidiabetic drugs	positive urine cultures among diabetic women treated with insulin	positive urine cultures among diabetic women not receiving treatment	*P* value
Post-menopausal diabetic	7 (28%)	13 (52%)	5 (20%)	0.03
Active age group diabetic	8 (28.57%)	14 (50%)	6 (21.42%)	0.043

Table (3): Microorganisms isolated from positive urine cultures of (treated and non-treated) postmenopausal diabetic and non-diabetic group of women.

Type of treatment used by post-menopausal diabetic women with positive urine cultures	Type of microorganisms isolated from positive urine cultures			
	E .coli	Klebsiella spp.	Staph. aureas	Proteus spp.
Hypoglycemic agents	6 (85.7%)	0	1 (14.2%)	0
Insulin	9 (69.2%)	2 (15.3%)	2 (15.3%)	0
Non treated group	4 (80%)	0	1 (20%)	0
Control group	7 (77.77%)	1 (11.11%)	0	1 (11.11%)
P value	0.7	0.26	0.9	0.9

Table (4): Microorganisms isolated from positive urine cultures of (treated and non-treated) active age group diabetic and non-diabetic group of women.

Types of treatments used by active age diabetic women with positive urine cultures.	Microorganisms isolated from positive urine cultures				
	E .coli	Klebssiella spp.	Staph. aureas	Pseudomonas spp.	Proteus spp.
Hypoglycemic agents	5 (62.5%)	0	2 (25%)	0	1 (12.5%)
Insulin	8 (57.1%)	3 (21.4%)	1 (7.1%)	1 (7.1%)	1 (7.1%)
Non treated group	4 (66.6%)	1 (16.6%)	1 (16.6%)	0	0
Control group	4 (57.14%)	0	1 (14.28%)	0	2 (28.57%)
P value	0.6	0.26	0.27	0.9	0.3

Table (5): AST of microorganisms isolated from urine cultures of active age group diabetic women.

Microorganisms	No. of susceptible isolates to antibiotics										
	No .of isolates	AM	AMC	CX	E	GM	AK	SXT	CIP	CTX	CRO
E.coli	17	15	14	14	1	9	9	6	5	4	6
Klebssiella spp.	4	2	2	3	0	1	2	1	1	1	1
Staph.aureas	4	0	1	0	0	3	4	1	1	2	3
P roteus spp.	2	0	1	1	0	0	2	2	1	1	2
Pseudomonas aerogenosa	1	0	0	0	0	1	1	1	1	1	1

AM = Ampicillin AMC = Augmentin CX = Cloxacillin E = Erythromycin
G = Gentamicin AK = Amikacin CTX = Cefotaxime CIP = Ciprofloxacin
CRO = Ceftriaxone SXT = Trimethoprim + Sulfamethaxazole

Table (6): AST of microorganisms isolated from urine cultures of active age non diabetic women.

Microorganisms	No. of susceptible isolates to antibiotics										
	No. of isolates	AM	AMC	CX	E	GM	AK	SXT	CIP	CTX	CRO
E. coli	4	2	3	3	1	4	3	2	1	3	2
Proteus spp.	2	1	1	1	0	1	2	1	1	1	1
Staph. aureas	1	1	1	1	0	1	1	1	1	0	1

Table (7): AST of microorganisms isolated from urine cultures of post-menopausal diabetic women.

Microorganisms	No. of susceptible isolates to antibiotics										
	No .of isolates	AM	AMC	CX	E	GM	AK	SXT	CIP	CTX	CRO
E. coli	19	16	81	81	3	11	7	5	5	3	6
Klebssiellaspp	2	1	1	2	0	1	1	1	1	1	1
Staph. aureas	4	0	1	0	0	3	4	1	1	2	3

Table (8): AST of microorganisms isolated from urine cultures of post-menopausal non-diabetic women.

Microorganisms	No. of susceptible isolates to antibiotics										
	No. of isolates	AM	AMC	CX	E	GM	AK	SXT	CIP	CTX	CRO
E.coli	7	6	6	6	1	4	5	3	5	3	3
Klebssiella spp.	1	1	1	1	0	1	1	1	1	1	1
Proteus spp.	1	0	0	0	0	1	1	0	0	1	1

Discussion:

Urinary tract infection (UTI) is the most common bacterial infection. Acute uncomplicated UTI occurs in young women with normal genitourinary tracts and, while frequently distressing, is seldom associated with significant morbidity. Acute pyelonephritis occurs in the same group of women but is a more serious illness. Complicated UTI occurs in individuals with functional or structural abnormalities of the genitourinary tract. It may be either symptomatic or asymptomatic and may present with a wide spectrum of clinical illness. The most severe manifestations occur in individuals with trauma or obstruction of the genitourinary tract. Selected groups, including pregnant women, diabetic patients, and the elderly, have some unique characteristics relevant to UTI that may require different approaches to management [16].

In the vast majority of UTIs, bacteria gain access to the bladder via the urethra. Ascent of bacteria from the bladder may follow and is probably the pathway for most renal parenchymal infections. The factors that predispose to periurethral colonization with gram negative bacilli remain poorly understood but probably include alteration of normal perineal flora by antibiotics, other genital infection such as by use of contraceptives especially diaphragms and spermicides, small no. of periurethral bacteria probably gain entry to the bladder frequently, a process that facilitated in some cases by urethral massage during intercourse [17, 18, 19]. The higher prevalence of UTI among females could be due to, Presence of short urethra in females; the female urethra appears to be particularly prone to colonization with colonic gram negative bacilli because of its proximity to the anus, and also sexual intercourse causes the introduction of bacteria to the bladder. So sexually active persons had more significant symptomatic UTI and finally due to the absence of prostatic secretion which contain bactericidal properties.

It is noteworthy to notice from (table 1) that the prevalence of UTI is higher among diabetic women compared to non-diabetic patient regardless of age. In both age groups of the present study concerning UTI significant difference was obvious between PM diabetic and non-diabetic women and between AAG diabetic and non-diabetic women (p-value=0.04, 0.02 respectively).

This results agrees with Balasion et al(1997), Kayima et al(1996) Zhanel et al(1995) and Epoke et al (2000) [20, 21, 22, 23]. The explanation of these results may be due to:

1. The presence of significant amount of glucose in diabetic urine which serves as favorable media for growth of bacteria [25].
2. A change in bacterial adhesion to the uroepithelium partly as a result of abnormal intracellular calcium metabolism which lead to decrease in tam horsfall protein which usually adhere to the bacteria and prevent attachment to the uroepithelium is involved in the pathogenesis of UTI. in diabetic patients [25].
3. Also abnormal intracellular calcium metabolism which lead to granulocytes dysfunction which promotes attachment of bacteria to uroepithelium causing more infection [25].
4. Finally it was found that diabetic women had a higher mean post void residual bladder volume, an indicator of bladder dysfunction and possibly autonomic neuropathy [25].

While it is disagreement with one study (Lindsay et al 2000) [24], which showed that the prevalence of UTI in diabetic outpatient women was no significantly higher than in non-diabetic women outpatient or healthy control (p-value =0.07) [23]. The explanation of these results may be due to:

Significant association was found between insulin treated diabetic women and the prevalence of UTI regardless of age as demonstrated in (table 2). Among postmenopausal diabetic treated women 13 out of 25 positive urine cultures were treated with insulin while only 7 out of 25 positive urine cultures were PM women treated with oral antidiabetic drugs and only 5 out of 25+ve urine cultures from PM diabetic women didn't receive any treatment (*p* value =0.03)

Regarding AAG diabetic women treated with insulin 14 out of 28 gave positive urine cultures and8 out of 28 were from AAG treated with oral antidiabetic drugs and only 6 positive urine cultures out of 28 from women didn't receive any treatment (*p* value=0.04).

These present findings are in agreement with other studies demonstrates by (Turner et al 1999) who stated that women taking insulin were mainly at higher risk of UTI, possibly because of more severe diabetes since the use of insulin considered to be a marker for disease severity [26].

In present study, and as shown in (table 3) and (table 4), *E. coli* was the most microorganisms isolated among diabetic and non-diabetic women. Regardless of age, followed respectively by *klebssiella spp., Staph aureaus, proteus spp. Pseudomonas spp.* No significant difference was demonstrated in the present study concerning types of microorganisms among UTI of diabetic and non-diabetic individuals.

The present findings are in agreement with other studies that demonstrate that E. coli was the most frequent microorganisms isolated from diabetic and non-diabetic women (Geerlings SE et al 2002) [27].

Although diabetic persons may be more susceptible to infection by opportunistic microorganisms, it was found that most of their infections were due to typical uropathogens, which suggest that diabetes facilitates the same route of infection as that for UTI in non-diabetic persons (i.e., ascending infection from urethra).

Conclusion:

1. The prevalence of UTI is higher among diabetic patients compared with non-diabetic patient regardless of age.
2. Diabetes treated with insulin is related to substantial increases in the risks of UTI among both age groups included in the present study.
3. *Escherichia coli*. Was the most common microorganism that causes UTI in both diabetic and non-diabetic of different age groups of women.
4. UTI should be considered as a complication of diabetes in both age groups of women included in the present study.
5. Diabetic women should be screened for UTI and asymptomatic bacteriuria and should be treated to prevent complications, such as chronic pyelonephritis, renal scarring and chronic renal failure.

References:

[1].The diabetic control and complications trial research group. The effect of intensive treatment of diabetes on the development and progression of long term complications in IDDM.NE.JM 2000:329.

[2]. Moy CS, ed.:vital statistics.American diabetic association,New york.2001:43.
[3]. Joshi N, Caputo GM, Weitekamp MR, Karckmen AW: Infections in patients with diabetes. *N Engl J Med*: 1999:341:1906-1912.
[4]. Patterson JE, Andriole VT: Bacterial urinary tract infections in diabetes. *Infect Dis Clin North Am: 1997*: 11:735–750.
[5]. Nicolle LE, Friesen D, Harding GKM, Roos LL: Hospitalization for acute pyelonephritisin Manitoba Canada, during the period from 1989 to 1992: impact of diabetes,pregnancy, and aboriginal origin. *Clin Infect Dis*: 1996:22:1051–1056.
[6]. Geerlings SE, Stolk RP, Camps MJL, Netten PM, Hoekstra JBL, Bouter KP, BravenboerB, Collet JT, Jansz AR, Hoepleman AIM: Asymptomatic bacteriuria might be considereda diabetic complication in women with diabetes. *Diabetes Care*: 2000:23:744–749.
[7]. Zhanel GG, Nicolle LE, Harding GKM, and the Manitoba Diabetic Urinary Infection Study Group: Prevalence of asymptomatic bacteriuria and associated host factors inwomen with diabetes mellitus. *Clin InfectDis*: 1995:21:316–322.
[8]. Stapleton A: Urinary tract infections in patients with diabetes. *Am J Med*: 2002: 113 (Suppl. 1A):80S–84S.
[9]. Zhanel GG, Nicolle LE, Harding GK: Prevalence of asymptomatic bacteriuria and associated host factors in women with diabetes mellitus: the Manitoba Diabetic Urinary Infection Study Group. *Clin Infect Dis*: 1995: 21:316–322.
[10]. Geerlings SE, Stolk RP, Camps MJ, Netten PM, Hoekstra JB, Bouter PK, Braveboer B, Collet TJ, Jansz AR, Hoepelman AM: Asymptomatic bacteriuria can be considered a diabetic complication in women with diabetes mellitus. *AdvExp Med Biol*: 2000: 485:309–314.
[11].Geerlings SE, Stolk RP, Camps MJ, Netten PM, Collet JT, Schneeberger PM, Hoepelman AI: Consequences of asymptomatic bacteriuria in women with diabetes mellitus. *Arch Intern Med*: 2001: 161:1421–1427.
[12].Hooton TM, Scholes D, Stapleton AE, Roberts PL, Winter C, Gupta K, Samadpour M, Stamm WE: A prospective study of asymptomatic bacteriuria in sexually active young women. *N Engl J Med*: 2000: 343:992–997.
[13].Geerlings SE, Stolk RP, Camps MJ, Netten PM, Collet TJ, Hoepelman AI: Risk factors for symptomatic urinary tract infection in women with diabetes. *Diabetes Care*: 2000:23:1737–1741.
[14]. Mackie TJ,McCartney JE .Practical Medical Microbiology.14thedition.long man Singapore Publishers 1996.
[15]. Bauer AW.Antibiotic susceptibility testing by astandarized single disc method.Am J clinpathol 1996; 44:493-496.
[16]. Hooton TM, Scholes D, Hughes JP, et al. A prospective study of risk factors for asymptomatic urinary tract infection in young women. *N Engl J Med.* 1996; 335:468-474.
[17]. Nicolle LE. A practical guide to the management of complicated urinary tract infections. *Drugs.* 1997; 53:583-592.
[18]. Nicolle LE. Asymptomatic bacteriuria in the elderly. *Infect Dis Clin North Am.* 1997; 11:647-662.
[19]. Zhanel GG, Nicolle LE, Harding GKM, for the Manitoba Diabetic Urinary Infection Study Group. Prevalence of asymptomatic bacteriuria in women with diabetes mellitus. *ClinInfect Dis*. 1995; 21:316-322.
[20]. Balasion. D; Van-Kessek-KG; Van-KatsRenano-HJ;Collet-TJ;Hopelman-Al,Granulocyte function in women with diabetes and asymptomatic bacteriuria, Diabetes care 1997;20930:392-5.
[21]. Kayima-TK; Otieno-LS; Twahir-A; Njene-E Asymptomatic Bacteriuria among diabetics attending Kenyatta National Hospital, East.Afr.Med.J.1996; 37(8).
[22]. Zhanel-GG; Nicolle-LE.Harding-GK.Prevelance of asymptomatic bacteriuria and associated host factors in women with diabetes mellitus, Clinic.Infect.Dis.1995:21(2):316-22
[23]. .Epoke,C.O.Odigue.GOCAnganwn and AAO Prevalence of significant

bacteriuria in diabetic patients in Calbar, Neigeria Diabetic Internation,2000, Vol 10 No.1,p.16-17.
[24]. Lindsay E. Nicolle,M.D,New Eng.J.Med.2000,vol.(343)No.(14),p.1037-1039.
[25]. Hosking DJ, Bennett T, Hampton JR. Diabetic autonomic neuropathy. Diabetes Care 1978; 27:1043–54.
[26]. Turner RC, Cull CA, Frighi V, et al. Glycemic control with diet, sulfonylurea, metformin, or insulin in patients with type 2 diabetes mellitus: progressive requirement for multiple therapies (UKPDS 49). UK Prospective Diabetes Study (UKPDS) Group. JAMA 1999; 281:2005–12.
[27]. Geerlings SE, Meiland R, Hoepelman AI. Pathogenesis of bacteriuria in women with diabetes mellitus. Int J Antimicrob Agents 2002; 19:539–45.