

None anticipated bacterial urinary tract infections in type 2 diabetic patients relative to duration and angiopathies

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Abstract:

Background: Diabetes mellitus is a well known metabolic and vascular illness associated with high incidence of bacterial urinary tract infections especially in diabetic complications including both micro and macro-vascular types.

Objective: To study the incidence of bacterial urinary tract infections in type 2 diabetic patients, the type of micro-organism responsible in relation to age, sex of patients, duration of the disease & related micro & macrovascular diabetic complications.

Methods: A prospective study of the diabetic patients including 40 males with mean age of 54(±9) years and 50 females, mean age of 51(±7) years and duration of the and sex matched controls (27 males and 33 females).

Symptoms of urinary tract infections, general urine examination, urine culture & ultrasound of abdomen were studied & reported for both groups.

Results: This study showed significant increase in urinary tract infections among diabetic patients with four fold rise in bacteriuria especially among diabetic women & Escherichia Coli was the predominant micro-organism in 85% of cases.

Conclusion: Urinary tract infection has significant increase incidence in type 2 diabetic patients with fourfold rise among diabetic women.

Key words: Urinary tract infections, Diabetes mellitus, angiopathies.

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Introduction:

Diabetes mellitus is a carbohydrate metabolic disorder causing hyperglycemia due to decrease insulin secretion or resistance to its action⁽¹⁾. It is common chronic disease in the world with prevalence of 8% in USA adult population and Europe and related to age; 8.6% in people more than 20 years, 20.1% above 65 years old⁽²⁾.

Type 2 diabetes mellitus is more predominant & account to 90% of cases after 30 years, though it can develop in obese adolescents⁽³⁾. The diagnosis depends on symptoms (polyuria, polydipsia) with fasting blood sugar 126 mg/dl or random value > 200 mg/dl or more than 200 mg/dl 2 hours after glucose tolerance test⁽⁴⁾.

Oral glucose tolerance test is not used for epidemiologic research since it is imprecise test with poor reproducibility⁽⁵⁾. WHO agree to use oral glucose tolerance test to patients with uncertain range of blood sugar⁽⁶⁾.

Type 2 diabetes mellitus increases with obesity⁽⁷⁾. No strong evidence for diabetic

patients susceptibility to infection in general but some infections are sever with high risk of complications in diabetes mellitus^(8,9,10). The incidence of urinary tract infections is higher in sever diabetes mellitus with end organ damage or with high HbA_{1C}⁽¹¹⁾. Postmenopausal women are at twice high risk for cystitis as non diabetic patients⁽¹²⁾. Upper urinary tract infections constitutes 80% of diabetic urinary tract infections with more complications^(13,14), 90% of bilateral pyelonephritis & emphysematous infections being seen in diabetes mellitus^(15,16), while papillary necrosis complicates 21%, 50-75% of cases caused by Escherichia Coli⁽¹⁷⁾ & the rest by other gram negative bacilli, and 36% of perinephric abscess was diabetic patients⁽¹⁸⁾.

Altered immunity in diabetic patients due to leukocyte dysfunction (adherence, chemotaxis & phagocytosis) changed bacterial adhesion to the epithelium & impaired antioxidant system^(19,20). The

clinical data on humeral immunity are limited but T-cell function may be depressed⁽²¹⁾ with reversal characters in diabetes mellitus that favors growth of bacteria in the urinary tract⁽²²⁾. Good glycemic control improves the efficiency of intracellular killing of micro-organism⁽²³⁾. Insulin infusion & blood glucose control is important in diabetic patients with infections^(23, 24).

Methods:

A prospective cross sectional study was conducted in Baghdad Teaching Hospital, outpatient & diabetic clinic, in the period of July to November 2004 including 90 type 2 diabetic patients & 60 ages, sex match control. Mean age 54.1(±) 9, 51.2 (±7) years & duration of the diabetes 11.30 years, 11.18 years, with male/female ratio 1:2.5. Mean age of non diabetic group 52.2 (±8) years, 49.7 (±6) years respectively with male/female ratio 1:2.2.

The exclusion criteria included patients taking antibiotics during last three months, pregnancy, frank renal failure & benign prostatic hyperplasia.

For all patients medical history, thorough clinical examination including IHD, blood pressure, retinal fundoscopy, neurological assessment for autonomic & peripheral nerve involvement & important investigations (general urine examination, urine culture & ultrasound of abdomen).

Statistical analysis:

Analysis was done using SPSS version 7.5 computer software. The statistical significance of difference in mean of certain variable between two groups was assessed by the independent sample t-test, while chi-square test used for assessment of statistical significance of categorical variables & a P-value of <0.05 was considered as significant.

Result:

A total of 90 type 2 diabetic patients treated by oral antidiabetic drugs & insulin therapy was given for 25 patients among them, with 60 non-diabetic individuals as control group. Table (1) showed composition of the two study groups relative to age, sex & duration of the disease.

Table (2) showed pyuria & bacteriuria in the study groups revealing higher prevalence of urinary tract infections in diabetic patients.

Table (3) & (4) showed more pyuria & bacteriuria in advanced age for diabetic men & women as (22.5%), (5%) versus (20%), (10%) respectively. Similarly they are more with urinary tract infections as (15%), (5%) versus (56%), (25%) revealing positive culture in 14 patients including E. Coli in 85% & pseudomonas infection in 15%.

Table (5) reveals pyuria & bacteriuria in diabetic patients with peripheral neuropathy, retinopathy, & macrovascular angiopathic complications, showing higher incidence of urinary tract infections in sever peripheral neuropathy (glove), proliferative retinopathy & macrovascular angiopathic complications, as (32.1%, 12.2%), (23.3%, 8.9%), & (47.8%, 15.6%) respectively.

Table 1. Gender distribution composition of the two study groups.

	Cases				Control		
	No.	Mean Age (years)	S.D.	Mean duration of DM	No.	Mean Age (years)	S.D.
Male	40	54.1	9.029	11.30	27	52.185	8.0098
Female	50	51.22	7.6779	11.18	33	49.697	6.8171
Total	90	52.5	8.0098	11.24	60	50.817	7.1129

Table 2. Gender distribution of Pyuria & Bacteriuria in the two study groups.

Gender		Groups			P-value	
		Cases	Control	Total		
Male	Pyuria	No. (%)	14(20.9%)	1(1.5%)	15(22.4%)	0.002
	No pyuria	No. (%)	26(38.8%)	26(38.8%)	52(77.6%)	
	Total	No. (%)	40(59.7%)	27(40.3%)	67(100%)	
Female	Pyuria	No. (%)	31(37.3%)	2(2.4%)	33(39.8%)	0.000
	No pyuria	No. (%)	19(22.9%)	31(37.3%)	50(60.2%)	
	Total	No. (%)	50(60.2%)	33(39.8%)	83(100%)	
Male	Bacteriuria	No. (%)	3(4.5%)	0	3(4.5%)	0.206
	No bacteriuria	No. (%)	37(55.2%)	27(40.3%)	64(95.5%)	
	Total	No. (%)	40(59.7%)	27(40.3%)	67(100%)	
Female	Bacteriuria	No. (%)	11(13.3%)	2(2.4%)	13(15.7%)	0.046
	No bacteriuria	No. (%)	39(47%)	31(37.3%)	70(84.3%)	
	Total	No. (%)	50(60.2)	33(39.8%)	83(100%)	

Table 3. Gender distribution of Pyuria & Bacteriuria in the three age groups of diabetic patients.

Gender	Age groups (Yrs)	Total No.(%)	GUE		Urine culture		P-value	
			Pyuria No.(%)	No pyuria No.(%)	Positive No.(%)	Negative No.(%)	Pyuria	Bacteriuria
Male	40-49	14(35%)	2(5%)	12(30%)	0	14(35%)	0.002	0.317
	50-59	13(32.5%)	3(7.5%)	10(25%)	1(2.5%)	12(30%)		
	60-70	13(32.5%)	9(22.5%)	4(10%)	2(5%)	11(27.5%)		
	Total	40(100%)	14(35%)	26(65%)	3(7.5%)	37(92.5%)		
Female	40-49	20(40%)	6(12%)	14(28%)	1(2%)	19(38%)	0.000	0.029
	50-59	19(38%)	15(30%)	4(8%)	5(10%)	14(28%)		
	60-70	11(22%)	10(20%)	1(2%)	5(10%)	6(12%)		
	Total	50(100%)	31(62%)	19(38%)	11(22%)	39(78%)		

Table 4. Gender distribution of Pyuria & Bacteriuria in diabetic patients in relation to presence of previous UTI.

Gender	previous UTI	Total No.(%)	GUE		Urine culture		P-value	
			Pyuria No.(%)	No pyuria No.(%)	Bacteriuria No.(%)	No bacteriuria No.(%)	Pyuria	Bacteriuria
Male	Positive	12(30%)	6(15%)	6(15%)	2(5%)	10(25%)	0.173	0.209
	Negative	28(70%)	8(20%)	20(50%)	1(2.5%)	27(67.5%)		
	Total	40(100%)	14(35%)	26(65%)	3(7.5%)	37(92.5%)		
Female	Positive	33(66%)	28(56%)	5(10%)	10(20%)	23(46%)	0.000	0.047
	Negative	17(34%)	3(6%)	14(28%)	1(2%)	16(23%)		
	Total	50(100%)	31(62%)	19(38%)	11(22%)	39(78%)		

Table 5. Distribution of pyuria and bacteriuria in diabetic patients in relation to different stages of diabetic peripheral neuropathy, retinopathy and macrovascular angiopathies.

Diabetic complications		Total No.(%)	GUE		Culture		P-value	
			Pyuria No.(%)	No pyuria No.(%)	Bacteriuria No.(%)	No bacteriuria No.(%)	Pyuria	Bacteriuria
Peripheral neuropathy	Non	28(31.1%)	2(2.2%)	26(28.9%)	0	28(31.1%)	0.000	0.002
	Blunt reflexes	28(31.1%)	15(16.7%)	13(14.4%)	3(3.3%)	25(27.8%)		
	Glove	34(37.8%)	28(32.1%)	6(6.7%)	11(12.2%)	23(25.6%)		
	Total	90(100%)	45(50%)	45(50%)	14(15.6%)	76(84.4%)		
Microvascular complications	Non	26(28.9%)	2(2.2%)	24(26.7%)	0	26(28.9%)	0.000	0.002
	Background	22(24.4%)	9(10%)	13(14.4%)	1(1.1%)	21(23.3%)		
	Preproliferative	17(18.9%)	13(14.4%)	4(4.4%)	5(5.6%)	12(13.3%)		
	proliferative	25(27.8%)	21(23.3%)	4(4.4%)	8(8.9%)	17(18.9%)		
Macrovascular complications	Non	25(27.8%)	2(2.2%)	23(25.6%)	0	25(27.8%)	0.000	0.007
	others	65(72.2%)	43(47.8%)	22(24.4%)	14(15.6%)	51(56.7%)		
	Total	90 (100%)	45(50%)	45(50%)	14(15.6%)	76(84.4%)		

Discussion:

There is a significant increase in the incidence of UTI among diabetic patients versus control group and this is reflected by the following observations; diabetic men were twice symptomatic as non-diabetic men (60% vs 30%), and diabetic women were three time more symptomatic than non-diabetic (63% vs 24%), diabetic men have more pyuria by a factor of 9.5 than non diabetics (35% vs 3.7%), while diabetic women have more pyuria by 10.3 times than non diabetic women (62% vs 6%), and lastly both diabetic patients men and women have more bacteriuria than non-diabetic group, revealing diabetic women with higher bacteriuria by four time (22% vs 6%).

Escherichia Coli was the predominant micro-organism and isolated in 85% of bacteriuria cases (12 out of 14 patients). The incidence of bacteriuria was 15.6% among all diabetic patients (14 out of 90 diabetics), 7.5% in diabetic men versus 22% in diabetic women. Therefore; there is a significant increase in the incidence of UTI in diabetic patients in general and specially among diabetic women (P-value < 0.05) which is reflected by 3.7 fold increase in the risk of bacteriuria among diabetic women which is consistent with Zhanel et al. study⁽¹¹⁾, and several other controlled studies which show two to four fold increase in the risk of UTI among diabetic women^(20, 22, 25, 26,27).

In this study, advanced age of diabetic patients and female sex appear to be strong risk factor for the genesis of UTI among diabetics, this is consistent with the result of other studies^(26, 27,28,29), this can be explained by longer duration of the disease and associated diabetic complications, neuropathy, nephropathy and cystopathy with advanced age of diabetic patients. In this study, history of previous UTI was risk factor for the development of UTI in diabetic women (pyuria and bacteriuria P-

value of <0.05 for both)⁽³⁰⁾ but not in diabetic men and similar outcome in relation to duration of diabetes mellitus.

This study demonstrated a highly significant association between the presence of either micro- or macro-vascular diabetic complications and the risk of UTI than those without these complication^(29,31,32). So also with their severity revealing more frequent UTI with gloves-stockings sensory loss and proliferative retinopathy than with milder sensory loss and retinopathy⁽³³⁾.

Majority of diabetic patients have symptomatic pyuria and the incidence of a symptomatic pyuria in diabetic men was 18.8% versus 6.3% in diabetic women. All diabetic patients with bacteriuria were symptomatic in both sexes⁽³⁴⁾.

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