Incidence of Microvascular Complications in Newly Diagnosed Diabetes Mellitus

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ABSTRACT

BACKGROUND

We wanted to determine the prevalence of various microvascular complications in newly diagnosed type 2 diabetes mellitus patients at initial presentation.

METHODS

A cross sectional descriptive study involving 100 patients was carried out over a period of 2 years at Mediciti Institute of Medical Sciences, Medchal. All the recruited 100 patients underwent detailed evaluation for the presence of diabetic microvascular complications like retinopathy, nephropathy and neuropathy.

RESULTS

At initial presentation of newly detected diabetic patients, prevalence of all the microvascular complications was 51%. Prevalence of retinopathy, nephropathy and neuropathy was found to be 29%, 28% and 20% respectively. HbA1c was found to have significant association with various microvascular complications at the initial diagnosis of type 2 diabetes. There was significant association between presence of hypertension and diabetic nephropathy in newly diagnosed cases of type 2 diabetes.

CONCLUSIONS

There is high prevalence of various diabetic microvascular complications at initial diagnosis of diabetes mellitus. Regular screening programs are warranted to detect diabetes mellitus in asymptomatic stage to prevent or delay diabetic complications.

KEYWORDS

Asymptomatic Diabetes Mellitus, Microvascular Complications, Initial Presentation

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BACKGROUND

Diabetes mellitus is one of the largest health problems affecting the world.[1] Globally, in 2014, there were 422 million adults having diabetes.[2] The prevalence of diabetes for all age groups worldwide was estimated to be 2.8% in 2000 and is expected to go up to 4.4% in 2030.[3] There is usually a period of 4-7 years of asymptomatic hyperglycaemia between the actual onset of hyperglycaemia and clinical diagnosis.[4] The asymptomatic phase of hyperglycaemia accounts for the relatively high prevalence of complications at initial presentation. In the UKPDS (United Kingdom prospective diabetes Study), 37% newly diagnosed Type 2 DM had developed at least one microvascular complication.[5] Diabetic retinopathy (DR) is a leading cause of visual disability in people with diabetes. In patients with type 2 diabetes, approximately 20% have retinopathy at the time of diabetes diagnosis.[4]

Up to 20% of patients with T2DM already have diabetic nephropathy when they are diagnosed with diabetes. Diabetic neuropathies are common long-term complications of diabetes causing significant morbidity and mortality.[6] Significant proportion of patients is found to have diabetic neuropathy at the time initial diagnosis of diabetes mellitus. Nambuya et al[7] reported 46.4% at initial diagnosis of diabetes. Even in the west careful questioning may elicit features of neuropathy in around 30% of the patients with newly diagnosed diabetes.[8]

We wanted to determine the prevalence of various diabetic microvascular complications at the time of initial diagnosis of type 2 diabetic mellitus.

METHODS

Source of Data

Patients with newly detected type 2 diabetes mellitus attending Department of Medicine, Mediciti Institute of Medical Sciences, Ghanpur, and Medchal were included in the study. They came to the hospital for either routine check-up or they were admitted for other illnesses and diabetes was detected by chance. It was a cross-sectional descriptive study carried out over a period of 2 years from November 2014 to October 2016 (24 months). Sample size comprised of 100 cases of newly diagnosed type 2 diabetes mellitus. Prevalence of various microvascular complications at initial diagnosis of DM has been found to be variable ranging from 20% to 46.6%[7] for diabetic neuropathy, up to 30% for diabetic nephropathy and 20% for diabetic retinopathy.[4] But if presence of any of the three microvascular complications is taken into consideration more than 40% of patients were found to have some complications. So, for sample size calculation we took a prevalence of 40% of one or other microvascular diabetic complication, and a precision factor of 10. Using following formula $n= Z^2P (1-P)/d^2$ we assumed that sample size of 100 would be reasonable for this study. In our study also we found a prevalence of 51% of at least one diabetic microvascular complication.

Inclusion Criteria

Newly diagnosed type 2 diabetes mellitus and age greater than 20 years. Laboratory diagnosis of DM was confirmed by latest criteria laid by American Diabetic Association. Blood glucose levels were checked on two separate occasions before making the diagnosis of DM.

Exclusion Criteria

Type 1 DM, urinary tract infection, previously diagnosed DM, pregnancy and chronic kidney disease.

Methods of Data Collection

Demographic characteristics such as age and sex were recorded. Symptoms suggestive of diabetes or of related complications were noted. Past history of hypertension and complications of diabetes was documented. Smoking or alcohol history was noted. The body mass index was determined. Presence of sensory and motor neuropathy was noted. Autonomic dysfunction was noted. Fundoscopy was carried out in all patients. Fasting and postprandial blood sugars (venous blood samples drawn) on two separate occasions. Renal function tests included blood urea, serum creatinine and urine analysis. Urine was analysed for glucose, ketone bodies and protein.

Statistical Analysis

Mean, standard deviation and confidence interval was calculated. Student`s t test and chi square test was used to calculate the significance between the variables. SPSS software was used for the statistical analysis.

RESULTS

Out of a total of 100 patients with newly diagnosed diabetes, 57% of the patients were males and 43% were females. The youngest patient was 29 years old and the oldest was 86 years of age. The mean age of the patients was 51.17 and the Standard deviation was 13.476.

In our study there were 41 patients who had history of smoking. All smokers were male (41 out of 57 male patients). In our study 29% (29 out of 100 patients) were found to have diabetic retinopathy. There was no significant difference in the incidence of retinopathy between the diabetic individuals who smoke and the diabetic individuals who did not smoke (p-value: 0.195). Twenty eight percent patients (28 out of 100 patients) had diabetic nephropathy but there was no significant difference between smoker and non-smoker in the incidence of nephropathy (p-value: 0.261). In this study 20% (20 out of 100 patients) were detected to have diabetic neuropathy. There was no significant difference in the incidence of neuropathy between the diabetic individuals who smoke and the diabetic individuals who did not smoke (p value: 0.684) (Table 1).

Smoking	Total	Retinopathy		Nephropathy		Neuropathy	
		Absent	Present	Absent	Present	Absent	Present
No	59	39	20	40	19	48	11
Yes	41	32	9	32	9	32	9
Total	100	71	29	72	28	80	20

Table 1. Relationship between Smoking and Diabetic Retinopathy, Nephropathy and Neuropathy

Out of 100 patients 31 had hypertension. Twenty six patients had stage-1 hypertension and 5 had stage-2 hypertension; and 39 had pre-hypertension. Thirty patients had normal blood pressure. There was no significant difference in the incidence of retinopathy between the diabetic individuals who had hypertension and those who did not have hypertension (p-value: 0.734). But there was a significant difference (p-value less than 0.001) in the incidence of nephropathy between the diabetic patients who had hypertension and the diabetic patients who did not have hypertension. There was no significant difference (p-value: 0.163) in the incidence of neuropathy between the diabetic patients who had a history of hypertension and those who did not have a history of hypertension (Table 2).

HTN		Diabetic Retinopathy		Diabetic Nephropathy		Diabetic Neuropathy	
		Absent	Present	Absent	Present	Absent	Present
No	69	49	19	57	11	57	11
Yes	31	22	10	15	17	23	9
Total	100	71	29	72	28	80	20

Table 2. Relationship Between Hypertension (HTN) and Diabetic Retinopathy, Nephropathy and Neuropathy

In our study more than half of the patients were overweight (45%) or obese (9%). 2% were underweight and 44% were normal. In this study, the relation between the incidence of microvascular complications at diagnosis and the body mass index of the patients was not found to be significant for retinopathy (p-value: 0.382), neuropathy(p-value: 0.860), or nephropathy(p value: 0.624) (Table 3).

				Diabetic Retinopathy		Diabetic Neuropathy		Diabetic Nephropathy	
BMI Groups	N	Mean	Std. Deviation	A	P	A	P	A	P
<18	2	17	0	2	0	2	0	2	0
>30	9	31.59	0.496	6	3	7	2	7	2
19-25	44	22.89	1.687	28	16	36	8	33	11
26-30	45	26.79	1.003	35	10	35	10	30	15
Total	100	25.31	3.207	71	29	80	20	72	28
Chi-Square Value				3.062		0.758		1.758	
p-value				0.382		0.860		0.624	

Table 3. BMI and Its Association with Microvascular Complications

Analysis was carried out to find relationship between gender and various diabetic microvascular complications (Table 4). In our study 29% of patients had diabetic retinopathy. Out of these, 27 had background (BDR) and 2 people had proliferative (PDR) retinopathy. Among the males, 41 patients (71.9%) had a normal fundus, 15 patients (26.3%) had BDR and 1 patient (1.8%) had PDR. Among the females, 30 patients (69.8%) had a normal fundus, 12 patients (27.9%) had BDR and 1 patient (2.3%) had PDR. In our study 28% of patients had diabetic nephropathy. Out of these, 25 had microalbuminuria and 3 people had macroalbuminuria. Among the males, 43 patients (75.4%) had a no proteinuria, 13 patients (22.8%) had microalbuminuria and 1 patient (1.8%) had macroalbuminuria. Among the females, 29 patients (67.4%) had a no proteinuria, 12 patients (27.9%) had microalbuminuria and 2 patients (4.7%) had macroalbuminuria. In our study, 20% of patients had diabetic neuropathy. Among the females, 34 patients (79.1%) had no neuropathy, 9 patients (20.9%) had peripheral neuropathy. Among the males, 46 patients (80.7%) had no neuropath, 11 patients (19.3%) had peripheral neuropathy.

Gender	Total	Retinopathy			Nephropathy			Neuropathy	
		BDR	PDR	A	Microalb	Macroalb	A	A	P
Female	43	12	1	30	12	2	29	34	9
Male	57	15	1	41	13	1	43	46	11

Table 4. Relationship Between Gender and Diabetic Retinopathy, Nephropathy and Neuropathy

Microalb= Microalbuminuria; Macroalb= Macroalbuminuria; A= Absent; BDR= Background; PDR= Proliferative

In our study, 3 patients (3 percent of the patients) had a HbA1c of less than 6.5. 32 patients (32 percent of the patients) had a HbA1c between 6.5 and 7.4, 30 patients (30 percent of the patients) had a HbA1c between 7.5 and 8.4, 15 patients (15 percent of the patients) had a HbA1c between 8.5 and 9.4 and 20 patients (20 percent of the patients) had a HbA1c greater than or equal to 9.5. Table 7. In our study diabetic retinopathy was found in 29% of newly detected diabetic patients. There was significant association between HbA1c level and incidence of diabetic retinopathy (p value <0.001). On analysis of data that 28% patients in our study were found to have diabetic nephropathy at initial diagnosis of diabetes. There was significant association between HbA1c and prevalence of diabetic nephropathy (p value <0.001). Out of 100 patients evaluated in this study there was prevalence diabetic neuropathy in 20% newly detected diabetic patients. There was significant association between level of HbA1c and prevalence of diabetic neuropathy with p value <0.001. Table 5.

HbA1c Groups	Total	Diabetic Retinopathy		Diabetic Nephropathy		Diabetic Neuropathy	
		Absent	Present	Absent	Present	Absent	Present
<6.5	3	3	0	3	0	3	0
>9.5	20	4	16	8	12	9	11
6.5- 7.4	32	31	1	28	4	32	0
7.5- 8.4	30	26	4	24	6	26	4
8.5- 9.4	15	7	8	9	6	10	5
Total	100	71	29	72	28	80	20

Table 5. Relationship Between HbA1c and Diabetic Retinopathy, Nephropathy and Neuropathy

DISCUSSION

Diabetes mellitus is a major health problem all over the world esp. in countries like India due to so called - Asian Indian Phenotype which refers to unique clinical and biochemical abnormalities that are found in Indians. The problem is further compounded by the delay in detecting diabetes in the early phase as there is a period of several years of asymptomatic hyperglycaemia before diagnosis is made. During this asymptomatic phase of hyperglycaemia many patients without their awareness develop various diabetes related microvascular complications like retinopathy, nephropathy and neuropathy.

This study was carried out over a period of 2 years including 100 newly detected type 2 diabetes patients (57 male and 43 female) to find out the prevalence of various microvascular complications at initial diagnosis of type 2 diabetes. The mean age of the diabetics in our study was 51.17±13.47 years. The maximum incidence of diabetes was seen in patients who were between 35-55 years of age. The mean age in our study correlates closely to the studies done by Manish et al[9] (mean age 56).

In our study 45% of patients were overweight and 9% were obese. 53.5% (33.8% females and 19.7% males) were overweight and 11.3% (8.5% men and 2.78% women) were underweight in Nambuya AP et al[7] study. The mean fasting blood glucose in our study was 189.11 with a standard deviation of 56.1 and the average PPBS was 274.4 with a standard deviation of 74.2. In the study done by Cathlineau et al,[10] the mean FBS was 182 with a standard deviation of 48 and the PPBS was 209 with a standard deviation of 68. Thirty one% of our patients (33.3% of males and 27.9% of females) had a past history of hypertension.

Diabetic retinopathy (DR) is a microvascular complication and is a leading cause of visual disability and blindness in people with diabetes. The prevalence of DR increases with prolonged duration of diabetes. Many patients develop diabetic retinopathy during asymptomatic phase of diabetes. In patients with type 2 diabetes, approximately 20% have retinopathy at the time of diagnosis of diabetes. In our study we found 29% having diabetic retinopathy at initial diagnosis of type 2 diabetes. Harris MI et al, found that prevalence of retinopathy at clinical diagnosis of diabetes was estimated to be 20.8% in US and 9.9% in Australia.[4] ICMR draft report in 1993, showed retinopathy in 16.4% of patients. Prevalence of DR has been found to be highly variable in various studies probably due to difference in type of population or clinical settings; in European population based targeted screening DR was seen in 7.6% patients but DR was seen in 1.9% in the general practice setting in the same geographic area.[11] In the Diabetes Prevention Program (DPP) cohort, the prevalence of diabetic retinopathy in new-onset diabetes was 12.6%.[12] Prevalence of diabetic retinopathy in newly diagnosed diabetes was 10.5% across 26 population-based studies (all from outside Europe).[13] The higher incidence in our study is probably due to the fact that our patients are largely rural based illiterate individuals in whom the diagnosis of diabetes mellitus has been made late.

Diabetic nephropathy is a progressive complication of diabetes mellitus which progresses from microalbuminuria to overt albuminuria and eventually to renal failure and is the leading cause of end-stage renal disease (ESRD). Significant number of patients develops nephropathy during asymptomatic phase of diabetes mellitus. Up to 20% of patients with T2DM already have diabetic kidney disease when they are diagnosed with diabetes and a further 30% to 40% develop diabetic nephropathy, mostly within 10 years of diagnosis. In our study the overall incidence of Nephropathy (both microalbuminuria and macroalbuminuria combined) was 28%. A very similar result was obtained in the study done by Weersuriya et al[14] in Sri Lanka. A Ramachandra et al found nephropathy in 16.5% of patients.[15] Moreover, studies conducted in Asian countries reported variability in the prevalence rate of microalbuminuria ranging from 14.2% in Iran, 24.2% in Pakistan, to 36.3% in India.[16]

Approximately one half of people with diabetes have some form of diabetic peripheral neuropathy (DPN). People with diabetes also frequently have autonomic neuropathy. In the West careful questioning may elicit features of neuropathy in around 30% of the patients with newly diagnosed diabetes. Significant proportion of patients is found to have diabetic neuropathy at the time initial diagnosis of diabetes mellitus. In various studies prevalence of DPN has been found to be highly variable. Rani PK et al[17] found DPN in 18.84% of their study population. Nambuya AP et al[7] found DPN in 46.4% of their newly diagnosed diabetic patients. The incidence of neuropathy in the present study was 20%. It is slightly higher than the studies done by Ratzmann K P et al[18] which revealed in incidence of DPN in 6.3% patients. Thompson T J et al[19] reported incidence of DPN to be 9% in their study. Weersuriya et al[14] found DPN in about 25% newly detected diabetic patients.

Further analysis of data of revealed no significant association between smoking, body mass index and prevalence of various diabetic microvascular complications in newly diagnosed type 2 diabetes patients in our study. Presence of hypertension had significant association with prevalence with diabetic nephropathy but there was no such significant association between presence of hypertension and prevalence of retinopathy and neuropathy.

Limitations

The study was mostly satisfactory in obtaining its goals. But, this study has a few limitations. The sample size of 100 patients is too small to generalise the results for larger groups. Almost all the patients were from low socio-economic backgrounds and the sample is not representative of the population as a whole. Patients suffering from Chronic Kidney disease had to be eliminated. Similarly patients suffering from urinary tract infections had to be excluded as it would be difficult to ascertain whether the proteinuria was due to the urinary tract infection or due to nephropathy. Thus there is a selection bias.

CONCLUSIONS

This study shows high prevalence of various microvascular complications at initial diagnosis of diabetes mellitus. 51% of the patients had at least one microvascular complication at the time of diagnosis. Incidence of diabetic retinopathy and diabetic nephropathy was found to be almost equal followed by that of diabetic neuropathy. This study highlights the need for regular screening programs to detect asymptomatic hyperglycaemia so that diagnosis can be made in early phase of diabetes mellitus and various microvascular complications can either be prevented or delayed, mitigating the burden of managing the complications of diabetes mellitus.

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