

Frequency of chronic complications of type 2 diabetes

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Abstract

Objective: To assess the frequency of chronic complications of type II diabetes in subjects attending a tertiary care unit in Karachi, Pakistan.

Design: A cross-sectional analytical study.

Place and Duration of Study: First visit of all type II diabetic subjects attending the outpatient department of Baqai Institute of Diabetology and Endocrinology from September 1996 to December 2001.

Subjects and Methods: Computerized clinical records of 2199 type II diabetic subjects were analyzed for this study. The clinical and laboratory variables were statistically evaluated with significance at p .

Results: Means of glycosylated hemoglobin HbA1c, fasting and random plasma glucose levels, systolic blood pressure, triglycerides and high density lipoproteins (HDL) were higher than the risk indicator value for both genders ($p < 0.005$). Mean body mass index and total blood cholesterol was higher for females only. Hyperglycemia was present in 88%, high HbA1c in 81%, low HDL in 81%, obesity in 66% and hypertriglyceridemia in 54%, neuropathy in 36%, proteinuria in 28% and hypertension in 50% of the subjects. Frequency of obesity, low HDL and hypertension was higher among females ($p < 0.001$ in each case). Retinopathy ($p < 0.05$), Nephropathy ($p < 0.005$), neuropathy ($p < 0.005$) and foot ulcers ($p < 0.001$) were higher among males. Frequency of obesity was significantly higher among those with shorter duration and in younger group while frequency of other complications was higher among those with longer duration and in the older groups.

Conclusion: Higher rates of complications were observed compared to previous studies. Certain variables showed significant association with gender and age described above.

Keywords: Diabetes. Obesity. Complications. Microvascular. Macrovascular. Frequency. Duration.

Introduction

The prevalence of diabetes in Pakistan, according to World Health Organization (WHO) criteria, is 8.6%, 11.1% and 13.9% in the provinces of Baluchistan, NWFP and Sindh respectively.¹⁻³ Prevalence rate of diabetes in Pakistan using the American Diabetes Association (ADA) fasting criteria in Hub area of Baluchistan, was 7.2%.⁴ Diabetic complications rates in Pakistan need further comprehensive work⁵⁻¹¹.

Subjects with type II diabetes can have metabolic and vascular complications. Control of these complications is possible and can lead to reduction in morbidity, and healthcare costs¹²⁻¹⁹. The frequency of these complications in different and assessment of rates

of these complications help in planning comprehensive and preventive measures. Furthermore, finding out the associations of diabetic complications with age, gender and its duration would help in planning relevant strategies. The present study, therefore, aims at assessing the frequency of chronic complications in type II diabetes in a large sample of type II diabetic subjects attending a tertiary care unit in Karachi, Pakistan.

Patients and Methods

It was a cross-sectional analytical study conducted at Baqai Institute of Diabetology and Endocrinology (BIDE), a unit of Baqai University Hospital. A set of forms with incorporated parameters required for standard

medical care of diabetes was used for recording information at the time of patients' first visit to outpatients department (OPD). For this study, computer coded records of the first visit of all type II diabetic subjects, older than 18 years, who visited the outpatient department of the Institute from September 1996 to December 2001 were analyzed without any breach of confidentiality regarding identification code.

Glycemic control was assessed by measuring glycosylated hemoglobin (HbA1c) by DiaSTAT Hemoglobin A1c Program, Bio-rad or alternatively by fasting plasma glucose (FPG) estimated by glucose oxidase method. HbA1c values of ,7%,⁷ - 8.5% and > 8.5% while FPG < 126 mg/dl, 126-144 mg/dl, and < 144 mg/dl were taken as good, fair and poor control respectively.²⁰ Enzymatic methods (GPO-PAP and CHOD-PAP) were used for total cholesterol, high density lipoproteins and triglycerides while low density lipoproteins (LDL) values were calculated.²¹ Total cholesterol > 200 mg/dl, triglycerides > 150 mg/dl, low density lipoproteins > 130 mg/dl while high density lipoproteins < 40 mg/dl for males and < 50 mg/dl for females were taken as abnormal²². Body mass index (BMI) was calculated by the standard formula and obesity was taken as BMI > 25 kg/m² as suggested by the International Obesity Task Force²³.

The fundus was examined using Vista 20 direct ophthalmoscope by a diabetologist. The retinopathy was classified as normal background (presence of microdots and hard exudates), pre-proliferative and proliferative (presence of soft exudates and new vessels) or

maculopathy²⁴. It also included subjects who had prior laser photocoagulation for diabetic retinopathy. Nephropathy was defined as protein > 1+ on dipstick (Combur 10, Roche Diagnostics) with no other abnormal findings on urinary examination. Twenty-four hours quantitative analyses for proteinuria were not done routinely²⁵⁻²⁶. Peripheral neuropathy was defined as absent touch or vibratory sensations of the feet²⁷. Touch sensation was assessed by 10gm monofilament and vibration sensation by 128 Hz tuning fork²⁸.

Hypertension was defined as either B.P >130/85 mmHg or isolated systolic and diastolic blood pressure of greater than 130 and 85 mmHg respectively²⁹. Patients with history of coronary artery disease and stroke were taken as having macro vascular complication. Subjects with absent dorsalis pedis or posterior tibial pulses on examination with or without a history of intermittent claudication were labeled as having peripheral vascular disease (PVD).

Data was analyzed on SPSS version 10. To assess the statistical significance of the sample mean with standard cutoff values one-sample t-test was performed. In order to assess association of chronic complications with age and duration of diabetes, subjects were categorized into two age groups and two duration of diabetes groups. Frequency of chronic complications in relatively younger and older subjects and in subjects with shorter and longer duration of diabetes was calculated. Chi-square test was done to assess the statistical significance of these differences.

Table I: Mean values for metabolic parameters of the subjects.

Parameters	Target Value*	Differences between group mean and target value indicator of metabolic risk													
		Sex of patients										p-value	95% CI of the difference		
		Male					Females								
Mean	SD	N	Mean difference	P value	95% CI of the difference	Mean	SD	N	Mean difference	95% CI of the difference					
						Lower	Upper						Lower	Upper	
Body mass index (kg/m ²)	25	25.2	3.9	845	0.21	0.120	-0.06	0.48	27.4	5.1	918	2.37	0.000	2.04	2.70
HbA 1c (%)	8.5	9.1	2.3	461	0.56	0.001	0.36	0.77	9.1	2.3	455	0.62	0.001	0.41	0.83
Fasting Plasma glucose (mg/dl)	144	195.4	77.0	599	51.42	0.001	45.24	57.60	198.5	76.9	625	54.47	0.001	48.43	60.51
Random plasma glucose (mg/dl)	200	263.5	98.1	576	63.52	0.001	55.49	71.55	258.3	98.6	666	58.32	0.001	50.81	65.82
Systolic blood pressure (mmHg)	85	131.3	21.1	855	46.29	0.001	44.87	47.70	137.1	23.3	902	52.06	0.001	50.54	53.59
Systolic blood pressure (mmHg)	130	82.5	11.4	850	-47.47	0.001	-48.24	-46.71	82.7	12.2	902	-47.35	0.001	-48.14	-46.55
Cholesterol (mg/dl)	200	197.4	51.8	488	-2.60	0.269	-7.21	2.01	205.6	46.5	478	5.58	0.009	1.40	9.76
Triglycerides (mg/dl)	150	197.4	130.2	459	47.37	0.000	35.43	59.32	189.6	109.4	449	39.65	0.000	29.50	49.80
Low density lipoproteins (mg/dl)	130	123.3	36.1	332	-6.66	0.001	-10.58	-2.79	130.7	38.9	307	0.66	0.767	-3.71	5.03
High density lipoproteins (mg/dl)	40m 50f	36.1	13.9	341	-3.85	0.000	-5.33	-2.38	41.3	29.1	308	-8.68	0.000	-11.95	-5.42

* One sample t-test

Results

A total of 2199 subjects studied included 48.5% males and 51.5% females. Mean age of the subjects was 51(±12) years. Mean age of females (50.7 ± 11.3 range = 20 to 90 years) was significant (p<0.003) lower than males (52.2 ± 11.6, range 21 to 95 years. At the time of first visit to BIDE, 3% were less than 30 years old, 11.21% were between 30-39 years, 27.6% were between 40-49 years of age, 30.7% were 50-59 years old and 27.9% were more than 60 years old. In 1.5% of the subjects diabetes was diagnosed before the age of 20 years, in 12.8% before the age 30 years, in 32% before the age of 40 years, in 30.8% before the age of 50 years and in 22.9% after the age of 50 years. Ninety-nine percent of the subjects were married. The subjects belonged to varied occupations; around 28% were businessmen; 19% were in service while 13% were professionals. Around 90% of the females were housewives.

Forty-five percent of the subjects had positive family history for diabetes in parents; 17.5% each had it in either parents and 9.8% had it in both. Thirty-seven percent of the subjects reported occurrence of diabetes in a sibling; and 5.3% reported having diabetes in an offspring. Overall 58% of the subjects had diabetes either in parents, siblings or offspring. Nineteen percent of males and 2% of females were smokers and 13.4% and 1.4% respectively were ex-smokers.

At the time of first visit to BIDE, 38% had been diagnosed for less than 5 year, 23% for 5-10 years; 22% for 11-15 years, 12% for 16-20 years and 6.2% for 21-30 years and 0.8% for more than 30 years. Eight percent were on dietary management alone, 85% were on oral hypoglycemic therapy and 7% were on insulin.

In order to compare the mean values with the target cutoff values indicative of metabolic risks, one sample t-test was performed. Mean value of metabolic parameters (glycemic control, lipid profile and body mass index), mean differences and statistical significance for means are given in Table I.

Frequency of diabetes complications, overall and categorically is shown in Table II. The most frequently occurring metabolic abnormality was hyperglycemia on the basis of FPG (88%), high HbA1c (81), followed by obesity (66%) and hypertriglyceridemia (54%). Among microvascular complications neuropathy was 36% and nephropathy 28%. Among half (50.4%) of the subjects were hypertensive.

Frequency of obesity, low HDL and hypertension was significantly higher among females (p<0.001 in each case). Frequency of retinopathy (p<0.05), nephropathy (p<0.005), neuropathy (p<0.005) and diabetes foot ulcers (p<0.001) was significantly higher among males.

Frequency of obesity was significantly higher among the younger group (p=0.031). Frequency of retinopathy (p=0.000) neuropathy (p=0.000), hypertension (p=0.007), coronary artery disease (CAD) (p=0.000), stroke

(p=0.002) and PVD (p=0.002), was significantly higher among the older group (Table III).

Frequency of obesity was significantly higher among those with shorter duration of diabetes i.e. < 10 years (p=0.000). Frequency of retinopathy (p=0.000), nephropathy (p=0.000), neuropathy (p=0.000), diabetic foot ulcer (p=0.000), coronary artery disease (p=0.000), stroke (p=0.000) and PVD (p=0.000), was significantly higher among those with longer duration of diabetes i.e. > 10 years (Table IV).

Table II: Frequency of diabetes complications.

	Sex		Significance p-value
	Overall %	Male Female	
Metabolic parameters			
Hyperglycemia on the basis of FPG	88.8	88.8 88.8	0.500
HbA1c>7%	81.3	83.1 79.6	0.100
Hypercholesterolemia	46.1	43.4 48.7	0.056
Hypertriglyceridemia	54.5	53.6 55.5	0.570
High LDL	39.6	38.9 40.4	0.370
Low LDL	81.5	76.5 87	<0.001
Obesity	59.2	52.2 65.6	<0.001
Microvascular complications			
Retinopathy	15.9	17.9 14.1	<0.018
Nephropathy	28.4	32.2 23.9	<0.005
Neuropathy	36.6	40.1 33.3	<0.005
Diabetic foot ulcer	10.4	14.1 6.9	<0.001
Macrovascular complications			
Hypertension	50.4	46.1 54.5	0.000
Coronary artery disease	15.1	16 14.3	0.6
Stroke	4.4	4.3 4.4	0.4
Peripheral vascular disease	5.5	7 4	0.002

Table III: Frequency of various chronic complications according to age.

Chronic complications	Age group		p-value Chi.sq test
	< 40	40 and above	
Metabolic			
Hyperglycemia on the basis of FPG	88.20	88.91	ns
HbA1c>7%	83.61	80.98	ns
Hypercholesterolemia	46.67	45.98	ns
Hypertriglyceridemia	53.10	54.72	ns
High low density lipoproteins	36.99	39.93	ns
Low high density lipoproteins	87.18	80.74	ns
Obesity	72.20	65.62	0.031
Microvascular			
Retinopathy	7.14	17.33	0.000
Nephropathy	23.20	29.17	ns
Neuropathy	15.65	39.96	0.000
Ulcer of diabetic foot	6.60	10.97	0.010
Macrovascular			
Hypertension	42.92	51.62	0.007
Coronary artery Disease	2.31	17.19	0.000
Stroke	1.32	4.85	0.002
PVD	2.04	6.05	0.002

Table IV: Frequency of various chronic complications according to duration of diabetes.

	Upto 10 years %	> 10 years %	p-value
Metabolic			
Hyperglycemia on the basis of FPG	89.68	87.31	ns
HbA1c>7%	80.74	82.29	ns
Hypercholesterolemia	45.66	46.70	ns
Hypertriglyceridemia	53.60	55.97	ns
High low density lipoproteins	38.78	40.89	ns
Low high density lipoproteins	82.13	80.49	ns
Obesity	71.46	58.74	0.000
Microvascular			
Retinopathy	9.66	26.18	0.000
Nephropathy	24.63	34.94	0.000
Neuropathy	30.08	47.24	0.000
Ulcer of diabetic foot	7.56	14.82	0.000
Macrovascular			
Hypertension	49.20	52.31	ns
Coronary artery disease	11.71	20.59	0.000
Stroke	3.04	6.47	0.000
PVD	3.96	8.02	0.000

Discussion

The results of this study revealed the relative rates of various diabetes related chronic complications in subjects attending a tertiary care unit in Karachi, Pakistan. The observations made were not radically different from other similar studies in terms of relative proportion of various complications but in terms of absolute frequencies. The findings were not always comparable as this was carried out in terms of relative proportion of various complications but in terms of absolute frequencies. The findings were not always comparable as this was carried out in a tertiary care centre and not a community based survey.

Fourteen percent of subjects were less than 40 years of age. This trend of occurrence of type II diabetes at a younger age in Asian population is comparable to other studies. Mean age of males and females was younger as compared to Caucasians. The high prevalence of diabetes in the 40-60 age group meant that majority of diabetes were suffering from diabetes in their most productive years of life³⁰. Mean age of the diabetics in this cohort was 52 years for males and 51 for females, whereas in a survey done in Sindh province it was 51 and 48 years respectively¹. As the survey was community based and included previously unidentified diabetics, it could be postulated that community based surveys identify a considerable lower mean age of the diabetics. The fact that more than 50% subjects of our population had first degree family history of diabetes indicated a strong familial propagation of the disease in our population. However, this could also be due to same dietary habits that may have affected the BMI as well as chemical parameters.

Information about overall glycemic control in type II diabetic in Pakistan is lacking. The mean values of HbA1c found in this study (9.06) are slightly higher than those observed in Bangladesh (8.01)³¹ and are closer to those found in India (8.6)³² and DIABCARE-ASIA (8.9)³⁰. Around three-fourth of the subjects had poor glycemic control on their first visit to the institute and 40% of them had diabetes for > 10 years. This in itself is indicative of high tendency of diabetes for > 10 years. This in itself is indicative of high tendency of diabetic complications. A high prescription rate of insulin was expected but only 7% of patients were on insulin therapy. This highlighted need of major steps for improving diabetes care in the community.

The pattern of dyslipidemias observed in this study was slightly different from that observed by other researchers in the region. Significantly higher triglycerides and low a HDL were seen which is typical of diabetes dyslipidemia as also seen in Diab Care India.³⁰ The high percentage of low HEL in our study, as compared to other Asian studies, could be due to our use of new higher cutoff values for HDL as suggested by NCEP Report²².

In February 2000, the WHO Regional Office for the Western Pacific, the International Association for the Study of Obesity, and the International Obesity Task published provisional recommendations for adults in Asia-Pacific as overweight at BMI > 21.3 kg/m² and obesity at BMI > 25 kg/m²,²³ According to this new recommendations two-third of our diabetic subjects were obese with a BMI > 25 kg/m². Another study in our region showed a similar pattern of body mass index⁷. Females was observed in other Asian studies³¹.

Various studies have shown prevalence of retinopathy around 16% as found in our study. Others have shown a higher prevalence^{7,30,34}. This observation may be due to their units being a tertiary specialized ophthalmology unit or their use of better screening methods.

Among the macrovascular complications in our study, rates of CAD was 15.1%, stroke 5.5% and PVD 4.4%. This pattern was similar to that reported from India (CAD was 11.4%, Stroke 0.9% and PVD 4%),³² the rate were much higher for stroke in this study. Although the prevalence of peripheral vascular disease was low, the number of cases with foot problems were also high in our study. This could be related to the social and cultural behaviour of these subjects, particularly bare-foot walking. Furthermore, neuropathy could aggravate the risk of injuries and foot ulceration. Also the diabetic foot ulcer rates were higher probably because the institute also serves as a tertiary specialized diabetes foot care unit. Obesity, low HDL and hypertension was found to be higher in females while microvascular complications and diabetic foot ulcers were more prevalent in males. Frequency of obesity, hypertension and dyslipidemia did not increase with age or duration of diabetes suggesting

that for a large proportion of subjects these disorders would have appeared before the onset of diabetes i.e. in the impaired glucose period. In fact obesity is taken as a risk factor for diabetes^{23,33}. More than 50% of our subjects were hypertensive. This close association of diabetes and hypertension is a well known phenomenon³¹⁻³². Weerasuriya et al. Showed a prevalence of 23% subjects with hypertension. However, they had included only newly diagnosed type II diabetic subjects in their study³⁴.

Conclusion

This study showed the pattern of diabetic complications and its associations with gender, age and duration of diabetes among type II diabetic subjects in a tertiary care centre. Some indications of relatively higher rates of complications as compared to other parts of the region, and different pattern of complications in males and females were also observed as described above.

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