IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 15, Issue 10 Ver. XII (October. 2016), PP 29-33
www.iosrjournals.org

A Study on Complications of Type 2 Diabetes Mellitus in a Diabetes Clinic of a Tertiary Care Hospital, Kolkata, West Bengal

Dr.Nabanita Chakraborty[1], Prof. Asok K. Mandal[2]
[1]*AssisstantProfessor,Department of Community Medicine, KPC Medical College and Hospital, Jadavpur, Kolkata, West Bengal, India.*
[2]*Professor & Head ,Department of Community Medicine, KPC Medical College and Hospital, Jadavpur, Kolkata, West Bengal, India.*

Abstract:
Background: *The prevalence of diabetes and its associated complications is increasing at an alarming rate over the last few decades .The burden of these complications if estimated, may help to prevent the morbidity and mortality by appropriate preventive strategies.*
Objective: *To determine the magnitude and distribution of complications of Type 2 diabetes mellitus among the patients attending the diabetes clinic of R.G.Kar Medical College and Hospital. Materials and Methods: A descriptive, observational, cross sectional study was conducted in the diabetes clinic of R.G.Kar Medical College and Hospital. The study population included all the Type 2 diabetic subjects who attended the clinic from May 2012 to April 2013.345 subjects were selected by systematic random sampling. A pre-designed and pre-tested schedule was used for data collection. Data were collected regarding socio-demographic characteristics and duration of diabetes.HbA1C levels were estimated. The data were analysed using statistical software SPSS 20.Proportions and Chi-square test were used for analysis.*
Results: *40% patients were suffering from complications of Type 2 diabetes mellitus. Cardiovascular, cerebrovascular and peripheral vascular disease were found in 32.5%,9%and 6.7% patients respectively whereas 13.3%,33.0% and 30.1% patients were having diabetic nephropathy, neuropathy and retinopathy respectively. Significant association was found between the complications with religion, socio-economic status, duration of diabetes,HbA1C.Also, significant association was found between duration of diabetes and HbA1C levels with each of theindividual complications.*
Conclusion: *Early diagnosis, periodic screening .and blood sugar control may help to reduce the complications of Type 2 diabetes.*
Keywords: *Nephropathy, neuropathy, retinopathy, Type 2 Diabetes Mellitus,*

I. Introduction

In the last few decades Diabetes mellitus has emerged as a major public health problem globally[1]. Studies conducted in different settings have shown an increase in the prevalence of diabetes[2,3].Worldwide, the prevalence of diabetes is expected to rise from 4% in 1995 to 5.4% by the year 2025[4].According to World Health Organisation, the developing countries will account for the major proportion of this increase. It is predicted that approximately one third of adult diabetics will be in India and China by the year 2025[5].A recent WHO report have shown that India accounts for the highest number of diabetic population of the world[4].Presently there are 40.9 million people suffering from diabetes in our country and this figure may rise to 80 million by 2030[6].Among the diabetic patients,90% suffer from Type 2 diabetes[4].

It has been found that long standing diabetes mellitus is associated with changes in the blood vessels which may be a cause of late complications of this disease. In the developed countries diabetes accounts for the principal cause of acquired blindness. Diabetic patients have 2-3 times higher risk of having myocardial infarction as well as stroke compared to non-diabetics. The risk of developing nephropathy in diabetics is 5 times higher and it accounts for 25% of new cases of end stage renal disease. Also the incidence of gangrene is 5 times higher in diabetics and 50% of all non-traumatic complications are result of diabetes[7]. A study conducted in South India also found a high prevalence of vascular complications of type 2 diabetes[3]. Various studies have been conducted on the prevalence of complications of Type 2 diabetes all over the world. Many hospital based as well as community based studies depict the prevalence of complications in different parts of India but there are few studies regarding the burden of complications of Type 2 diabetes in West Bengal. This study was taken up for estimating the pattern, magnitude and distribution of complications of Type 2 diabetes in a diabetes clinic of a tertiary care hospital, Kolkata, West Bengal.

II. Materials And Methods

A descriptive, observational, cross-sectional study was carried out in the diabetes clinic of R. G. Kar Medical College and Hospital. The study population included all Type 2 diabetes mellitus subjects who attended the diabetes clinic from May 2012 to April 2013.A hospital based study by Rema et al. in South India showed prevalence of 34.1% retinopathy[7]. This prevalence has been taken for sample size calculation as literature review have shown this prevalence to be maximum. With 95% confidence limit and 5% absolute error, the sample size was 345. Type 2 diabetes mellitus patients were selected by systematic random sampling.
Inclusion/Exclusion Criteria:

Inclusion criteria:
(1) Diagnosed cases of Type 2 Diabetes
(2) Informed consent to participate in the study could be obtained .

Exclusion criteria:
1) Pregnant women with type 2 diabetes were excluded from the study.
Type 2 diabetic patients were interviewed with a pre-designed and pre-tested schedule. Details regarding socio-demographic parameters such as age, sex, religion, socio-economic status of family (B.G. Prasad scale) were taken.
History regarding duration of diabetes was also taken.
Detailed clinical examination and relevant biochemical investigations were done.
For diagnosis of Type 2 Diabetes Mellitus international standards (WHO 1999) were followed.(fasting plasma glucose ≥ 7.0 mmol/L or 126mg/dl and/or 2 hours postprandial plasma glucose or casual plasma glucose ≥ 11.1 mmol/L or 200mg/dl.
The cut-off for HbA1C was taken as per WHO guidelines according to which good glycaemic control was defined as HbA1C of <7% , while 7%-8% range is acceptable and >8% was poor glycaemic control.

Definition of Outcome:
The complications of diabetes :
1. Micro vascular Complications
- Retinopathy
- Nephropathy
- Neuropathy

2. Macro vascular Complications –
Coronary Heart Disease
Peripheral Vascular Disease
Cerebrovascular Disease

Cardiovascular complications were diagnosed using the Minnesota criterion[8].

CT scan reports along with clinically diagnosed cases of cerebrovascular accidents was used for diagnosis of cerebrovascular complications[9]. History of intermittent claudication or absence of one or more peripheral pulses in the feet, presence of ulcer or amputation was used to define peripheral vascular disease [10].Presence of microalbuminuria(urinary albumin ranging from 30-300mg/day), macroalbuminuria or elevated serum creatinine was used to define diabetic nephropathy[11].Diabetic neuropathy[12]was diagnosed if there is bilateral absence of ankle jerks or bilateral loss of sensation to touch, pain and temperature. For diagnosis of diabetic retinopathy[13], fundoscopy was done.

All the reports were scrutinised by experts and expert opinion was sought for reaching at a diagnosis.
The data wereanalysed using appropriate statistical tests viz. proportions and Chi-square test. SPSS version 20 was used for data analysis.

III. Results

Out of 345 diabetic patients,138(40.0%) had one or more complications while 207(60.0%) did not have any complications. It was found that cardiovascular complications were present in 112 (32.5%)patients, cerebrovascular complications were present in 31(9%) patients, peripheral vascular disease was present in 23(6.7%)patients, while 46(13.3%) patients were having diabetic nephropathy,114(33%)patients were having diabetic neuropathy and 104(30.1%) patients were suffering from diabetic retinopathy.

It was found that complications were present in 20% patients in both ≤50 years and >50 years age group.23.7% of males and 13.3% of females were having complications. The presence of complications were more in Hindu patients(33.3%) compared to Muslims. Complications were more common in patients belonging

to class 4 socio-economic status(20.0%),followed by those belonging to class 3(13.3%) and class 5(6.7%)socio-economic status respectively, while patients belonging to class 1 and class 2 socio-economic status were not presenting with any complications. The presence of complications were mostly seen in patients who are suffering from Type 2 diabetes for 5-15 years(26.7%)while it was 13.3% for patients who have diabetes for more than 15 years and patients suffering from diabetes for <5 years did not present with any complications. Complications were more frequently present in patients with HbA1C level 7%-8%,followed by 13.3% in patients with HbA1C level >8% while only 6.7% patients with HbA1C level <7% were presenting with complications. It was found that the association of complications were statistically significant(p<.005) with religion, socio-economic status, duration of diabetes and glycated haemoglobin levels(HbA1C)(Table 1)

Table 1: Association of complications of Type 2 diabetes mellitus with the following characteristics:

Characteristic	Complications		
	Present	Absent	
Age			X^2 -1.027
≤50 years	69(20.0)	115(33.3)	P value - .311
>50 years	69(20.0)	92(26.7)	
Total	138(40.0)	207(60.0)	
Sex			X^2-4.259
Male	92(26.7)	115(33.3)	P value-.039
Female	46(13.3)	92(26.7)	
Total	138(40.0)	207(60.0)	
Religion			**X^2-11.761**
Hindu	115(33.3)	138(40.0)	**P value-.001**
Muslim	23(6.7)	69(20.0)	
Total	138(40.0)	207(60.0)	
Socio-economic status			
Class 1	0(0.0)	23(6.7)	**X^2-230.000**
Class 2	0(0.0)	115(33.3)	**P value-.000**
Class 3	46(13.3)	69(20.0)	
Class 4	69(20.0)	0(0.0)	
Class 5	23(6.7)	0(0.0)	
Total	138(40.0)	207(60.0)	
Duration of diabetes			**X^2-268.333**
<5 years	0(0.0)	184(53.3)	**P value-.000**
5-15 years	92(26.7)	23(6.7)	
>15 years	46(13.3)	0(0.0)	
Total	138(40.0)	207(60.0)	
HbA1C			**X^2-258.750**
<7%	23(6.7)	207(60.0)	**P value-.000**
7-8%	69(20.0)	0(0.0)	
>8%	46(13.3)	0(0.0)	
Total	138(40.0)	207(60.0)	

Among the patients suffering from diabetes for 5-15 years, 19.7% had cardiovascular complications, 1.4% had cerebrovascular complications while none of the patients had peripheral vascular disease. Diabetic nephropathy, neuropathy and retinopathy were found in 6.7%, 26.7% and 16.8% patients respectively. Again, among the patients suffering from diabetes for more than 15 years, 12.8% patients had cardiovascular complications, 7.5% patients had cerebrovascular complications while 6.7% of the patients had peripheral vascular disease. Diabetic nephropathy, neuropathy and retinopathy were found in 6.7%,6.7% and 13.3% patients respectively. The association between duration of diabetes and cardiovascular complications, cerebrovascular complications, peripheral vascular disease, diabetic nephropathy, neuropathy and retinopathy were statistically significant.(p<.005)

HbA1C was <7% in 4.1% patients with cardiovascular complications and 6.7% patients of diabetic neuropathy and retinopathy each. None of the patients with cerebrovascular complications, peripheral vascular disease and diabetic nephropathy had HbA1C level <7%.HbA1C was 7%-8% in 15.7% patients with cardiovascular complications,1.4%patients with cerebrovascular complications,6.7% patients with diabetic nephropathy,20.0% patients with diabetic neuropathy and 10.1% patients with diabetic retinopathy. None of the patients with peripheral vascular disease had HbA1C level between 7%-8%.In the patients with HbA1C level >8%,cardiovascular complications were seen in 12.8% patients, cerebrovascular complications were seen in 7.5% patients, diabetic nephropathy and diabetic neuropathy were seen in 6.7% patients each while diabetic retinopathy is seen in 13.3% patients. None of the patients with peripheral vascular disease had HbA1C level between >8%.The association between HbA1C level and cardiovascular complications, cerebrovascular complications, peripheral vascular disease, diabetic nephropathy, neuropathy and retinopathy were statistically significant.(p<.005)(Table 2)

Table 2: Association of different types of complications with the following characteristics:

Characteristic	Different types of Complications					
Duration of diabetes	Cardio vascular complications(%)	Cerebro vascular complications(%)	Peripheral Vascular Disease(%)	Diabetic Nephropathy (%)	Diabetic Neuropathy (%)	Diabetic Retinopathy (%)
<5 years	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
5-15 years	68(19.7)	5(1.4)	0(0.0)	23(6.7)	92(26.7)	58(16.8)
>15 years	44(12.8)	26(7.5)	23(6.7) 23(6.7)	23(6.7)	23(6.7)	46(13.3)
Total	112(32.5)	31(9.0)	160.179	46(13.3)	115(33.3)	104(30.01)
X^2	212.612	148.293	**.000***	86.250	210.450	208.481
P value	**.000***	**.000***		**.000**	**.000**	**.000**
HbA1C						
<7%	14(4.1)	0(0.0)	0(0.0)	0(0.0)	23(6.7)	23(6.7)
7%-8%	54(15.7)	5(1.4)	0(0.0)	23(6.7)	69(20.0)	35(10.1)
>8%	44(12.8)	26(7.5)	23(6.7)	23(6.7)	23(6.7)	46(13.3)
Total	112(32.5)	31(9.0)	23(6.7)	46(13.3)	115(33.3)	104(30.1)
X^2-	228.455	150.065	160.179	112.788	200.100	164.799
P value-	**.000***	**.000***	**.000***	**.000**	**.000**	**.000**

*As 1 or more cells have expected count less than 5, Fischer's exact test has been used for analysis.

IV. Discussion

The present study showed that the prevalence of macrovascular and microvascular complications among the diabetic patients were 40%.Significant association was found between these vascular complications with religion, socio-economic status, duration of diabetes and HbA1C levels. Though there are limited studies showing the association of complications of Type 2 diabetes with the above mentioned characteristics, one study has found significant association with complications and duration of diabetes and HbA1C levels[14].

Among the diabetic patients with complications, cardiovascular complications were present in 32.5% patients, cerebrovascular complications were present in 9% patients, peripheral vascular disease was present in 6.7% patients, while 13.3% patients were having diabetic nephropathy,33%patients were having diabetic neuropathy and 30.1% patients were suffering from diabetic retinopathy. Both cardiovascular complications and diabetic retinopathy were more in patients sufferingfrom diabetes for 5-15 years and HbA1C levels ranging between 7%-8%.All the associations were found to be statistically significant. The prevalence of cerebrovascular disease, peripheral vascular disease and diabetic nephropathy were more in patients suffering from diabetes for more than 15 years, higher levels of HbA1C and the associations were statistically significant. Diabetic neuropathy was more in patients having diabetes for more than 15 years and HbA1C levels 7%-8% and the associations were statistically significant.

Ramachandran et al.[15] also revealed a high prevalence(30.1%) of coronary heart disease in a study conducted in South India. The prevalence of stroke and peripheral vascular disease was found to be 0.9% and 4.1% respectively (Ramachandran et al.)[16].Another study have shown the prevalence of cerebrovascular disease to be 6.9%(9).Studies have shown that the prevalence of peripheral vascular disease is as low as 2.3% among diabetic patients[17] .Another study showed the prevalence of peripheral vascular disease to be 4% among Indian patients with Type 2 diabetes[18]. The higher prevalence of cerebrovascular complications and peripheral vascular disease in this study may be due to the fact, that the study was conducted in diabetes clinic of a tertiary care hospital which is a specialized centre. Significant association was found between duration of diabetes and peripheral vascular disease in studies conducted by Raman et al[19]inIndore and Ramachandran et al.[20] in South India. However no significant association was found with glycaemic control in these studies[19].The prevalence of nephropathy in the form of microalbuminuria was found to be 19.7% by Ramachandran et al.[20]in Chennai and 26.6% by Gupta et al.[21] in New Delhi. A wide variation in the prevalence of diabetic nephropathy was also found in WHO multicentric study of vascular disease[22] (2.4% in Hong Kong,23% in Delhi and 37% in Oklahoma,USA).This geographic variation may be attributed to difference in genetic as well as socio-economic,cultural and environmental factors of different ethnic groups. Diabetic nephropathy was found to have significant association with duration of diabetes in studies conducted by Mohan et al.[17]and Verghese et al.[23]. Also, increased prevalence of diabetic nephropathy has been found in patients with increased glycosylated haemoglobin in studies by Viswanathan et al[24] and Gupta et al.[21].A study has shown the prevalence of neuropathy among diabetic patients to be 30.1%[11]. The study conducted by Rema et al[7] in South India, found the prevalence of retinopathy to be 34.1% among diabetics.The prevalence of retinopathy was found to be 23.7% in the study conducted by Ramachandran et al.[20] in Chennai. The association between diabetic retinopathy and duration of diabetes was found to be statistically significant in both the studies. Studies conducted in different settings[7,25] also revealed the increased prevalence of diabetic retinopathy with poor glycaemic control.

V. Conclusion

The following study has shown that among the diabetic patients 40% were suffering from complications. It is seen that the complications were more in those suffering from diabetes for a long duration and having a poor glycaemiccontrol. Thus early screening, regular blood glucose monitoring along with HbA1C estimation and control of blood sugar level by lifestyle modification and treatment may help to reduce the morbidity and mortality of Type 2 diabetes in the form of vascular complications.

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