

Status of Ocular Complications in Type 2 Diabetes and Relationship Between Other Comorbidities

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Abstract

Introduction : Diabetes Mellitus is a multifactorial disease, associated with a number of micro vascular (Retinopathy, Neuropathy and Nephropathy) and macro vascular (Ischemic Heart Disease, Cerebrovascular Disease and Peripheral Vascular Diseases) complications. Duration of diabetes, current smoking and presence of co morbidities such as HTN, IHD all are significantly associated with the ocular complications in this study. **Objective:** The purpose of the study is to see the glycaemic status and co morbidities influencing the ocular complications. **Methods:** The patients for the study were randomly recruited from the Eye outpatient clinics in Chattagram Maa Shishu-O-General Hospital, Chittagong, Bangladesh, from July 2014 to October 2014. Risk factors of DR like age, sex, duration of diabetes and hypertension, IHD, smoking status were evaluated. **Results:** The study showed that 53 are male and 47 are female. Maximum age is 85 and minimum age is studied at 28. Cataract was the predominant complications presented our study. 22% patient had unilateral and 20% had bilateral cataract. 29% had retinopathy. Mean FPG, PPG & HBA1c levels in unilateral cataract were 7.0 mmol/L, 8.9 mmol/L and 7.03 mmol/L in comparative to retinopathy group was 8.4 mmol/L, 10.6 mmol/L and 8.6 mmol/L respectively. Major complications are retinopathy are found in 26% hypertensive and 24% IHD patients, prevalence of Diabetic retinopathy is 6.9% after 5 years onset of DM and 73.9% after 15 years of diabetes. **Conclusion :** Prevalence of Diabetic ocular complications is high in our country, Ocular complications increases proportionately to duration and presence of co morbidities. Tight control of DM and periodic eye examination can prevent complications.

Key words: Posterior subcapsular cataract; Diabetic retinopathy; Ischemic heart diseases.

INTRODUCTION

Diabetes mellitus is currently the commonest endocrine disorder, affecting nearly 6% of the world's population¹. According to recent estimates by the International Diabetes Federation, the number of patients with diabetes will increase by 55% to nearly 600 million by year 2035².

Data from prospective and cross-sectional studies consistently point to the fact that diabetic patients are more likely to develop micro- as well as macro-vascular conditions³⁻⁴. About 50% of the subjects of UKPDS had substantial macro- or micro-vascular abnormalities at the time of T2 DM diagnosis⁵.

About 50-80% of all individuals with diabetes die of cardiovascular disease, with cerebrovascular disease, and kidney failure also among the leading causes of death⁶.

Diabetic retinopathy caused by complications of diabetes mellitus and is the fifth-leading cause of global blindness. It is an ocular manifestation of systemic disease which affects up to 80% of all patients who have had diabetes⁷.

While occurrence of diabetic retinopathy cannot be prevented, early detection and management of the disease can minimize its sight-threatening complications.

Current treatment modalities are effective in preventing 98% of vision loss, if treatment is provided at the appropriate time. There is additional evidence that the risk of cataract increases with increasing diabetes duration and severity of hyperglycemia^{8,9}.

Deposition of advanced glycation end products in the lens has been postulated as one possible pathogenic mechanism for diabetic cataract¹⁰.

The surge in diabetes in low-resource settings is partly attributed to the insidious nature of the condition, with many people remaining undiagnosed until complications such as vision loss and renal disease manifest.

Consequently, large proportions of people remain undiagnosed or fall within pre-diabetes categories which predispose them to progressing to diabetes¹¹.

MATERIAL AND METHODS

This was a prospective questionnaire based study. The patients for the study were purposively selected from the Eye outpatient clinics in Chattagram Maa Shishu-O-General Hospital, Chittagong, Bangladesh, from July 2014 to October 2014. Subjects were chosen who were more than 16 years old & who were able to understand clearly the instructions of the survey. All the patients were answered voluntarily and confidently against the administered pre-tested questionnaires. The study was conducted on 100 diabetics patients presented with eye complaints. The patients were informed about the study, and written consent was obtained from them. Confidentiality of the patient was maintained. All questionnaires were administered and collected by the same person. The data was entered using an excel sheet and analyzed using Statistical Package for Social Sciences (SPSS software, version 22).

The frequency of ocular complications, cardiovascular diseases, and hypertension were assessed in these patients. The diagnosis of diabetes is confirmed by fasting plasma glucose, measured from a venous sample after an overnight fast. Ophthalmologists examined all these patients. Vision of each eye was noted with the best possible correction. Snellen's projection chart was used for this purpose. The pupils were dilated by instilling one drop of 1.0% tropicamide, and examined by fundoscopy and all retinopathic changes are noted.

RESULTS

Characteristics of the study subjects

A total of 100 patients were included in the study. From 100 patients, 53 are male and 47 are female. Maximum age is 85 and minimum age is studied at 28, mean age is 57.9. Maximum duration of diabetes presented complications after 24 years and minimum duration after diagnosis is 1 year and mean duration is 7.3 years (Table 1, 2, 3, 4).

Glycemic Control

The mean Fasting Blood Glucose (FBG) levels of patients measured were 7.38 ± 0.97 mmol/L in patient with regular exercise groups (n=52) and 7.82 ± 1.02 mmol/L, (n=48) who doesn't undergoes regular exercise. Mean Post Prandial Glucose (PPG) level found 9.19 ± 1.2 mmol/L in patient with regular exercise groups (n=52) and 9.79 ± 1.27 mmol/L in patients who doesn't exercise regularly. Mean HbA1c was $7.43 \pm .80$ in exercise group and 7.89 ± 1.03 in patient with non exercise group. The mean FBG and PPG values increased significantly with the duration of diabetes. In compliant group (n=83) FPG was found 7.4 mmol/L, PPG was 9.2 mmol/L and HbA1c was 7.4 in comparative to non compliant group (n=17) FPG was 8.2 mmol/L PPG was 10.2 mmol/L and HbA1c was 8.5 respectively (Table 5, 6, 7).

Cataract was the predominant complications presented our study. 22% patient had unilateral and 20% had bilateral cataract. 29% had retinopathy and rest were refractive error. Mean FPG, PPG & HbA1c levels in unilateral cataract were 7.0 mmol/L, 8.9 mmol/L and 7.03 mmol/L in comparative to retinopathy group was 8.4 mmol/L, 10.6 mmol/L and 8.6 mmol/L respectively. In our study 72 patients were found hypertensive and those who had HTN, mean FPG, PPG & HbA1c levels were 7.6 mmol/L, 9.5 mmol/L and 7.6 mmol/L in comparative to normotensive group were 7.3 mmol/L, 9.2 mmol/L and 7.4 mmol/L respectively. 55% (n=55) patient had association of IHD and mean FPG, PPG & HbA1c levels were 7.8, 9.8 and 9.8 in this groups comparative to 7.2, 9.0 and 7.3 in patients who had no IHD.

Major complications is retinopathy are found in 26% hypertensive and 24% IHD patients. Maximum 8 patients developed retinopathy after 15 years of diabetes onset. Only 2 patients was found retinopathy just after 5 years of diabetes comparative with 7 patients presented with unilateral and 6 patients with bilateral cataract (Table 8).

Table 1 : Baseline characteristics of study populations (n=100)

	Minimum	Maximum	Mean	Std. Deviation
Age (Years)	28	85	57.97	11.934
Duration (Years)	1	24	8.34	5.373
BMI	14.6	42.8	26.864	6.5786
Fasting plasma glucose (mmol/L)	5.30	9.60	7.5710	1.01507
Post prandial blood glucose (mmol/L)	7.30	14.20	9.4470	1.29922
HbA1C level (%)	6.20	10.70	7.6250	.93034

Table 2 : Co-morbidity status in relation to age group

Age Grouping	IHD	HTN
<30 Years	0	1
30 -50 Years	7	16
50 -70 Years	38	46
>70 Years	10	9
Total	55	72

Table 3 : Distribution of patients according to drug intake

Drug	Frequency	Percent
Oral	51	51.0
Insulin	25	25.0
Oral + Insulin	22	22.0
None	2	2.0
Total	100	100.0

Table 4 : Distribution of patient according to smoking status

	Smoking	Complications					Total
		Unilateral cataract	Bilateral cataract	PSC*	Retinopathy	Refractive error	
Yes	4	8	2	11	6	31	
No	18	12	5	18	16	69	
Total	22	20	7	29	22	100	

(*PSC : Posterior Subcapsular Cataract)

Table 5: Relationship between glycaemic status and exercise group

Exercise	Fasting plasma glucose (mmol/L)	Post prandial blood glucose (mmol/L)	HbA1C level (%)
Yes Mean	7.38± .97	9.19 ±1.26	7.43 ± .80
No Mean	7.82± 1.02	9.79 ±1.27	7.89 ±1.01
Total Mean	7.57± 1.01	9.44 ±1.29	7.62 ±.93

Table 6 : Glycaemic status according to age group

	N	Mean (mmol/L)	Std. Deviation	p value
Post prandial blood glucose				
<30 Years	2	8.2000	.14142	0.001
30 -50 Years	32	9.1094	1.06872	
50 -70 Years	54	9.4000	1.25908	
>70 Years	12	10.7667	1.34457	
Total	100	9.4470	1.29922	
Fasting plasma glucose				
<30 Years	2	7.2500	.07071	0.0001
30 -50 Years	32	7.1531	1.00899	
50 -70 Years	54	7.6037	.89737	
>70 Years	12	8.5917	.92487	
Total	100	7.5710	1.01507	

Table 7 : Glycaemic status in ocular complications

Complications	Fasting plasma glucose (mmol/L)	Post prandial blood glucose (mmol/L)	HbA1C level (%)
Unilateral cataract Mean	7.09 ± .74	8.92 ±.90	7.03 ±.46
Bilateral cataract Mean	7.56±.79	9.32±1.32	7.41±.70
PSC Mean	7.60±.61	9.15±.73	7.55±.52
Retinopathy Mean	8.49±.84	10.61±1.17	8.61±.94
Refractive error Mean	6.83 ±.83	8.61 ±.78	7.12 ±.31
Total Mean	7.57±1.01	9.44±1.29	7.62±.93

Table 8 : Relationship between complications and other co-morbidities

Complications	IHD	HTN
Unilateral cataract	10	14
Bilateral cataract	12	17
PSC	2	4
Retinopathy	24	26
Refractive error	7	11
Total	55	72

DISCUSSION

Diabetes Mellitus is a multifactorial disease, associated with a number of microvascular (Retinopathy, Neuropathy and Nephropathy) and macrovascular (Ischemic heart disease, Cerebrovascular disease and Peripheral vascular diseases) complications¹².

Type 2 DM is likely to remain undiagnosed for many years. The gap between the onset of the disease and clinical diagnosis of diabetes leads to the development of these chronic complications. Duration of diabetes, current smoking and presence of diabetes peripheral neuropathy all were significantly associated with the prevalence of DR in the present study population.

Duration of diabetes is a well known risk factor for DR and most other complications of diabetes¹³. The relationship between smoking and DR is controversial, where several studies have shown no relationship between smoking and long-term incidence, progression of DR^{14,15,16}.

Large prospective studies of both type 1 and type 2 diabetics have shown that a tight control of glycemia reduces the occurrence of DR and other micro vascular complications compared to diabetics on a conventional therapy (The Diabetes Control and Complications Trial Research Group 1993, United Kingdom Prospective Diabetes Study (UKPDS) Group 1998). The prevalence of cataract was higher in those with a longer duration of diabetes and known diabetes, suggesting a more prolonged influence of biochemical cataractogenic stimuli (Hyperglycemia). However, the pathways by which hyperglycemia leads to cataract are still unknown but they probably involve a modification of the lens proteins leading to AGE formation or modification of the ATPase pumps, leading to osmotic stress, or both¹⁷.

The Blue Mountains Eye Study showed that an impaired fasting glucose, in the absence of clinical diabetes, was also a risk factor for the development of cortical cataract¹⁸. Both the Framingham eye study and National Health and Nutrition Examination Survey¹⁴ reported a positive association between diabetics and cataract prevalence only in those younger than 65 years of age. At older ages the association was not significant in the Framingham eye study¹⁵ and became less significant in NHNES¹⁹.

The prevalence of DR has been documented to be higher in Type 1 DM compared to Type 2 DM. We had information on patients currently being treated with insulin and/or by other treatment modalities. We found that the rate of DR among patients using insulin was significantly higher compared to those using other medications. But long duration of DM and poor glycemic control could have prompted physicians to treat these cases with insulin. Thus association of type of treatment with DR could have been confounded by the duration and poor glycemic control in our study.

The study had few limitations as patients were selected from outdoor visiting patients in eye department. Patients were selected only type 2. In our institute only less severe patients attended here as there is large number of patient attending in nearby specialized eye hospital. In our study bilateral cataract was found on 8 patients with active smoker and. Retinopathy was found on 11 patients. Results is comparatively less than nonsmoker due to large number of female patients. Result of our study on diabetics with cataract somewhat consistent with Barbados eye study as our study also shows positive influence below 60 years of age on cataract.

Those who are hypertensive, 26 patients had retinopathy (36.1%). Only 3 retinopathy patients are found in non hypertensive group.

In one eye hospital based study of 350 patients in Sana, Yemen, prevalence of Diabetic retinopathy is 18.6% after 5 years onset of DM and 87% after 15 years of diabetes²⁰. In our study it is 6.9% and 73.9% respectively ,so this is consistent with that study.

Diabetes treated with Insulin in our study is 43.5% in retinopathy group and 48.5% is managed by both oral and insulin in same group, but in Yemen study it is comparatively 73.9% and 43.5%, provided by severe cases enrolled in that hospital.

CONCLUSION

Prevalence of Diabetic ocular complications is high in our country, as early diabetes detection, prolonged durations, drug compliance, exercise all are closely related to eye complications .Other co morbidities such as HTN ,IHD all are proportionately related with cataract and retinopathy, So Early visit to ophthalmologists as well as control of co morbidities and DM should be emphasized.

DISCLOSURE

Both the authors declared no competing interest.

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