Original Article

Evaluation of Ophthalmoscopic Findings in Type 2 Diabetic Patients at a Tertiary Level Hospital

Akhter MT[1], *Chowdhury MFK[2], Saha T[3], Miah MSA[4], Mahmudunnaby M[5], Newaz AAS[6], Mahbub-Uz-Zaman K[7], Islam S[8], Linckon MK[9]

Abstract

Diabetes mellitus (DM) is a global burden of disease. Long standing disease causes macrovascular and microvascular complications. Diabetic retinopathy (DR) is the most common microvascular complication of diabetes and it remains a leading cause of blindness and visual impairment in the working-age population in both developing and developed world. Patients with diabetes often developed other ophthalmic complications, such as corneal abnormalities, glaucoma, iris neovascularization, cataracts, and maculopathy. The study was carried out to evaluate the ophthalmoscopic changes in type-2 diabetes mellitus (T2DM) patients. This hospital based cross-sectional study was conducted in the department of Medicine, Shaheed Suhrawardy Medical College Hospital, Dhaka, from September 2018 to March 2019. Patients with T2DM attended at the department of medicine within the mentioned period were enrolled after fulfilling the selection criteria. Patients with dense, lentalopacities and other media opacities which prevented posterior segment examination were excluded from the study. Sample was selected by purposive sampling method. Detail demographic data were collected from the patients and recorded in structured case report form. Clinical examination and relevant investigations were done meticulously. Then pupil was dilated and ophthalmoscopic examination was done. Among the 50 diabetic patient's male was 54%, middle aged (49-60 years) was 54% and sedentary workers was 84.0% with a positive family history of DM was 56.0%. Most of the patients were known hypertensive (64.0%) at the time of enrolment and almost all (94.0%) were taking antihypertensive drug. Retinal photography was performed in all patients and retinopathy was detected in 29 (58%) patients. Fundoscopic findings revealed that cotton-wool spots detected in 32.0% patients, Flame-shaped hemorrhages was 16.0% patients; Arteriovenous nipping was is 18.0% patients and opticdisc swelling (Papilloedema) in 26.0% patients. In this study 21 (42%) patients had normal fundoscopic findings. Retinopathy was more common in smoker (70.0%). Uncontrolled and long-standing diabetes and high HbA1c was major risk factors for the development of retinopathy (P < 0.001). In conclusion, diabetic retinopathy is more common in male smoker with uncontrolled and long-standing diabetic patients. T2DM is a major cause of blindness as it affects microvasculature of retina.

Keywords: *Diabetes mellitus, diabetic retinopathy, ophthalmoscopic.*

1. Dr. Md. Tuhin Akhter, Registrar, Sheikh Russel National Gastroliver Institute and Hospital (SRNGIH), Mohakhali, Dhaka.
2. *Dr. Md. Fazlul Karim Chowdhury, Assistant Professor, Department of Gastroenterology, Bangabandhu Sheikh Mujib Medical University, (BSMMU), Shahbag, Dhaka. E-mail: chanchal 4234@gmail.com, Phone: 01716-330906
3. Dr. Tanmoy Saha, Medical officer, SRNGIH, Mohakhali, Dhaka.
4. Dr. Md. Shah Alam Miah, Assistant Registrar, SRNGIH, Mohakhali, Dhaka.
5. Dr. Md. Mahmudunnaby, Registrar (Medicine), ShSMCH, Dhaka.
6. Dr. Abdullah Al Shah Newaz, Registrar, SRNGLIH, Mohakhali, Dhaka.
7. Dr. Khandker Mahbub-Uz-Zaman, MD (Rheumatology), Major, Classified Specialist in Medicine (Rheumatology), CMH, Dhaka.
8. Dr. Susmita Islam, Assistant Professor, Department of Gastroenterology, BSMMU, Shahbag, Dhaka.
9. Dr. Md. Khalequzzaman Linckon. OSD, DGHS.

* For correspondence

INTRODUCTION

Diabetes mellitus (DM) is associated with reduced life expectancy, significant morbidity due to diabetes related microvascular and macrovascular complications.[1]

Diabetes mellitus (DM) is e of the oldest diseases known to man. It was first reported in Egyptian about 3000 years.[2]A study showed there were 171 million people in the world with diabetes in the year 2000 and this figure will be 366 million by 2030.[3] The American Diabetes association (ADA) assumed` the national costs of diabetes will be $192 billion in 2020.[4,5]

DM is linked with carbohydrate, protein and fat metabolism and results in microvascular, macrovascular and neuropathic complications.[6]The differentiation between type 1 and type 2 DM was clearly made in 1936.[7] Symptoms of marked hyperglycemia include polyuria, polydipsia, weight loss, sometimes with polyphagia, and blurred vision. Impairment of growth and susceptibility to certain infections may also accompany chronic hyperglycemia. Acute, life-threatening consequences of uncontrolled diabetes are hyperglycemia with ketoacidosis or the nonketotic hyperosmolar syndrome. Diabetes can be classified into the following general categories: [8] 1) Type 1 diabetes (due to β-cell destruction, usually leading to absolute insulin deficiency), 2) Type 2 diabetes (due to a progressive loss of insulin secretion on the background of insulin resistance), 3) Gestational diabetes mellitus (GDM) (diabetes diagnosed in the second or third trimester of pregnancy that is not clearly overt diabetes) and 4) specific types of diabetes due to other causes, e.g., monogenic diabetes syndromes (such as neonatal diabetes and maturity-onset diabetes of the young [MODY]), diseases of the exocrine pancreas (such as cystic fibrosis), and drug- or chemical-induced diabetes (such as with glucocorticoid use, in the treatment of HIV/AIDS or after organ transplantation).

Diabetes mellitusis a heterogeneous diseasein which clinical presentation and disease progression may vary considerably. Discrimination between type 1 or type 2 diabetes is important, but at the time of diagnosis clear classification is not possible in most of the cases.There is no age limitation of DM. Type 2 diabetes occurs only in adult and type 1 diabetes occurs in children is no longer accurate. Patients with type 2 diabetes may present with diabetic ketoacidosis and Children with type 1 diabetes typical symptoms of DM.[9]

Potential loss of vision, nephropathy, peripheral neuropathy, and autonomic neuropathy causing gastrointestinal, genitourinary, and cardiovascular symptoms and sexual dysfunction are recognized complications of DM. Hypertension and atherosclerotic events are more common in people with DM.

Diabetic Retinopathy (DR) is a chronic disease of the retina caused by microangiopathy due to long term effects of DM, leads to progressive damage of retina causing blindness. Diabetic Retinopathy (DR) is the leading cause of vision loss in adults aged 20–74 years.[10] From 1990–2010, DR ranked as the fifth most common cause of preventable blindness and fifth most common cause of moderate to severe visual impairment.[11] With diabetes now recognized as a global epidemic, the incidence of retinopathy, a common microvascular complication of diabetes, is expected to rise to alarming levels. Diabetic retinopathy is classified into non- proliferative diabetic retinopathy (NPDR) and proliferative diabetic retinopathy (PDR), characterized by the growth of new blood vessels (retinal neovascularization). NPDR is further divided into mild, moderate, and severe stages that may or may not involve the development of a macula diabetic macular oedema (DME).[12] The major causes of severe visual impairment are PDR and DME. Nearly all patients with Type 1 diabetes and >60% of patients with Type 2 diabetes are expected to have some form of retinopathy by the first decade of incidence of diabetes .[13,14]

DR, and severe non-proliferative DR or proliferative DR (PDR) or the presence of diabetic macular edema (DME) are more common in uncontrolled DM patients.[15]

The Diabetes Control and Complications Trial (DCCT) and United Kingdom Prospective Diabetes Study (UKPDS) clinical trials confirmed the strong relationship between chronic hyperglycemia and the development and progression of diabetic retinopathy, but the underlying mechanism that leads to the development of microvascular damage as a result of hyperglycemia remains unclear .[16,17]

PDR is the most common vision-threatening lesion particularly among patients with type 1 diabetes. However, DME is responsible for most of the visual loss experienced by patients with diabetes as it remains the major cause of vision loss in the highly prevalent type 2 diabetes[18] and is invariably present in patients with type 2 diabetes with PDR.[19] In addition to vision loss, DR and DME have also been shown to contribute to the development of other diabetes-related complications including nephropathy, peripheral neuropathy and cardiovascular events .[20,21,22,23]

The most clinically important risk factors for progression to vision loss include duration of diabetes, hyperglycemia and hypertension. Control of serum glucose and blood pressure have been shown to be effective in preventing vision loss due to DR. Prevalence and risk factors of DR have been studied widely in previous studies including regional and ethnic differences, but epidemiological data on DME are relatively scarce. In, Bangladesh there are only few study regarding this. So, this study was carried out to see the pattern of diabetic retinopathy and to evaluate the risk factors in type 2 diabetes patients in Bangladesh.

MATERIAL AND METHODS

This cross-sectional observational study was conducted in the Department of Medicine, Shaheed Suhrawardy Medical College Hospital, Dhaka, Bangladesh during the period of September 2018 to March 2019. Patients with diabetes mellitus attended indoor or emergency department of medicine within the mentioned period were enrolled after fulfilling the selection criteria. Patients with dense, lental opacities and other media opacities which prevented posterior segment examination were excluded from the study.

DATA COLLECTION

The study protocol included a thorough history taking regarding age, onset, duration of manifestation of DM, associated medical problem and complaintsrelated anycomplications were noted in detail. A thorough clinical examination including general physical examination, investigations was conducted meticulously. Risk factorsincluding HTN, smoking, dyslipidemia, obesity and family history of premature coronary artery disease were noted. Baseline laboratory investigation e.g., CBC, serum creatinine, HbA1C, fasting blood sugar, fasting lipid profile, ECG, was done in each patient. Then pupilswere dilated and direct as well as indirect ophthalmoscopic examinations were done. Note was made of any abnormalities in media, appearance of disc and blood vessels and of the presence and hemorrhages and exudates. Whenever possible, the retinal abnormalities were photographed.

STASTICAL ANALYSIS

Data for socio- demographic and clinical variables were obtained from all participants by the use of a pre- designed and easily understandable questionnaire. After collection of all information, these data were checked, verified for consistency and edited for finalized result. After editing and coding, the coded data were directly entered into the computer by using SPSS (Statistical Package for Social Sciences). Quantitative data will be expressed as mean and standard deviation and qualitative; data will be expressed as frequency and percentage. Comparison will be done by Chi-Square (χ^2) test and unpaired t-test where necessary. A probability (p) value of < 0.05 was considered statistically significant.

ETHICAL CONSIDERATION

Prior to the commencement of this study, the research protocol was approved by the ethical committee in Shaheed Suhrawardy Medical College Hospital. The aims and objectives of the study along with its procedure, method, risks & benefits of this study explained to the respondents in easily understandable local language and then informed written consent was taken from each patient or relatives or parents in case of minor. They were assured that all the information and records would be kept confidential and the procedure will be helpful for both the physician and the patients in making rational approach of the case management.

RESULTS

Table I shows distribution of socio-demographic variables among the study subjects. A total 50 patients were enrolled, male was slightly predominant (56%) and in age group 54.0% were within 40-60 years old age group.

Table I: Distribution of socio-demographic variables among the study subjects (n = 50)

Socio-demographic Variables		Frequency	Percentage
Age Group	≤ 40 Years	3	6.0
	40 – 60 Years	27	54.0
	≥ 60 Years	20	40.0
Sex	Male	27	54.0
	Female	23	46.0
Occupation	Sedentary	42	84.0
	Non-sedentary	8	16.0
Total		50	100.0

Table II shows distribution of risk factors among the study subjects. Known hypertensive was 64.0% and 94.0% was taking antihypertensive, where 40% had history of abnormal lipid profile and 88.0% were continuing treatment for that.

Table II: Distribution of risk factors among the study subjects (n = 50)

Risk Factors		Frequency	Percentage
Smoking Habit	Smoker	10	20.0
	Ex-smoker	7	14.0
	Non-smoker	33	66.0
Family History of Diabetes	Present	28	56.0
	Absent	22	44.0
Total		50	100.0

Table III shows distribution of risk factors among the study subjects. Fundoscopic findings revealed that cotton-wool spots detected in (32.0%) patients, Flame-shaped hemorrhages was 16.0% patients; arteriovenous nipping was 18.0% patients and disc oedema(Papilloedema) in 26.0% patients, where 42% patients had normal fundoscopic findings.

Table III: Distribution of risk factors among the study subjects (n = 50)

Risk Factors		Frequency	Percentage
History of Hypertension	Present	32	64.0
	Absent	18	36.0
History of Dyslipidemia	Present	20	40.0
	Absent	30	60.0
Total		50	100.0

Table IV contains eye examination and fundoscopic findings. Out of 50 patients, who had fulfilled the inclusion criteria, 29(58.0%) patients had ocular fundus abnormalities. The rest 41(42%) patients showed no ocular fundus abnormalities.

Table IV: Eye examination and fundoscopic findings (n=50)

Fundoscopic findings	Frequency*	Percentage
Cotton-wool spots	16	32.0
Flame-shaped hemorrhages	8	16.0
Arteriovenous nipping	9	18.0
Optic disc swelling(Papilloedema)	13	26.0
Hard exudates	6	12.0
Macular oedema/maculopathy	19	38.0
Dot and blot hemorrhages	5	10.0
Normal fundus	21	42.0

*Multiple respondents

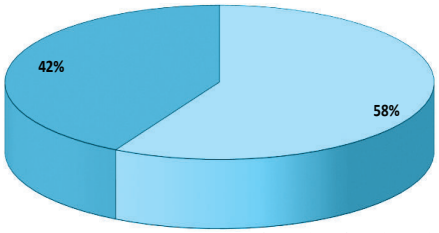

Figure I shows the Frequency of ocular fundus abnormality (n=50)

Table V shows spectrum of maculopathy amongst the patients with *retinopathy.* In this study 38.0% of total patient had maculopathy which complicate 65.5% of patients with retinopathy.

Table V: Spectrum of maculopathy amongst the patients with *retinopathy* (n = 29)

Maculopathy	Frequency	Percentage (%)
Absent	10	34.5
Present	19	65.5
Total	29	100.0

Table VI shows frequency of retinopathy among the study subjects**.** Retinopathy was present in 70.0% of the patients with a history of smoking. Ex-smokers had an increased incidence (57.1%).

Table VI: Frequency of retinopathy among the study subjects (n = 50)

Sex	Retinopathy		Total (n = 100%) n (%)
	Present (n = 29) n(%)	Absent (n = 21) n(%)	
Male	16 (59.26)	11 (41.74)	27 (54.0)
Female	13 (56.52)	10 (43.47)	23 (46.0)

Table VII shows duration of diabetes was found highly significant (p value <0.001) in the development of retinopathy but not in its progression and severity. Median duration with retinopathy was 10 (SD ±6.62).

Table VII: Evaluation of smoking habit as a risk factor of retinopathy among the study subjects.

Smoking Habit	Retinopathy		Total (n = 100%) n (%)
	Present (n = 29) n (%)	Absent (n = 21) n (%)	
Smoker	7 (70.0)	3 (30.0)	10 (20.0)
Ex-smoker	4 (57.1)	3 (42.8)	7 (14.0)
Non-smoker	18 (54.5)	15 (45.4)	33 (66.0)

Table VIII shows distribution of *duration of diabetes* according to presence and severity of retinopathy among the study subjects**.** Duration of DM was found to have non-significant role in the development of maculopathy (p>0.05).

Table VIII: Distribution of *duration of diabetes* according to presence and severity of retinopathy among the study subjects

Duration of DM(Years)	Retinopathy	N	MEAN	± SD	MEDIAN	RANGE	SIGN. *
	Present	29	10.91	6.620	10.00	30-1	P = 0.001^S
	Absent	21	6.89	5.346	5.50	25-1	
	Total	50	9.72	6.408	8.00	30-1	

* Independent samples t – test. S = Significant (P < 0.05)

Table IX shows association of glycemic status (*HbA1c*) with retinopathy among the study subjects .Median HbA1c was 8.90 (±2.17) in patients with retinopathy but 7.20 (±1.63) who did not have retinal change which is highly significant (P < 0.001).

Table IX: Association of glycemic status (*HbA1c*) with retinopathy among the study subjects

HbA1c (%)	Retinopathy	N	MEAN	± SD	MEDIAN	RANGE	SIGN. *
	Present	29	9.481	2.173	8.90	14.2-5.8	P = <0.001S
	Absent	21	7.750	1.633	7.20	12.3-5.6	
	Total	50	8.743	2.132	8.25	14.2-5.6	

* Independent samples t – test. S = Significant (P < 0.05)

Table X shows association of comorbidity of HTN with retinopathy among the study subjects

Table X :Association of comorbidity of HTN with retinopathy among the study subjects

HTN (n=32)	Retinopathy	N	MEAN	± SD	MEDIAN	RANGE	SIGN.*
	Present	25	9.652	2.25	8.90	14.2-5.8	P = <0.001S
	Absent	7	7.281	1.85	7.20	12.3-5.6	
	Total	32	8.743	2.132	8.25	14.2-5.6	

* Independent samples t – test. S = Significant (P < 0.05)

DISCUSSION

This hospital based cross-sectional study was done during a period of six months. Known diabetic patients confirmed by ADA criteria were enrolled in this study. A total of 50 patients after fulfilling the inclusion and exclusion criteria were included in the study. Out of 50, 27 (54%) were male. Age varied from 38-90 yrs., with majority (68%) from middle aged group (40-60 yrs). This was significant because the active population group suffering from diabetes most with risk of complications like retinopathy, nephropathy etc.

Most of the patients enjoyed sedentary life style. Out of 50, 42 (84.0%) fall in this category. Weight of the patients ranged from 38-93 kgs with Median 62 kg.

All patients enrolled in this study were known diabetic and on treatment. The duration of diabetes ranged from 1 yr. to 30 yrs. (median 8 yrs.). HbA1c was done in all patients to know the glycemic control. Median HbA1c 8.250 (14.2-5.6) which indicates poor control of diabetes in many patients.

In this study, retinopathy of any form was present in 29 patients (58.0%) and diabetic maculopathy detected in 19 patients which much more correlates with results of other study. A pooled individual participant meta-analysis involving 35 studies conducted worldwide from 1980 to 2008, estimated global prevalence of any DR and PDR among patients with diabetes to be 35.4 and 7.5 % respectively.[24] Diabetic retinopathy (DR) is a leading cause

of vision-loss globally. Of an estimated 285 million people with diabetes mellitus worldwide, approximately one third have signs of DR and of these, a further one third of DR is vision-threatening DR, including diabetic macular edema (DME).[24] A recent cross-sectional study at rural level found the prevalence was 21.6%[92]. Previous individual studies in other countries have shown considerable variability in DR prevalence estimates among individuals with both diagnosed and undiagnosed diabetes, with rates ranging from 17.6% in a study in India [25] to 19.9% in China[26] to 33.2% in a large U.S. study.[27] Differences in study methodologies, population characteristics, and ascertainment and classification of DR have made direct comparisons between studies difficult.

In this study 38.0% of total patient had maculopathy which complicate 65.5% of patients with retinopathy. Slight male predominance in the development of DR was observed (59.26% vs 55.07%) in this study. Male gender was observed to be associated a little more with the presence of any DR.[28] as this study. Similar observations were made by Pradeepa et al., in an urban Indian population and in the Los Angeles Latino Eye Study. [29,30] The reason for this may be gene or life style.

Smokers and ex-smokers, although small in number, showed increased prevalence of DR. 70.0% of smokers and 57.1% of x-smokers had DR in comparison to 54.5% of non-smoker who develop DR. This is supported by studies conducted by Cho NC et al,[31] where incidence of DM was increased in smokers. Same result were observed in Jee SH *et al*, Uchimoto S *et al* and Wannamethee SG *et al* [32,33.34] .

Duration of DM was seen to be important in the development of retinopathy. in this study, median duration was found 10 yrs in patients with DR and 5.5 yrs who did not develop (p<0.001). Many studies investigated and concluded that the duration of diabetes is a strong risk factor for development of DR supporting this study findings.[35,36,37] The Wisconsin Epidemiologic Study of Diabetic Retinopathy (WESDR) had revealed the prevalence of any retinopathy was 8% at duration of 3 years diabetes, 25% at duration of 5 years diabetes, 60% at duration of 10 years diabetes, and 80% at duration of 15 years diabetes. The prevalence of PDR was 0% at duration of 3 years diabetes and increased to 25% at duration of 15 years diabetes. In the study conducted by Dandona et al in type 2 diabetes, it is reported that 87.5 per cent of those with >15 yr duration of diabetes had DR compared with 18.9 per cent of those who had <15 yr duration.[38] So annual retinal examination and early detection of DR could considerably reduce the risk of visual loss in diabetic individuals.

In many studies, severity of DR increased with the duration of diabetes and most of the moderate to severe NPDR cases were identified at 15 years after diagnosis.[39,40,41] Most of the diabetic retinopathy was of the mild or moderate NPDR and PDR type in India [38] as well as European population in ten years after diagnosis [41]. The prevalence of more severe grades of retinopathy was higher in Pima Indians with longer durations of diabetes [42]. Severe retinopathy (NPDR/PDR) however was more frequent in type 2 than type 1 diabetic patient has shown in European study [41]. In the Wisconsin Epidemiologic Study of Diabetic Retinopathy (WESDR), the rate of PDR varied from 2% in patients who had DM for less than 5 years to 15.5% in diabetics who had DM for 15 or more years. All the above study findings were not consistent with this study. Though duration of DM was found highly significant for development of retinopathy, severity of DR was not found influencive by the duration of DM in this study (p>0.05).

There was strong evidence to suggest that the development and progression of DR was influenced by the level of hyperglycemia [43,44] It was observed in another study that glycosylated hemoglobin levels was a significant risk factor for the long-term progression of diabetic retinopathy.[45] This study showed here a similar result where HbA1c , the marker for glycemic control , had direct influence in the development of DR (Median 8.9 vs 7.2 for DR and NDR) and also in its severity (12.0 vs 8.3 for PDR and mild NPDR) with high significance (p value <0.001). European population with retinopathy had worse glycemic control than patients without retinopathy in ten years after diagnosis .[41] Development of Maculopathy also influenced by value of HbA1c in this study. Patients with maculopathy (DME) showed median HbA1c of 9.2 vs 8.3 who did not have maculopathy. (p<0.01)

CONCLUSIONS

Diabetic retinopathy is more common in uncontrolled diabetic patients and those with long duration of disease. Regular screening and eye examinations of diabetic patients may reduce the burden of visual impairment and blindness.

Limitation

This study did not cover all the aspects of diabetic retinopathy , carried out in a single center and in a short period of time which does not reflect the whole country

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