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Original Research Article

A Hospital-Based Assessment of the Prevalence and Factors Associated with Diabetic Retinopathy among Type 2 Diabetic Patients

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Abstract:

Aim: We conducted a study among outpatients of a tertiary diabetes care centre and screened for DR, non-adherence to drug therapy and other clinical characteristics.

Methods: A cross-sectional, observational study was conducted at Darbhanga Medical College and Hospital, Darbhanga, Bihar, India and however, due to time constraints, we managed 500 patients. Study participants were selected using a systematic random sampling technique based on daily attendance in the hospital.

Results: A total of 500 participants with a complete retina evaluation were included in this study. Among them, 275 were female (55%) and 225 were male (45%). The mean age of the participants was 52.4±11.2 years. The mean duration of diabetes was 9.7±7.0 years. More than half of the study subjects were housewives (51%). 18% of the participants came from the high-income class and 30% had a lower middle income. 18% of the study subjects were obese, 48% were overweight and 2% were underweight. Based on FPG, 280 (70%) of the participants had uncontrolled diabetes.

Conclusion: Undiagnosed diabetic retinopathy is still common among patients even at tertiary care centers. It is associated with longer disease duration, poor metabolic control and self-reported non-adherence to therapy. Regular screening for diabetic retinopathy should be implemented in resource-limited settings and further efforts should be made to improve the patients' drug adherence and metabolic control.

Keywords: Diabetes, Diabetic Retinopathy, Drug Adherence, Fundus Photography.

Introduction

Diabetes mellitus (DM) is a metabolic disorder of carbohydrate, fat and protein and it affects the body's ability to process and use glucose for energy. [1] Main causes for DM are defects in insulin secretion, insulin action, or both. About 5±10% and 90±95% of patients with diabetes have type1 and type2 respectively.[1,2] People

with diabetes are increasing due to population growth, aging, urbanization and sedentary life style. [3] Since last decade, DM has emerged as an important clinical and public health problem throughout the world and its prevalence reached an epidemic proportion. [4,5]

Globally the prevalence of diabetes mellitus in 2014 was 8.5% among the adult population. [6] The prevalence of diabetes has been steadily increasing for the past three decades and is growing most rapidly in low and middle-income countries. [7] The prevalence of DR differs between patient populations in different countries and settings. It ranges from 14% to 40%.. [8] Globally, the prevalence of diabetic retinopathy among diabetic patients is estimated to be 27.0%, which leads to 0.4 million blindness in the world. [9]

The prevalence of diabetes mellitus has been steadily increasing for the past three decades and its economic, social and healthcare impacts will be seen mainly in low and middle-income countries. [10] The major risk factors for DR are chronic hyperglycemia and hypertension and one possible reason for both of these factors is non-adherence to the prescribed drug therapy, which, in turn, may e.g. be due to insufficient patient education or financial reasons. [11] The World Health Organization (WHO) has estimated that every individual who had diabetes for over 20 years will have some form of DR and that DR is responsible for 4.8% of the 37 million cases of blindness throughout the world. [12] With this, DR is the most frequent cause of acquired blindness among adults aged 20–74 years. [13] However, appropriate treatment can reduce the risk of blindness and also moderate vision loss because of DR by at least 90%. [12] Among South Asians, secondary complications of diabetes start early and progress rapidly. [14,15] It t is therefore expected that diabetic secondary complications, like DR, will increase along with the rising trend of diabetes mellitus. The major risk factors for DR are chronic hyperglycemia and hypertension and one possible reason for both of these factors is non-adherence to the prescribed drug therapy, which, in turn, may e.g. be due to insufficient patient education or financial reasons. [16-18] Although very few studies conducted on the prevalence of DR. But there is no previous study conducted to find the determinants of DR with non-adherence to drug therapy.

We, therefore, conducted a study among outpatients of a tertiary diabetes care centre and screened for DR, non-adherence to drug therapy and other clinical characteristics.

Materials and Methods

A cross-sectional, observational study was conducted at Darbhanga Medical College and Hospital, Darbhanga, Bihar, India and however, due to time constraints, we managed 500 patients. Study participants were selected using a systematic random sampling technique based on daily attendance in the hospital.

Data collection

Adults with type 2 diabetes for at least one year, on antidiabetic medication and free from acute concomitant diseases, such as heart attack or stroke, who attended the clinic for a routine visit were included.

Socio-demographic and clinical characteristics were collected using a pretested, semi-structured and interviewer-administered questionnaire. The patient's self-reported adherence to drug therapy was collected by a face-to-face interview technique. Blood pressure, height, weight, waist to hip ratio, fasting plasma glucose (FPG) and 2 hours after postprandial glucose (2hPPG) were recorded for every participant. Retinal fundus photography was obtained from all participants.

Assessment of DR

The detection of DR by retinal photography has been validated previously.18 Digital colour images were captured from each eye

(Figure 1) and the severity of DR was categorized according to the international clinical DR severity scales recommended by the Global Diabetic Retinopathy Project Group. [19] The photographs were evaluated by a senior ophthalmologist and graded as no retinopathy (NDR), mild non-proliferative diabetic retinopathy (NPDR), moderate NPDR, severe NPDR and PDR. HbA1c, Lipid status, and Serum Creatinine were recorded as available

Assessment of non-adherence to drugs, diet and physical activities

Non-adherence to the prescribed drug therapy was self-reported via a questionnaire. [20] Each medicine was checked separately according to the prescription by the attending physician. Non-adherence was recorded if the study participant indicated the following statements regularly (1) changes the prescribed amount and dose of medicine, (2) doesn't observe the time the medicine should be taken, (3) takes more than the prescribed dose and (4) takes less than the prescribed dose. In our study, a participant was classified exercise-adherent if she or he reported exercising for at least 30 minutes per day and at least 5 days a week, corresponding to 150 minutes per week. [21]

Regarding dietary adherence, the patient was considered non-adherent if they did not follow the recommended diet chart (total kcal/day ±10%) provided by a nutritionist or dietitian. Moreover, not following specific meal times and recommended quality and quantity of food was also considered dietary non-adherence. [20] Food consumption and daily calory intake were assessed using the 72-hour dietary recall method. [22,23]

Data management and statistical analysis

A standard data entry interface was designed using Microsoft Office Access for entering study data. Data were checked and cleaned before analysis. IBM SPSS version 24.0 was used in the analysis. Metric variables are represented as mean±standard deviation and categorical variables as numbers and percentages. Univariate and multivariate logistic regression models were used to identify factors associated with the presence of DR. P values were calculated for each of the test statistics and estimates using appropriate methods and a p value equal to or greater than 0.05 was used as the standard to declare an estimate or test statistic to be non-significant.

Ethical consideration

Informed written consent was obtained from all participants after a full explanation of the nature, purpose, and procedures of the study. Ethical approval was obtained from the Ethics and Research Review Committee.

Results

Table 1: Baseline characteristic of study subjects

Characteristics	N%
Gender	
Male	225 (45)
Female	275 (55)
Age (years)	
≤40	100 (20)
41-55	210 (42)
>56	190 (38)
Mean±SD	52.4±11.2
Education	
Illiterate	100 (20)
Secondary and below	225 (45)

Higher secondary and above	175 (35)
Occupation	
Unemployed/retired	85 (17)
Service	90 (18)
Business	70 (14)
Housewife	255 (51)
Family income	
Low-middle income (<Tk.21271)	150 (30)
Upper-middle income (Tk. 21271- Tk.65761)	260 (52)
High Income (>Tk.65761)	90 (18)
Mean±SD	19970.6±11.2
BMI	
Underweight (<18.5 kg/m2)	10 (2)
Normal (18.5-24.99 kg/m2)	160 (32)
Overweight (24.99-29.99 kg/m2)	240 (48)
Obese (≥30.0 kg/m2)	90 (18)
Family history of diabetes	
Yes	325 (65)
No	175 (35)
FPG	
Uncontrolled (>7.2)	350 (70)
Control (≤7.2)	150 (30)
Mean±SD	9.3±3.5
2h-PPG	
Uncontrolled (>10)	360 (72)
Control (≤10)	140 (28)
Mean±SD	12.8±4.5
SBP	
Uncontrolled (>140 mm of hg)	125 (25)
Control (≤140 mm of hg)	375 (75)
Mean±SD	128±15.5
DBP	
Uncontrolled (>90 mm of hg)	100 (20)
Control (≤90 mm of hg)	400 (80)
Mean±SD	79.9±8.5
Duration of diabetes	
Less than 10 years	290 (58)
10 years or more	210 (42)
Mean±SD	9.7±7.0
Drug adherence	
Adherence	260 (52)
Non-Adherence	240 (48)
Fundus photography	
NDR	410 (82)
DR	90 (18)

A total of 500 participants with a complete retina evaluation were included in this study. Among them, 275 were female (55%) and 225 were male (45%). The mean

age of the participants was 52.4±11.2 years. The mean duration of diabetes was 9.7±7.0 years. More than half of the study subjects were housewives (51%). 18% of the participants came from the high-income class and 30% had a lower middle income. 18% of the study subjects were obese, 48% were overweight and 2% were underweight. Based on FPG, 280 (70%) of the participants had uncontrolled diabetes.

Table 2: Association between socio-demographic, anthropometric and clinical variables with the presence (DR) vs. absence (NDR) of diabetic retinopathy

Characteristics	DR N=90	NDR N = 410	P value
Gender			
Male	44	160	0.180
Female	46	250	
Age (years)			
≤40	8	75	
41-55	34	180	0.002
>56	48	155	
Education			
Illiterate	10	70	
Secondary and below	45	185	0.430
Higher secondary and above	35	155	
Occupation			
Unemployed/retired	20	65	
Service	15	75	0.340
Business	15	50	
Housewife	40	220	
Family income			
Low-middle income (<Tk.21271)	35	120	0.125
Upper-middle income (Tk. 21271- Tk.65761)	40	220	
High Income (>Tk.65761)	15	70	
BMI			
Underweight (<18.5 kg/m2)	2	10	
Normal (18.5-24.99 kg/m2)	36	120	0.117
Overweight (24.99-29.99 kg/m2)	37	190	
Obese (≥30.0 kg/m2)	15	90	
Family history of diabetes			
Yes	40	210	
No	50	200	0.511
FPG			
Uncontrolled (>7.2)	76	270	<0.001
Control (≤7.2)	14	140	
2h-PPG			
Uncontrolled (>10)	80	280	<0.001
Control (≤10)	10	130	
SBP			
Uncontrolled (>140 mm of hg)	30	95	0.036
Control (≤140 mm of hg)	60	315	
DBP			
Uncontrolled (>90 mm of hg)	17	85	0.871
Control (≤90 mm of hg)	73	325	

Duration of diabetes			
Less than 10 years	25	300	<0.001
10 years or more	65	110	
Drug adherence			
Adherence	32	230	0.002
Non-Adherence	58	180	

In univariate logistic regression analyses, higher age, FPG, PPG, HbA1c and duration of diabetes, as well as the presence of chronic kidney disease, uncontrolled blood pressure and non-adherence to drug therapy were associated with diabetic retinopathy.

Discussion

Diabetes mellitus is a chronic disease of elevated blood glucose levels due to either suboptimal production of insulin by the pancreas or peripheral resistance of the body to insulin. [24]

The prevalence of diabetes has been steadily increasing for the past three decades and is growing most rapidly in low and middle-income countries. [25] Globally, the prevalence of diabetic retinopathy among diabetic patients is estimated to be 27.0%, which leads to 0.4 million blindness in the world. [26] The International Diabetic Federation estimated that the global prevalence of diabetic retinopathy in 2019 was more than 25%. [27] The retinal tissue swells as a consequence, causing foggy or impaired vision. In our study, the prevalence of DR was 3% with a known duration of diabetes of 3 years and rose to 40% with 15 years or more. This result is similar to previously published studies in populations of other ethnic groups. [28,29] Patients with diabetes should be regularly assessed by an ophthalmologist. Globally, visual impairment has decreased, but the number of people who are blind as a result of diabetic retinopathy grew from 0.2 million to 0.4 million. [30] An early diagnosis with proper treatment may control eyesight.

In addition to the duration of diabetes, uncontrolled FPG was independently associated with DR in our study. A similar result was seen by Ahmed et al in a study conducted at the outpatient department of Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine and Metabolic Disorder (BIRDEM) and also in another study in Bangladesh. [31,33] It is widely known that persistent hyperglycemia is linked to the initiation and progression of microvascular complications. Our finding is consistent with that of many other previous studies that showed fasting glucose variability as a significant risk factor for the onset of DR in type 2 diabetes. [32]

In our study, we found that DR was independently associated with drug non-adherence. This finding contrasts with a previous study from Pakistan, which found no relationship between non-adherence to drug therapy with DR. [34]

The internet, smartphones, and wearable gadgets have vastly aided diabetes treatment because of advances in digital technology. Smartphone apps and wearable devices help people take better care of themselves by allowing them to track their health behaviours in real-time, such as diet, exercise, weight loss, sleep patterns, and health indicators like blood sugar and blood pressure; and by improving medication adherence with features like automated schedules, alerts, and reminders. [35]

Conclusion

Our study provides further evidence that undiagnosed DR among individuals with diabetes in outpatient tertiary care hospitals. Regular screening for DR should therefore be included in standard patient care, in particular with a longer duration of diabetes. Furthermore, adequate patient education and universal access to sufficient

doses of medication should be supported to reduce the risk of non-adherence to drug therapy.

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