Original Research Article

A Hospital Based Prospective Study to Correlate of Microvascular Complications with Different (Fpg, 2hpg & HbA1c) Glycemic Indices Among Type 2 Diabetes Mellitus Patients

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Abstract

Background: Microvascular complications in type 2 diabetes have significant impact on morbidity, mortality and patients' quality of life. There are few clinical studies in this direction but most of them lack sufficient power and are focused only towards one specific complication. The aim of this study to determine the association of microvascular complications with duration of diabetes and glycemic indices (Fpg, 2hpg & HbA1c) among type 2 diabetes mellitus patients.**Materials & Methods:** This is a hospital based prospective study done on 100 cases of type 2 diabetes mellitus in upgraded department of medicine, Government Medical College & attached group of Hospitals, Barmer, Rajasthan. Each subject underwent detailed history and complete clinical examination. Diabetes was diagnosed according to American Diabetes Association (ADA) revised criteria. The selected patients were evaluated for presence of micro complications i.e. diabetic retinopathy, diabetic nephropathy and diabetic neuropathy by relevant investigations.**Results:** Our study showed that The fasting blood glucose level, 2 hr. postprandial glucose level & HbA1c was not significant correlate but >10 years duration of diabetes was higher mean value as compared to less than 5 year duration of diabetes. The spearmen correlation analysis showing association of various risk factors with diabetic neuropathy, diabetic retinopathy & diabetic nephropathy. The fasting blood glucose level, 2 hr. postprandial glucose level & HbA1c was significant correlate ($P<0.0001$, $p<0.0001$ & $p<0.0001$ respectively).**Conclusion:** We concluded that on applying spearman correlation for microvascular complications, a positive association was observed for age of patients, duration of diabetes, fasting blood sugar, 2 hr. postprandial glucose and HbA1C.

Keywords: Type 2 Diabetes Mellitus, Fasting Blood Sugar, 2 Hr. Postprandial Glucose, HbA1C, Microvascular Complications.

Introduction

Diabetes Mellitus (DM) is a metabolic disorder characterized by the presence of chronic hyperglycemia accompanied by greater or lesser impairment in the metabolism of carbohydrates, lipids and proteins. DM is probably one of the oldest diseases known to man. It was first reported in Egyptian manuscript about 3000-year ago[1]. In 1936, the distinction between type 1 and type 2 DM was clearly made. Type 2 DM was first described as a component of metabolic syndrome in 1988[2].

Type 2 DM results from interaction between genetic, environmental, and behavioral risk factors[3,4].

In present scenario the 50% of people with diabetes were undiagnosed.Since therapeutic intervention can reduce complications of the disease, there is a need to detect diabetes early in its course. The risk of developing Type 2 diabetes increases with age, obesity, and lack of physical activity. Its incidence is increasing rapidly, and by 2030 this number is estimated to reach almost around 552 million[5].Diabetes mellitus occurs throughout the world but is more common (especially type 2) in the more developed countries, where the majority of patients are aged between 45 and 64 years. According to The International Diabetes Federation (IDF) estimation, India will have increase in number of people living with diabetes up to 87.0 million by 2030 from 50.8 million (2010), making it the 'Diabetes Capital' of the world[6-8].

Most of the burden of T2DM is related to its micro and macro vascular complications.Microvascular complications have significant impact on morbidity, mortality and patients' quality of life. Diabetic retinopathy (DR) is one of the leading causes of blindness in the Western world. Diabetic nephropathy can lead to end-stage renal disease, which requires dialysis and/or renal transplantation and increases risk of vascular disease. Diabetic neuropathy (DN) results in the development of foot ulcers that can result in amputations, sexual dysfunction, and many other unpleasant symptoms in addition to increased mortality. The presence of microvascularcomplications has been shown to have a negative impact on patient's quality of life[9,10]. As aresult, it is not surprising that there is great interest in improving understanding of the microvascular complications in patients with diabetes in order to develop effective strategies to treat, and ideally prevent, the development of such complications.The development of chronic complications is related to the duration of Diabetes Mellitus, however it may not reflect the true duration of disease, rather it reflects the time since diagnosis[11].Longer the duration of diabetes, higher the frequency of diabetic nephropathy. Studies from different centres agreed that microalbuminuria is a strong predictor of subsequent development of overt diabetic nephropathy[12]. Diabetic nephropathy is a clinical hall mark of microangiopathy[13].The most Common form of diabetic neuropathy is distal symmetric polyneuropathy involving sensory, motor and autonomic nerve fibres[14,15].Diabetic retinopathy is leading cause of blindness in developing country[16].It can be broadly categorized in to Non Proliferative and Proliferative Diabetic Retinopathy[17].

There are few clinical studies in this direction but most of them lack sufficient power and are focused only towards one specific complication. The aim of this study to determine the association of microvascular complications with duration of diabetes and glycemic

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indices (Fpg, 2hpg & HbA1c) among type 2 diabetes mellitus patients.

Material & Methods

This is a hospital based prospective study done on 100 cases of type 2 diabetes mellitus in upgraded department of medicine, Government Medical College & attached group of Hospitals, Barmer, Rajasthan.

Inclusion Criteria

- All diagnosed cases of T2DM defined by ADA as FPG ≥126 mg/dl and 2HPG≥200 mg/dl.
- Patients who taking specific medication forT2DM.

Exclusion Criteria

- Patients with malignancy, liver disease, HBV, HCV and HIV
- Patient who had nephropathy before being diagnosed with Diabetes.
- Patients having neuropathy due to other systemic causes (vitamin deficiency, drug exposure, connective tissue disorders, thyroid disorder etc.) or local causes.

Methods

Each subject underwent detailed history and complete clinical examination.Diabetes was diagnosed according to American Diabetes Association (ADA) revised criteria. Blood glucose level estimation was done by glucose oxidase method in venous blood. Glycosylated haemoglobin (HbA1C) was measured by ion-exchange chromatography method.

The selected patients were evaluated for presence of micro complications i.e. diabetic retinopathy, diabetic nephropathy, and diabetic neuropathy by relevant investigations. Retinopathy was diagnosed by detailed fundus examination and was classified according to diabetes retinopathy study (DRS) and early treatment diabetic retinopathy study (ETDRS).Urine for microalbuminuria (30-300 mg/ 24 hrs) was tested by micral test for incipient nephropathy. Overt nephropathy was confirmed by estimation of level ofblood urea, serum creatinine and macroalbuminuria.Neuropathy was diagnosed by history of numbness, paraesthesia, tingling sensation and confirmed by touch sensation with 10 gm monofilament, vibration sense by biothesiometer and ankle reflex.

Statistical Analysis

Significance of difference in means were inferred by unpaired 't'-test. Association between microvascular complications and factors (duration and glycemic indices) were inferred by Chi-square test. Logistic regression was done to predict microvascular complications on the basis of various independent predictors.

Results

Our study showed that The fasting blood glucose level, 2 hr. postprandial glucose level & HbA1c was not significant correlate but >10 years duration of diabetes was higher mean value as compared to less than 5 year duration of diabetes (table 1).

The spearmen correlation analysis showing association of various risk factors with diabetic neuropathy, diabetic retinopathy & diabetic nephropathy. The fasting blood glucose level, 2 hr. postprandial glucose level & HbA1c was significant correlate (P<0.0001, p<0.0001 & p<0.0001 respectively) (table 2, 3 & 4).

Table 1: Mean value of various risk factors according to duration of diabetes

Risk factors	<5 Years	5-10 Years	>10 Years	rs	95%CI	P-value
FPG (gm/dl)	162.5±54.83	164.2±58.90	183.8±50.78	0.1623	-0.0756-0.378	>0.05
2 hr. PG (gm/dl)	241.7±81.72	242.8±77.95	272.5±69.23	0.0723	-0.189-0.282	>0.05
HbA1c	8.483±2.478	8.539±2.323	9.783±2.208	-0.0876	-0.294-0.158	>0.05

Table 2: Results of spearmen correlation analysis showing association of various risk factors with Diabetic neuropathy

Risk factors	rs	95%CI	P-value
FPG (gm/dl)	0.5467	0.2820-0.1876	<0.0001
2 hr. PG (gm/dl)	0.432	0.2591-0.2174	<0.0001
HbA1c	0.1723	0.2482-0.2569	<0.0001

Table 3: Results of spearmen correlation analysis showing association of various risk factors with Diabetic retinopathy

Risk factors	rs	95%CI	P-value
FPG (gm/dl)	0.7842	0.6982-0.8567	<0.0001
2 hr. PG (gm/dl)	0.7956	0.7153-0.8649	<0.0001
HbA1c	0.8319	0.7640-0.8918	<0.0001

Table 4: Results of spearmen correlation analysis showing association of various risk factors with Diabetic nephropathy (Microalbuminuria)

Risk factors	rs	95%CI	P-value
FPG (gm/dl)	0.7721	0.6892-0.8356	<0.0001
2 hr. PG (gm/dl)	0.7678	0.7122-0.8360	<0.0001
HbA1c	0.8242	0.7589-0.8789	<0.0001

Discussion

Diabetes mellitus is the commonest metabolic disorder and has a high prevalence in India. The progress of the diabetic patients largely depends on the complications seen in the natural course of illness. Chronic complications of diabetes mellitus have a significant role in increasing morbidity, mortality, disability, and health cost. People with diabetes are at increased risk of cardiovascular, peripheral vascular and cerebrovascular disease.Our study showed that the 5-10 years of duration of diabetes was present in 42% cases and less than 5 years duration of diabetes was present in 39%. Only 19% cases had more than 10 years of diabetes.Tri J.E. Tarigan et al (2015)[18]found maximum patients (46%) were seen more than 70 years of age group. Most of the subjects who came to the clinic had experienced type 2 diabetes for more than five years and only 5% of them had been diagnosed type 2 diabetes since less than a year ago.The proportion of neuropathy significantly increases, when duration of diabetes increased in our results. Song, reported neuropathy became significantly higher in T2DM after 20 years duration[19]. Distal symmetrical polyneuropathy shows a constant rise with duration reported by Orchard and Dorman et al[20].The spearmen correlation analysis showing association of various risk factors with diabetic neuropathy, diabetic retinopathy & diabetic nephropathy. The fasting blood glucose level, 2 hr. postprandial glucose level & HbA1c was significant correlate (P<0.0001, p<0.0001 & p<0.0001 respectively) in our study. Which supported our result with RP Agrawal et al (2014)[21]found that on applying multiple regression analysis for

diabetic neuropathy retinopathy, a positive association revealed for duration of diabetes, blood pressure, fasting blood sugar, serum cholesterol, serum LDL and serum VLDL.Rema and Ponnaiya et al [22], studied duration of diabetes, glycosylated haemoglobin, type of treatment, systolic and diastolic blood pressures and serum creatinine, showed a positive association with retinopathy but body mass index (BMI) showed an inverse association.The proportion of nephropathy significantly increases, when duration of diabetes increased in our results. Significant associations of duration of diabetes with nephropathy were also observed by Mohan et al (2000) [23] and Verghese et al (2001)[24].Earlier, Rema et al[22] and Ramachandran et al[25] had also observed the positive association of hypertension with diabetic nephropathy. Poor glycaemic control indicated by raised glycosylated haemoglobin was significantly associated with increased incidences of diabetic nephropathy. Gupta et al (1991) from New Delhi found that glycosylated haemoglobin was significantly higher in microalbuminuric NIDDM patients[26].

Conclusion

We concluded that on applying spearman correlation for microvascular complications, a positive association was observed for age of patients, duration of diabetes, fasting blood sugar, 2 hr. postprandial glucose and HbA1C. Duration of diabetes was found to be a main culprit of micro vascular complication.

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