

Co-relation of Glycosylated Hemoglobin (HbA1c) levels and Duration of Diabetes with Peripheral Artery Disease

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Abstract:

Introduction: Peripheral artery disease is a major macrovascular complication of diabetes mellitus. The present study was carried out to find out the levels of glycosylated haemoglobin and duration of diabetes in diabetics with PAD and study its comparison to diabetics without PAD.

Materials and Method: This prospective observational study was carried out from June 2015 to May 2017 and 100 diabetics were enrolled who underwent Ankle Brachial Pressure Index measurement for diagnosis of PAD. The HbA1c levels and duration of Diabetes were compared between diabetics with PAD and Diabetics without PAD.

Result: We observed a direct relationship between the HbA1c levels and PAD. The mean HbA1c in diabetics with PAD was 8.25 ± 0.65 compared to 7.32 ± 0.47 in diabetics without PAD. The known duration of diabetes was 7.98 ± 1.7 years in diabetics with PAD compared to 6.07 ± 2.1 years in diabetics without PAD.

Keywords: Diabetes, HbA1c, PVD, ankle Brachial Pressure index (ABI)

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I. Introduction

Peripheral artery disease (PAD) is defined as atherosclerotic occlusive disease of lower extremities. PAD is associated with increased risk of lower extremity amputation and is also a marker for atherothrombosis in cardiovascular, cerebrovascular and renovascular beds. Patients with PAD therefore have an increased risk of MI, stroke and death.¹ Additionally, PAD causes significant long-term disability in diabetic patients. PAD can be clinically identified by intermittent claudication and/or absence of peripheral pulsations in the lower extremities. With the use of doppler technology and ankle brachial pressure index measurement, peripheral artery disease can be identified non invasively before clinical manifestations.

Peripheral vascular disease is a major macrovascular complication of diabetes mellitus.² Because of the unique involvement of distal pattern of vessels and invariable association with neuropathy, peripheral arterial disease in diabetics presents late, having already developed limb threatening ischaemia.³ In the present study, 100 patients with diabetes mellitus were enrolled and the levels of glycosylated haemoglobin and duration of diabetes were compared in diabetics with PAD and diabetics without PAD.

II. Materials and Method

This prospective observational study was carried out at the Department of Medicine at Subharti Medical College, Swami Vivekanand Subharti University, Meerut, India. Patients of all age group presenting with Diabetes Mellitus in the department of medicine and admitted to the hospital were studied. The sample size was estimated on the basis of a single proportion design. There were 100 patients, who were diagnosed and admitted in the department of medicine in the hospital with diabetes mellitus. The research procedure followed was in accordance with the approved ethical standards of Subharti Medical College, Swami Vivekanand Subharti University, Meerut ethics Committee.

All patients diagnosed with Diabetes Mellitus by ADA 2014 criteria⁴ were included in the study. A written consent was taken from all potentially eligible subjects and excluded from the study if they were not matched with inclusion criteria of the study. Detailed history and physical examination was performed and recorded on predesigned proforma from each patient. Patient's personal history, physical examination findings like the blood pressure (BP), age, height (cms), weight (kg), BMI (kg/m^2), presence and quality of the lower limb

pulses on palpation, presence of ulcers/gangrene on inspection, calculated ABI, patients clinical history (age at initial diagnosis of DM, duration of DM, family history of diabetics, current medical therapy, history of hypertension (HT) and history of symptoms of intermittent claudication), associated symptoms, , Occupation, smoking history, duration of hypertension, alcoholic habit, blood sugar level, developmental history and laboratory measurement (HbA1c) were recorded.

A detailed physical examination of the peripheral lower limb was also performed (palpation for quality of foot pulses and clinical inspection for any skin colour, hair and nail changes, temperature variations). A resting ABI of each lower limb was then determined in supine position using a portable Doppler machine with a 5-8MHz probe for peripheral vessels. Blood pressure cuffs were placed bilaterally on the upper arm (brachial pressure) and at the ankle just above the medial malleoli.

An ultrasound transducer was used to locate the arterial Doppler signals distal to the blood pressure cuffs. The Doppler signal from the brachial artery was used to obtain the arm pressure while that from the dorsalispedis and posterior tibial arteries was used to obtain the ankle pressure. The higher systolic pressure of the anterior dorsalispedis or posterior tibial measurement for each foot was divided by the highest brachial systolic pressure to obtain the ABI for each limb. An ABI of <0.9 was considered significant.

Data was analyzed using Statistical Package for Social Sciences, version 20. The level $P < 0.05$ was considered as the cutoff value or significance.

III. Results

Demographic profile of the 100 patient enrolled for study was as follows. Mean age of patients was 58.21 ± 9.81 (year), mean height was 164.30 ± 5.5 (cm), mean weight was 68.59 ± 10.3 (kg), mean BMI was 25.45 ± 3.9 (Kg/M^2) and mean Waist Circumference was 102.96 ± 5.54 cm. The male and female ratio was 41: 59.

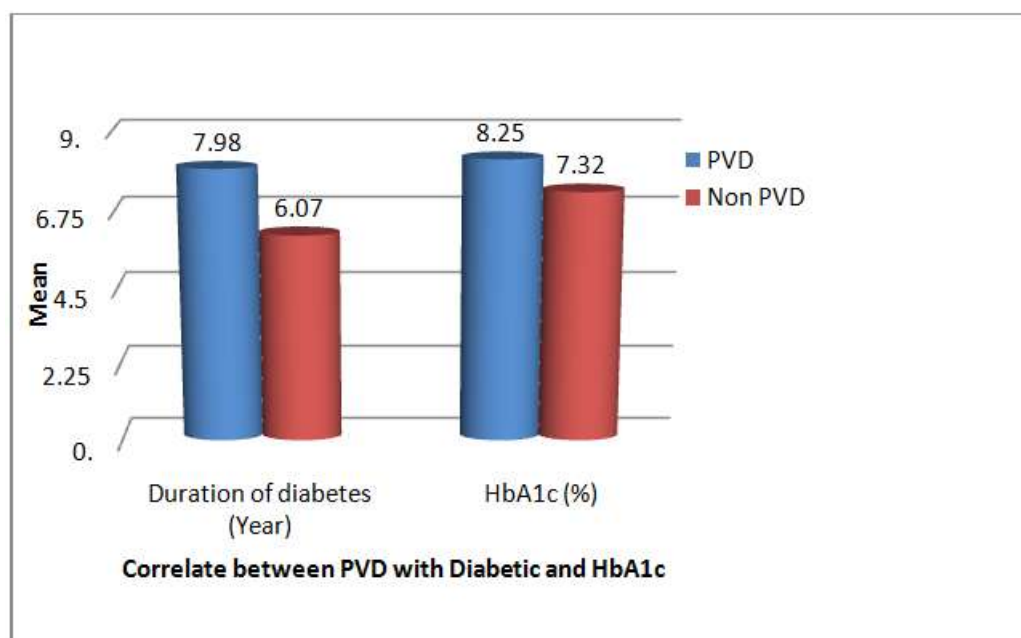
Table No. 1: showing distribution of PVD of studied patient

PVD	Number (%) (N=100)
Yes	40 (40%)
No	60 (60%)

While 40 (40%) patients were afflicted with Peripheral vascular disease (PVD), 60 percent others were free from such an ailment as indicated in the table.

Table No. 2: showing correlation between Peripheral vascular disease (PVD) with Diabetes and glyatedhaemoglobin (HbA1c)

	PVD(Mean±SD)	Non-PVD(Mean±SD)	P Value
Duration of diabetes (Year)	7.98 ± 1.7	6.07 ± 2.1	<0.001
HbA1c (%)	8.25 ± 0.65	7.32 ± 0.47	<0.001



Correlation between Peripheral vascular disease (PVD) with Diabetes and glyatedhaemoglobin (HbA1c), in patients has been shown here. The statistical difference in respect of both the parameters i.e. Duration of diabetes as well as glyatedhaemoglobin HbA1c (%) were highly significant $P < 0.001$.

IV. Discussion

Macro vascular complications like stroke, myocardial infarction and PAD tend to occur earlier in diabetics compared to non diabetics⁵. PAD is a manifestation of widespread systemic atherosclerosis in adult diabetic patients. The majority of diabetic patients with PAD have concomitant coronary artery disease.^{6,7} Epidemiologic data has shown a strong association between PAD and DM. Other notable traditional risk factors of PAD include smoking, increasing age, hypertension and hyperlipidemia and ethnicity.⁸

The noninvasive techniques like Ankle Brachial Pressure Index (ABPI) and Duplex ultrasonography are coming to the forefront for early diagnosis of PVD. ABI is the ratio of the peak systolic pressure in the ankle and brachial artery. It is a quick, reliable and sensitive method to detect subclinical disease.⁹

ABI measurement is a non-invasive procedure performed using a Doppler ultra sound device and has a 95% sensitivity and 100% specificity for diagnosing PAD compared to the gold standard angiography. An ABI of less than 0.9 is diagnostic of PAD. The normal range is between 0.9 and 1.1 while values ≥ 1.3 signify non compressible or calcified peripheral arteries.¹⁰

Mwebaze RM et al¹¹ reported a prevalence of PAD of 39% in the study population. Majority of the study participants had symptomatic PAD (59.6%) and mild obstruction (99.3%) according to the ABI measurement. Asymptomatic PAD was noted in 41.4% of the study participants. The presence of symptoms of intermittent claudication and microalbuminuria were significantly associated with PAD.

This documented prevalence is higher than what is reported from other regions of India and other developing countries. Data from the Framingham Heart study revealed a prevalence of symptomatic PAD of 20% in adult diabetic patients.¹² In the Bypass Angioplasty Revascularization Investigation 2 Diabetes (BARI 2D) Trial another large study to examine the magnitude of ABI abnormalities in 2,240 diabetic patients with coronary artery disease, low ABI was found in 19% of the patients.¹³

Correlation between Peripheral vascular disease (PVD) with Diabetes and glyatedhaemoglobin (HbA1c), in patients has been shown in the table no. 2. The statistical difference in respect of both the parameters i.e. Duration of diabetes as well as glyatedhaemoglobin HbA1c (%) were highly significant $P < 0.001$. The severity and duration of DM are important predictors of both the incidence and the extent of PAD, as observed in United Kingdom Prospective Diabetes Study, where each 1% increase in glycosylated hemoglobin was correlated with a 28% increase in incidence of PAD, and higher rates of death, microvascular complications and major amputation as reported by Selvin E et al¹⁴ and Jude EB et al.¹⁵

Yurong Zhang et al¹⁶ conducted a meta-analysis of prospective studies to estimate the association of glycosylated hemoglobin level with the risk of all-cause mortality and cardiovascular outcomes among patients with type 2 diabetes. Result indicated that the pooled relative risk associated with a 1% increase in glycosylated hemoglobin level among patients with type 2 diabetes was 1.15 (95% CI, 1.11 to 1.20) for all-cause mortality. Jinling Ma et al¹⁷ concluded that HbA1c is significantly associated with the complexity of coronary lesions among older patients with DM.

V. Conclusion

From the present study it can be concluded that in patients of Diabetes Mellitus, there is a direct relation between HbA1c levels and duration of DM with peripheral artery disease. Atherosclerosis of the peripheral vessels is also associated with generalized atherosclerotic changes in the coronary and vascular beds. It is also associated with significant mortality and morbidity. Hence early detection of peripheral vascular diseases should be attempted in all patients with elevated HbA1c or longer duration of diabetes.

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