

Study Of Peripheral Vascular Diseases In Patients Of Diabetes Type Ii By Clinical Methods, Ankle-Brachial Index, Pulse Oximetry, And Arterial Doppler

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Abstract

Background: Diabetes mellitus (DM) comprises a group of metabolic disorders that share the common feature of hyperglycemia. Due to the fact that diabetes is a risk factor for atherosclerosis, diabetes patients also have Peripheral vascular Disease (PVD) more frequently than people without diabetes. Early detection is increasingly being done using non-invasive methods like Duplex ultrasonography and the Ankle Brachial Pressure Index (ABU ABPI). This study was conducted to determine peripheral vascular diseases in patients of diabetes type II by clinical methods, ankle-brachial index, pulse oximetry, and arterial Doppler.

Aims: To study peripheral vascular diseases in patients of diabetes type II by clinical methods, ankle-brachial index, pulse oximetry, and arterial Doppler.

Study Design: Cross sectional observational study of 60 type 2 diabetes patients.

Place and Duration of Study: Study was conducted at Department of general medicine, Medicine OPD and Wards of a semi-urban Medical College and Hospital in Western Maharashtra. **Period of Study:** July 2020-september 2022. **Methodology:** 60 diagnosed patients of Type 2 Diabetes Mellitus ranging from 18-80 years of age were investigated

Data analysis was done using SPSS (Statistical Package for Social Sciences) Software version 20.

Results and Conclusions

In our study, 85% showed presence of PVD and 15% showed absence of PVD. The mean difference of PVD across duration of diabetes was statistically significant. (p value <0.05). The mean difference of PVD across ABI was statistically significant. (p value <0.05). The mean difference of PVD across Pulse oximetry reading of right limb was not statistically significant. (p value >0.05). The mean difference of PVD across Pulse oximetry reading of left limb was not statistically significant. (p value >0.05).

Keywords: Type 2 diabetes, pulse oximetry, ankle brachial index, peripheral vascular disease.

INTRODUCTION

Diabetes mellitus (DM) comprises a group of metabolic disorders that share the common feature of hyperglycemia. DM is currently classified on the basis of the pathogenic process that leads to hyperglycemia. Diabetes mellitus is a serious health issue that is pervasive throughout the world and has become much more

common over the past 20 years.¹ Due to the fact that diabetes is a risk factor for atherosclerosis, diabetes patients also have PVD more frequently than people without diabetes. It's interesting to note that among DM patients, foot-related problems are one of the most frequent reasons for hospitalization. Patients with PVD may not have any symptoms at all or they may have gangrene, intermittent claudication, and/or ischemic rest discomfort.² When the atherosclerotic narrowing of the blood arteries approaches 70% of the lumen, ischemia signs and symptoms appear (critical stenosis). The focus of care in patients with PVD) lies in the early detection of the disease in order to prevent or at least lower the rate of complications. This is because clinical symptoms and signs are not present in the early stages of the disease. Angiography is the gold standard for the diagnosis of PVD. A non-invasive technique of assessing carotid atherosclerosis or peripheral arterial disease by Doppler ultra sound scanning has generated considerable interest as a marker of atherosclerosis and in the prediction of clinical coronary events and coronary artery disease, especially in resource limited country like India. The present study is an example of evidence-based medicine in correlating multiple vascular beds, coronary, carotid and peripheral which share the same atherosclerotic risk factors.

AIMS

1. To study peripheral vascular diseases in patients of diabetes type II by clinical methods, ankle-brachial index, pulse oximetry, and arterial Doppler.

OBJECTIVES

1. To observe the clinical findings of peripheral vascular diseases in patients of type II diabetes mellitus, by ankle-brachial index, pulse oximetry and arterial Doppler.
2. To correlate the findings in each of those investigations with other diabetic complications like retinopathy, Nephropathy and Coronary Artery Disease

MATERIALS AND METHODS

60 patients from General Medicine OPD, Specialty Diabetes OPD and Wards enrolled for study were explained the procedure and the purpose of the study, informed consent was taken from the patient. Details of history as demographic, personal, family history, and any significant past history were recorded in study proforma. Required physical examination and necessary investigations were done.

Study was conducted in a medical college and Hospital in Maharashtra, India.

Period of study was from July 2020 to September 2022, in type 2 diabetes mellitus patients.

Pulse oximeter: Positive reading is when the difference of the reading of pulse oximetry between the upper limb and ipsilateral lower limb is 2%

Negative reading is when the difference is less than 2%

Ankle Brachial Index: Normal- patients with ABI of >0.9.
Abnormal-ABI of less than 0.9

Duplex doppler ultrasound: presence of peripheral vascular disease was confirmed with a duplex doppler scan which was done by radiologist of the same hospital

INCLUSION CRITERIA

- Patients in the age group of 18- 80 years, diagnosed as diabetes mellitus type II with symptoms of pain during walking, decreased sensations of affected limb, presence of ulcers on limb, calf or limb tenderness, change in temperature of limb, tingling sensation in limb, discolouration of skin, absence or feeble peripheral pulses.

EXCLUSION CRITERIA

- Vasculitic disorders of major and minor arteries
- Trauma
- Coarctation of aorta
- Primary vascular tumours

DATA ANALYSIS

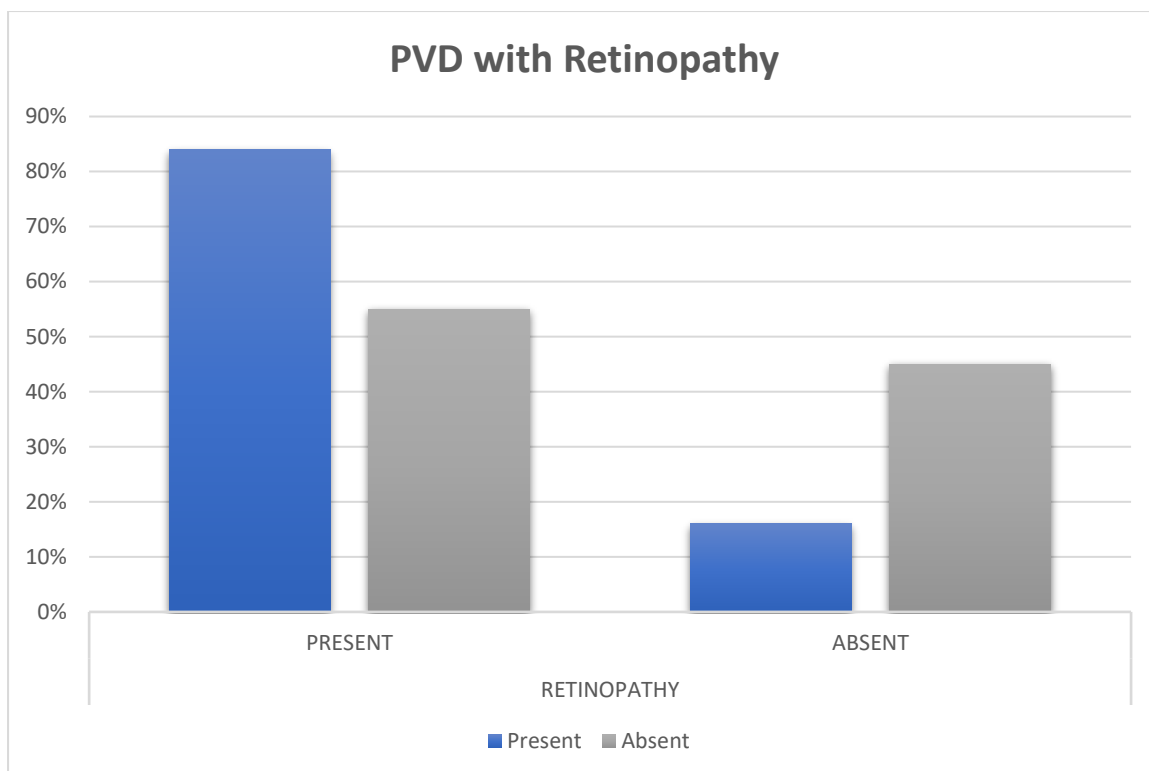
Data collected, and tabulated in Microsoft Excel in Master Chart. Analysis done using SPSS (Statistical Package for Social Sciences) Software version 20.

Categorical variables expressed in terms of frequency and percentage and continuous variables in terms of mean and Standard Deviation. Association between Peripheral Vascular Disease and diabetic complications and Coronary artery Disease were analysed using chi square test. ANOVA test was applied to find any difference in mean value of study of variables across patient groups with $p < 0.05$ as statistically significant value at 95% Confidence interval.

RESULTS:

PVD	ABI		P VALUE
	NORMAL (0)	ABNORMAL (1)	
Present	60.78%	39.22%	0.03
Absent	22.2%	77.8%	

PVD	DURATION OF DIABETES		P VALUE
	LESS THAN 5	MORE THAN 5	
Present	23%	76%	0.05
Absent	55%	44%	



In our study, 85% showed presence of PVD and 15% showed absence of PVD. The mean difference of PVD across duration of diabetes was statistically significant. (p value <0.05). The mean difference of PVD across ABI was statistically significant. (p value <0.05). The mean difference of PVD across Pulse oximetry reading of right and left limb was not statistically significant. (p value >0.05). In our study, 80% had retinopathy, 20% did not have retinopathy. In our study, 63% had neuropathy, 37% did not have neuropathy. In our study, 38% had nephropathy, 62% did not have nephropathy. The mean difference of PVD across Nephropathy was not statistically significant. (p value >0.05). The mean difference of PVD across Neuropathy was not statistically significant. (p value >0.05). The mean difference of PVD across Retinopathy was statistically significant. (p value <0.05).

DISCUSSION

It is generally agreed that peripheral arterial disease is a complication of diabetes mellitus, and that this is especially true for people who have had diabetes for a longer period of time. In order to accomplish this goal, a total of sixty patients with type 2 diabetes mellitus who were attending either the hospital's outdoor or indoor wards and who met the inclusion criteria for the study were asked for and given their signed and informed consent before being included in the study. PAD was categorised based on the pressure that was measured in the ankle and brachial artery (ABPI).

There is a significant amount of variation in the prevalence of PAD among diabetes patients that has been observed across studies. When using ABPI as a criterion, its prevalence can range from as low as 3.5 percent in newly diagnosed diabetics II to as high as 42.6 percent³ in a study population with a median age of 52.5 years. However, when using a combination of ABPI and symptomatic criteria, its prevalence could be as high as 87.2 percent.⁴

Findings that are comparable to those found in the present study were also obtained by Solanki et al. (2012)⁵ (35 percent), Mwebaze and Kibirige (2014)⁴(39 percent), and Ali et al. (2012)⁶ when these researchers used the same criteria (39.28 percent). Other investigations that found a prevalence of PAD similar to ours were carried out by Akram et al. (2011)⁷ and Khurana et al. (2013).⁸ These studies found that the prevalence of PAD was, respectively, 31.6 percent and 33.3 percent.

According to a recent study by Parameswaran et al⁹, PO has a sensitivity of 77% and a specificity of 97% when used as a screening method for PVD. Out of 78 patients (155 limbs), Siao et al¹⁰ examined the usefulness of PO

as a PVD screening tool and discovered that it had a sensitivity and specificity of 76.7% and 85.3%, respectively. Kwon et al¹¹ observed that the sensitivity and specificity were 87.06% and 87.8%, respectively, in a study that was similar to theirs. The specificity and sensitivity of ABI in the diagnosis of PVD were examined by Xu et al. Pulse oximetry is better than ABI for the screening for asymptomatic PVD among diabetics. However, the blend of the two tests has a much higher sensitivity, specificity and accuracy.¹²

According to the study's findings of Marinelli et al, vascular disease was discovered in about one third of the patients who claimed not to have had intermittent claudication. Non invasive testing revealed aberrant results in one-fifth of the individuals with what were regarded as normal physical examination results. The use of non invasive equipment efficiently excludes or confirms the presence of hemodynamically severe arterial blockage when history and physical examination fail to identify an arterial disease.¹³

Among the study of Nath et al, PVD was present in 22.4% of the 148 patients who participated in the trial. The PVD group was more likely to be elderly, male, currently smoking, long-term diabetic, and had co-morbid conditions. ABI has a sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of 82.9%, 93.8%, 80.6%, and 94.6%, compared to pulse oximetry's 77.1%, 91.9%, 75%, and 84.5%. Diagnostic precision increased to 95.5% and net sensitivity to 93.6% in parallel testing.¹⁴

PVD was present in 22.5% of the study's 120 individuals (95% CI: 15.9, 30.8). The PVD group was more likely to be older, male, currently smoking, long-term diabetic, and have concomitant conditions. Pulse oximetry's sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were respectively 74.1% (95% CI: 55.3, 86.8), 95.7% (89.4, 98.3), 83.3% (64.1, 93.3), and 92.7% (85.7, 96.4), whereas those of ABI were respectively 70.3% (51.5, 84.2), 87.1 (78.8, 92.5), 61.¹⁵

Waveform analysis and duplex colour mapping are two accurate but pricey doppler ultrasonography technologies that should not be used for screening. Foot pulse palpation is not sensitive and has little interobserver variability on its own.¹⁶ It was demonstrated that the ankle-brachial index (ABI), the current recommended screening test for LEAD¹⁷, is a sensitive marker for LEAD. In individuals with LEAD, it has been found to have a sensitivity and specificity above 90%. According to Yao et al¹⁸, the ABI was less than 1 in 93% of patients in those with lower limb artery stenosis that had been angiographically shown. A sensitivity of 87% was observed by Stoffers et al¹⁹ at an ABI cutoff value of less than 0.92. These investigators, however, did not study asymptomatic patients; rather, they looked at patients with symptoms and indicators of LEAD. When individuals with LEAD symptoms and signs were eliminated, Feigelson et al.⁸ discovered that the sensitivity of ABI values less than 0.9 was only 28.4%. As a result, the ABI appears to be less reliable as a screening test in patients without LEAD symptoms or indications. Doubts have also been raised concerning the ABI's accuracy in detecting diabetes, likely as a result of the increased frequency of arterial calcification in people with diabetes mellitus, which can artificially raise the ABI.²⁰

Pulse oximetry of the toes seems as accurate as ABI to screen for LEAD in patients with type 2 diabetes. Combination of the two tests increases sensitivity.

CONCLUSION

The findings of our research indicate that there is a prevalence of peripheral arterial disease quite common among diabetes population. Apart from the intensified multifactorial treatment of all modifiable risk factors intensive therapy targeted at glycemic control and other modifiable cardiovascular risk factor is needed to prevent micro and macro-vascular complications of diabetes especially PVD. These findings need to be confirmed by a bigger study, and screening for PAD should be performed on all diabetes patients in order to identify this problem at an early stage.

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DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we

do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

CONSENT

All authors have declared that “Written informed consent were taken from all study subjects”.

ETHICAL APPROVAL

All authors hereby declare that the study was approved by the Institutional ethics sub- committee of Dr. D. Y. Patil Medical College, Hospital and Research Centre, Pimpri (I.E.S.C./98/2021)

COMPETING INTERESTS: Authors have declared that there are no competing interests.

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