



## Study of Prevalence and Clinical Profile of Peripheral Arterial Disease in Type II Diabetes

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### Introduction

Peripheral arterial disease, is clinically manifested as intermittent claudication or critical ischaemia, or identified by an ankle/brachial index (ABI) < 0.9, is present in at least one in every four patients with type 2 diabetes mellitus. Various risk factors like persistent hyperglycemia, smoking and hypertension, and dyslipidaemia are associated with Peripheral artery disease (PAD).

The increasing burden of diabetes is considered as one of the greatest global public health problem of our time<sup>1</sup>. The microvascular and macrovascular complications associated with this diabetes, as well as the resulting morbidity and mortality, the personal, medical, and societal costs are enormous.<sup>2,3</sup> Despite of advances in diabetes pharmacotherapy, less than half of adults with type 2 diabetes mellitus (T2DM) attain therapeutic goals designed to reduce long-term risks of complications, especially for glycemic control<sup>4</sup>, and lifestyle interventions are disappointing in the long term.

Peripheral arterial disease (PAD) is one of the macrovascular complications of type 2 diabetes

mellitus. Unlike other complications, it has received little attention, especially in the India. Hence, we carried out the present study to assess the prevalence and clinical profile of PAD in type 2 diabetes by measuring ankle brachial index using duplex Doppler ultrasound of the lower limbs and to correlated it with various risk factors.

### Aims and Objectives

1. To ascertain the prevalence of peripheral arterial disease in type 2 diabetes mellitus patients by using ankle brachial index and colour Doppler study.
2. To study the clinical profile & various risk factors contributing to development of peripheral arterial disease.
3. To assess sensitivity and specificity of Ankle Brachial Index compared to Doppler study

### Materials and Methods

This Cross sectional study of patients with newly diagnosed Diabetes Mellitus was conducted at MGM Institute of Health Sciences, Navi Mumbai

from 2015 to 2016. On presentation detailed history with chief complaints was taken from the patients followed by clinical examination for detection of peripheral arterial disease and investigations were advised to diagnose the same. Patients were included in the study after taking an informed consent. Institutional ethics committee permission was taken. Patients with Type 2 Diabetes Mellitus with the age group 30-80yrs fulfilling criteria for establishing Diabetes Mellitus according to ADA guidelines were included: a) Fasting plasma glucose  $> 126$  mg/dl (7.0mmol/dl). [Fasting is defined as no calorie intake for at least 8 hours]. b) Postprandial plasma glucose  $>200$ mg/dl [ 2 hours after 75gm of oral glucose intake] c) HbA1c  $>6.5\%$ . The test performed in laboratory using a method that is NGSP certified and standardized to the DCCT assay, Type 1 Diabetes Mellitus or other types of DM except type 2 DM and conditions which would interfere with the measurement of ankle brachial index

A detailed history was obtained from each patient which included age, sex, smoking, alcohol intake, history of diabetes mellitus with duration and treatment. Family history of diabetes was also taken. Smoking status was defined as :Smoker: smoking  $\geq 1$  cigarette/ bidi per day at the time of the study or quit smoking  $< 10$  years back and non-smoker: never smoked/left smoking for  $\geq 10$  years. History of peripheral arterial disease was taken in detail which included history of tingling and numbness of the legs, burning sensation and claudication in the legs and so on.

All the Type 2 diabetic patients were screened by Vascular Doppler instrument, for peripheral arterial disease using Ankle brachial index(ABI). An ABI of  $< 0.9$  was defined as a low ABI indicative of peripheral arterial disease. Patients with ankle brachial index  $<0.9$  were subjected to color Doppler of both lower limbs to confirm presence of peripheral arterial disease. Colour Doppler was done on Philips HD 15 & Philips HD 11 ultrasonography machine with High Frequency

Linear Transducer (L12-3) probe producing a frequency of upto 12Hz.

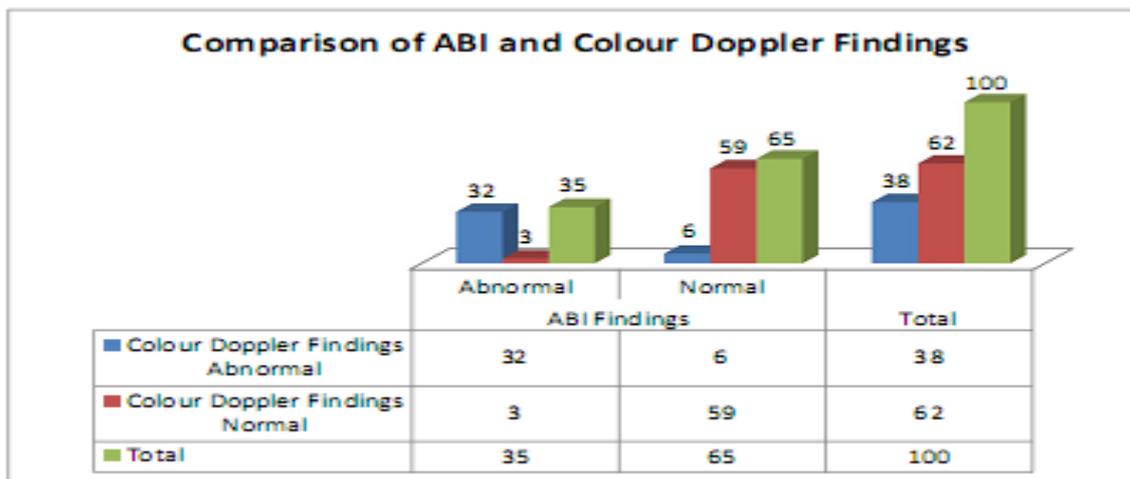
### Statistical Analysis

Quantitative data is presented with the help of Mean and Standard deviation. Comparison among the study groups is done with the help of unpaired t test as per results of normality test. Qualitative data is presented with the help of frequency and percentage table. Association among the study groups is assessed with the help of Chi-Square test. Results were graphically represented in MS Excel 2010 where deemed necessary. SPSS ver. 20 was used for statistical analysis. P value less than 0.05 was considered significant.

### Results

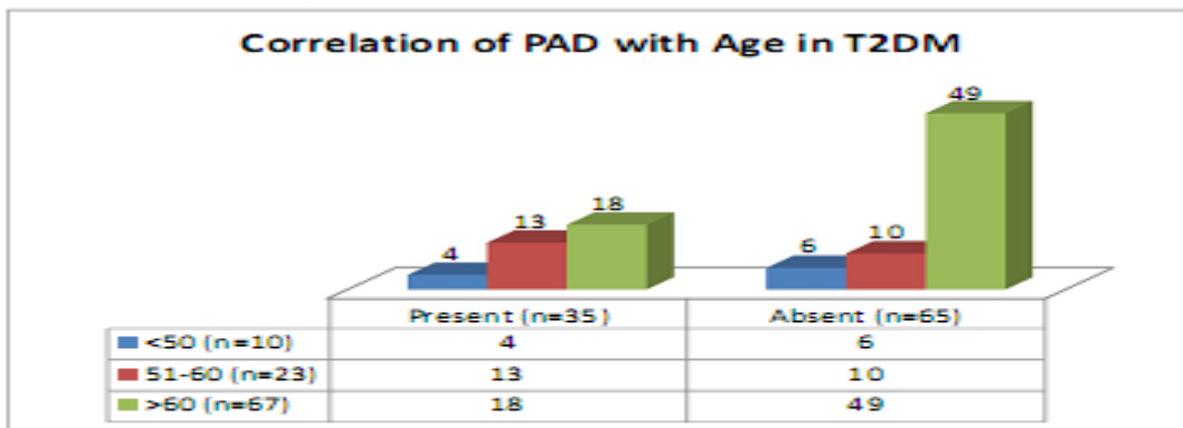
Majority (67%) patients were in the age group of  $>60$  years followed by 23% patients from the age group of 51-60 years with male (63%) predominance whereas female patients constituted 37% of the study group. Total 35% patients had  $ABI < 0.9$  while 65% patients had  $ABI \geq 0.9$ . Among the patients with abnormal ABI, 20% patients had  $ABI < 0.5$ , 31.4% patients had  $ABI 0.5-0.79$  and 48.6% patients had  $ABI 0.8-0.89$ . Most of the patients (59%) were asymptomatic while 41% patients were symptomatic. Most of the patients (70%) were non-smokers while 30% patients were smokers. HbA1c levels  $\geq 7$  in most of the patients (72%) while 28% patients had HbA1c levels  $< 7$ . Ankle Brachial Index (ABI) showed Peripheral Arterial Disease (PAD) in 35 (35%) patients and absence of PAD in 65 (65%) patients whereas Colour Doppler showed PAD in 38 (38%) patients.

**Figure no 1** Comparison of Ankle Brachial Index (ABI) and Colour Doppler Finding



The prevalence of PAD in Type 2 Diabetes patients showed an increasing trend with increasing age.

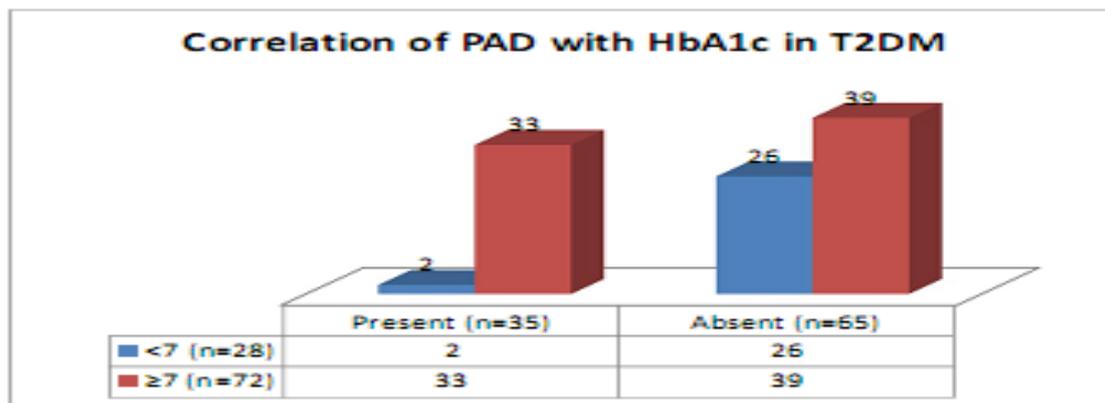
**Figure no 2** Correlation of Peripheral Arterial Disease (PAD) with Age in T2DM

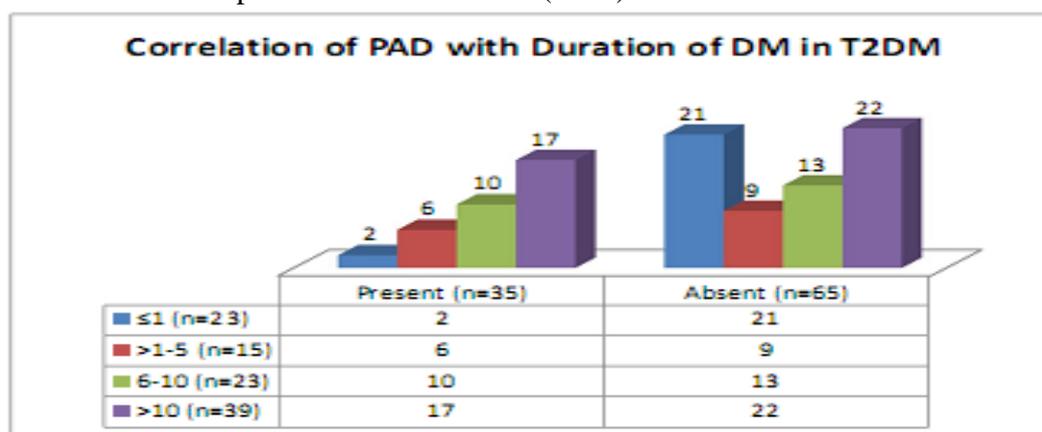


There was higher occurrence of peripheral arterial disease in males as compared to females, however the association was insignificant.

Age, smoking, HbA1C (Glycosylated haemoglobin), duration of diabetes, systolic BP and diastolic BP were found to be significantly different between the two groups.

**Figure no 3** Correlation of Peripheral Arterial Disease (PAD) with HbA1c in T2DM



**Figure no 4** Correlation of Peripheral Arterial Disease (PAD) with Duration of DM in T2DM**Table 1:** Cardiovascular disease risk factors in PAD and non-PAD sub groups

Risk factors	Non-PAD	PAD	p Value
Age (years)	58.39 ± 8.18	64.21 ± 7.63	p<0.05*
Smoker	6 (44%)	29 (56%)	p<0.05*
HbA1c	6.3 ± 0.5	7.6 ± 0.8	p<0.05*
Duration of diabetes (years)	8.16 ± 3.4	12.43 ± 4.8	p<0.05*
BMI	25.47 ± 3.26	26.15 ± 3.74	p>0.05
Total cholesterol (mg%)	183.1 ± 42.5	180.4 ± 41.6	p>0.05
Serum LDL (mg%)	107.9 ± 40.1	115.4 ± 53.8	p>0.05
Serum HDL (mg%)	47.4 ± 16.7	42.4 ± 10.8	p>0.05
Serum triglycerides (mg%)	128.6 ± 61.4	124.8 ± 44.2	p>0.05
Hypertension	32 (49.2%)	22 (62.8%)	p>0.05
SBP	133.24 ± 12.43	145.37 ± 11.56	p<0.05*
DBP	85.72 ± 7.14	89.65 ± 6.51	p<0.05*

\* p&lt;0.05 – Statistically Significant

## Discussion

Ankle-brachial pressure index is the most efficient, objective, and practical means of documenting presence and severity of peripheral arterial disease<sup>5</sup>. In the present study, 100 patients were enrolled to study Peripheral arterial disease (PAD) in Type 2 Diabetics. 67% patients were in the age group of >60 years followed by 23% patients from the age group of 51-60 years. Majority of the patients were male (63%) whereas female patients constituted 37% of the study group. It was also observed that 39% patients had diabetes for more than 10 years. This is similar to the study of Al-Kaabi JM et al<sup>6</sup> in which patient's mean (±SD) age was 54 (±12) years and duration of diabetes 10 (±8) years. Thirty five percent of patients had ABI<0.9 while 65% patients had

ABI≥0.9. Among the patients with abnormal ABI, 20% patients had ABI <0.5, 31.4% patients had ABI 0.5-0.79 and 48.6% patients had ABI 0.8-0.89. 59% patients were asymptomatic while 41% patients were symptomatic. 30% patients were smokers while 70% patients were non-smokers. This is in agreement to the findings of El Toony LF et al<sup>7</sup> and Mourad JJ et al<sup>8</sup>.

In the study of Toony LF et al<sup>7</sup>, it was observed that 71 (35.5%) of patients had abnormal ABI and 129 (64.5%) patients had normal ABI in 200 type 2 diabetes mellitus patients. Also 29% patients were smokers. Mourad JJ et al<sup>8</sup> also reported the prevalence of peripheral arterial disease to be 41.1%. 28% patients had HbA1c levels <7 while 72% had HbA1c levels ≥7. In the present study, Ankle Brachial Index (ABI) showed Peripheral

Arterial Disease (PAD) in 35 (35%) patients and absence of PAD in 65 (65%) patients whereas Colour Doppler showed PAD in 32 (32%) patients. ABI was unable to detect PAD in 6 patients. Also 3 of the 35 patients diagnosed as having PAD by ABI were classified as normal by the Colour Doppler. Hence sensitivity and specificity of ABI is 84.2% & 95.1% respectively in comparison with Colour Doppler. The positive predictive value and negative predictive value of ABI is 91.4% and 90.75 respectively. This is in agreement to the study of Khurana A et al<sup>9</sup>. Khurana A et al<sup>9</sup> used a 12MHz Doppler probe in the arms and legs to assess the ankle brachial index (ABI) in 200 type 2 diabetes mellitus patients aged more than 40 years. The objective was to determine the prevalence of peripheral arterial disease in type 2 diabetes mellitus using the ankle-brachial pressure index. 63.6% (42) patients had HbA1C levels >7, while 36.4% (24) had HbA1C levels <7. The prevalence of PAD as detected by Doppler ultrasound (ABI) was 32%. Previous studies by Marinelli MR et al<sup>10</sup>, Janka HU et al<sup>11</sup>, Walter DP et al<sup>12</sup>, Migdolis LN et al<sup>13</sup> and the Fremantle diabetes study by Norman PE et al<sup>14</sup> found the prevalence of PAD to be 33%, 15.9%, 23.5%, 44% and 13.6%, respectively. Few Indian studies have assessed PAD in diabetics. Two large studies from South India, namely, by Mohan V et al<sup>15</sup> (n=4941) and CUPS 23 (n=1262) found a prevalence of PAD in diabetics to be 3.9% and 6.3%, respectively. CUPS, a community based study, found a lower prevalence of PAD than our study which was hospital based. Two recent studies from North India, one by Agrawal RP et al<sup>16</sup> (n=4400) and the other by Madhu SV et al<sup>17</sup> (n=364) found the prevalence of PAD in diabetics to be 18.1% and 13.73%, respectively.

Age, smoking, HbA1C, duration of diabetes, systolic BP and diastolic BP were found to be significantly different between the two groups. There was a significant association of PAD with age in T2DM. It was observed that with increasing age, the prevalence of PAD in t2DM showed an

increasing trend ( $p < 0.05$ ). This is in similar to the study of Lekshmi NRM et al<sup>18</sup>.

In the present study, there was significant association of duration of diabetes with PAD in T2DM. This is in agreement to the study of Papanas N et al<sup>19</sup>

The study limitations included lack of confirmatory tests, such as magnetic resonance angiography, computerized tomography scan and invasive arteriography. The study is based on a single center and thus the prevalence of PAD cannot be generalized for the entire population. Multicenter study is needed. Follow up studies are needed to assess the progression of PAD with various risk factors and outcome of using different classes of medications.

### Conclusion

Diabetes, once considered as a disease of developed countries, is one of the endocrine disorders that has reached epidemic proportions worldwide. Peripheral arterial disease is one of the macrovascular complications of type 2 diabetes mellitus and presents late, having already developed ischaemia because of the unique involvement of distal pattern of vessels and invariable association with neuropathy.

### Limitation of Study

Single centre study hence not representative of the general population

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