



Prevalence of Asymptomatic Peripheral Vascular Disease in Patients with Type-2 Diabetes Mellitus by Colour Doppler Study and Correlation with Risk Factors and Myocardial Infarction

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Abstract:

Background

Peripheral Arterial Disease (PAD) is a condition characterized by atherosclerotic occlusive disease of the lower extremities. While PAD is a major risk factor for lower-extremity amputation, it is also accompanied by a high likelihood for symptomatic cardiovascular and cerebrovascular disease, leading to an elevated risk of events, such as myocardial infarction (MI), stroke, and death. It has been reported that of those patients with PAD, over one-half of them are asymptomatic or have atypical symptoms. The current study is intended to study the prevalence of asymptomatic PAD in patients with DM-2 by Colour Doppler study and to correlate it ischemic heart disease.

Aims And Objectives:

1. To study the prevalence of asymptomatic peripheral artery disease in 40 patients with Type-2 Diabetes by Colour Doppler Study.
2. To study the correlation of PAD with myocardial ischemia by Electrocardiography.

Material And Methods: A total number of 40 patients of DM-2 patients who had no history of symptomatic peripheral vascular disease attending outpatient department at Mamata General Hospital, Khammam, during the period of August 2013 to August 2014, were selected randomly and Colour Doppler of peripheral vessels performed. Cross sectional analysis regarding risk factors and electrocardiographic changes were done

Results: Prevalence of asymptomatic peripheral vascular disease was found to be 25% which is significant. 40% of patients with PAD were found to have myocardial ischemia by electrocardiogram. 80% of patients with peripheral artery disease, identified by Colour Doppler study, have normal peripheral pulses on clinical examination suggesting more sensitivity of Colour Doppler examination.

Conclusion: The prevalence of asymptomatic PAD in DM-2 was found to be significant (25%)

Myocardial ischemia suggested by electrocardiogram was found to have strong positive correlation with the development of PAD ($P=0.040$, Significant)

80% of patients with PAD, identified by Colour Doppler study, have normal peripheral pulses on clinical examination suggesting more sensitivity of Colour Doppler study.

Key Words: Diabetes mellitus, peripheral artery disease, colour doppler, myocardial infarction.

INTRODUCTION

Atherosclerosis is a progressive process affecting multiple vascular beds, its clinical consequences, which include coronary artery disease (CAD), cerebrovascular disease, and peripheral artery disease (PAD) are potentially lifethreatening.¹

Atherosclerotic disease in one vascular bed indicates possible disease in others.² The risk of atherosclerotic disease is markedly increased among individuals with diabetes. The increased risk is independent of, and additive to, other cardiovascular risk factors. Atherosclerosis causes most of the death and disability in patients with diabetes, particularly in the DM-2 patients.³

The Verona Diabetes Study showed that cardiovascular disease is responsible for 44% of all-cause fatalities in the diabetic patient population.⁴ The duration of diabetes increases the risk of death from cardiovascular disease, independent of co-existing risk factors. DM-2 predisposes to higher rates of coronary artery disease, cerebral vascular disease, and PAD.⁶

PAD is a manifestation of atherosclerosis. Although many patients are asymptomatic. Extreme presentations of PAD include rest pain, tissue loss, or gangrene. PAD in patients with diabetes adversely affects quality of life and is associated with substantial functional impairment.⁷

The true prevalence of PAD in people with diabetes has been difficult to determine, as most patients are asymptomatic. Screening modalities have not been uniformly agreed upon, and pain perception may be blunted by the presence of peripheral neuropathy. PAD is associated with a substantial increase in the risk of fatal and non-fatal cardiovascular and cerebrovascular events, including MI and stroke⁸. Furthermore, cardiovascular and cerebrovascular event rates are higher in diabetic individuals with PAD than in comparable non-diabetic populations.⁹

METHODOLOGY

A total number of 40 patients of DM-2 patients attending outpatient department at Mamata

General Hospital, Khammam, during the period of August 2013 to August 2014, were selected randomly and a cross sectional analysis was done

Study period: august 2013 to august 2014

Place of study: mamata general and superspeciality hospital ,khammam

Inclusion Criteria

1) All DM-2 Patients with duration of Diabetes \geq 7 years.

Exclusion Criteria

Patients with Type-1 Diabetes mellitus.

Patients with DM-2 with symptomatic Peripheral vascular disease

Procedure

The initial history was directed towards obtaining details regarding age/sex of the patient, symptoms/duration of DM-2, glycemic control based on Fasting and post lunch blood glucose levels, presence of hypertension, habit of smoking, symptoms suggestive of limb ischemia, past history of Diabetic foot lesions.

Clinical examination included height, weight, screening for foot lesions and any deformities of foot, detailed examination of all peripheral pulses of lower limbs, and blood pressure recording.

Investigations included Fasting and post lunch blood sugar levels, HbA1c, Fasting lipid profile, 12 lead electrocardiography and Colour Doppler Sonography of lower limb arterial system

RESULTS

In the present study, among 40 patients of DM-2, 10 patients were found to have asymptomatic PAD through Colour Doppler evaluation.

These 10 patients who were having asymptomatic peripheral arterial disease were designated as GROUP-I

The remaining patients i.e., 30 patients who had no peripheral arterial disease were designated as GROUP-II.

The Prevalence of Asymptomatic PAD in DM-2 is 25%

In our study, Primer of biostatistics was used for statistical analysis. Yates corrected chi-square test was used for all . P value of less than 0.05 was taken as significant.

Distribution of age in GROUP -I and GROUP-II. 3 out of 10 in Group-I & 22 out of 30 in Group-II are below 50 years of age and 7 out of 10 in Group-I & 8 out of 30 in Group-II are above 50 years of age . The difference is statistically significant $P=0.038$

Distribution of sex in GROUP-I And GROUP -I. 8 out of 10 in Group-I & 9 out of 30 in Group-II are males and 2 out of 10 in Group-I & 21 out of 30 in Group-II are females, The difference is statistically significant $P=0.016$.

Distribution of smoking in GROUP-I and GROUP-II. 3 out of 10 in Group-I & 24 out of 30 in Group-II are non-smokers and 7 out of 10 in Group-I & 6 out of 30 in Group-II are smokers, and this difference is statistically significant $P=0.011$

Distribution of duration of DM-2 in GROUP-I and GROUP-II. 9 out of 10 in Group-I & 11 out of 30 in Group-II have duration of diabetes mellitus-2 more than 10 years and 1 out of 10 in Group-I & 19 out of 30 in Group-II have duration of DM-2 less than 20 years, and this difference is statistically significant $P=0.016$.

Distribution of glycemic control in GROUP-I and GROUP-II. 8 out of 10 in Group-I & 10 out of 30 in Group-II have poor glycemic control ($HbA1c > 7\%$) and 2 out of 10 in Group-I & 20 out of 30 in Group-II have good glycemic control ($HbA1c < 7\%$), and this difference is statistically significant $P=0.027$

Distribution of hypertension in GROUP-I and GROUP-II. 7 out of 10 in Group-I & 6 out of 30 in Group-II are hypertensives and 3 out of 10 in Group-I & 24 out of 30 in Group-II are non hypertensives, and this difference is statistically significant $P=0.006$.

Distribution of body mass index in GROUP-I and GROUP-II. 9 out of 10 in Group-I & 12 out of 30 in Group-II have BMI more than 25 (Kg/m^2) and 1 out of 10 in Group-I & 18 out of 30 in Group-II

have BMI less than 25 (Kg/m^2) and this difference is statistically significant $P=0.017$

Distribution of serum cholesterol in GROUP -I and GROUP-II. 8 out of 10 in Group-I & 8 out of 30 in Group-II have serum cholesterol more than 200 mg/dl and 2 out of 10 in Group-I & 22 out of 30 in Group-II have serum cholesterol less than 200 mg/dl and this difference is statistically significant $P=0.009$.

Distribution of serum triglycerides in GROUP -I and GROUP-II. 6 out of 10 in Group-I & 5 out of 30 in Group-II have serum Triglycerides more than 150 mg/dl and 4 out of 10 in Group-I & 25 out of 30 in Group-II have serum Triglycerides less than 150 mg/dl and this difference is statistically significant $P=0.024$

Distribution of serum ldl in GROUP-I and GROUP-II. 7 out of 10 in Group-I & 4 out of 30 in Group-II have serum LDL more than 130 mg/dl and 3 out of 10 in Group-I & 26 out of 30 in Group-II have serum LDL less than 130 mg/dl and this difference is statistically significant $P=0.002$.

Distribution of serum HDL in GROUP-I and GROUP-II. 4 out of 10 in Group-I & 25 out of 30 in Group-II have serum HDL ($M > 40$, $F > 50$) and 6 out of 10 in Group-I & 5 out of 30 in Group-II have SERUM HDL ($M < 40$, $F < 50$) and this difference is statistically significant $P=0.024$.

Distribution of ecg abnormalities (ischemic changes in group-i and group-ii. 4 out of 10 in Group-I & 2 out of 30 in Group-II have ECG abnormalities (ischemic changes) and 6 out of 10 in Group-I & 28 out of 30 in Group-II have no ECG abnormalities (ischemic changes absent) and this difference is statistically significant $P=0.040$

DISCUSSION

Diabetes is an important risk factor for PAD. Hypertension, smoking, Dyslipidemia are frequently associated in patients with diabetes contributing additional risk for vascular disease.¹⁰ PAD in Diabetes is compounded by the presence of peripheral neuropathy and by susceptibility to infection. These factors contribute to progression

of PAD to ulceration, gangrene and ultimately to amputation of affected extremity.²⁰

Atherosclerotic disease in one vascular bed indicates possible disease in others. PAD is a particularly strong prognostic indicator of future clinical cardiovascular disease events, and the importance of its recognition has been highlighted in several guidelines.²

The risk of atherosclerotic disease is markedly increased among individuals with diabetes. The increased risk is independent of, and additive to, other cardiovascular risk factors. Atherosclerosis causes most of the death and disability in patients with diabetes, particularly in DM-2 patients.³

Only one third of patients with PAD have classical claudication symptoms and the remaining patients are asymptomatic or have atypical symptoms.⁵ In PARTNERS study conducted across 350 primary care centers across the United States, only 8.7% patients in the PAD-only group had classical symptoms of PAD.¹¹

PAD in patients with diabetes adversely affects quality of life and is associated with substantial functional impairment.⁷ The reduced walking speed and distance associated with intermittent claudication may result in progressive loss of function and long-term disability.⁹ With more severe disease, Critical Limb Ischemia may develop, resulting in ischemic ulceration of the foot and risk of limb loss.^{13,14}

Importantly, PAD is associated with a substantial increase in the risk of fatal and non-fatal cardiovascular and cerebrovascular events, including MI and stroke.⁸ Furthermore, cardiovascular and cerebrovascular event rates are higher in diabetic individuals with PAD than in comparable non-diabetic populations.

Diabetes accounts for nearly fifty percent of all nontraumatic amputations in United States. By the time, the PAD becomes clinically manifested, it may be too late to salvage an extremity or it may require more costly resources to improve circulatory health of the extremity. Mortality and Morbidity is increasing in patients with PAD. Hence, prevention is an important component in

the management of PAD.⁸

Screening for DM-2 is directed at the identification of patients at an early stage of the disease. Consequently, with screening one would expect to identify patients earlier in the development of hyperglycaemia than when they are newly diagnosed in general practice. Accordingly, diabetes -related complications are also expected to be less prevalent or less extensive in patients identified by screening.¹⁵

The introduction of Colour Doppler adds a new dimension to the assessment of PAD, as it is fairly sensitive and specific in detecting PAD. The purpose of screening of diabetic patients with risk factors for PAD is to anticipate future complications thus getting an early chance to assess its progression.⁶

The present study was aimed to know the prevalence of asymptomatic PAD in DM-2 by Colour Doppler study and to correlate it with risk factors and ischemic heart disease.

In the current study, 10 patients (25%) out of 40 were found to have PAD by colour Doppler study. This value is higher than that reported by Mohan V, et al. (1996)¹⁰, who studied 726 south Indian DM-2 patients with more than 25 years duration and found to have 15.4% prevalence of PAD by Colour Doppler study.

This value is lesser than that reported by Beks PJ, et al.: the Hoorn Study¹⁶, which reported 41.8% prevalence of PAD by Colour Doppler Study.

The prevalence of PAD found in the current study is also less than that reported by Bembi v, et al.¹⁷ which reported 24% prevalence of PAD in diabetics. Another study from Pakistan by Javed Akram, et al., reported 31.5% prevalence of PAD, diagnosed by colour Doppler in diabetic patients, which is higher than that found in this study.¹⁸

In the current study, 70% of patients with PAD are above the age of 50 years & 26.6% of the patients without PAD are above the age of 50 years and this difference is statistically significant. (P=0.038, Significant). This observation is in agreement with the findings reported by Premalatha G, et al.¹⁹ who reported an association

of PAD with an age of more than 50 years.

In the current study, 80% of patients with PAD are males, & 30% of patients without PAD are males and this difference is statistically significant ($P=0.016$, Significant). This observation is in agreement with the findings reported by Alcolado JC, et al.²⁰ which supports the fact that male sex is an independent risk factor for PAD. Another study by

Bembi, et al.¹⁷ also reported that the prevalence of PAD was more in males when compared to females.

In the current study, 90% of patients with PAD have duration of diabetes mellitus-2 more than 10 years & 36.6% of patients without PAD have duration of DM-2 more than 10 years and this difference is statistically significant ($P=0.016$, Significant). This observation is in agreement with the findings reported by Al-Delaimy WK, et al.²¹ The duration of diabetes correlates with the incidence and extent of PAD. They found a strong positive association between the duration of diabetes and the risk of developing PAD. The association was particularly strong among men with hypertension or who were current smokers. Adler et al.¹⁰ estimated the prevalence of PAD up to 18 years after the diagnosis of diabetes in 4,987 subjects (United Kingdom Prospective Diabetes Study [UKPDS]) reported a higher prevalence of PAD in those with longer duration of diabetes. Data from other studies also suggested that vascular abnormalities in people with diabetes increase with duration of diabetes.⁹

Three studies of HbA1c and PAD among DM-2 were identified.^{22,23,24}

Each of the identified studies reported HbA1c to be associated with a significant increased risk of PAD. After pooling together the results from the three studies, Selvin E, et al., reported higher prevalence of PAD in those with longer duration of diabetes. The degree of diabetic control is an independent risk factor for PAD; with every 1% increase in HbA1c, the risk of PAD has been shown to increase by 28%.²⁰

In the current study, 70% of patients with PAD

were Hypertensive & 20% of patients without PAD were Hypertensive and this difference is statistically significant ($P=0.006$, Significant). This observation is in agreement with findings reported by Adler AI, et al.¹⁰. Framingham Study found a 2.5 to four-fold increased risk of PAD in men and women with hypertension. There is evidently a clear association between PAD and hypertension. Large epidemiological studies have shown that not only is hypertension a risk factor for PAD but also the risk seems to increase with increase in systolic blood pressure, and about 40% of patients with PAD have hypertension.⁶⁷

Data from other studies also suggested that vascular abnormalities in people with diabetes increase with worsening of blood pressure.

In the current study, 90% of patients with PAD have increased Body Mass Index & 40% of patients without PAD have increased Body Mass Index and this difference is statistically significant ($P=0.017$, Significant). This observation is in agreement with the findings reported by Katsilambros NL, et al.²⁷

In the current study, 80% of patients with PAD have increased serum cholesterol & 26.6% of patients without PAD have increased serum cholesterol and this difference is statistically significant ($P=0.009$, Significant). This observation is in agreement with the findings reported by Adler AI, et al.¹⁰ Another study by O'Neal DN, et al., reported significant association of increased serum cholesterol levels and PAD.²⁸

In the current study, 70% of patients with PAD have increased serum LDL & 13.3% of patients without PAD have increased serum LDL and suggested that vascular abnormalities in people with diabetes increase with worsening of blood pressure.¹

In the current study, 90% of patients with PAD have increased Body Mass Index & 40% of patients without PAD have increased Body Mass Index and this difference is statistically significant ($P=0.017$, Significant). This observation is in agreement with the findings reported by Katsilambros NL, et al.²⁷

In the current study, 80% of patients with PAD have increased serum cholesterol & 26.6% of patients without PAD have increased serum cholesterol and this difference is statistically significant ($P=0.009$, Significant). This observation is in agreement with the findings reported by Adler AI, et al.¹⁰ Another study by O'Neal DN, et al., reported significant association of increased serum cholesterol levels and PAD.²⁸

In the current study, 70% of patients with PAD have increased serum LDL & 13.3% of patients without PAD have increased serum LDL and this difference is statistically significant ($P=0.027$, Significant). This observation is in agreement with the findings reported by Adler AI, et al.¹⁰ Another study by Harris LM, et al., reported significant association of increased LDL and PAD.²⁹

In the current study, 60% of patients with PAD have increased serum Triglycerides & 16.6% of patients without PAD have increased serum Triglycerides and this difference is statistically significant ($P=0.024$, Significant). This observation is in agreement with the findings reported by Adler AI, et al.¹⁰ Another study by M. Trayner, et al.,³⁰ also reported significant association of increased triglyceride levels and PAD.

In the current study, 60% of patients with PAD have decreased serum HDL & 16.6% of patients without PAD have decreased serum HDL and this difference is statistically significant ($P=0.024$, Significant). This observation is in agreement with the findings reported by Adler AI, et al.¹⁹ Another study by M. Trayner, et al.,³⁰ also reported significant association of decreased HDL levels in patients with PAD.

In the current study, 40% of patients with PAD were found to have myocardial ischemia by electrocardiogram & 6.6% of patients without PAD were found to have myocardial ischemia by electrocardiogram and this difference is statistically significant ($P=0.040$, Significant). This observation is in agreement with findings reported by Mohan V, et al.³¹

Another study by Agnes Jager, et al., who studied a group of patients with PAD of age more than 50 years and followed them prospectively for 5 years. This study reported that PAD was associated with a 4-fold increase in cardiovascular mortality.³²

Michael H. Criqui, et al., Studied a group of 508 patients with diagnosed PAD and after following up them for 3 years, reported that 121 (23.8%) patients had been hospitalised with a diagnosis of Cardio Vascular Disease, 65 (12.8%) patients were dead due to Cardio Vascular Disease. This study also supports that PAD is associated with increased cardiovascular mortality.³³

In the current study, among patients with PAD detected by Colour Doppler Study, only 20% of patients were having abnormal peripheral pulses on examination. This shows the higher sensitivity of Colour Doppler scanning in detecting PAD.

LIMITATION

A limitation of the study was the self-reporting of duration of diabetes. There were no medical records to verify the duration of diabetes.

CONCLUSIONS:

The conclusions drawn are as follows:

1. The prevalence of asymptomatic PAD in DM-2 was found to be significant (25%)
- 1) Age (more than 50 years) was found to have strong positive correlation with development of PAD ($P=0.038$, Significant)
- 2) Male sex was found to have strong positive correlation with development of PAD ($P=0.016$, Significant)
- 3) Smoking was found to have strong positive correlation with development of PAD ($P=0.011$, Significant)
- 4) Duration of DM-2 (more than 10 years) was found to have strong positive correlation with development of PAD ($P=0.016$, Significant)
- 5) Poor Glycemic control ($HbA1c > 7\%$) was found to have strong positive correlation with development of PAD ($P=0.027$,

Significant)

- 6) Hypertension was found to have strong positive correlation with
- 7) development of PAD (P=0.006, Significant)
- 8) Increased Body Mass Index was found to have strong positive correlation with development of PAD (P=0.017, Significant)
- 9) Increased Serum Cholesterol was found to have strong positive correlation with development of PAD (P=0.009, Significant).
- 10) Increased Serum LDL was found to have strong positive correlation with development of PAD (P=0.002, Significant).
- 11) Increased Serum Triglycerides was found to have strong positive correlation with development of PAD (P=0.024, Significant).
- 12) Decreased Serum HDL was found to have strong positive correlation with development of PAD (P=0.024, Significant).
- 13) Myocardial ischemia suggested by electrocardiogram was found to have strong positive correlation with the development of PAD (P=0.040, Significant).
- 14) 80% of patients with PAD, identified by Colour Doppler study, have normal peripheral pulses on clinical examination suggesting more sensitivity of Colour Doppler study.

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