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Original Research Article

Correlation Between Peripheral Arterial Disease and Coronary Artery Disease Using Ankle Brachial Index in Patients with Type II Diabetes Mellitus

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Abstract: Aim of the study was to evaluate the severity of peripheral artery disease in diabetic and non-diabetic patients , using Ankle Brachial Index and to correlate the severity of Peripheral Arterial Disease with severity of Coronary Artery Disease , by clinical and non- invasive methods. 50 diabetic and 50 non diabetic patients with Peripheral Arterial Disease(PAD) were included in the study. PAD was assessed clinically by using Ankle Brachial Index (ABI) value of less than 0.9. Presence of Coronary Artery Disease (CAD) in the two groups was assessed by clinical criteria and by non-invasive investigations namely 12 lead Electrocardiography (ECG), 2 D Echocardiography (ECHO) and Treadmill test (TMT). The severity of PAD in the diabetic group was correlated with the extent of CAD. Results: Presence of CAD in the diabetic and non- diabetic patients with PAD was found to be 48% and 8% respectively. Patients with more severe PAD in the diabetic group had higher mean blood sugar levels. ABI values were lower in long standing diabetic patients. ABI values were also lower in diabetic patients who had more symptoms of PAD, as assessed by Fontaine's grading, and was statistically significant. 24 patients were found to have CAD in the diabetic group. Patients with low ABI had more severe CAD. ECG changes and ECHO findings in these patients were significant. We conclude that ABI is a very useful non- invasive tool to pick up the patients with PAD. It is also an important parameter to predict CAD especially in the diabetic patients.
Keywords: Ankle Brachial Index, Peripheral artery disease, Coronary artery disease, Diabetes Mellitus, Fontaine's grading

INTRODUCTION

Coronary Artery Disease (CAD) is the main cause of death and disability in the elderly people. Several cohort studies have shown that subclinical atherosclerosis is associated with an increased risk of subsequent Cardio Vascular events [1]. Presence of Peripheral Arterial Disease (PAD) is also an indicator and marker of atherosclerotic disease in other vascular beds [2]. Identification of PAD provides valuable prognostic information. Mortality is inversely related to the severity of PAD. 5 year mortality rate for patients with PAD is approximately 30%, with 75 % of deaths from cardiovascular diseases [3].

Ankle Brachial Index (ABI) is one non-invasive tool frequently used to detect Peripheral vascular disease in lower limbs. ABI is a ratio of supine brachial to ankle blood pressure and a value of less than 0.9 is indicative of PAD [3]. It is quick, easy to measure, and has high patient acceptability. It is accurate and reliable indicator of atherosclerosis [1 4, 5]. The Sandiago study Rottendon study, using the ABI have shown that the prevalence of asymptomatic PAD is much higher than the symptomatic disease [6].

Diabetic patients are at a greater risk of atherosclerosis . The burden of Diabetes is increasing with alarming proportions in India and abroad. India will have more than one fifth of world's diabetic population by 2030. Whether diabetic patients with low ABI have more severe and increased prevalence of CAD, as compared to non- diabetics has not been studied well.

We took up this study to evaluate 1. The presence of CAD in diabetic and non-diabetic patients

with PAD, using ABI as an indicator of PAD. 2 To correlate the severity of PAD (assessed clinically and by ABI) with the presence of CAD diagnosed clinically and by non- invasive investigations.

MATERIAL AND METHODS

The study was conducted in the Department of Medicine Vydehi Institute of Medical Sciences Bengaluru, between the period Jan 2014 to June 2015. Ethical committee approval was taken before starting the study. Patients clinically suspected of having peripheral disease were investigated for the presence of Diabetes mellitus. We made two groups of 50 patients each according to presence or absence of Diabetes. PAD was confirmed by measuring ABI. ABI was obtained in a standard fashion by measuring supine systolic blood pressure of the brachial and ankle arteries with a 5-7 HZ hand held Doppler. Ankle brachial ratio was calculated and a value of less than 0.9 was considered to be indicative of PAD [3].

Detailed history and examination was done in all patients to detect the presence of PAD and CAD. Fontaine's crieteria [7] was used to quantify the severity of PAD. Colour Doppler studies were done in selected cases using a general purpose linear probe with image frequency of 5.7 to 10.0 Mhz. Modified Rose WHO questionnaire [8, 9] was applied for clinical diagnosis of CAD and further confirmed by ECG and ECHO. TMT was done to confirm CAD in doubtful cases. Relevant investigations were done to know the etiology of PAD and also to assess other risk factors.

Inclusion criteria

Male and Female diabetic and non- diabetic Patients with PAD, above the age of 45 years, attending VIMS & RC.

Exclusion Criteria

1.Patients < 45 years of age. 2. Patients who were regularly consuming alcohol.3. Chronic smokers. 4. Known hypertensive patients.5.Type I diabetes patients. 6. Conditions which would affect measurement of ABI like trauma, patients with leg ulcers , lower limb amputation.

Statistical analysis

All details were recorded in a well- structured proforma. Continuous data are presented as means and standard deviation. The differences in the two groups were analyzed by using appropriate statistical methods.

RESULTS

We had 50 diabetic and 50 non- diabetic patients with PAD in the study. In the diabetic group 74 % were males and 26% females. Most patients in this group were in the age group of 45-65 (37 patients). 26 % were above the age 65. 68% of the patients were in Fontaine's grade 1 & 2. 9 patients had rest and night pain (Fontaine's 3) and seven had evidence of gangrene and necrosis (Fontaine's grade 4).

Majority of patients had diabetes of 6-15 years duration (78%) and only few had diabetes for more than 15 years (8%). Mean blood sugar values in each grade is given in the Table 1.

Incidence of CAD in diabetic and non - diabetic patients with PAD is given in table 2.

Among the 24 CAD patients in the diabetic group ECG and ECHO findings were significant in patients with low ABI and those in higher Fontaine's grade. Table (3, 4 & 5). Patients with low ABI in this group also had significant regional wall motion abnormalities (RWMA)and low ejection fraction (EF), as shown in Table 6, 7, and 8. 24 out of 50 patients were found to be having CAD among the study group

Table 1 : mean glycemic values according to symptoms in the study group(n=50)

Sl . No.	Fontaine's Grade	No. of subjects n=50(100%)	Mean FBS	Mean PPBS	Mean HbA1c%
1	1	16(32%)	184	348	8
2	2	18(36%)	196	368	8.5
3	3	9(18%)	184	403	8.8
4	4	7(14%)	200	477	9.2

The two –sided P value is 0.0069, considered significant. The row /column association is statistically significant. Relative risk =0.7556, 95% confidence interval: 0.6116 to 0.9335

Table 2: Incidence of CAD in both the groups

Sl. No.	Group	CAD Pts
1	Diabetic	24(48%)
2	Non diabetic	4(8%)

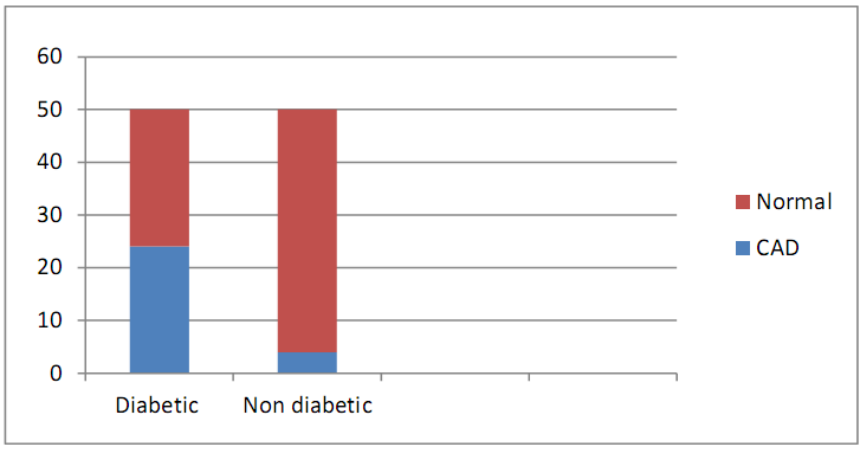

Fig-1: Incidence of CAD

Table 3: ECG findings of CAD patients according to Fontaine's grading in the study group

Sl. No.	Fontaine's Grade	T wave changes	ST segment abnormalities	Pathological Q waves	Others
1	1	3	2	2	4
2	2	4	0	2	4
3	3	5	1	3	6
4	4	5	5	2	6

The two sided P value is 0.0013 considered significant. The row/column association is statistically significant. Relative risk =3.000, 95% Confidence Interval: 1.493 to 6.028

Table 4: ECG findings of CAD patients according to ABI in the study group

Sl.no	ABI	T wave changes	ST segment abnormalities	Pathological Q waves	Others
1	0.99 – 0.80	4	2	1	1
2	0.79 - 0.60	4	0	3	7
3	0.59 - 0.40	4	4	2	5
4	≤0.39	1	1	0	1

The two- sided P value is 0.0243, considered significant. The row/column association is statistically significant. Relative risk = 2.375, 95% confidence interval: 1.148 to 4.915

Table 5: Distribution of EF in CAD patients according to Fontaine's grading in the study group

Sl. No	Fontaine's Grade	No. of subjects n = 18(100%)	Mild (EF = 45-54)	Moderate (EF= 30-44)	Severe (EF≤ 29)
1	1	4(22.22%)	4(22.22%)	0	0
2	2	3(16.66%)	2(11.11%)	1(5.55%)	0
3	3	5(27.79%)	3(16.66%)	2(11.11%)	0
4	4	6(33.33%)	2(11.11%)	4(22.22%)	0

The two-sided P value is 0.0002, considered significant. The row/column association is statistically significant. RR = 9.000, 95% CI: 2.2 – 36.8

Table 6: Distribution of EF in CAD patients according to ABI in the study group

Sl. No	ABI	No.of students n = 18(100%)	Mild (EF=45-54)	Moderate (EF=30-44)	Severe (EF≤ 29)
1	0.99 – 0.80	4(22.22%)	4(22.22%)	0	0
2	0.79 - 0.60	8(44.44%)	5(27.79%)	3(16.66%)	0
3	0.59 - 0.40	5(27.79%)	2(11.11%)	3(16.66%)	0
4	≤0.39	1(5.55%)	0	1(5.55%)	0

The two-sided P value is 0.0008, considered significant. The row/column association is statistically significant. Relative risk = 7.000, 95% confidence interval: 1.8 to 27.6.

Table 7: Distribution of RWMA according to Fontaine's grading in the study group

Sl. No.	Fontaine's Grade	RWMA n = 16(100%)
1	1	4(25%)
2	2	3(18.75%)
3	3	3(18.75%)
4	4	6(37.50%)

The two-sided P value is 0.0007, considered significant. The row/column association is statistically significant. Relative risk = 8.000, 95% confidence interval: 1.939 to 33.001

Table 8: Distribution of RWMA according to ABI in the study group

Sl.No.	ABI	RWMA n = 16(100%)
1	0.99 – 0.80	3(18.75%)
2	0.79 – 0.60	7(43.75%)
3	0.59 – 0.40	5(31.25%)
4	≤ 0.39	1(6.25%)

The two-sided P value is 0.0004, considered significant. The row/column association is also statistically significant. Relative risk = 6.5000, 95% confidence interval: 1.740 to 24.282

Table 9: Distribution of TMT positive findings according to ABI in the study group

Sl. No.	ABI	TMT Positive n = 8(100%)
1	0.99 – 0.80	3(37.50%)
2	0.79 – 0.60	5(62.50%)
3	0.59 – 0.40	0
4	≤ 0.39	0

DISCUSSION

Several noninvasive tests have been designed for the detection of PAD in clinical practice. Among them ABI is the most simple and inexpensive test with high sensitivity and specificity [10] and a cut off value of < 0.9, as recommended by AHA, is generally accepted to indicate significant PAD. ADA study also found ABI to be more accurate and has found to be 95% sensitive and almost 100 % specificity [11, 12]. Diagnostic accuracy of ABI in angiographically proven PAD has been established in many studies. Anand Dubey and others conducted a systematic review of ABI in 9 different studies and concluded that low ABI of less than 0.9 has high specificity in predicting future cardiovascular events. Low ABI helps to rule in high risk patients, but a normal ABI does not rule out a high risk patient [13].

PAD is an indicator of atherosclerosis in other vascular beds. Morcelo and others [14] prospectively evaluated 312 angiographically proven cases of CAD and found high prevalence of PAD in these patients. Shamita Sarangi et.al also in their study found CAD in 46.88 % of patients with PAD [6]. Michel H *et.al* in a follow up study of 10 years found that patients with severe large vessel disease have four to seven times the risk of mortality from all causes [15] Several other studies also have established definite positive correlation between PAD, ABI and CAD [16].

In our study we used ABI to diagnose PAD in clinically suspected patients and made an attempt to correlate with the presence of CAD in diabetic and non-diabetic patients with PAD. We found higher incidence of CAD in diabetic patients with PAD as compared to non- diabetic patients with PAD. Our findings are consistent with the observations made by Agarwal and others who found CAD in 54% of diabetic patients with PAD. Diabetic patients are much older and usually have other risk factors of CAD and this may be the reason of higher incidence of CAD, as compared to non- diabetic patients. Papanas et al. in their study on 302 patients of angiographically proven PAD, found that diabetic patients have significantly longer duration of diabetes and higher frequency of insulin treatment [17].

Another important observation in our study is that severity of PAD as detected by ABI values, correlated well with the diabetic status of the patients. Uncontrolled diabetics had much lower ABI values. We assessed PAD clinically by applying Fontaine's grading. Patients with clinically severe PAD had much lower ABI values, again indicating the value of measuring ABI. Edward Jude and others

angiographically demonstrated that diabetics have worse PAD than non-diabetic patients and have high risk of limb amputation [18].

24 out of 50 diabetics had clinical evidence of CAD. ECG and Echocardiographic findings of CAD were significantly higher in patients with low ABI and high Fontaine's grade. TMT was done only in selected cases where doubt existed about CAD. TMT positive patients had more severe PAD as evidenced by ABI value between 0.6-0.89 in these patients. These findings support the observation made by many authors that cut off ABI value <0.9 is very sensitive indicator of presence of CAD. Framingham study has found that low ABI is not only a marker of CAD but also indicates increased risk of strokes and TIA [19].

India is a country with large burden of diabetic patients. There is a strong need to identify patients with sub clinical atherosclerosis to prevent CV morbidity. ABI is very useful non- invasive tool to pick up the patients at risk. ADA consensus statement recommends ABI measurement in all Diabetics above the age of 50 [20].

This study stresses the recommendation that ABI should be measured in all diabetic patients, so that CAD may be detected early.

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