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Original Research Article

Association of Ankle brachial pressure index with coronary artery disease and ejection fraction in post myocardial infarction patients

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Abstract: Much is known regarding peripheral arterial disease in the general population, assessment & management of peripheral arterial disease in those with myocardial infarction is less clear & poses some special issues. Due to the frequent coexistence of atherosclerotic process in distinct vascular territories, previous studies demonstrated that the ABPI presents a strong correlation with the presence and severity of atherosclerosis in carotid and coronary arteries. The aim of present study is to investigate the association between ankle brachial pressure index & coronary artery disease extent and severity and ejection fraction in post MI patients. The present study was carried out in 150 post MI patients at ICU & medicine ward of Sir-T hospital, Bhavnagar & CCU of Sterling hospital, Bhavnagar, ABPI was done using vascular doppler. We found no significant association between extent of CAD and ABPI. But low ABPI was associated with severe CAD (>70% block).There was extremely significant association between low ejection fraction and ABPI. This cost effective method can be used as a primary preventive measure to screen PAD patients prior to angiography and echocardiography.

Keywords: Peripheral arterial disease, Ankle brachial pressure index, Coronary artery disease, Myocardial infarction.

INTRODUCTION

It is estimated that one in every 20 Indians over the age of 50 has Peripheral Arterial Disease & it is estimated to affect more than 9 million people in India [1]. Although much is known regarding Peripheral Arterial Disease in the general population, Assessment & Management of Peripheral Arterial Disease in those with Myocardial Infarction is less clear & poses some special Issues. Myocardial infarction (MI), results from the partial interruption of blood supply to a part of the heart muscle causing the heart cells to be damaged or die. This is most commonly due to occlusion of a coronary artery following the rupture of a vulnerable atherosclerotic plaque in the wall of an artery [2]. Atherosclerosis, if present in the periphery, is also likely in other parts of the arterial tree. Peripheral Arterial Disease is under diagnosed in Primary care practices, yet the extent of unrecognized Peripheral Arterial Disease in patients with Coronary Artery Disease is not uncommon [3]. Due to the frequent coexistence of atherosclerotic process in distinct vascular territories, previous studies demonstrated that the ABI presents a strong correlation with the presence and severity of atherosclerosis in carotid and coronary arteries [4, 5]. Non-invasive measures of subclinical atherosclerosis such as ABPI could improve predicting risk of future cardiovascular & cerebrovascular events than conventional risk factors alone& provide more focused primary prevention strategies [6].

The aim of our study is to investigate the association between Ankle Brachial Pressure Index & Coronary Artery Disease extent and severity in post MI patients and association between Ankle Brachial Pressure Index & Left ventricular ejection fraction in post MI patients.

MATERIAL AND METHODS

The present study was carried out at ICU &Medicine Ward of Sir-T hospital, Bhavnagar & CCU of Sterling hospital, Bhavnagar, Gujarat during June 2013 to February 2014.The study protocol was approved by Institutional Review Board (IRB). The study population was consisting of 150 post Myocardial Infarction patients, both male and female between 30-90 years of age.

Inclusion Criteria

AGE: 30–90 years, SEX: Males and Females both, Myocardial Infarction patients (1 year duration) diagnosed by angiography & echocardiography, those who are willing to give written informed consent.

Exclusion Criteria

Severe & Non tolerable Lower limb pain, Malignancy, Pregnancy, Mental disorder, acute inflammation state.

The present study was carried out by VERSADOP vascular Doppler (table top vascular Doppler with 8 MHz probe**,** manufactured by Diabetik Foot Care India Limited, Chennai, India. All patients were informed and explained about the procedure to alleviate apprehension and to get full relaxation and desired co-operation during the procedure and written informed consent were taken. The measurements were taken in the Supine Position according to patient′s comfort, after a 10 minutes Rest. We measure the Brachial Systolic Blood Pressure in both arms and the Posterior Tibial and Dorsalis Pedis Systolic Blood Pressures in both legs. Then Divide the higher of the two systolic pressures (DP & PT) for right & left leg by the higher of the two arm pressures to get the right and left ABPI. Transthoracic echocardiography was Performed at sterling hospital in all patients and interpreted by experienced echocardiographer blinded to the ABPI results. Left ventricular ejection fraction was measured by using the Simpson method. A normal left ventricular ejection fraction (LVEF) was defined as ≥50%. Coronary Angiography was done via the femoral approach with a 5F or 6F catheter using the standard technique. Omnipaque 300 (iohexol 647 mg, trometamol 1.2 mg) was the contrast used in all of the cases. Angiographers made a subjective assessment of coronary vessels involvements including the left main artery (LMA), left circumflex coronary artery (LCX), right coronary artery (RCA), diagonal artery 1 (D1), diagonal artery 2 (D2) and large obtuse marginatus (OM). Lesion severity assessed visually if more than 70% or less than 40% but for lesions between 40% - 70% Computer-Assisted Quantitative Angiography (QCA) used to calculate the severity of the lesion. Lesion considered being significant if the luminal stenosis exceeds 50% in any epicardial vessel. The extent of CAD was reported as one, two or three vessel disease.

Statistical Analysis

The data were transferred on Excel spreadsheet and descriptive analysis was expressed as Mean ± Standard Deviation (SD). All calculations were accomplished by using MedCalc software 12.5.0 version. The comparison of mean differences will be done by unpaired t- test. Difference was considered statistically significant with p value <0.05 with 95% CI.

RESULT

Socio-demographic distribution of study population shows out of 150 post MI patients, 102 (68%) were >50 years of age and 48 (32%) of < 50 years. 106 (70.7%) were male and 44 (29.3%) were females. 54.7% were obese and 18% were overweight.

Table-1: Distribution of patients according to ABPI:

ABPI Value	Number (n=150)	Percentage
>1.3	5	3.3%
1-1.3	25	16%
0.81-1	103	69.33%
0.5-0.8	17	11.33%
<0.5	0	0%
<0.3	0	0%

Table 1 shows classification of ABPI. Out of 150 post MI patients 125 patients were having abnormal ABPI and 25 patients were having normal ABPI. ABPI value 1-1.3 shows no arterial disease. 0.81-1 shows mild or insignificant arterial disease, 0.5-0.8 shows moderate arterial disease, <0.5 shows severe arterial disease. <0.3 shows critical limb ischemia. >1.3 shows calcification may be present.

In above 50 years age group we found 90 (72%) patients were having abnormal ABPI and 20 (80%) of patients were having normal ABPI. In less than 50 years age group 35 (28%) of patients were having abnormal ABPI and 5 (20%) of patients were having normal ABPI. We found no significant relation (p= 0.56 at 95% CI) between age and ABPI. 89 (71.2%) males were having abnormal ABPI and 17 (68%) were having normal ABPI. 36 (28.8%) females were having abnormal ABPI as compared to 8 (32%) having normal ABPI. We found no significant relation (p=0.936 at 95% CI) between ABPI and sex. Mean height, weight and BMI were 160.51± 6.50, 64.28 ± 9.799, 24.92 ± 3.62 respectively in patients having abnormal ABPI. In patients having normal ABPI Mean height, weight and BMI were 159.72 ± 8.09, 66.31 ± 8.25, 26.07 ± 3.69 respectively. We also found no significant correlation (p= 0.1505 at 95% CI) between ABPI and these standard anthropometric measurements.

Table-2: Association of ABPI with extent of vessels diseases:

CAD	Abnormal ABPI (n=125)	Normal ABPI (n=25)	P value
SVD	42(33.6%)	8 (32%)	0.9383 (NS)
DVD	34 (27.2%)	7 (32%)	0.8073 (NS)
TVD	46 (36.8%)	10 (40%)	0.9398 (NS)

Table 2 shows no significant association of ABPI with extent of CAD. SVD= Single Vessel Disease, DVD= Double Vessel Disease, TVD= Tripple Vessel Disease.

Table-3: Association of ABPI with severity of vessels diseases:

CAD	Abnormal ABPI (n=125)	Normal ABPI (n=25)	P value
20-40%blockage (Mild CAD)	36 (28.8%)	8 (32%)	0.8091 (NS)
40-70%blockage (Moderate CAD)	37 (29.6%)	12 (48%)	0.0648 (NS)
>70% blockage (Severe CAD)	56 (44.8%)	5 (20%)	**0.0427 (S)**

Table 3 shows significant association of ABPI with >70% i.e. severe CAD.

Table 4 shows mean value of Ejection Fraction, which shows extremely significant difference between the groups as regards Ejection Fraction.

Table-4: Association of ABPI and LVEF

LVEF (Mean ± SD)		p Value
Abnormal ABPI	**Normal ABPI**	**< 0.0001 (ES)**
33.80 ± 12.02	47.05 ± 12.83	

DISCUSSION

Different studies show that prevalence of PAD is more in older age. The Rotterdam study done by Wouter *et al*. [7] suggested that age older than 75 years was an important risk factor for PAD. In study conducted by Raj Mohan *et al*. [8], as compared to patients without PAD, patients with PAD were older (66.8 years vs. 59.1 years of age) with p value of <0.001 which was highly significant. Study conducted by Hachiro Ohnishi *et al*. [9], the mean age for development of PAD was 77.5 ± 5.2. In our study higher number of PAD (60%) seen in age more than 50 years. But result shows no statistical significant relationship of ABPI with age. The angiographic study done by Masoumeh Sadeghi *et al*. [10] also shows age between subjects of ABPI < 0.9 i.e. those with PAD and those without PAD was not significantly different. It may be a result of studying a selective group of patients.

Comparing sex in study conducted by Raj Mohan *et al*. [8], shows that in PAD subjects 48.1% were male while in non-PAD subjects 48.9% were male with p-value of 0.054 which suggests that there was no significant gender difference between two groups. In our study out of 44 female subjects 36(24%) females and out of 106 male subjects 89(59%) males were having arterial diseases. p-value of 0.81 between the groups shows that there is no significant association between PAD and sex. Our result were in line with the study of Papamichael *et al*. [11], Taylor Piliae *et al*., the prevalence of PAD is same in both sexes.

In our study we carried out anthropometric measurements height, weight and BMI. We found no significant correlation between abnormal BMI (> 25 kg/ sq.m.) and development of PAD with p-value of 0.0631. Same wise in study conducted by Raj Mohan *et al*. [8], showed no significant correlation between these parameters. Similarly study conducted by Hachiro Ohnishi et al (2009) [9] showed that the mean BMI in male patients were 22.2±3.1 and 23.1±2.9 in PAD and non-PAD subjects respectively with p-value being 0.06.

In disagreement with the Peripheral Arterial Disease in Interventional Patients Study (PIPS) [12] no significant correlation was found between low APBI and the extent of CAD (mean number of arteries involved). Study conducted by A. M. ALSHEHRI in Saudi [13] also showed no significant correlation between low ABPI and the extent of CAD.

It is shown that ABI is influenced by LV systolic function, independent of coronary disease [14]. In our study compared with subjects with a normal ABPI, those with a low ABPI had significantly lower LVEF (p=0.0076). Rizvi and coworkers found that mean LVEF significantly increased from low ABPI to normal and high ABPI. ABPI was independently related to LVEF [14]. Likewise, Ward *et al*. [15] in study of

204 patients with symptomatic PAD found that LVEF less than 55% among patients with low ABI is more common than normal ABI. Also in the study by Santo Signorelli *et al*. LVEF <50% had higher prevalence in patients with ABI ≤ 0.9 [16]. Compared with subjects with a normal ABPI, those with a low ABPI had a lower LVEF.

CONCLUSION

The present study revealed high prevalence of low ABI in myocardial infarction patients that is an individual risk factor for Cardiovascular Disease. This cost effective method can be used as a primary preventive measure to screen PAD patients prior to angiography and echocardiography. This simple non-invasive method is a boon for developing countries like India.

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