

Ankle- Brachial Index predicts Coronary Artery Disease associated with Peripheral Arterial Disease.

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Abstract

Most common cause of Peripheral Arterial Disease (PAD) is atherosclerosis. Atherosclerosis is a generalized disease, also involving coronary and carotid arteries. Often atherosclerotic coronary artery disease (CAD) is associated with PAD. This prospective observational study was conducted in the National Institute of Cardiovascular Diseases, Dhaka, Bangladesh, during July 2004 to June 2005. Total 58 patients with PAD were included in the study. Patients were classified as group I having normal coronary artery, group II insignificant CAD (Left main <50% stenosis, others <70% stenosis) and group III, significant CAD (Left main \geq 50% stenosis, others \geq 70% stenosis). Ankle-brachial index was significantly low (0.75 ± 0.25 Vs 0.37 ± 0.40) in the patients with coronary artery disease (Group II and III) compare to non- CAD ($P = 0.001$). This study suggests that ankle-brachial index (ABI) have significant relation with the presence of CAD.

Key words: Ankle-Brachial Index, peripheral arterial disease.

Introduction

Patients with peripheral arterial disease often present with coronary atherosclerosis and are at increased risk for adverse cardiovascular events.¹⁻⁴ In a San Diego population study,⁵ 32% of men with clinical coronary artery disease (CAD) and cerebrovascular disease (CVD) also had PAD, compared to 13% of men without cardiovascular disease. On the other hand 25% of women without clinical CAD, met non-invasive criteria for peripheral arterial disease (PAD). This signifies a 2-3-fold increase.⁶

A Saudi study of patients aged 50-80 years (mean 59 years) showed a PAD prevalence of 21% in those with ischemic heart disease, contrasted with 4% in controls without heart disease suggesting up to a 5 fold increase.⁷

Resting ankle-brachial pressure index (ABI) is a noninvasive method to assess the patency of the lower extremity arteries.⁸ ABI has been shown to be a strong predictor of subsequent cardiovascular events in patients with peripheral arterial disease in middle-aged population and in older subjects.⁹ ABI was found to be independently and inversely related to CAD.^{9, 10} ABI is a simple index related to the extent

of atherosclerosis in coronary and noncoronary arterial beds, reflecting generalized atherosclerosis. ABI could be useful in assessing the risk for cardiovascular events in patients with coronary artery disease.⁹⁻¹¹ The main objective of the study was to correlate ABI with the severity and extent of CAD in patient suffering from clinically significant peripheral artery disease of lower limbs.

Patients and Method

This prospective observational study was conducted in the National Institute of Cardiovascular Diseases (NICVD), Dhaka during July 2004 to June 2005. Total 58 patients with PAD were included in the study. Patients were classified as group I having normal coronary artery, group II with insignificant CAD (LM <50% stenosis, others <70% stenosis) and group III with significant CAD (Left main \geq 50% stenosis, others \geq 70% stenosis).

Patients with age 40 years and above were included. Relevant physical examination like skin changes (local temperature, hair distribution, ulcer, gangrene), arterial pulses, blood pressure, elevation pallor, capillary filling, bruits and ABI were also done. ABI less than 0.90 are considered abnormal.

Patient's age below 40 years and suspected systemic vasculitis were excluded. Informed written consent was taken from each patient. Baseline clinical data, physical examination, ABI and peripheral and coronary angiogram were done in all patients as per standard protocol. A normal ABI should be 1.0 or greater. ABI less than 0.90 was considered abnormal and is 95% sensitive for angiographically verified atherosclerotic peripheral arterial stenosis.⁸

Methodology

Ankle-Brachial Index (ABI): The ABI is the ratio of systolic blood pressure measured at the ankle to systolic blood pressure at the brachial artery.⁸ It is a simple, noninvasive, inexpensive measurement to assess the patency of the lower extremity arterial system. ABI was measured by a person who was unaware of about the clinical history of the patient. Measurement was performed after the patient seated comfortably for five minutes and it was ensured that he/she did not smoke for at least one hour. The ABI is measured by having the patient lie in the supine position. Hand held Doppler probe (8MHZ) [HADECO, UK] was used to measure the ankle systolic pressure.

Coronary and Peripheral Angiogram: Peripheral angiogram and CAG were done in all the patients. Both angiograms were done by standard technique using and radioiodinated contrast media.^{8, 12} In peripheral arteriography pigtail, multipurpose or right Judkins and in CAG both right and left Judkins & pigtail catheters were used. Routine views were taken.^{5,10} After angiography patient population were divided into 3 groups based on CAG findings.

Results

Table I demonstrates that among the 58 patients included in the study, 52 were male and 6 were female. The mean age of the patients were 53.3±7.9 years ranging from 40 to 75 years. The mean age of the male patients was 53.0±7.4 years and the female patients was 56.3±12.1 years.

Figure 1 shows that out of 58 patients, 41.4% had no coronary arterial disease, 15.5% had insignificant coronary arterial disease that is <50% stenosis in LM and or <70% stenosis in other coronary artery and 43.1% had showed significant coronary arterial disease that is 50 and above percentage of stenosis in LM and or 70% and above stenosis in other coronary artery, so overall 58.6% had coronary artery disease.

Figure II depicts major atherosclerotic risk factor profile of study population had highest of smoking (67.2%) followed by diabetes mellitus (55.2%), dyslipidaemia (51.7%), family history of IHD (44.8%) and hypertension (34.5%).

Table II shows that the mean Ankle-Brachial Index for group I, group II and group III patients were 0.75±0.25, 0.52±0.34, 0.37±0.40 respectively. Analysis found a statistically significant mean difference between group I and group III patients (p<0.001), but no statistically significant mean difference was found between group I vs. group II and group II vs. group III patients (p>0.05). This indicated that the ankle-brachial index was significantly low among the patients with coronary artery disease than non-CAD.

Table I. Distribution of patients by age and sex (n=58).

| Age in years | Sex | | | | Total | | *p value |
|--------------|----------|-------|-----------|-------|----------|-------|----------|
| | Male | | Female | | No. | % | |
| | No. | % | No. | % | | | |
| 40-49 | 18 | 34.6 | 2 | 33.3 | 20 | 34.5 | |
| 50-59 | 23 | 44.2 | 1 | 16.7 | 24 | 41.4 | |
| 60+ | 11 | 21.2 | 3 | 50.0 | 14 | 24.1 | |
| Total | 52 | 100.0 | 6 | 100.0 | 58 | 100.0 | |
| Mean±SD | 53.0±7.4 | | 56.3±12.1 | | 53.3±7.9 | | |
| Range | 40-75 | | 40-70 | | 40-75 | | 0.331 |

*p value reached from unpaired student's t test

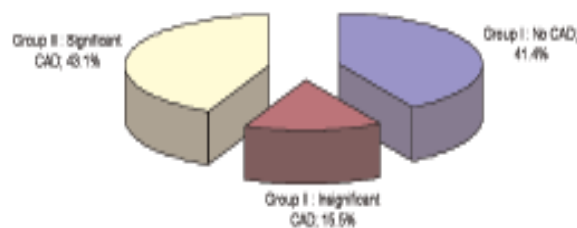


Fig 1: Distribution of patients by coronary artery disease

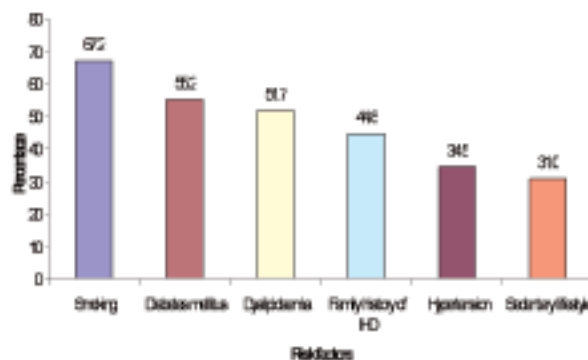


Fig 2: Distribution of patients by risk factors (n=58)

Table II. Ankle-Brachial Index in different groups of patients (n=58)

| Ankle-Brachial Index | No CAD | CAD | |
|----------------------|----------------|----------------|------------------|
| | Group I (n=24) | Group II (n=9) | Group III (n=25) |
| Range | 0.0-0.96 | 0.0-0.97 | 0.0-1.0 |
| Mean±SD | 0.75±0.25 | 0.52±0.34 | 0.37±0.4 |

Group I: No Coronary Artery Disease

Group II: Insignificant Coronary Artery Disease

Group III: Significant Coronary Artery Disease.

Discussion

Among the 58 patients included in the study 52 were male and 6 were female. It shows that small number of female patients with PAD of lower limbs attended the hospital for treatment. The age of the patients ranged from 40 years to 75 years and mean age 53.3 ± 7.9 years. Among the 58 patients 24(41.4%) had no coronary artery disease; 9 patients (15.5%) had insignificant coronary artery disease and 25 patients (43.1%) had significant coronary artery disease. Data analysis revealed that the proportion of smoking, diabetes mellitus, dyslipidemia, family history of IHD, hypertension and sedentary life style was significantly higher in patients with CAD than non CAD. This is consistent with the study of Balasubramanian et al. (2004) in which it was found that in patients with peripheral vascular disease, coronary artery disease was associated with hypertension, smoking and dyslipidaemia.^{1, 2}

The mean Ankle-Brachial Index (ABI) for group I, group II and group III patients were 0.75, 0.52, 0.37 respectively. Analysis found a statistically significant difference was found between group I and group III, but no significant difference between group II group III, This indicates that low ABI is significantly related with the presence of coronary artery disease. This is consistent with the study of Papamichael et al.⁹ In which it was found that 75% of patients with ABI <0.90 are associated with coronary artery disease. It was concluded that ABI was inversely related with extent and severity of coronary artery disease.⁷

Conclusion

Patients with peripheral arterial disease are more likely to have coronary artery disease. In this study Ankle-Brachial Index (ABI) had significant relation with severity of CAD. Coronary angiogram should be done in all cases of PAD especially in patients with low Ankle –Brachial Index.

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