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RESEARCH ARTICLE

A study to find out prevalence of low ankle-brachial index in patients of ischemic heart disease

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ABSTRACT

Background: The ankle-brachial index (ABI) is the ratio of systolic pressure at the ankle and systolic pressure at the arm. ABI is a tool to diagnose the peripheral arterial disease (PAD) and it has been shown to predict mortality and adverse cardiovascular (CV) events. **Aims and Objectives:** This study was aimed to collect the data pertaining to diagnostic value of ABI and its prevalence in patients of ischemic heart disease. **Materials and Methods:** A cross-sectional descriptive-analytic study was done by the measurement of ABI on patients undergoing coronary angiography admitted in the Idaho Central Credit Union and Cath Lab at V. S. General Hospital, Ahmedabad. Statistical analysis was done using the SPSS 23.0 version. Univariate analysis was performed by applying the Pearson Chi-squared test. **Results:** According to the present study, the prevalence of low ABI in patients undergoing cardiac angiography is very low 4.6% and among those patients, true positives confirmed by peripheral angiography or Doppler studies were 91%. The association between a low ABI and CV risk factors such as smoking, hypertension, and diabetes is significant. **Conclusion:** ABI is a simple and cost-effective mode of diagnosis of PAD. It can identify the involvement of coronaries as an early intervention.

KEY WORDS: Coronary Artery Disease; Ankle-brachial Index; Peripheral Arterial Disease; Cardiovascular; MI; STEMI; NSTEMI; ECG

INTRODUCTION

The ankle-brachial index (ABI) is a ratio of systolic blood pressure between ankle and arm. The term ABI was given by the proceedings of the American Heart Association on atherosclerotic peripheral vascular disease on the basis of its current widespread use in research and academics and the same term is used throughout this study. Blood pressure is the lateral pressure exerted by circulating blood column on the walls of blood vessels. Systolic blood pressure is maximum pressure exerted during systole and it is more at ankle than in arm physiologically.

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In India, since last so many years, cardiovascular diseases (CVDs) are the top five causes of deaths in Indian population and that is why it is given importance nowadays in academics and research. In 2000, in India, the prevalence of coronary heart disease (CHD) was 3%. Approximately 29.8 million peoples are suffering from CHD.[1,2] According to world bank estimates, CVD had a 31% share in the total burden of disease in 2015. In 2003, according to population-based cross-sectional surveys, the prevalence was estimated to be 3–4% in rural areas and 8–10% in urban areas.[3,4] In 2001–2003, the Registrar General of India reported that CHD led to 17% of total deaths and 26% of adult deaths, which increased to 23%

of total and 32% of adult deaths in 2010–2013.[5] In 2013, coronary artery disease (CAD) was the most common cause of death globally, resulting in 8.14 million deaths (16.8%) up from 5.74 million deaths (12%) in 1990.[6] The morbidity and mortality of CHD is very high so appropriate measures should be taken for prevention and control of CHD at very initial level.

The ABI is an efficient and precise tool for documenting the presence of peripheral arterial disease (PAD).[7,8] It is a simple, reproducible, and cost-effective method that can be used to detect lower-extremity arterial stenosis in the primary care setting. An ABI <0.90 is having a sensitivity of 69–73% and a specificity of 83–99% for detecting a lower-extremity stenosis of >50%.[9]

In population cohort studies,[10] a low ABI has been related to an increased incidence of cardiovascular (CV) mortality. The ABI which is related to increased CV problems is independent of baseline CV disease and its triggering risk factors, suggesting that the ABI may have an independent role in predicting CV events.[11]

The major global CV societies have advised measurement of ABI in primary health care that may help in early diagnosis of CVD and, therefore, reducing their prevalence.

The increased prevalence of CVD and its mortality warranted this study which is aimed to collect the data pertaining to the diagnostic value of ABI and its prevalence in patients of ischemic heart disease. In the primary care setting, ABI is useful to diagnose PAD in a symptomatic patient and to assess the vascular risk for PAD in an asymptomatic patient.[9]

MATERIALS AND METHODS

The present cross-sectional descriptive-analytic study was undertaken in the Department of Physiology in collaboration with the Department of Cardiology at Smt. NHL Municipal Medical College, Ahmedabad.

Measurement of ABI was done on patients undergoing coronary angiography admitted in the Idaho Central Credit Union and Cath Lab. Written informed consents were taken from all patients included in the study.

All the 1423 patients aged 23–90 years including 1047 males and 376 females undergoing coronary angiography between December 2013 and August 2015 were included in the study. The patients who were critically ill or had severe limb ischemia or with amputation were excluded from the study.

Statistical analysis was done using the SPSS 23.0 version. Univariate analysis was performed by applying the Pearson Chi-squared test.

RESULTS

Correlation of Age and ABI

In this study, patients with low ABI, aging 23–90 years, were evaluated, of which maximum 21 (32%) patients were from age group 61 to 70 years, following 18 (27%) from 51 to 60 years, 15 (23%) from 41 to 50 years, 5 (8%) from 31 to 40 years, 4 (6%) from 71 to 80 years, 3 (5%) from 21 to 30 years, and 0 patient was from 81 to 90 years. This distribution is similar in patients with normal ABI. Pearson Chi-square test shows $P = 0.562$ which is not statistically significant [Figure 1].

Correlation of Gender and ABI

Of total 1423 patients, 1047 were male and 376 female and of them, 60 (5.7%) males and 6 (1.6%) females were found having low ABI. Of 66 patients with low ABI, 60 (91%) were male and 6 (9%) were female showing high prevalence in male. Pearson Chi-square shows $P = 0.001$ which is highly statistically significant [Figure 2].

Correlation of Risk Factors and ABI

Of 1423 patients, 665 patients were hypertensive including 28 (42.4%) patients having low ABI and 637 (46.9%) patients

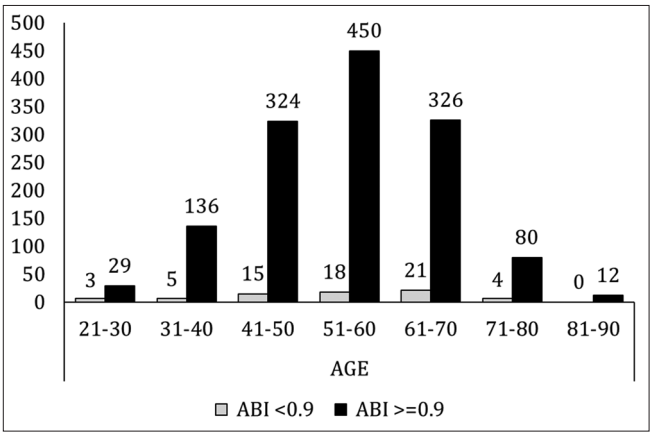

Figure 1: Correlation of age and ankle-brachial index

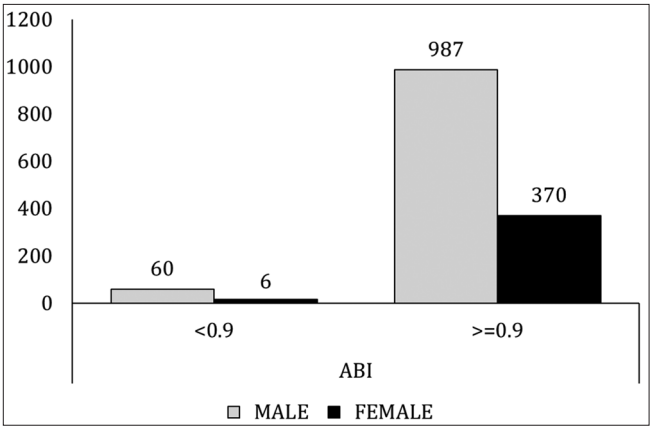

Figure 2: Correlation of gender and ankle-brachial index

having normal ABI with Pearson Chi-square shows $P = 0.437$ which is not significant. 411 patients were diabetic including 40 (60.6%) patients having low ABI and 371 (27.3%) patients having normal ABI with Pearson Chi-Square shows $P = 0.000$ which is highly statistically significant. 418 patients were smokers including 35 (53%) patients having low ABI and 383 (28.2%) patients having normal ABI with Pearson Chi-square shows $P = 0.000$ which is highly statistically significant [Figure 3].

Correlation of ABI and Coronary Angiography Findings

In patients having low ABI shows that 12 (18.2%) have single-vessel disease, 11 (16.7%) have double-vessel disease, 26 (39.4%) have triple-vessel disease, 11 (16.7%) have minor coronary disease, and 6 (9.1%) have no disease showing more involvement of multivessel disease. Comparing this with patients having normal ABI Pearson Chi-square shows $P = 0.035$ which is statistically significant [Figure 4].

DISCUSSION

PAD which is considered a risk factor CHD can be detected by ABI.[12] According to present study out of 1423 patients who have undergone the cardiac angiography 4.6 % ($n = 66$) patients had low ABI. Out of 66 patients who were having low ABI, 91% (n = 60) patients are true positives for CHD confirmed by peripheral angiography or Doppler studies. These values are almost similar with one Japanese study (5%)[13] and higher than a Korean population study (2.2% in men and 1.8% in women).[14] The study by Premanath and Raghunath shows that in 12 males (10%) and six females (7.5%), ABI values were low. Of 12 males, 11 (91.6%) had a CHD confirmed by angiography, whereas of 6 females, 3 (50%) were having CHD.[15] Of 160 patients, 69 had significantly low ABI value (43.12%) which indicates a very high prevalence of low ABI in the community.[16] The prevalence of PAD was 7.6% in population-based cohort study in Spain.[17] In another study, of 493 patients without known atherosclerotic vascular disease, only 1 patient (0.2%) had low ABI which suggests that ABI is not much sensitive as a screening tool for detecting subclinical atherosclerosis.[18]

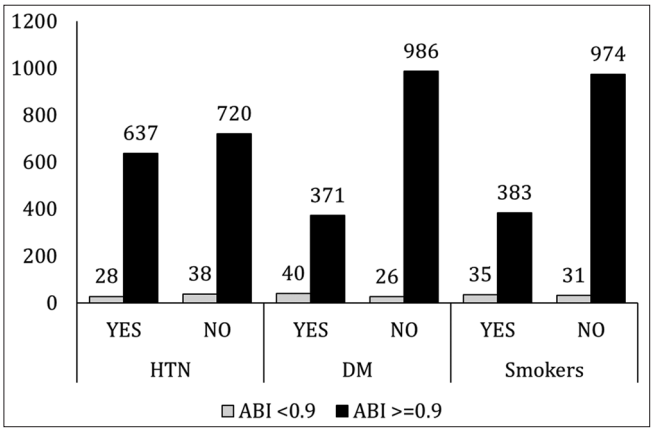

Figure 3: Correlation of risk factors and ankle-brachial index

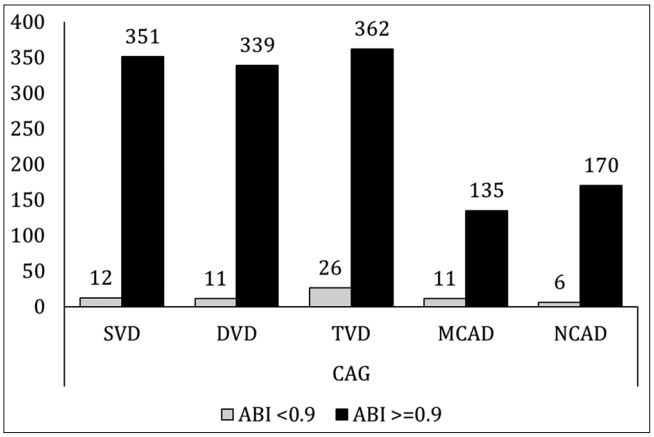

Figure 4: Correlation of ankle-brachial index and coronary angiography findings

Physiological Conditions Affecting the ABI

Age, sex, height, weight, and body mass index can affect the ABI. According to some cross-sectional and longitudinal studies, increased prevalence and progression of PAD will lead to decrease in ABI with age.[19,20]

Gender-based differences in ABI have been reported in many population studies.[19,21-24] In the San Luis Valley Diabetes Study, the average ABI was 0.07 (less in women than in men).[25]

In our study, there is no significant association between BMI and low ABI value; these findings are similar to another study.[26] Multiethnic study of atherosclerosis shows that baseline obesity is associated with the development of low ABI and mean ABI decreases overtime.[27]

ABI and its Relation with Various Risk Factors

Low ABI values are associated significantly with CV risk factors such as smoking, hypertension, and diabetes. These are consistent findings with the previous studies.

Diabetes mellitus (DM) is a very strong independent risk factor for PAD which can lead to critical limb ischemia and amputation.[28,29] Several studies have demonstrated a substantially higher prevalence of low ABI in subjects with PAD, particularly in those with DM.[28] These results are similar to the present study.

Cigarette smoking is one of the most important risk factors for PAD.[28] In our study, the prevalence of smoking was higher in low ABI patients. This finding is consistent with the previous studies.[29,30]

ABI and CAD

Our aim of this study was to evaluate the value of the ABI as a marker of CV events in patients suspected of CAD and to evaluate the relationship between the ABI and the extent of CAD, as documented by coronary angiography. In our study, 40% of patients had triple-vessel disease and total 57% had multivessel disease which shows significantly higher atherosclerotic risk factors. In various other studies, prevalence is 63%,[28] 49%,[29] and 26%[30] in three- or four-vessel CAD. In one other study, the prevalence of multivessel disease is 52%[31] which is similar to the present study. There are very few studies correlating low ABI with number of coronaries involved but all of them show increasing risk of CAD with low ABI.

CONCLUSION

In the present study, we may conclude that ABI values can be used to identify the risk of PAD and subsequent coronary involvement. In patients with ACS, an abnormal ABI was independently associated with the risk of multivessel CAD.

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