Angiographic Pattern of Coronary Artery Disease in Diabetic Patients Having Abnormal Ankle Brachial Index

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Abstract

Introduction: An abnormal ankle-brachial index (ABI) is associated with higher risk for future cardio-vascular (CV) events; however, it is unknown whether this association is true in patients with associated diabetes mellitus (DM).

Objectives: The objective of this study was to determine frequency of coronary artery disease in terms of number of vessels involved using angiography in diabetic patients with abnormal ankle brachial index.

Subjects and methods: This Cross Sectional Study was done at Department of Adult Cardiology, CPE institute of Cardiology Multan. ABI was measured using the standard method. After measuring the ABI, angiography was done on patients with abnormal ABI and pattern of Coronary Artery Disease (CAD) was recorded noting the number of vessels involved.

Results: A total of 115 patients were included in the study. The mean age of patients was 62.40 years with standard deviation of 2.78 years. Majority of the patients in the study were male (68.7%). Mean ABI was of study participants was 1.2 with standard deviation of 0.58 while mean duration of disease was 3.2 years with standard deviation of 0.7 years. 97 of the study participants were hypertensive and 18 were smokers. A total of 28 patients (24.3%) did not have CAD as per angiography while the rest had 1 vessel disease (33.4%), 2 vessel disease (29.5%), and 3 vessel disease (20.9%). Stratification of patients by age, gender, duration of disease, hypertension and low/high ABI showed p value > 0.05 in all cases showing statistically insignificant difference between various subgroups.

Conclusion: It is concluded that there is high frequency of CAD in diabetic patients with abnormal ABI.

Keywords
Coronary artery disease, Ankle brachial index, Peripheral arterial disease

Introduction

Ankle-brachial index (ABI) has been suggested as a useful predictor of generalized atherosclerosis; individuals with a low ABI have an increased risk of death from cardiovascular disease (CVD) in epidemiological studies. ABI is an inexpensive and reliable method for detection of peripheral artery disease (PAD), and it has also been proposed as a marker of subclinical atherosclerosis and cardiovascular prognosis [1,2]. PAD caused by...
Materials and Methods

Study design
Cross Sectional Study.

Setting
The study was conducted in Department of Adult Cardiology, CPE institute of Cardiology Multan.

Duration of study
6 months after approval of synopsis.

From
01.01.2016 to 30.06.2016.

Sample size
Sample size was calculated to be 115 with 95% confidence interval, 10% margin of error and 11.8% expected frequency of CAD2 (one vessel disease) in diabetic patients abnormal ABI using WHO sample size calculator.

Sampling technique
Non probability consecutive sampling.

Sample selection

Inclusion criteria:
• Diabetic patients with disease duration more than one year as per operational definition
• Both Genders
• Aged 50-70 years
• ABIs of patient in abnormal range low ≤ 0.9; high > 1.4.

Exclusion criteria:
• Patients with unstable cardiopulmonary, neurological, or psychiatric disease based on history and/or previous medical record
• Patients having vascular surgery of lower limbs as determined from medical record and history/examination.
• Patients not willing to participate in the study.

Data collection procedures
115 patients with diabetes mellitus who fulfill the inclusion and exclusion criteria were included in the study after taking Informed consent. ABI was measured using the standard method described previously. ABI ≤ 0.90 and ≥ 1.40 was taken as abnormal. After measuring the ABI, angiography was done on patients with abnormal ABI and pattern of CAD was recorded noting the number of vessels involved and degree of stenosis. Biodata was be entered in a predesigned structured proforma.

Statistical analysis
Statistical analysis was done using Statistical Package
for Social Sciences (SPSS) version 16. Qualitative data like gender, presence of CAD, low/high ABI, hypertension, smoking history were presented as frequencies and percentages. Quantitative data i.e., age, ABI, duration of disease, number of vessel involved, were presented as means and standard deviations. Effect modifiers like age, gender, duration of disease, hypertension, low/high ABI, were dealt with through stratification. Post stratification chi square test was applied with p value < 0.05 was taken statistically significant.

Results

A total of 115 patients were included in the study. The mean age of patients was 62.40 years with standard
deviation of 2.78 years with most of the patients in the age range 61-70 years. Age distribution of the patients is given in Figure 1. Majority of the patients in the study were male (68.7%). Gender distribution is outlined in Figure 2. Mean ABI of study participants was 1.2 with standard deviation of 0.58. Classification of ABI is given in Figure 3. Mean duration of disease was 3.2 years with standard deviation of 0.7 years, outlines in Figure 4:

Figure 4: Duration of disease, n = 115, Mean ± SD: 3.2 ± 0.7 years.

Figure 5: Frequency of hypertension, n = 115.

Figure 6: Combination of Figure 5, Figure 6, Figure 7 (n = 115).
Table 1: Combination of Figure 1, Figure 2, Figure 3, Figure 4.

<table>
<thead>
<tr>
<th>Category</th>
<th>Interval</th>
<th>No.</th>
<th>%</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in years</td>
<td>50-60</td>
<td>52</td>
<td>45.20%</td>
<td>62.40 ± 2.78 years</td>
</tr>
<tr>
<td></td>
<td>61-70</td>
<td>63</td>
<td>54.80%</td>
<td></td>
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<tr>
<td>Gender</td>
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<td>79</td>
<td>68.70%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>36</td>
<td>31.30%</td>
<td></td>
</tr>
<tr>
<td>ABI</td>
<td>Low ABI</td>
<td>70</td>
<td>60.90%</td>
<td>Mean ± SD: 1.2 ± 0.58</td>
</tr>
<tr>
<td></td>
<td>High ABI</td>
<td>45</td>
<td>39.10%</td>
<td></td>
</tr>
<tr>
<td>Duration of disease</td>
<td>&lt; 2 years</td>
<td>45</td>
<td>39.10%</td>
<td>Mean ± SD: 3.2 ± 0.7 years</td>
</tr>
<tr>
<td></td>
<td>≥ 2 years</td>
<td>70</td>
<td>60.90%</td>
<td></td>
</tr>
</tbody>
</table>

Figure 7: No. of vessel involved in CAD, mean number of vessels involved 1.76 ± 0.32

Figure 8: Stratification by age (n = 115). Chi Square Test, Value: 0.258, Df: 3, P value: 0.878.

4, Table 1. The 97 of the study participants were hypertensive and 18 were smokers, given in Figure 5, Figure 6 respectively.

A total of 28 patients (24.3%) did not have CAD as per angiography while the rest had 1 vessel disease (33.4%), 2 vessel disease (29.5%), and 3 vessel disease (20.9%) given in Figure 7. Stratification of patients by age, gender, and duration of disease, hypertension and low/high ABI is given in Figure 8, Figure 9, Figure 10, Figure 11, Figure 12 and Figure 13 respectively. P value was > 0.05 in all cases showing statistically insignificant difference between various subgroups.

Discussion

The findings of this study are in agreement with some previous studies and reinforce the importance of screening for ABI and CAD in diabetic patients.

The findings of our study underscore the facts that...
CAD may provide important prognostic information in addition to the presence of DM, an independent

Figure 9: No. of vessels involved, stratification by age.
Chi Square Test, Value: 0.085, Df: 3, P value: 0.770.

Figure 10: Stratification by gender.
Chi Square Test, Value: 0.019, Df: 3, P value: 0.891.

Figure 11: Stratification by duration of diseases.

there is significant overlap between CAD and PAD and that the identification of PAD in patients with stable
and important risk factor for death and myocardial infarction.

The overlap between PAD and CAD has been established on the basis of various population-based studies [3-5]. Although the prevalence and outcomes of associated CAD in patients with PAD are well defined, there are limited data on the prevalence and prognostic significance of establishing the diagnosis of PAD in patients with stable CAD. Studies that have investigated the predictive value of ABI in a patient cohort with CAD are scarce. Dieter, et al. reported a 40% prevalence of PAD in hospitalized patients with CAD and the feasibility of performing an ABI in that setting [6]. Grenon, et al. reported a 70% increased risk of subsequent CV events (adjusted HR 1.7, 95% CI 1.0 to 2.9, p = 0.04) and an 80% increased risk of death (adjusted HR 1.8, 95% CI 1.2 to 2.7, p = 0.006) after adjusting for traditional risk factors [7]. Evidence from the Strong Heart Study identified the association between an abnormal ABI and mortality, highlighting a U-shaped relation between this noninvasive measure of PAD and mortality risk [8]. It also identified the cutoff values of abnormal ABI (< 0.9 and > 1.4), adopted by the American College of Cardiology (ACC) and American Heart Association (AHA) PAD guidelines and also used in our analysis [9]. Evidence from the Coronary Artery Surgery Study indicated that in patients with CAD, presence of PAD had a 25% greater likelihood of mortality than patients without (multivariate chi-square 25.83, HR 1.25, 95% CI 1.15 to 1.36, p < 0.001) [10].

The increased vulnerability to CV events in patients with CAD with an abnormal ABI can be partially explained by shared CV risk factors and excess inflammation indicated by significantly higher serum levels of inflammatory bio-markers in this patient population [11,12]. The higher repeat coronary events and revascularization rate in patients with CAD and PAD, observed in our study, can be potentially attributed to the significantly greater constrictive remodeling and plaque progression of atherosclerotic coronary arteries in patients with PAD.

In a recent study Mostaza, et al. reported that in patients with CV disease, ABI is a good predictor of the risk

![Figure 12: Stratification by hypertension, n = 115, P = 0.804.](image1)

![Figure 13: Stratification by low/high ABI, n = 115, P = 0.770.](image2)
of recurrent CV events and death, however, only in subjects without DM [13]. The investigators argued that the presence of DM in patients with already established CV disease in itself confers such a high risk that an abnormal ABI does not add any prognostic value. As the CV outcomes in patients with CAD are strongly influenced by secondary prevention strategies, the findings from our study conducted in the current era of CV care may be of greater relevance to current practice. Many of the earlier studies were either conducted in highly selective patient populations, such as the Strong Heart Study in American Indians, or did not include an ABI in defining the presence of PAD. Exclusive reliance for establishing the diagnosis of PAD on the basis of prior cerebrovascular and/or other noncoronary peripheral arterial events or interventions could not only underestimate the prevalence of PAD but also limit the significance of such studies. The findings of our study and that of others on the predictive value of ABI in patients with CAD should be clearly distinguished from those conducted in at-risk patient populations, where there is inadequate evidence that an ABI test result provided additional information to predict CV events, beyond the Framingham risk score [14]. Further, the US Preventive Services Task Force recommendation suggested that research is needed to identify potential high-risk subgroups who might benefit from ABI screening [15].

Conclusion

It is concluded that there is high frequency of CAD in diabetic patients with abnormal ABI. Further studies are needed to determine the risk conferred by this high prevalence of CAD in this age group and steps taken to decrease the associated morbidity and mortality.

References