Relationship between Peripheral Artery Disease and Cardiac Function in Elderly Patients with Ischemic Heart Disease

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Abstract

 Background: There is high prevalence of combined peripheral and coronary artery disease (CAD) related to atherosclerosis with associated increase in morbidity and mortality .
Objectives:The aim of our study was to find an association between ankle brachial index (ABI) and cardiac function in elderly patients with CAD using ejection fraction (EF).
Method: A Case control study. The case group included 100 elderly patients who had peripheral artery disease (PAD) divided into 2 groups according to age (60- 70 and > 70 years). The control group included 100 elderly subjects who didn't have PAD which were divided also into 2 groups according to age . Both groups have CAD and underwent coronary angiography (CA) showing significant CAD lesions. Echocardiography were done to all patients showing cardiac function. **Results:** EF was lowest in cases > 70 years (46.84 ± 9.82) and was highest in controls > 70 years (53.02 ± 5.53) which is statistically significant **(P-Value 0.009).** Also EF is correlated with ABI.
Conclusion: There is a significant positive relationship between ABI and EF.

Keywords: Coronary artery disease – Peripheral artery disease – Ankle brachial index – Ejection Fraction – Elderly

Introduction

Atherosclerosis is a disorder that comprises the development of focal atheromas, within the intima and inner portion of the media. As the disorder advances, the atheromas undergo a variety of complications as calcification, internal hemorrhages, ulceration, and sometimes superimposed thrombosis [1].

Studies found that in patients with PAD, the prevalence of CAD ranges from 20% to 60% when based on medical history, physical examination, and electocardiography (ECG) and up to 90% in patients who have undergone CA [2].

In about 99 % of cases, CAD is due to atherosclerotic changes. Atherosclerosis begins as early as the first or second decade of life and is a progressive disease over time. Manifestations of CAD are seen as early as the second or third decade of life, but as patients age, the severity of the disease increases [3].

Patients with lower extremity PAD undergoing PCI for CAD have lower procedural success rates, higher in-hospital cardiovascular complication rates, and higher longterm rates of MI, target vessel revascularization, and mortality [4].

Studies have consistently shown that patients with PAD have more severe CAD, often with severe and multivessel involvement, than CAD patients without PAD [5].

Methodology:
Study design:
The study is a case control study conducted to assess the relationship between PAD using ABI and EF in elderly patients with CAD

Selection of Subjects
Sample size:
200 male and female elderly patients ≥ 60 years known to have ischemic heart disease are divided into two groups:

Case group:
100 cases with ABI < 0.9 further subdivided according to age into:

- 50 patients aged 60-70 years and
- 50 patients aged >70 years

Control group:

100 controls with ABI ≥ 0.9 also subdivided into:

- 50 patients aged 60-70 years and
- 50 patients aged >70 years

Exclusion criteria:

1-Patients with ABI >1.3 indicating calcification of peripheral arteries

2-Patients with severe lower limb ischemia having ischemic ulcer or gangrene or ABI < 0.4

Assessment:

Both groups were subjected to:

1) Comprehensive geriatric assessment.
- Complete medical history.
- Physical examination
- Mini-mental state examination [6]
- Activities of daily living (ADL) [7]
- Instrumental activities of daily living (IADL)assessment[8]
- Screening for depression using Geriatric depression scale-15 items (GDS-15 [9]

2) Electrocardiography(ECG):
looking for evidence of ischemia or myocardial infarction

3) Echocardiography: looking for wall motion abnormality and ejection fraction

4) Measuring ABI

Using the hand held Doppler method :

Using Bistos hand held vascular Doppler (BT 200V,8 MHz)

Method: The ankle-brachial index is calculated by dividing the higher of the two ankle systolic blood pressures in each leg by the higher of the two brachial systolic blood pressures. The higher of the two brachial pressures is used as the denominator to account for the possibility of subclavian artery stenosis. The ankle-brachial index is calculated for each leg, and the lower value is the patient's overall ankle-brachial index[10]

Statistical Analysis:

Analysis of data was performed by using the 13th version of Statistical Package for Social Science (SPSS). Description of all data in the form of mean (M) and standard deviation (SD) for all quantitative variables was done. Frequency and percentage for all qualitative variables was

calculated. Comparison between quantitative variables was done using t-test to compare two groups and ANOVA (analysis of variance) to compare more than two groups. Post Hoc test was done to detect the least significant difference. Comparison of qualitative variables was done using the Chi-square test. Correlation coefficient also was done to find linear relation between different variables using t-test or Sperman correlation co-efficient. Significant level measured according to P value (probability), P>0.05 is insignificant, and P<0.05 is significant.

Results:

The mean age in our study is 67.14 ± 6.21 for cases and 67.26 ± 5.73. About two thirds of our study subjects were hypertensive and half of them were diabetic. Also half of them were current and ex-smokers , this is for both study groups. Only 5% of cases and 6% of controls were aware of being dyslipidemic. There was no significant difference between groups regarding age, gender, smoking , accompanied comorbidities including HTN, DM , dyslipidemia. EF was lowest in cases > 70 years (46.84 ± 9.82) followed by cases 60-70 (48.54 ± 12.49) , then controls 60-70 years (52.60 ± 13.40) and was highest in controls > 70 years (53.02 ± 5.53) which is statistically significant (**P-Value 0.009**). Also EF is correlated with ABI **(P-Value 0.011, 0.006)** for cases and controls **respectively.**

Discussion

In our study EF worsens with more severe PAD and this correlation shows a statistical significance **(P-Value 0.011, 0.006)** for cases and controls respectively.This agrees with **Rizvi *et al.***11] who conducted a study on 175 patients in USA referred for ABI determination who had the left ventricular (LV) EF determined using echocardiography and subjects were divided into 3 groups according to ABI (subjects with low, normal and high ABI). The mean LVEF increased in a stepwise manner from the low, to normal, to abnormally high ABI groups (43 +/- 13% vs 51 +/- 12% vs 57 +/- 5%, respectively; **P <0.01**) which support the hypothesis that ABI could be an indicator of CAD severity , even having impact on cardiac function.

Also **Abbasnezhad *et al.*** [12] conducted a a study on 75 diabetic patients (36% malee with mean age of 59.98 ± 10.27 years) referred for ABI determination that had theire LVEF determined using trans-thoracicc echocardiography and showed that in cases with low ABI,percent of patients with LVEFF below 50% was higher than in patients withh normal ABI (85.7% vs. 18.5%, **p < 0.001**)

concluding that ABI would be influenced by LVEF in diabetics.

However , in the two previous studies patients were not known to have CAD. One possible explanation is that LV systolic function has been shown to influence arterial wave reflective properties [13] , so the ABI would reflect LV systolic function independent of coronary disease, however it can be affected also by atherosclerosis.

Table (1):Clinical Characteristics in Cases and controls

		Cases ABI< 0.9 N= 100	Controls ABI ≥ 0.9 N= 100
Age (years) Mean ± SD		67.14 ± 6.21	67.26 ± 5.73
Gender	Males (%)	53 (53%)	62(62%)
	Females (%)	47 (47%)	38(38%)
Number of smokers & ex-smokers (%)		50 (50%)	48 (48%)
Common Medical diseases	Number of diabetics (%)	53 (53%)	44 (44%)
	Number of Hypertensives (%)	68 (68%)	68(68%)
	Number of Dyslipidemic patients (%)	5 (5%)	6 (6%)
ABI	hand held Doppler Mean ± SD	0.714 ± 0.103	1.037 ± 0.079

Table (2): EF in relation to cases and control

	Cases 60-70	Cases >70	Control 60-70	Control >70	P Value
EF (%) Mean ± SD	48.54 ± 12.49	46.84 ± 9.82	52.60 ± 13.40	53.02 ± 5.53	**0.009***

Table (3): Correlation between EF, ABI in Cases and Controls

	EF in cases		EF in controls	
	r	P-value	r	P-value
ABI doppler	0.255	**0.011***	0.275	**0.006***

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