

Screening for Peripheral Arterial Disease in Patients with Coronary Artery Disease Using Ankle-Brachial Index

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Abstract

Background : To screen for presence of peripheral arterial disease (PAD) in coronary artery disease (CAD) patients using ankle-brachial index (ABI).

Methods: In this descriptive cross-sectional study patients (n=310) above the age of 40 years of both genders, admitted with diagnosis of coronary artery disease were included. Smokers and patients with hyperlipidemias, diabetes mellitus, or ankle brachial index (ABI) >1.5 were excluded. Patients with ABI of less than 0.9 in one or both lower limbs were diagnosed to have PAD.

Results : Out of 310 patients, 26.77% (n= 83) had ABI < 0.9. Majority of these patients (85.1%) were asymptomatic. ABI was able to detect PAD in all these patients. There was no statistical difference in prevalence between genders.

Conclusion: Arterial brachial index is able to detect peripheral arterial disease in patients with coronary artery disease .

Key Words:Peripheral artery disease, Coronary artery disease, Ankle-brachial index.

Introduction

Peripheral arterial disease (PAD) is atherosclerosis of arteries beyond aortic bifurcation.¹ Atherosclerosis can affect multiple vascular beds simultaneously. So peripheral arterial disease often co-exists with symptoms of systemic atherosclerosis elsewhere, including cerebrovascular disease and coronary artery disease (CAD).² Patients with PAD are 3-6 times more likely to develop myocardial infarction (MI) and stroke than patients without PAD.³ Overall mortality rate after the diagnosis of PAD has been shown to be as much as 30% at 5 years and 70% at 15 years and it is mainly attributed to the coexistence of CAD.³ The evidence that PAD represents an independent indicator for cardiovascular morbidity has triggered a renewed clinical interest in PAD and its epidemiology.⁴

The process of development of atheromatous plaque is similar in all genders, ethnicities and in all geographical locations. However, the rate of growth of

plaque is more rapid in patients with certain risk factors. These include diabetes mellitus, hypertension, obesity, tobacco smoking, and a genetic predisposition to the disease.⁵ Frequency of coexisting CAD with peripheral arterial disease accounts from 28% to 94%.⁶ Race, ethnicity and geographical location have a bearing on the coexistence of peripheral disease with CAD,⁶ it is necessary to be aware of the extent of this association in Pakistani patients.⁶

It has been reported that some patients, particularly those more than 70 years old, may not present with typical symptoms of PAD.⁷ Patients undergoing conservative or surgical treatment for CAD may also be suffering from asymptomatic PAD. Admission in hospital of patients with CAD is an opportunity to screen other vascular beds for atherosclerosis. It is important to know the status of peripheral arteries in patients with CAD for another reason. These patients are prone to arrhythmias that can lead to embolism to the lower limbs. Differentiating an acute ischemic event in the limb, which is reversible with prompt treatment, becomes easier when the status of peripheral pulses in the limb is already known.⁸

Calculating the ankle-brachial index (ABI) is a cost-effective, non-invasive and objective method of detecting the presence and severity of peripheral arterial disease.⁹ ABI ratio less than 0.9 is an indication of presence of PAD with 95% sensitivity and 100% specificity.¹ An ABI value 0.9 -1.2 is considered normal, 0.4 - 0.9 indicates mild to moderate disease in the limb and a value lesser than 0.4 indicates severe peripheral arterial disease or critical limb ischemia, implying a threat to viability of affected limb. Therefore, ABI has been shown to be an effective screening tool to diagnose PAD in asymptomatic patients and to estimate severity of the disease in symptomatic ones.¹

Patients and Methods

This descriptive cross-sectional study was conducted in the Surgery Department and Coronary Care Unit of Fauji Foundation Hospital, Rawalpindi from October 2014 to March 2017. Consecutive patients (n=310) were selected for the study after obtaining their

informed consent. Sample size was calculated using WHO sample size calculator. Anticipated population proportion was 0.28, with a confidence interval of 95%. Patients above 40 years of age, of either gender, admitted in coronary care unit with diagnosis of CAD, were included in the study. Diagnosis of CAD was confirmed if there was evidence of myocardial ischemia or infarction on ECG, coronary angiogram or myocardial perfusion scan (Thallium²⁰¹ scan). Patients having ankle brachial index value of more than 1.5 were excluded as this is usually related to non-compressible vessels in legs. Patients with history of diabetes mellitus, smoking and hyperlipidemia were also excluded as these are independent risk factors for PAD.¹⁰ Each patient was then evaluated for peripheral vascular disease. Variables included were history of intermittent claudication or rest pain, and physical examination findings of chronic ischemia, arterial pulses and ABI value. ABI was obtained by dividing systolic blood pressure (SBP) in lower limb by the SBP in upper limb. If SBP was unequal in both upper limbs, the higher reading was used and limbs evaluated by performing a CT angiogram. Diagnosis of PAD was made when ABI was less than 0.9 in one or both lower limbs. The SBP in the arm was recorded with a standard sphygmomanometer and stethoscope while that in ankle was recorded using a portable Doppler ultrasound sensor. All recordings were made with the patient at rest and lying down in bed. All patients with ABI <0.9 were evaluated for PAD using CT angiogram. Descriptive statistics were calculated for qualitative variables. Frequency of PAD in patients with CAD was analyzed as percentage, and comparison of PAD in males and females was done using chi-square test with a statistical significance of 0.05 or less.

Results

A total of 310 patients with CAD were included in the study with their ages ranging between 44 and 90 years. Mean age of patients was 60.38 ± 8.8 years. Median age was 59 years. 46.5% (n=144) patients were male while 53.5% (n=166) patients were female. The ankle brachial index values ranged from 0.5 to 1.2 (Table 1). Out of these, 83 were found to have ABI of less than 0.9 (Table 2). CT angiogram confirmed presence of peripheral vascular disease of varying degree in all these patients. Out of all patients with PAD, 37 were male and 46 were female (Table 3). Chi square test was applied to compare prevalence of PAD in males and females and it was found to be not significant statistically (p = .394). Patients diagnosed with CAD

presented with angina, myocardial infarction or congestive cardiac failure (Table 4). Most of the patients diagnosed to have coexistent PAD had asymptomatic disease. Only 18 patients were symptomatic (Table 5).

Table 1: Ankle-Brachial Index

ABI Value	Number	Percentage
.5	3	1.0
.6	17	6.5
.7	29	15.8
.7	1	16.1
.8	33	26.8
.9	96	57.7
1.0	99	89.7
1.1	24	97.4
1.2	8	100.0
Total	310	

Table 2: Frequency of ABI <0.9

ABI Value	Number	Percentage
ABI <0.9	83	26.8
ABI 0.9 or more	227	73.2
Total	310	100.0

Table 3: Gender comparison (p = .394)

Gender of Patient	ABI Value		Total
	<0.9	0.9 or more	
Male	37	107	144
Female	46	120	166
Total	83	227	310

Table 4: Frequency of various presentations of CAD

Presentation of CAD	Percent of total
Angina	33.8% (n = 105)
Myocardial Infarction	28.8% (n = 89)
Congestive cardiac failure	37.4% (n = 116)

Table 5: Symptomatic vs asymptomatic PAD patients

Patients with PAD	n = 83
Symptomatic	14.9% (n = 18)
Asymptomatic	85.1% (n = 71)

Discussion

Awareness regarding association of PAD with CAD is grossly deficient amongst all levels of health care professionals.¹¹ This accounts for inability to diagnose the condition at a stage when limb salvage is possible. There is a general perception amongst Pakistani physicians that peripheral arterial disease is relatively uncommon in Pakistan. Another misconception is that

diagnosis of PAD requires resorting to expertise of a vascular surgeon and expensive investigations like angiography. Therefore, patients even with coronary disease are not investigated for PAD unless they have symptoms suggesting it. Principal finding of this study was that by using measurement of ankle-brachial index, it is possible to diagnose all patients harbouring latent PAD. This conforms to previous studies done in different ethnic populations.^{1,12}

In patients admitted with CAD in a tertiary care hospital at Rawalpindi, 26.77% were suffering from overt or asymptomatic peripheral arterial disease in one or both lower limbs. This finding is similar to Kriessmann et al, who reported a prevalence of 28%.¹³ A similar study by Siddiqi et al, conducted at Karachi reported a frequency of PAD of 17.7% in patients with CAD.¹⁴ Prevalence in our study would be even higher if we account for the fact that diabetics, smokers and patients with hyperlipidemia were excluded in our study. The different sampled population may be the reason for this finding. Population in this study was mostly from northern Pakistan, including northern Punjab, Khyber Pakhtunkhwa and Gilgit/ Baltistan.

Patients with symptomatic PAD were found to be 14.9%. Symptoms included intermittent claudication, rest pain or both, unilaterally or bilaterally. Hennion et al reported that only 10% patients with PAD were symptomatic whereas Siddiqi et al reported 12% patients who had symptoms.^{14,15} It is pertinent to note that diabetics, who were not included in our study but included by Siddiqi et al, are well known to have an asymptomatic PAD. A ratio of 85.1%, even after excluding diabetic patients, indicates that most patients with PAD are asymptomatic. This makes it imperative to look for the disease in patients who are prone to this disorder including diabetics and those who are suffering from other atherosclerotic manifestations like CAD. Detecting and managing PAD in time can avoid preventable limb loss in these patients.

There was no statistically significant difference based on gender, in prevalence of PAD in patients who presented with CAD, in our study ($p = .394$). This finding is different from the higher frequency in males as reported by Siddiqi et al.¹⁴ Practice guidelines of 2005 by American Heart Association (AHA) describe male gender as a risk factor for PAD.¹⁶ However, many recent studies report similar or higher prevalence of PAD in women.¹⁷⁻²⁰ Sigvant et al reported a prevalence of 16.5% and 19.2% in men and women respectively in a population based study.¹⁷ The difference was

analyzed to be statistically insignificant. This is similar to the findings in our study.

The present study is of a singular kind in Pakistan for three reasons. Firstly, it confirms that ABI is a sensitive measure of presence of PAD in Pakistani population. Secondly, no such study has previously attempted to assess the population for presence of PAD in CAD patients in northern Pakistan. Finally, in our study, confounding variables like smoking, hyperlipidemias and diabetes mellitus were excluded unlike the previous studies elsewhere.^{21,22} This was important to establish a direct association between coronary and peripheral arterial disease as smoking and diabetes mellitus are known risk factors for both.^{23,24} Our study could have been further strengthened by inclusion of patients from other hospitals in the region and by a larger sample size.²⁵

Conclusion

1. It is important to realize by primary healthcare professionals, cardiologists as well as surgeons that patients with CAD may also be suffering from overt or latent peripheral arterial disease and vice versa.
2. PAD can easily be ruled out by measuring ABI. Keeping this in mind while treating either condition, we can prevent and preempt undue morbidity and mortality.

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