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Original Article

Evaluation of the Frequency and Severity of Peripheral Artery Disease using Ankle Brachial Index among Patients Undergoing Coronary Angioplasty

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ABSTRACT

One of the important markers for the risk stratification of patients with coronary artery disease is peripheral artery disease (PAD). **Objective:** To define the severity and frequency of peripheral artery disease using ABI among patients undergoing coronary angioplasty. **Methods**: The cross-sectional study was conducted at department of adult cardiology Tabba Heart Institute Karachi, Pakistan. This research was conducted for the duration of 6 months from 10th Dec 2019 to 10th June 2020. 120 patients met the inclusion criteria. They were admitted to the department of adult Cardiology. In all cases, patient's detailed history was taken after taking informed and written consent. The ankle brachial index (ABI) was calculated as per the operational definition to reach the outcome PAD and its severity. **Results:** A total of 120 patients undergoing coronary angioplasty were included. 89 (74.2%) were males & 31 (25.8%) were females with the mean age of 58.89±10.190 years. The PAD was seen in 9 patients (7.5%) and the severity of PAD was severe in 0(0%) patients, mild in 6(5%), and moderate in 3(2.5%). **Conclusions:** In conclusion, peripheral artery disease of the lower leg is not much frequent in patients receiving percutaneous coronary intervention with coronary artery disease but it is associated with disease severity and it & its severity increases with the increase in age and predominant in male gender. The peripheral artery disease severity is also significantly associated with body mass index & obesity.

INTRODUCTION

One of the important markers for the risk stratification of patients with coronary artery disease is peripheral artery disease (PAD) [1, 2]. The higher risk of cardiovascular events is associated with this condition. Different studies have reported the co-occurrence of peripheral arterial disease and coronary artery disease. Moreover, the increased incidence of the multivessel and obstructive coronary artery disease are also linked to the PAD [3]. This relationship doesn't depend on the other cardiovascular risk factors [4, 5]. The patients diagnosed with the symptomatic or asymptomatic PAD are more prone to the development of cardiovascular disease. The mortality cases are also observed to be grater in such patients. Therefore, the diagnosis of the patient's having symptomatic and asymptomatic PAD is considered as the crucial prognostic factor [6, 7]. The intermittent claudication is the commonly observed symptom of PAD. The ankle brachial index is used to calculate the incidence and prevalence of the symptom. It is observed that the asymptomatic PAD is several times more common. The incidence and prevalence of PAD are highly associated with the age. It rises to greater than 10% among the patients of age range between 60 to 70 years. The studies have suggested that the PAD will be 10 times more common in the future. It is more prevalent in man than woman for more severe or symptomatic disease [8]. The ratio of the

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systolic blood pressure at the ankle to that in the arm is called as ABI. The lower values of ABI depict that there is atherosclerosis in the leg. For the diagnosis of the PAD the ABI is highly used. ABI had clinical and epidemiological application. It helps to diagnose both symptomatic and symptomatic PAD [9, 10]. The poor prognosis of peripheral arterial disease is observed among the patients undergoing PCI. A study reported prevalence of PAD, as ≤0.90 as 12.8% among the patients undergoing PCI for CAD. This value was calculated by the ankle-brachial pressure index [11]. There is paucity of local data on frequency of patients with PAD among the patients with CAD undergoing coronary angioplasty [12, 13]. And due to diversified socioeconomic background and varying degrees of risk profile of our population we expect to see variation in our data compared to the data from other parts of the world.

METHODS

According to the Inter-Society Consensus for the Management of Peripheral Arterial Disease, guidelines for the ABI was defined:

$$\text{Ankle brachial indwx (ABI)} = \frac{\text{(Highest systolic blood pressure of the 2 ankle)}}{\text{(Highest systolic blood pressure of the both arms)}}$$

PAD was labelled as "Yes" for the patients with ABI ≤ 0.9 otherwise will be labelled as "No". The severity of PAD was defined as; Sample size was calculated using WHO sample size calculator 12.8% frequency of peripheral arterial disease (PAD) among the patients undergoing coronary angioplasty, with 95% confidence level, margin of error (d) of 6% [14, 15]. The sample size was calculated as 120. The non-probability and consecutive sampling technique was used. According to the inclusion criteria following patients were selected for the study; Patients with the age range between 18 to 80 years, Patients were added irrespective of gender male and female both were added and Patients that visited the hospital for undergoing Coronary Angioplasty. The patient with history of peripheral arterial disease (PAD) and cardiac related disease were excluded. CPSP approved the study. The Tabba Heart Institute ethical committee approved the study. The principal investigator conducted the verbal informed consent from all patients. Before undergoing Coronary Angioplasty, patients were asked to be seated and rest for 10 min before taking blood pressure reading. Systolic blood pressures of the 2 ankle arteries of that limb (either the dorsalis pedis or the tibial artery) and 2 upper limbs was obtained. The ankle brachial index (ABI) was calculated. Peripheral arterial disease (PAD) and its severity was recorded for the patients as per the operational definitions. All data were recorded on a predesigned proforma (provided in annexure A). The SPSS tool was used for the analysis of the collected data. Effect modifiers like gender, age group, family history, smoking, obesity and dyslipidemia was controlled through stratification. The fisher exact test was performed.

RESULTS

A total of 120 patients undergoing coronary angioplasty were selected to conduct this study. The mean age was 58.89+10.190 years. The mean height was 163.98+11.630 cm. The mean weight was 73.63+12.349 kg as shown in table 1.

Statistics	Age (Years)	Height (cm)	Weight (kg)	BMI (kg/m2)
Minimum	36	97	49	18.30
Maximum	80	188	115	34
Mean	58.89	163.98	73.63	26.3233
Std. Deviation	10.190	11.630	12.349	2.3630

Table 1: Statistical description of age, height, weight and BMI

In our study 89 patients (74.2%) were males & 31 patients (25.8%) were females. The indication of PCI was seen ACS in 94 patients (78.3%) while non-ACS in 26 patients (21.7%). In our study peripheral arterial disease was seen 9 patients (7.5%). The peripheral arterial disease severity was mild in 6 patients (5%), moderate in 3 patients (2.5%) and severe in 0 patients (0%) as shown in table 2.

Severity of peripheral arterial disease	Frequency (%)
Mild	6 (5%)
Moderate	3 (2.5%)
Severe	0 (0%)
Total	9 (7.5%)

Table 2: Frequency distribution of severity of PAD

In our study the severity of peripheral arterial disease was associated with BMI but was not statistically linked with the age, gender, indication of PCI, hypertension, family history, smoking & dyslipidemia with P-value of 0.001, .٠275, .٠571, 0.560, 0.343, 0.635, 0.257, 0.275,1.000, & 0.571 as shown in table 3.

Age (years)	Peripheral Arterial Disease		Total	P-value
	Yes	No		
18-50	2(1.7%)	25(20.8%)	27(22.5%)	.0983
51-80	7(5.8%)	86(71.7%)	93(77.5%)	
Total	9(7.5%)	111(92.5%)	120(100%)	

Age (years)	Severity of peripheral arterial disease			Total	P-value
	Mild	Moderate	Severe		
18-50	2(1.7%)	0(0%)	0(0%)	2(1.7%)	0.257
51-80	4(3.4%)	3(2.4%)	0(0%)	7(5.8%)	
Total	6(5.1%)	3(2.4%)	0(0%)	9(7.5%)	

Gender	Peripheral Arterial Disease		Total	P-value
	Yes	No		
Male	7(5.8%)	82(68.3%)	89(74.2%)	.0797
Female	2(1.7%)	29(24.2%)	31(25.8%)	
Total	9(7.5%)	111(92.5%)	120(100%)	

Gender	Severity of peripheral arterial disease			Total	P-value
	Mild	Moderate	Severe		
Male	1(0.85%)	1(0.85%)	0(%)	2(1.7%)	0.571
Female	5(4.1%)	2(1.7%)	0(%)	7(5.8%)	
Total	6(5.1%)	3(2.4%)	0(0%)	9(7.5%)	

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BMI (kg/m2)	Peripheral Arterial Disease		Total	P-value
	Yes	No		
18.1-26	0(0%)	61(50.8%)	61(50.8%)	.0002
26.1-34	9(7.5%)	50(41.7%)	59(49.2%)	
Total	9(7.5%)	111(92.5%)	120(100%)	

BMI (kg/m2)	Severity of peripheral arterial disease			Total	P-value
	Mild	Moderate	Severe		
18.1-26	0(%)	0(%)	0(0%)	0(0%)	0.001
26.1-34	6(5.1%)	3(2.4%)	0(0%)	9(7.5%)	
Total	6(5.1%)	3(2.4%)	0(0%)	9(7.5%)	

Indication of PCI	Peripheral Arterial Disease		Total	P-value
	Yes	No		
ACS	7(5.8%)	87(72.5%)	94(78.3%)	.0966
Non-ACS	2(1.7%)	24(20%)	26(21.7%)	
Total	9(7.5%)	111(92.5%)	120(100%)	

Indication of PCI	Severity of peripheral arterial disease			Total	P-value
	Mild	Moderate	Severe		
ACS	1(0.85%)	1(0.85%)	0(0%)	2(1.7%)	0.560
Non-ACS	5(4.1%)	2(1.7%)	0(0%)	7(5.8%)	
Total	6(5.1%)	3(2.4%)	0(0%)	9(7.5%)	

Diabetes mellitus	Peripheral Arterial Disease		Total	P-value
	Yes	No		
Yes	4(3.3%)	56(46.7%)	60(50%)	.0729
No	5(4.2%)	55(45.8%)	60(50%)	
Total	9(7.5%)	111(92.5%)	120(100%)	

Diabetes mellitus	Severity of peripheral arterial disease			Total	P-value
	Mild	Moderate	Severe		
Yes	2(1.7%)	2(1.7%)	0(0%)	4(3.3%)	0.343
No	4(3.4%)	1(0.85%)	0(0%)	5(4.2%)	
Total	6(5.1%)	3(2.4%)	0(0%)	9(7.5%)	

Hypertension	Peripheral Arterial Disease		Total	P-value
	Yes	No		
Yes	5(4.2%)	68(56.7%)	73(60.8%)	.0736
No	4(3.3%)	43(35.8%)	47(39.2%)	
Total	9(7.5%)	111(92.5%)	120(100%)	

Hypertension	Severity of peripheral arterial disease			Total	P-value
	Mild	Moderate	Severe		
Yes	3(2.5%)	1(0.8%)	0(0%)	4(3.3%)	0.635
No	3(2.4%)	2(1.8%)	0(0%)	5(4.2%)	
Total	6(5.1%)	3(2.4%)	0(0%)	9(7.5%)	

Family history	Peripheral Arterial Disease		Total	P-value
	Yes	No		
Yes	2(1.7%)	28(23.3%)	30(25%)	.0841
No	7(5.8%)	83(69.2%)	90(75%)	
Total	9(7.5%)	111(92.5%)	120(100%)	

Family history	Severity of peripheral arterial disease			Total	P-value
	Mild	Moderate	Severe		
Yes	2(1.7%)	0(%)	0(0%)	2(1.7%)	0.275
No	4(3.3%)	3(2.5%)	0(0%)	7(5.8%)	
Total	6(5.1%)	3(2.4%)	0(0%)	9(7.5%)	

Smoking	Peripheral Arterial Disease		Total	P-value
	Yes	No		
Yes	2(1.7%)	32(26.7%)	34(28.4%)	.0672
No	7(5.8%)	79(65.8%)	86(71.7%)	
Total	9(7.5%)	111(92.5%)	120(100%)	

Smoking	Severity of peripheral arterial disease			Total	P-value
	Mild	Moderate	Severe		
Yes	4(3.3%)	3(2.4%)	0(%)	7(5.7%)	0.257
No	2(1.8%)	0(%)	0(%)	2(1.8%)	
Total	6(5.1%)	3(2.4%)	0(0%)	9(7.5%)	

Dyslipidemia	Peripheral Arterial Disease		Total	P-value
	Yes	No		
Yes	3(2.5%)	33(27.5%)	36(30%)	.0821
No	6(5%)	78(65%)	84(70%)	
Total	9(7.5%)	111(92.5%)	120(100%)	

Dyslipidemia	Severity of peripheral arterial disease			Total	P-value
	Mild	Moderate	Severe		
Yes	2(1.7%)	1(0.8%)	0(%)	3(2.5%)	1.000
No	4(3.3%)	2(1.7%)	0(%)	6(5%)	
Total	6(5.1%)	3(2.4%)	0(0%)	9(7.5%)	

Obesity	Peripheral Arterial Disease		Total	P-value
	Yes	No		
Yes	7(5.8%)	22(18.3%)	29(24.2%)	.0001
No	2(1.7%)	89(74.2%)	91(76.8%)	
Total	9(7.5%)	111(92.5%)	120(100%)	

Obesity	Severity of peripheral arterial disease			Total	P-value
	Mild	Moderate	Severe		
Yes	5(4.3%)	1(0.7%)	0(%)	6(5%)	0.571
No	1(0.75%)	2(1.75%).	0(%)	3(2.5%)	
Total	6(5%)	3(2.4%)	0(0%)	9(7.5%)	

Table 3: Peripheral Arterial Disease and its severity

DISCUSSION

According to the previous studies the prevalence of peripheral artery diseases ranges from 5% to 40% in the patients undergoing PCI for CAD [16]. The highly diverse demographic population background of patients and the CAD manifestation ultimately leads to the highly wide range of PAD. The prevalence of unknown CAD significantly increased with the diabetes mellitus. There is no association of myocardial infarction with the higher rate of PAD. According to a study, the factors which are considered as independent predictors of PAD are the current or former smoking and older age [17, 18]. In the IPSILON cohort the PAD prevalence was reported to be 27.8%. The prevalence of peripheral artery disease ranges from 10.4% in patients with a high-risk cardiovascular profile to approximately 38% in patients with PAD symptoms. The PAD has a poor prognosis in patients undergoing percutaneous coronary intervention or stable coronary artery disease. According to a study conducted by group of scientists it was reported that the prevalence of PAD is 12.8% among patients undergoing percutaneous coronary intervention for CAD on the basis of ankle-brachial pressure index of 0.90 [19]. Another study found that the peripheral artery disease is observed in the 26.6% of patients diagnosed with CAD had (ABI 0.90), while 16.2% were asymptomatic [20]. In many patients approximately 0.8% of cases with an ABI less than 0.5 has the moderate level of peripheral artery disease severity in only. The high

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prevalence (27%) of unknown PAD is reported in another study. This is consistent with earlier estimates that used ABI measurement (30-40%). It is higher than estimates. It is solely based on the clinical findings (10%). The higher short- and long-term mortality is reported in the patients with coronary artery disease and peripheral arterial disease who undergo percutaneous coronary intervention. The procedural success is also lower in such cases. The subset of patients especially those who are vulnerable to these diseases can be identify by the widespread use of ABI measurement. Indeed, one-year outcomes are worse in CAD patients with PAD than in those without PAD. According to previous studies the peripheral arterial disease in coronary artery disease patients is associated with increased disease severity [21]. The increased rate of mortality after PCI are observed in the previous studies. The findings recommend that there is need to improve the process of risk factor detection and management procedure of PAD patients. Our study has a small sample size. There is need to conduct large sample size study.

CONCLUSIONS

In conclusion, peripheral artery disease of the lower leg is not much frequent in patients receiving percutaneous coronary intervention with coronary artery disease but it is associated with disease severity and it & its severity increases with the increase in age and predominant in male gender. The severity of peripheral artery disease is also significantly associated with body mass index & obesity.

Conflicts of Interest

The authors declare no conflict of interest

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