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Prevalence of Asymptomatic Peripheral Artery Disease in Patients Undergoing Coronary Artery Bypass Grafting

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1. ABSTRACT

1.1. Purpose: The Ankle-Brachial Index (ABI) is an efficient tool to determine the presence of lower-extremity Peripheral Artery Disease (PAD). It is an important marker for risk stratification in patients with Coronary Artery Disease (CAD) and predicts mortality and morbidity in CABG procedures. The presence of a subclinical occlusive PAD is associated with a three-fold excess risk of a subsequent cardiovascular event after CABG. Assessment of PAD is simple, reproducible, and cost-effective to detect lower-extremity arterial stenosis to identify patients risk undergoing CABG. The aim of this study was to determine the frequency of PAD in patients undergoing CABG at a tertiary care hospital in South Asian region.

1.2. Materials: After ethical review committee review all elective patients undergone isolated CABG were prospectively recruited for 18 months. Information was collected on demographics, co-morbidities. Systolic pressures in the posterior tibial and the dorsalis pedis arteries at each ankle were measured using the standard algorithm recommended by the American Heart Association. Mean of ABI of 1.0 to 1.4 is considered as normal and <0.9 suggests PAD.

1.3. Results: A total of 151 patients were consecutively recruited. Mean age of the patients was 54.4 ± 6.4 years and mean BMI was 28.8 ± 1.8. Males were dominant 137 (90.7%). Mean ABI was 1.29 ± 0.21 (range from 0.7 to 1.6). Prevalence of PAD was found to be 10% (n=15). Proportion of smoker was comparable 51%, however, hypertension 106 (70.2%) and dyslipidemia 111 (73.5%) were high in PAD positive group.

1.4. Conclusion: The prevalence of a symptomatic PAD was 10% in isolated CABG candidates. Screening of PAD through ABI is a proven important clinical marker for risk stratification in patients with CAD. Pre-CABG procedure diagnosis of PAD is important to monitor the efficacy of revascularization procedures of lower

extremities. It also provides important prognostic information about future cardiovascular events. Use of ABI is recommended for risk assessment of the patients undergoing lower extremity revascularization procedures.

2. INTRODUCTION

Cardiovascular Diseases (CVD) are now recognized as the leading causes of death in the world. In 2013 there were >54 million deaths globally and 17 million (32%) of these deaths were attributable to CVD. [1] Cardiovascular Disease (CVD) is a group of diseases that include both the heart and blood vessels, thereby including Coronary Artery Disease (CAD) which causes about one-third of all deaths in people older than 35 years [2]. CVD is known to co-exist with Peripheral Arterial Disease (PAD) which is the occlusive disease of arteries distal to the aortic bifurcation. This correlation was first described nearly 50 years ago [3,4].

PAD refers to atherosclerotic and thromboembolic processes that affect the aorta, its visceral arterial branches and arteries of the lower extremities [3,5]. PAD is a marker of increased risk of cardiovascular events and of poor prognosis in patients with Coronary Artery Disease (CAD) [6]. The Ankle Brachial Index (ABI) is a sensitive and cost-effective screening tool for PAD [7,8]. Numerous studies have demonstrated that PAD adversely affects outcomes of patients who undergo CABG, which is a common procedure to manage multi-vessel CAD [9]. However, majority of affected population have asymptomatic disease and asymptomatic peripheral atherosclerosis is considered at least as important as symptomatic PAD in identification of patients at high risk for cardiovascular events. Intermittent claudication is the classic symptom of PAD, i.e., leg pain with walking that improves with rest. Most patients have atypical leg symptoms or no symptoms at all. Critical limb ischemia is a dreadful sign of PAD, and is described by ischemic pain, severely diminished circulation, tissue loss and/or gangrene and ulceration [10].

Timely diagnosis of PAD in CABG patients will facilitate in selection of bypass graft conduits and directed treatment of PAD. In patients undergoing CABG, clinical PAD is a well-known factor of poor short-term and long-term prognosis [11,12].

This study is designed to evaluate the prevalence of peripheral artery disease in a group of patients who are undergoing coronary artery bypass grafting. This will help us in early detection of peripheral artery disease in CAD patients. Timely diagnosis of peripheral artery disease in CABG patients will facilitate in selection of bypass graft conduits and directed treatment of PAD. The literature shows that there is no study done in this part of the world to assess frequency of PAD in patients undergoing CABG.

3. MATERIAL AND METHODS

This is a cross-sectional study performed at the tertiary care Hospital. We included patients in age groups 18-70 years undergoing elective isolated Coronary Artery Bypass Grafting (CABG) without any symptoms of peripheral artery disease (PAD). We excluded patients already intubated or undergoing emergency CABGs, previous history of PAD, amputation, and Deep Venous Thrombosis (DVT).

Systolic pressures in the posterior tibial and the dorsalis pedis arteries at each ankle were measured using the standard algorithm recommended by the American Heart Association divided by systolic pressure in the arm (either the left or right brachial artery, whichever is higher). The average the two values obtained from (left and right) is considered as overall ankle-brachial index. [13] Mean of ABI between 1.0 to 1.4 is considered as

normal and <0.9 suggests PAD. Ethical approval was obtained from Ethical Review Committee (ERC) of the hospital. All patients who met the inclusion criteria were approached and were explained and counselled regarding ABI testing for PAD screening. An informed consent was obtained before recruitment in the study. A structured questionnaire was used for data collection. ABI measurement done using conventional Doppler method by cardiac surgery resident or fellow.

All the data entry and statistical analysis was done using SPSS version 19. Mean and standard deviation were calculated for continuous variables and frequency and percentages will be computed for categorical variables. Post stratification data was compared using chi-square test. A p-value <0.05 was considered as level as significance.

4. RESULTS

A total 151 patients were enrolled in the study which included 137(91%) males and 14 (9%) females in the span of 18 months. The mean age of the patients was 54.4 ± 6.39 years. The average body mass index BMI of the patients was 28.78 ± 1.74. The comorbid conditions were also studied, and hyperlipidemia was most prevalent (73.5%), followed by diabetes (72.1%) hypertension (70.2%) and tobacco use (51%).

We found that in our study population Peripheral Artery Disease (PAD) was present in 15(10%) patients. The stratification on PAD on co-morbid conditions revealed that smoking (p-value 0.001) and age more than 53 years (p-value <0.001) are significantly associated with PAD. Prevalence of diabetes, hypertension and dyslipidemia was comparable in PAD and without PAD patients (Table 1).

Table 1. Association of demographic variables with PAD, n=151.

	PVD, Yes		PVD, No		P-Value
	n=15		n=136		
Variables	**n**	**%**	**n**	**%**	
Age group: >55 Years	15	9.90%	59	39.10%	**<0.001**
Gender male,	13	8.60%	125	82.80%	**0.492**
Smoking	14	9.30%	63	41.70%	**0.001**
Diabetes	9	6.00%	100	66.90%	**0.238**
Hypertension	10	6.60%	96	63.60%	**0.753**
Dyslipidemia	11	7.30%	101	66.90%	**0.938**

5. DISCUSSION

Coronary artery disease and peripheral vascular disease are both manifestations of atherosclerosis which systemic process with variable expression in different vascular beds, which explains the co-existence of the two pathologies [14]. We estimate a prevalence of PAD with CAD of 10% in population planned for CABG surgery. This is lower compared to the prevalence reported by most studies performed at different center worldwide. Even Siddiqi et al. found a prevalence of about 30% in patients with Acute Coronary Syndrome in Pakistani adults [15]. South Asians are at higher risk of CAD. Kin et al., found a prevalence of PAD of 13% in Korean adult population undergoing CABG [14]. The reported prevalence of PAD in patients undergoing PCI with CAD varies from 5% to 40% in previous studies [16-18].

The high prevalence of combined CAD and PVD has been confirmed in two large international studies-the REACH (Reduction in Atherothrombosis for Continued Health) registry and the AGATHA (A Global Atherothrombosis Assessment) study in which 16% to 35% of patients (with established atherosclerotic disease or three or more risk factors) had polyvascular disease [19].

Risk factors involved in the pathogenesis of PAD are also like those involved in coronary artery disease because of the common underlying pathology. The traditional risk factors such as smoking, diabetes, hypertension, dyslipidemia, obesity, physical inactivity and increased age are associated with PAD, the strongest correlation being with smoking and diabetes. [8] A study similar to ours assessed the risk factors associated with PAD and it showed that after controlling for multiple potential confounders, diabetes, an increased Low-Density Lipoprotein Cholesterol (LDL-C)/High-Density Lipoprotein Cholesterol (HDL-C) ratio, and hypertension were significantly or marginally associated with PAD. [20] Our study demonstrated that age group >53 years and smoking have correlation with PAD. However, no association was found with other comorbidities including diabetes which has been strongly associated with PAD in other studies. This variation can be due to different ethnic background of our study population from North America or Europe, where most the studies have been conducted.

In addition to common risk factors, PAD is associated with poor prognosis of patients with CAD. An extensive review of literature shows that the prevalence of PAD in patients with coronary artery disease varied in several studies between 26% and 71%. Moreover, these patients often undergo Coronary Artery Bypass Grafting (CABG) and PAD is also an important predictor of death after Coronary Artery Bypass Grafting (CABG) which is a procedure used worldwide to manage multivessel CAD [9,21,22]. There are numerous studies which have assessed the increase in mortality in this patient population and subgroup analyses of large series of CABG operations have shown that the presence of PVD increases operative mortality rates 1.6- to 2.9-fold [23]. In the ASCERT study, patients with PAD who underwent CABG, had 30-day; 1 year and 3 year mortality was 5.1% , 13.4% and 35.3% respectively [24].

The high prevalence of co-existing PAD and CAD and the increased postoperative morality in this group of patients emphasizes the need for preoperative assessment of patients undergoing CABG to screen for asymptomatic PAD. The Ankle Brachial Index (ABI) is a sensitive and cost-effective screening tool for PAD [8]. It is a non-invasive method to test for PAD. The ABI is performed by measuring the systolic blood pressure from both brachial arteries and from both the dorsalis pedis and posterior tibial arteries with a handheld Doppler instrument. The ABI value is determined by taking the higher pressure of the 2 arteries at the ankle, divided by the brachial arterial systolic pressure and is calculated separately for both ankles. Since ankle pressures are normally greater than 90% of the brachial pressure, an ABI < 0:9 is diagnostic of PAD. An ABI < 0:9 is a surrogate for PAD with up to 95% sensitivity and specificity for the diagnosis of PAD [25]. There is a large body of evidence (18 population-based cohorts) suggesting that a low ABI (<0.9) is independently associated with increased CAD and CVD risk, after adjusting for FRS (Framingham Risk Score) factors [11]. These characteristics make ABI measurement a suitable screening tool for PAD and therefore we used it to diagnose asymptomatic PAD in our patients undergoing CABG.

6. LIMITATIONS

The results should be interpreted considering few limitations, first this was as descriptive cross-sectional study of shorter period, so we cannot establish temporal relationship between exposure and disease. This was conducted in a single centre and large-scale multi-centre cohort studies are required for true burden of disease in a subset of population.

7. CONCLUSION

The prevalence of a symptomatic PAD was 10% in isolated CABG candidates. Screening of PAD through ABI is a proven important clinical marker for risk stratification in patients with CAD. Pre-CABG procedure diagnosis of PAD is important to monitor the efficacy of revascularization procedures of lower extremities. It also provides important prognostic information about future cardiovascular events. Use of ABI is recommended for risk assessment of the patients undergoing lower extremity revascularization procedures.

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