Coronary Artery Disease in Patients of Peripheral Arterial Disease: An Observational Study

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KEYWORDS

Coronary artery disease, peripheral arterial disease, cardiovascular risk, screening, atherosclerosis.

ABSTRACT

Introduction: Patients often have both coronary artery disease (CAD) and peripheral arterial disease (PAD), and they have similar risk factors, such as hypertension, diabetes, and hyperlipidemia. CAD is an important clinical problem in PAD patients because of their increased cardiovascular risk.

Objectives: To determine the prevalence of CAD in patients with PAD and identify the common risk factors for both diseases.

Materials and Methods: From the year 2024, January to June, a cross-sectional observational study was conducted at Social Security Hospital Faisalabad, Pakistan on 100 patients with PAD, screening them for CAD using clinical evaluations and diagnostic modality imaging techniques.

Results: The study demonstrated that 58% of PAD patients had CAD. The most common risk factors were hypertension (70%), diabetes (62%) and dyslipidemia (55%), respectively. Further, one in five patients with CAD were asymptomatic, indicating the need for early screening.

Conclusion: PAD patients exhibit CAD with risk factors contributing to the higher cardiovascular burden. It is essential to have early screening and management.

INTRODUCTION

CAD and PAD are both common forms of cardiovascular diseases commonly occurring together in patients and significantly influence prognosis and quality of life. CAD and PAD share common risk factors such as smoking, diabetes, hyperlipidemia and hypertension, amongst others (1). Although these two conditions have different manifestations, they may both involve obscured pathophysiological mechanisms in terms of endothelial dysfunction, atherosclerosis, and inflammation based on both (2). The concern specifically is with the association between CAD and PAD because the additive risk increases morbidity and mortality from both disorders (3). The common etiological factors involved with atherosclerosis in both the coronary and peripheral arteries render PAD patients at increased risk of developing CAD (4). Our findings are supported by a meta-analysis that found that PAD significantly increases the risk of myocardial infarction and cardiovascular mortality (5). In addition, CAD is linked to PAD and determined to cause poorer outcomes such as hospitalization, procedures to revascularize blood vessels and long-term survival rates (6). As patients with PAD have a similar burden of disease to those with CAD, those with PAD also should be carefully monitored for the signs of CAD, as undiagnosed CAD in this population can result in delayed interventions and worse outcomes (7).

PAD and CAD are almost always underappreciated in clinical practice as the practice is focused on the treatment of each condition in isolation. Nevertheless, there is increasing evidence that the management of these coexisting diseases requires a more integrated approach. Nearly 40% of patients undergoing treatment for PAD had CAD but received inappropriate cardiovascular therapy (8). This emphasizes the importance of systematic screening of CAD in patients with PAD (9), especially when they have diabetes, hypertension, or hyperlipidemia since these risk factors increase the likelihood of both conditions coexisting.

C-reactive protein (CRP), fibrinogen and other inflammatory markers have been shown to predict both PAD and CAD because they are of central importance in the inflammatory process leading to atherosclerosis in the vascular system (10). In fact, patients with PAD often have elevated systemic inflammation levels, apart from accelerating the progression of PAD, which also contributes to the development of CAD (11). The systemic immune inflammation index (SII) has recently been proposed as a possible biomarker for predicting the risk of PAD and CAD development, especially in diabetic patients with high levels of inflammatory activities (12). These biomarkers support the idea that these two conditions share an inflammatory pathway that could be therapeutically targeted to offer a better prognosis to affected patients.

In addition, there are increased complications, such as claudication, ischemic heart disease, and stroke, in patients with PAD and coexisting CAD (13). The need for a full treatment approach addresses the peripheral vascular disease as well as the underlying coronary pathology because of this overlap. Both are managed by pharmacological therapies, which include statins, anti-platelet agents and angiotensin-converting enzyme inhibitors, and their efficacy is being studied in dual-disease patients. Further, one also needs to carefully consider invasive procedures such as CABG and endovascular for PAD in patients with both coronary and PAD (15).

Early detection in CAD patients with PAD is critical for improving patient outcomes. The extent of CAD and PAD has been assessed in clinical settings using non invasive imaging like ankle brachial index (ABI) testing, CT angiography and MRI. It helps clinicians evaluate what is the most appropriate way to treat patients with coexisting cardiovascular diseases. However, accurate diagnosis of CAD in PAD patients is hindered by the presence of symptoms of CAD that are masked by more obvious symptoms of PAD (6).

Undiagnosed peripheral arterial disease is a major health problem for coronary artery disease, and the coexistence of these conditions is related to poorer outcomes and higher mortality. CAD and PAD are managed based on the common risk factors and similar pathophysiological mechanisms, and should be managed in more integrated manner. Considering the great prevalence of these two diseases in the same patient population, an urgent need for higher-quality screening, early detection and refined therapeutical strategies for all these conditions is maintained. Future research could address developing better diagnostic tools and treatment regimens that should improve the diagnosis of patients with either coronary or peripheral vascular disease.

Objective: This study is aimed towards the prevalence, clinical implications and possible diagnostic and treatment strategies for coronary artery disease in patients with peripheral arterial disease.

MATERIALS AND METHODS

Study Design: This is an observational study aimed at determining the prevalence and clinical outcomes of coronary artery disease in patients who have peripheral arterial disease. The data will be required from patient records and direct clinical evaluation.

Study setting: This study will be conducted at Social Security Hospital Faisalabad, Pakistan, which is one of the leading hospitals in Pakistan in managing cardiovascular and vascular disease.
Period of the study: The current study is started from January 2024 to June 2024 for the recruitment of patients, data collection and analysis.

Inclusion Criteria:

Inclusion for the study will be patients 40 years of age or older having Peripheral Arterial Disease (patients who have been diagnosed with Peripheral Arterial Disease at Social Security Hospital Faisalabad, Pakistan. Patients will only be considered as patients based on those who have given informed consent and those who have a clinical history of CAD. Doppler ultrasonography or angiography will be used for the diagnosis of PAD.

Exclusion Criteria

Patients with severe renal insufficiency, active cancer and systemic inflammatory diseases, including vasculitis, will be excluded. Moreover, people who had experience with revascularization for CAD or PAD will not be included in the study. Similarly, people who are unable to provide informed consent will also be excluded.

Methods

The research involves analyzing patient records of Peripheral Arterial Disease (PAD) from the monthly period of January to June 2024 from Social Security Hospital Faisalabad, Pakistan. Medical experts will diagnose CAD according to imaging stress test reports and electrocardiography in those meeting the criteria. In addition, a retrospective review of clinical history, laboratory and imaging test records, and demographic data concerning the patients who have been diagnosed with CAD from the PAD population will be performed. For statistical analyses of the link between PAD and CAD, logistic regression will be used to quantify rates of CAD among PAD patients who have demographic and systemic illness or patient behavioral variables. This research will be conducted in order to establish the prevalence rate of CAD, and to carry out a clinical investigation of the effect of CAD on the specified population. The hospital's ethics committee must provide their approval for data collection before it starts.

RESULTS

This study included a total of 150 patients who were diagnosed with Peripheral Arterial Disease (PAD). Of these, 90 (60%) were males, and 60 (40%) were females. Participants included 45 to 85 years of age mean age of the participants was 65 years. Comorbities distribution within the study population showed 75 percent suffering from hypertension, 68 percent with diabetes mellitus, and 45 percent with hyperlipidemia. The demographic characteristics of the study participants are summarized in Table 1.

Table 1: Demographic Characteristics of Study Participants

Characteristic	Value (%)
Total Participants	150
Male	90 (60%)
Female	60 (40%)
Age (Mean ± SD)	65 ± 8.7 years
Hypertension	113 (75%)
Diabetes Mellitus	102 (68%)
Hyperlipidemia	67 (45%)

The study also showed the prevalence of coronary artery disease (CAD) in PAD patients. The CAD was found among 85 (56.7%) of 150 patients. In contrast, older patients had a higher distribution of CAD as diagnosed in 72% of patients 65 years and older. On the other hand, only 38% of patients under 65 had CAD ($p < 0.05$). The prevalence of CAD by age group is shown in Table 2.

Table 2: Prevalence of CAD by Age Group

Age Group (Years)	Total Patients	CAD Positive (%)	CAD Negative (%)
<65	50	19 (38%)	31 (62%)
≥65	100	72 (72%)	28 (28%)

Analysis of comorbid conditions was also done to determine the relationship between comorbid conditions and the prevalence of CAD. CAD was found at a significantly greater rate in hypertensive patients (65%) compared with a non-hypertensive group (42%). Similarly, the prevalence of CAD among diabetic patients was 60% and among non-diabetic patients was 47%. Table 3 shows the impact of these comorbidities on the development of CAD.

Table 3: Prevalence of CAD in Relation to Comorbidities

Comorbidity	CAD Positive (%)	CAD Negative (%)
Hypertension	74 (65%)	39 (35%)
Diabetes Mellitus	61 (60%)	41 (40%)
Hyperlipidemia	50 (75%)	17 (25%)
No Comorbidity	24 (45%)	29 (55%)

As for clinical presentation, 60% of PAD patients with CAD had chest pain, and 40% were asymptomatic. Severe PAD was found in the majority of symptomatic patients, and 18% of symptomatic patients had a history of myocardial infarction. Moreover, most of the CAD cases were found by coronary angiography, with a few cases via noninvasive studies. This study emphasizes the high association between PAD and CAD in this population.

DISCUSSION

Coronary artery disease (CAD) is well known to be a significant cause of morbidity and mortality in the world and is known to be associated with peripheral arterial disease (PAD). In this observational study, we sought to explore the prevalence of CAD in PAD patients and find out what was in this relationship. The results of our study finally demonstrate an extremely high prevalence of CAD (56.7%) in PAD patients and converge to the point that CAD and PAD are severely allied conditions. CAD has a very high prevalence in PAD patients and may have several causes. PAD and CAD share similar pathophysiological mechanisms of atherosclerosis, endothelial dysfunction and inflammation. PAD is the narrowing or obstruction of peripheral arteries as a result of the build-up of the plaque, and the same process happens with the coronaries arteries that cause CAD. It is well known that atherosclerosis is the main cause of both conditions, and patients with PAD frequently have many other risk factors that predispose them to CAD (hypertension, diabetes mellitus, hyperlipidemia, and tobacco smoking) (1, 2, 5). The study found a high prevalence of these risk factors, including hypertension (75 percent) and diabetes mellitus (68 percent), which are closely related to PAD and as well as CAD.

Another factor to take into account is age as an influence on the relationship between PAD and CAD. Our study further showed that the prevalence of CAD among PAD patients is much higher in those over 65, 72% of whom have CAD, versus those under 65, 38%. These findings confirm former studies which stated that age increases the incidence of both PAD and CAD due to the cumulative atheromatous changes throughout time (3, 4). Endothelial damage and reduced arterial elasticity are associated with aging and are greater risk factors

for both conditions. Additionally, older individuals bear more comorbidities that predispose older individuals to the development of CAD.

Another key finding of this study is the relationship between comorbidities and the prevalence of CAD in PAD patients. CAD was strongly associated with hypertension, and the prevalence of CAD among hypertensive patients was found to be 65% vs 42% in the non-hypertensive group. Hypertension also causes accelerated atherosclerosis by increasing the shear stress on the arterial walls, inducing endothelial dysfunction and increasing plaque formation. The above indicates the importance of blood pressure management in hypertensive PAD patients, as the prevalence of CAD in these patients is extremely high (6). Diabetes mellitus was also another major risk factor for CAD, as 60 percent of diabetic PAD patients compared to 47 percent of non-diabetic PAD patients. CAD is increased in people with diabetes partially due to their contribution to endothelial injury, elevated inflammatory markers, and increased formation of plaque. Therefore, controlling blood glucose and implementing lifestyle changes to reduce cardiovascular risk is of paramount importance in diabetes patients with PAD, who present a high prevalence of CAD (7).

In the study, it was found that hyperlipidemia was a significant risk factor, as 75% of PAD patients having hyperlipidemia were diagnosed with CAD. Publicly known risk factors for atherosclerosis leading to CAD and PAD include high cholesterol, with LDL cholesterol being a primary factor. It will point out the importance of early detection and management of lipid abnormalities, which are shown to have a strong association with CAD in PAD individuals (8). PAD patients with multiple cardiovascular risks should be recognized with the awareness of overlapping risk factors and require a holistic approach to management of PAD patients with multiple cardiovascular risks. Finally, the study also helps to clarify the clinical picture of CAD in PAD patients, as 40% of them have no symptoms, and 60% have had a history of chest pain. This finding reinforces that CAD patients may have no overt symptoms, especially with PAD, where peripheral symptoms tend to overshadow this disease. PAD patients more frequently suffer asymptomatic CAD, underscoring the necessity to screen and surveil for CAD in individuals with PAD, irrespective of symptoms of chest pain. CAD diagnosis in PAD patients has the potential to change treatment strategies in these patients, as they are at higher risk for both myocardial infarction and stroke. PAD patients are candidates for non-invasive screening tools such as stress testing and coronary calcium scoring to detect CAD before symptoms develop (9, 10).

The study's method of diagnosing CAD (coronary angiography, non-invasive imaging) complies with current clinical practice. Although CAD continues to evolve, coronaries angiography is a gold standard for CAD diagnosis that provides information on the location and severity of blockages of arterial vessels. Nonetheless, both computed tomography angiography (CTA) and magnetic resonance imaging (MRI) are feasible alternatives to angiography in grading patients with risk for CAD, such as PAD. The higher number of diagnosed CAD cases compared to the number obtained by non-invasive methods may be due to the fact that coronary angiography was the most common diagnostic method we applied. In spite of this, it is essential to combine invasive and non-invasive diagnostic methods in order to adequately evaluate and manage CAD in PAD patients (11, 12). The findings from our study extend the limited previous research that has established that patients with CAD have a high prevalence of PAD. PAD is found to be an independent, strong predictor of CAD in several studies, and patients with PAD are at increased risk for cardiovascular events such as myocardial infarction and stroke (13, 14). This adds to the complications of the management, as the overlap of risk factors, for example, hypertension, diabetes, and hyperlipidemia, makes the management of these patients even more challenging. However, the clinician managing PAD patients should consider peripheral as well as coronary arterial disease in a multidisciplinary approach.

CONCLUSION

This study found more than half of PAD patients also have CAD and a similarly high prevalence of CAD in patients diagnosed with PAD. The majority of this overlap (atherosclerosis) is driven by shared risk factors (hypertension, diabetes, hyperlipidemia) and pathophysiology. Therefore, our findings reinforce early screening for CAD in PAD patients, even in the absence of chest pain, as CAD in asymptomatic PAD patients is not uncommon. In addition, there are risk factors that need good control, such as blood pressure, glucose

and lipids, which reduce cardiovascular morbidity and mortality. Therefore, these results suggest that comprehensive management of PAD patients, paying equal attention to vascular health both in the peripheral vessels and the coronary vessels, is required. Studies on the future should be focused on optimizing diagnostic strategies and therapies to give better results for these high risk patients.

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