ORIGINAL ARTICLE

PATTERN OF VASCULAR INVOLVEMENT IN PATIENTS WITH LOWER EXTREMITY PERIPHERAL ARTERIAL DISEASE

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Objectives: Peripheral arterial disease (PAD) is still underdiagnosed and undertreated diseases accounts for a considerable part of cardiovascular disease. Therefore, the objective of this study was to determine the pattern of vascular involvement in patients with lower extremity peripheral artery disease.

Methodology: In this study we reviewed hospital record files and angiographic films of the patients' undergone conventional peripheral angiography. Patterns of vascular involvement was assessed in terms of involved arterial segments, site (right, left, or both), size (%), and type of lesion (discrete, tubular, or diffused).

Results: A total of 74 patients were included, out of which 60 (81.1%) patients were male. A majority, 85.1% (63), were diabetic, 78.4% (58) were hypertensive, 43.2% (32) were smokers, and 23% (17) had coronary artery disease. The most common involved location was superficial femoral (51.4%) followed by anterior tibial (45.9%), posterior tibial (45.9%), popliteal (21.6%), and peroneal (16.2%). Female patients had significantly higher rate of superficial femoral diseases as compare to the male patients with rate of 85.7% (12/14) vs. 43.3% (26/60); p=0.004 respectively.

Conclusion: In conclusion, the most common risk factor for PAD was found to be diabetes and a significant number of patients were also found to have hypertension, and smoking. The most common involved segment was superficial femoral in our population followed by anterior tibial, posterior tibial, popliteal, and peroneal.

Keywords: peripheral arterial disease, lower extremity, cardiovascular disease, critical limb ischemia, Pakistan

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INTRODUCTION

Peripheral arterial disease (PAD) is a condition usually used to describe the stenosis in non-coronary circulation. It mostly affects lower extremities.[1] Nearly ten percent of men older than 65 years of age have atherosclerotic PAD, which rises to 20% in men and women aged ≥75 years.[2-3] PAD is still underdiagnosed and undertreated diseases, despite its high prevalence.[4] Peripheral arterial disease reduces functional capability, which can lead to poor quality of life and in some cases disability in the long run. Patients with PAD are also more likely to have a myocardial infarction (MI), stroke or even death. Risk of stroke and heart attack are around are 3 to 6 times more among patients with PAD as compared to those without PAD.[5]

Worldwide, PAD accounts for a considerable part of cardiovascular disease (CVD) prevalence.[6] PAD affected more than 200 million people by the year 2010, according to estimates. Between 2000 and 2010, low- and middle-income countries saw a 28.7% increase in prevalence, while high income countries saw a 13.1% increase.[7,8] When compared to coronary artery disease (CAD), the prevalence is even higher, with 110.55 million cases reported during the same time period.[6] The under-appreciation of PAD is related to a lack of mass level screening and lack of awareness among general and primary care physicians, as well as the fact that classic claudication occurs infrequently and is commonly mistaken for musculoskeletal abnormalities in older people. Only a small percentage of patients with chronic stable PAD go on to develop acute symptoms.

In 2015, only 52500 deaths were reported from PAD, compared to an estimated 7 million acute myocardial infarctions (AMI) and 8.92 million deaths owing to CAD. In PAD patients, the rates of morbidity, procedural interventions, hospitalization, and readmission are all high, and the quality of life measures are low. Intermittent claudication affects around a quarter of the PAD population, but only about 1% to 3% develops critical limb ischemia (CLI).[8,9]

Systemic atherosclerosis manifests in form of PAD, lower extremity atherosclerosis is caused by modifiable risk factors such as poor diet quality, dyslipidemia, cigarette smoking, diabetes, obesity, and physical inactivity, as well as underlying hereditary factors. Patients with PAD are more likely to have coexisting coronary or cerebrovascular illness, as well as an increased risk of significant adverse cardiovascular events like AMI, stroke and mortality. Patients with PAD often have a limited ability to walk and are at risk of acute and chronic CLI, which can result in significant limb events such as peripheral revascularization or amputation.[10]

Treatment options for people with PAD have improved over the last decade, with better early identification, more frequent referral for diagnostic imaging and better revascularization choices. However, data on pattern of vascular disease involvement in patients with PAD disease in South Asian population is still lacking. Understanding of the anatomic localization of occlusive arterial disease in patients with PAD is very important for interventional management and emerging new endovascular therapies. Treatment options are totally different and vary according to site, size and extent of vascular disease in peripheral arterial disease patients.
Therefore, this study will help in further plan and better understanding of interventional management in patients with peripheral artery disease. Hence, the main aim of this study was to determine the pattern of vascular involvement in patients with peripheral artery disease.

METHODOLOGY

This retrospective study was conducted at the National Institute of Cardiovascular Diseases (NICVD) Karachi, Pakistan. Hospital record files of the patients' undergone conventional peripheral angiography as a part of their management of signs/symptoms of lower extremity PAD between January 2018 and July 2020 were reviewed after the approval form the ethical review committee of the institution.

Clinical characteristics such as gender and conventional risk factors such as hypertension, diabetes, history of coronary artery diseases, and smoking were obtained and angiographic films were reviewed. Patterns of vascular involvement was assessed in terms of involved arterial segments (aorta, common iliac, external iliac, internal iliac, profunda femoris, popliteal, superficial femoral, posterior tibial, anterior tibial, peroneal, and dorsalis pedis), site (right, left, or both), size (%), and type of lesion (discrete, tubular, or diffused).

Data for the patterns of vascular involvement were analyzed using IBM SPSS version 19. Descriptive statistics such as frequency (%) or mean ± standard deviation (SD) were calculated and appropriate Chi-square test was applied to compare data by gender and $p \leq 0.05$ was considered significant.

RESULTS

A total of 74 patients with PAD undergone peripheral angiography were included, out of which 60 (81.1%) patients were male. A majority, 85.1% (63), were diabetic, 78.4% (58) were hypertensive, 43.2% (32) were smokers, and 23% (17) had coronary artery disease. The most common involved location was superficial femoral (51.4%) followed by anterior tibial (45.9%), posterior tibial (45.9%), popliteal (21.6%), and peroneal (16.2%) (Table 1). Female patients had significantly higher rate of superficial femoral diseases as compare to the male patients with rate of 85.7% (12/14) vs. 43.3% (26/60); p=0.004 respectively.

Table 1: Clinical profile and arterial segmental involvement by gender

Characteristics	Total	Gender	
		Male	Female
Total (N)	**74**	**60 (81.1%)**	**14 (19%)**
Co-morbid conditions			
Hypertension	78.4% (58)	78.3% (47)	78.6% (11)
Diabetes mellitus	85.1% (63)	86.7% (52)	78.6% (11)
Coronary artery disease	23% (17)	23.3% (14)	21.4% (3)
Smoking	43.2% (32)	53.3% (32)	0% (0)
Arterial segment involved			
Superficial femoral	51.4% (38)	43.3% (26)	85.7% (12)
Anterior tibial	45.9% (34)	45% (27)	50% (7)
Posterior tibial	45.9% (34)	48.3% (29)	35.7% (5)
Popliteal	21.6% (16)	21.7% (13)	21.4% (3)
Peroneal	16.2% (12)	18.3% (11)	7.1% (1)
Dorsalis pedis	8.1% (6)	8.3% (5)	7.1% (1)
Common iliac	6.8% (5)	8.3% (5)	0% (0)
External iliac	6.8% (5)	8.3% (5)	0% (0)
Profunda femoris	4.1% (3)	3.3% (2)	7.1% (1)

Distribution of site, size, and type of lesion by various locations is presented in Table 2, lesion type was diffused at most of the locations. Single site, either left or right, were affected in most of the patients, both sites involvement was less common at most of the locations.

DISCUSSION

This study was conducted to determine the pattern of vascular involvement in patients with lower extremity PAD, we observed that the most common involved segment was superficial femoral followed by anterior tibial, posterior tibial, popliteal, and peroneal. The type of lesion was found to be diffused at most of the

segments and single site, either left or right, were affected in most of the patients. The most common risk factor was found to be diabetes followed by hypertension, and smoking.

A study conducted by Graziani L et al.[1] reported the common segment as peroneal stenosis followed by femoral stenosis, anterior tibial stenosis, popliteal stenosis, and posterior tibial stenosis in diabetic subjects with critical limb ischemia. A very similarly to our observations, other studies have shown that the majority of individuals with PAD, particularly diabetics, had widespread vascular disease in the lower limb arteries, with the illness being most severs in vessels below the knee.[1] Strandness et al. found that diabetic patients had more infrapopliteal arterial disease,[11] whereas King et al. findings revealed that diabetic patients had higher involvement of the profundal femoris.[12] Motsumi MJ et al. also observed that the diabetic people exhibit substantial tibioperoneal artery damage.[13]

Table 2: Distribution of site, size, and type of lesion by various locations

	Total	Site			Size (%)	Type		
		Right	Left	Both		Discrete	Tubular	Diffused
Superficial femoral	38	39.5% (15)	47.4% (18)	13.2% (5)	86.9 ±12.3	0% (0)	10.5% (4)	89.5% (34)
Anterior tibial	34	41.2% (14)	58.8% (20)	0% (0)	90.2 ±9.8	0% (0)	2.9% (1)	97.1% (33)
Posterior tibial	34	44.1% (15)	52.9% (18)	2.9% (1)	90.1 ±11.5	0% (0)	2.9% (1)	97.1% (33)
Popliteal	16	50% (8)	37.5% (6)	12.5% (2)	93.8 ±8.1	0% (0)	50% (8)	50% (8)
Peroneal	12	33.3% (4)	66.7% (8)	0% (0)	80.4 ±15.7	16.7% (2)	8.3% (1)	75% (9)
Dorsalis pedis	6	16.7% (1)	66.7% (4)	16.7% (1)	89.8 ±19.9	0% (0)	16.7% (1)	83.3% (5)
Common iliac	5	80% (4)	20% (1)	0% (0)	76 ±11.4	0% (0)	60% (3)	40% (2)
External iliac	5	20% (1)	20% (1)	60% (3)	70 ±23.5	0% (0)	0% (0)	100% (5)
Profunda femoris	3	0% (0)	66.7% (2)	33.3% (1)	100 ±0	0% (0)	0% (0)	100% (3)

The lower extremity has a lot of arteries, which means there is a lot of room for collateralization. As a result, it's critical to comprehend the mechanisms that influence many arterial segments at the same time, resulting in CLI, in order to create ways to help prevent the progression of asymptomatic or symptomatic PAD to CLI.[14] The pathology and plaque composition of arteries in the lower limbs in PAD patients are poorly understood, but it is widely thought to be comparable to the pathology of plague formation in the carotid and coronary arteries.[15,16]

PAD can manifest itself in a variety of ways, including no symptoms, intermittent claudication (IC), unusual limb pain, rest pain, ischemic ulcers, and gangrene. PAD is divided into two categories: asymptomatic and symptomatic. Patients with symptomatic PAD are further split into two groups: IC and CLI. Patients with asymptomatic PAD, IC, and CLI have diverse disease prognoses and natural histories; therefore it's vital to distinguish between them when it comes to long term management.[17]

The dual antiplatelet therapy (DAPT) in patients with PAD was found to be effective in reducing risk of ischemic vascular events, however, the risk of bleeding is the most serious side effect of continuous DAPT.[18] There have been previous researches on the relationship between DAPT and bleeding in PAD after endovascular intervention. Beiswenger AC et al.[19] conducteda meta-analysis and reported that the risk of severe bleeding after revascularization in PAD patients remained identical between DAPT and mono antiplatelet therapy (MAPT). The MIRROR research found no difference in bleeding events for 6 months following the intervention between MAPT and DAPT (5% vs. 2.5%; p=0.559).[20] In one study, >80% of patients with PAD were on post endovascular revascularization DAPT, and >50% of those on were on DAPT for at least six months. DAPT for six months were found to be associated with significantly lower rates of major adverse limb events (MALE) and major adverse cardiac events (MACE) as compared to MAPT, and the results were consistent in different sensitivity analyses.[21]

Outcomes after endovascular intervention in PAD patients are associated with several factors in various trials such as older age, diabetes, CLI, renal impairment (hemodialysis), and inflammatory

markers such as d-dimer were all predictors of death after iliac artery endovascular stenting, according to Kumakura et al.[22] Similarly, Patel et al.[23] found that class IV chronic kidney disease and end-stage renal disease were linked to amputation, short-term mortality, and log-term mortality after infrainguinal endovascular interventions. Female sex was linked to a greater risk of MALE after endovascular therapy, according to Choi et al.[24] Women had smaller vessels, a higher proportion of infrainguinal and multilayer illness, and a higher rate of complications than men, reported in their study.

It takes more than a procedure to effectively revascularize a patient with PAD. Understanding the heterogeneity in clinical presentation and identifying patients at higher risk are the first step in the prevention and management of a patient with limb threatening ischemia and symptom limiting intermittent claudication. The need for revascularization varies significantly depending on the patients presentation, ranging from intermittent claudication patients who should undergo structured exercise rehabilitation before revascularization to those with acute limb ischemia, which requires revascularization within hours. Wires, catheters, drug eluting technologies, customized balloons and biomimetic stents have all witnessed significant advancement in recent years. For individuals with severe illness, open surgical bypass remains a viable choice.[25]

Our study has certain limitations, single center study with small sample size and retrospective study design may limit the generalizability of the study findings.

CONCLUSION

In conclusion, the most common risk factor for PAD was found to be diabetes mellitus and a significant number of patients were found to have hypertension, and smoking. The most common involved segment was superficial femoral in our population followed by anterior tibial, posterior tibial, popliteal, and peroneal. The type of lesion was found to be diffused at most of the atrial segments. Further larger studies are required to understand the segmental distribution of PAD in our population.

AUTHORS' CONTRIBUTION

MK, NK, and JJ: Concept and design, data acquisition, interpretation, drafting, final approval, and agree to be accountable for all aspects of the work. MK, NK, JJ, GSS, HI, and AHS: Data acquisition, interpretation, drafting, final approval and agree to be accountable for all aspects of the work.

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