

Peripheral arterial disease: a single center experience

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ABSTRACT

Aims: Angiography and interventional treatment modalities in peripheral arterial disease have recently been widely used because they are easier to perform and more comfortable than surgical treatment. Revascularization is the most effective treatment method in cases such as critical leg ischemia in this disease where pharmacological agents are also widely used. In this study, we aimed to investigate interventional treatment methods in peripheral arterial disease in our center.

Methods: Patients who underwent peripheral angiography or endovascular intervention in the Cardiology Clinic of Kırıkkale University Medical Faculty Hospital between March 2020 and June 2024 were retrospectively reviewed.

Results: A total of 55 patients, including 10 women and 45 men, were included in the study. The mean age of the patients included in the study was 64 years. Of the angiographic procedures, 46 were performed in the lower extremity, 6 in the upper extremity and 3 in the renal arteries. Endovascular treatment were performed in 26 of them. Of the endovascular treatment, 11 were balloon angioplasty and 15 were stent implantation. In 5 patients, peripheral bypass was decided.

Conclusion: Interventional treatment of peripheral arterial disease is increasingly and successfully performed in our center.

Keywords: Peripheral arterial disease, endovascular intervention, balloon angioplasty, stent implantation

INTRODUCTION

Peripheral arterial disease (PAD) is a disease characterized by narrowing or occlusion of the arterial circulation, especially in the lower extremities, due to atherosclerosis. The prevalence of PAD increases with age and has been reported to be between 3-7% under the age of 60 years, 20% in men and 15% in women over the age of 65 years.¹ In a multicenter study called "careful" conducted in Turkey in 2010 to investigate the prevalence of peripheral artery disease, patients aged 50-69 years with at least one cardiovascular risk factor and all patients over the age of 70 years were included in the study. The diagnosis of PAD was made by measuring the ankle-brachial index (ABI). As a result of the study, the prevalence of PAD was found to be 20% in all age groups and 30% in patients over 70 years of age.² Advanced age, male gender, smoking status, and diseases such as diabetes, hypertension, hyperlipidemia and metabolic syndrome have been reported as risk factors for PAD.³ Especially in diabetic patients, symptoms are recognized late due to peripheral neuropathy and complications such as limb amputation are more common.

Although 1/3-1/2 of patients are asymptomatic, the most common symptom is leg pain (claudication intermittent), which initially occurs with exertion, but as the severity of the

stenosis increases, this pain starts to occur at rest. In advanced cases, sores appear on the foot. ABI measurement is widely used as a non-invasive screening method for the diagnosis of peripheral arterial disease. ABI between 1.0-1.3 is considered normal. An ABI ≤ 0.9 is diagnostic for PAD.⁴ This value may be abnormally high due to highly calcified arteries, which may be present in diabetes and renal diseases.⁴ Although peripheral arterial surgery is still performed in the treatment of PAD, endovascular interventional treatments are preferred in most cases with the development of device and balloon-stent technology.^{5,6} PAD, which causes a significant increase in comorbidity and mortality when left untreated, is an important disease to be diagnosed early. Easy diagnosis with ABI and treatment with interventional and surgical methods may prevent serious complications such as amputation.⁶

In this study, we retrospectively analyzed the patients who underwent peripheral angiography and peripheral angioplasty in appropriate patients in our clinic.

METHODS

This is an observational study in which patients who underwent peripheral angiography and endovascular intervention for



peripheral arterial disease were retrospectively analyzed. Ethics committee approval was obtained from Kırıkkale University Non-interventional Clinical Researches Ethics Committee (Date: 17.04.2024, Decision No: 2024.04.12). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki. Patients who were hospitalized for peripheral angiography or endovascular intervention in the Cardiology Clinic of Kırıkkale University Medical Faculty Hospital between March 2020 and June 2024 were retrospectively reviewed. Peripheral angiography was performed in patients with foot pain and $ABI \leq 0.9$, and renal angiography was performed in those with resistant hypertension. Inclusion criteria: age older than 18 years, undergoing angiography or endovascular intervention on iliac, femoral, popliteal, tibial, peroneal, carotid, vertebral, subclavian, brachial, renal and mesenteric arteries.

Medical history, demographic characteristics, laboratory parameters, and in-hospital adverse events such as post-procedural death, myocardial infarction, cerebrovascular accident, contrast nephropathy, and access site complications were obtained from hospital records. The characteristics of the angiography, types of lesions, type of balloon and stent used in endovascular intervention, success and complications of the procedure were recorded. The success of the procedure was defined as antegrade flow after balloon dilatation or stenting.

Statistical Analysis

Statistical analysis of the data was performed using the Statistical Package for the Social Sciences for Windows (SPSS Inc., Chicago, Illinois, USA) 21.0 program. Descriptive statistics were expressed as mean±standard deviation for continuous variables and number of cases and (%) for categorical variables. The Kolmogorov-Smirnov test was used to determine whether the distributions of continuous variables were normal. Continuous variables with normal distribution were compared by Student-t test and continuous variables without normal distribution were compared by Mann-Whitney-U test. Chi-square test or Fischer Exact test was used to compare categorical variables. The statistical significance level of the obtained data was interpreted with “p” value. $p < 0.05$ values were considered statistically significant.

RESULTS

A total of 57 peripheral angiography procedures between March 2020 and June 2024 were retrospectively analyzed. Peripheral angiography was performed on the following patients; for extremities; patients with claudication, foot wounds, $ABI \leq 0.9$ and patients with lesions detected on noninvasive imaging methods, for renal arteries; patients with resistant hypertension. A total of 55 patients, including 10 women and 45 men, were included in the study. The mean age of the patients included in the study was 64 years. Of the angiographic procedures, 46 were performed in the lower extremity, 6 in the upper extremity and 3 in the renal arteries (Figure 1). Demographic and clinical characteristics of the patients are given in Table 1.

Endovascular intervention was performed in 26 patients, 15 of whom also underwent stent implantation. Balloon angioplasty was performed on 11 patients. Heparin and clopidogrel were administered to patients before endovascular treatment. The mean age of patients undergoing interventional procedures

was 64 years, in line with the study population, and 19 (73%) were male. Peripheral artery endovascular treatment was performed in the iliac arteries, femoral arteries, tibialis anterior/posterior and peroneal arteries. Balloon angioplasty was performed in lesions without total occlusion or with short total occlusion (Figure 2). In patients with dissection after balloon angioplasty, a balloon expanding stent was deployed in the iliac artery and a self-expanding stent was deployed in the femoral artery (Figure 3, 4). Stent deployment was not performed in the tibialis anterior/posterior and peroneal arteries. The balloons and stents used during endovascular procedures were not drug-eluting. Rupture occurred during intervention in the superficial femoral artery in 2 patients, but the rupture was self-limiting and surgery was not required.

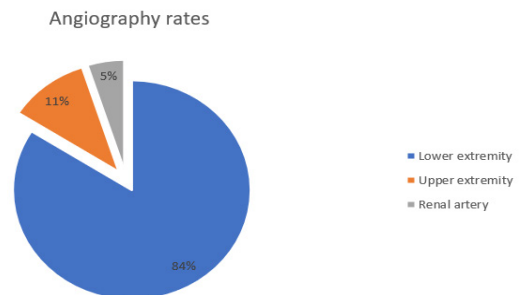


Figure 1. Distribution of peripheral angiographic procedures

Table 1. Demographic and clinical characteristics of the PAD patients		
Demographic characteristics	n (total=55)	%
Age (year)	64±10	
Gender (male)	45	82.1
Diabetes	32	56.1
Hypertension	38	66.7
Hyperlipidemia	42	73.7
Cigarette	25	48.1
History of cerebrovascular accident	5	8.9
Coronary artery disease	15	26.8
Types of peripheral angiography		
Subclavian artery	6	10.7
Iliac artery	16	28.6
Superficial femoral artery	23	41.1
Tibialis anterior/posterior and peroneal artery	7	12.5
Renal artery	3	5.4
Angioplasty data		
Medical treatment	25	44.6
Balloon angioplasty	11	19.6
Stent	15	26.8
Surgery	5	8.9

PAD: Peripheral arterial disease

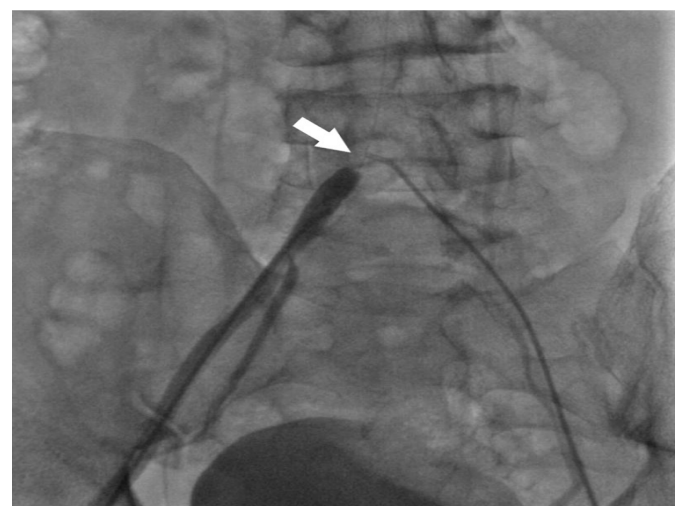


Figure 2. Total occlusion of the common iliac artery

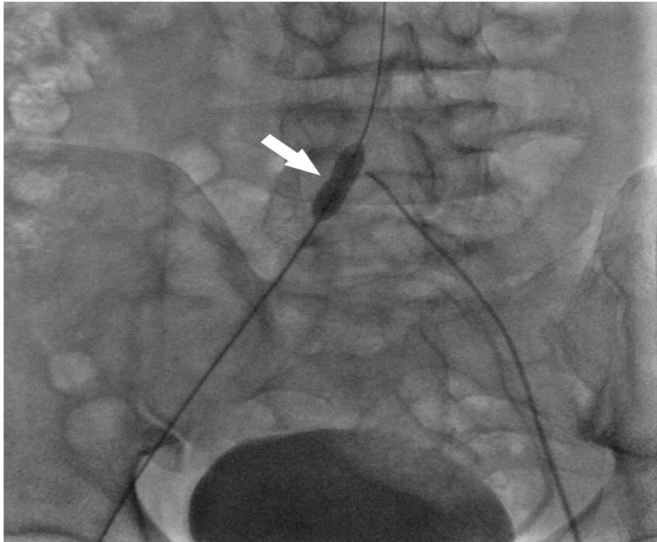


Figure 3. Stent deployment



Figure 4. Revascularization of the common iliac artery

Diabetes, one of the most important risk factors for peripheral arterial disease, was present in 32 patients (56.1%). Hyperlipidemia was also the most common risk factor (73.7%). The mean HbA1c of the study population was 9.8%.

Table 2. Laboratory findings of the PAD patients

Laboratory findings	mean±SD
Systolic blood pressure (mmHg)	132±23
Diastolic blood pressure (mmHg)	82±15
Pulse	75±11
White blood cell ($10^3/\mu\text{L}$)	9.0±2.8
Hemoglobin (g/dl)	13.6±1.7
Platelet ($\times 10^9/\text{L}$)	271±80
Glucose (mg/dl)	140±54
HbA1c (%)	9.8±2.1
Creatinine (mg/dl)	1.08±0.8
Total cholesterol (mg/dl)	171±44
LDL cholesterol (mg/dl)	91±20
HDL cholesterol (mg/dl)	45±13
Triglycerides (mg/dl)	184±48

PAD: Peripheral arterial disease, SD: Standard deviation

DISCUSSION

Peripheral arterial disease is a condition that should be kept in mind together with coronary artery disease, especially in patients with high cardiovascular risk factors, as it can

be asymptomatic. If left untreated, it can lead to lower limb amputations and upper limb pain and limitation of mobility. The diagnosis of PAD can be made by non-invasive methods such as ABI. In the treatment of PAD, peripheral balloons, especially drug-coated peripheral balloons and stents, which have been developed in parallel with technological developments in the last decade, have significantly reduced restenosis rates. When we look at the rates of peripheral angiography and endovascular intervention in our center, percutaneous transluminal angioplasty was performed in almost half of the patients. In the past, most patients with PAD were treated medically or surgically, but recently, with the development and widespread use of imaging methods and endovascular devices, endovascular intervention can be performed in a significant proportion of patients. Compared to surgery, endovascular interventions are more preferred today because they are more comfortable, cause less bleeding and infection, allow for repeated interventions and cause fewer in-hospital events.

The results of endovascular interventions in large diameter arteries such as the subclavian, iliac and femoral arteries are encouraging. In the resilient study, primary implantation of a self-expanding nitinol stent in medium-length lesions in the superficial femoral artery and proximal popliteal artery was associated with better acute angiographic results and improved patency compared with balloon angioplasty.⁷ In a study of 775 patients comparing paclitaxel-eluting stents with bare metal stents in superficial femoral and proximal popliteal artery lesions, there was no difference in all-cause mortality between the two groups, but the incidence of primary sustained clinical improvement was higher with drug eluting stents than with bare metal stents.⁸ A meta-analysis compared old balloon angioplasty with drug-coated balloon angioplasty and showed that drug-coated angioplasty significantly reduced late lumen loss, dual restenosis and target lesion revascularization in the treatment of femoropopliteal disease.⁹ It should be kept in mind that stent implantation may carry some risks because the femoropopliteal region is a region with active joint movements. Drug-coated balloon angioplasty is currently considered the most appropriate treatment option. In case of dissection after balloon, self-expanding stent may be considered. Restenosis rates are high with standard balloon treatment in the tibialis anterior, tibialis posterior and peroneal arteries below the knee. In a study by Fernandez et al.¹⁰ in patients with critical leg ischemia, the one-year re-intervention rate after bare balloon treatment was found to be 50%. Regarding drug-eluting balloons, while some studies showed no difference compared to standard balloons, a study by Gür et al.¹¹ found that drug-eluting balloons were superior to bare balloons in terms of 12-month patency rates and amputation rates. There is no consensus in studies on endovascular intervention in the arteries below the knee. For lesions in this region, treatment modalities such as pharmacologic therapy, smoking cessation and exercise can be applied. However, endovascular intervention is recommended if the patient has critical foot ischemia or a foot wound.¹²

Limitations

Since it was a single center, the number of patients was small, and since it was a retrospective study, post-discharge follow-up data were not available.

CONCLUSION

As a result, PAD is a disease whose prevalence increases with age in our country as in the whole world. Interventional treatment methods in PAD have recently been applied more frequently than surgical methods with improved materials and increasing experience.

ETHICAL DECLARATIONS

Ethics Committee Approval

The study was initiated with the approval of the Kırıkkale University Non-interventional Clinical Researches Ethics Committee (Date: 17.04.2024, Decision No: 2024.04.12).

Informed Consent

Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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