

RETROGRAD POPLİTEAL ARTER GİRİŞİMLERİN ENDOVASKÜLER TEDAVİ AÇISINDAN GÜVENLİLİK VE EFEKTİVİTE SONUÇLARI

SAFETY AND EFFECTIVENESS RESULTS OF RETROGRADE POPLITEAL ARTERY INTERVENTIONS IN TERMS OF ENDOVASCULAR TREATMENT

Metin Onur BEYAZ¹, Senem URFALI², Sefer KAYA¹, İbrahim DEMİR³, Onur KOYUNCU², İyad FANSA¹

¹Hatay Mustafa Kemal Üniversitesi Tayfur Ata Sökmen Tıp Fakültesi, Kalp Damar Cerrahisi Ana Bilim Dalı

²Hatay Mustafa Kemal Üniversitesi Tayfur Ata Sökmen Tıp Fakültesi, Anesteziyoloji ve Reanimasyon Ana Bilim Dalı

³Kırşehir Eğitim ve Araştırma Hastanesi, Kalp Damar Cerrahisi Kliniği

ÖZET

AMAÇ: Bu çalışma, femoropopliteal darlıklarda sıklıkla kullanılan antegrad girişimlerin yapılamadığı durumlarda retrograde popliteal yaklaşımın güvenli ve efektif olup olmadığını anlamak adına yapılmıştır.

GEREÇ VE YÖNTEM: Eylül 2020 ile 2022 arasında, distal retrograd popliteal müdahale ile rekanalizasyon sağlanan kronik tam tıkalı periferik arter hastalığı olan 89 hasta incelendi. Tüm retrograd popliteal arter girişimleri; hasta prone pozisyonunda iken ve diz ekleminin hemen üstünden yapılan ponksiyonlar ile gerçekleştirildi. Tüm hastalara atarektomi ve uygun boyutlu balon anjiyoplasti uygulandı.

BULGULAR: İşlemden sonra tüm hastalara anjiyografik görüntüleme yapıldı. 83 hastanın hiçbirinde %30'dan fazla rezidü darlık gözlenmedi. Bir hastada atarektomi kateterinin tıkalı SFA lezyonunun lümeninde sıkışması nedeniyle hasta acil ameliyata alındı ve işlem başarısız kabul edildi. İzole süperfisyal femoral arter (SFA) lezyonu olan 2 hastada, ana femoral arter (CFA) lezyonu olan 3 hastada ve iliak arter lezyonu olan 1 hastada tedaviye rağmen %30'dan az darlık elde edilemedi.

SONUÇ: Retrograd popliteal endovasküler yöntemler, antegrad müdahalenin mümkün olmadığı kronik tam tıkalı arterleri olan hastalar için güvenli ve etkili bir alternatif olarak ortaya çıkmaktadır.

ANAHTAR KELİMELEER: Ateroskleroz, Endovasküler Prosedürler, Periferik Arteriyel Hastalık.

ABSTRACT

OBJECTIVE: This study was conducted to understand whether the retrograde popliteal approach is safe and effective in cases where antegrade approaches, which are frequently used in femoropopliteal stenosis, cannot be performed.

MATERIAL AND METHODS: Between September 2020 and 2022, 89 patients with chronic totally occluded peripheral artery disease who underwent recanalization with distal retrograde popliteal intervention were studied. All retrograde popliteal artery punctures were performed with the patient in the prone position and with the punctures made just above the knee joint. All patients underwent atherectomy and appropriate sized balloon angioplasty.

RESULTS: All patients underwent angiographic imaging after the procedure. More than 30% stenosis was not observed in any of the 83 patients. One patient was taken to emergency surgery because the atherectomy catheter was stuck in the lumen of the occluded SFA lesion, and the procedure was considered unsuccessful. In 2 patients with isolated superficial femoral artery (SFA) lesion, 3 patients with common femoral artery (CFA) lesion and 1 patient with iliac artery lesion, less than 30% stenosis could not be achieved despite treatment.

CONCLUSIONS: Retrograde popliteal endovascular methods is a safe and effective alternative for patients with chronic totally occluded arteries in which antegrade intervention isn't possible.

KEYWORDS: Atherosclerosis, Endovascular Procedures, Peripheral Arterial Disease.

Geliş Tarihi / Received: 06.05.2024

Kabul Tarihi / Accepted: 27.11.2024

Yazışma Adresi / Correspondence: Dr. İbrahim DEMİR

Kırşehir Eğitim ve Araştırma Hastanesi, Kalp Damar Cerrahisi Kliniği

E-mail: ibrahimd128@gmail.com

Orcid No (Sırasıyla): /0000-0001-9338-8152, 0000-0003-4500-2408, 0000-0003-2814-5327, 0000-0003-3813-922X, 0000-0002-0282-181X, 0000-0002-5390-5511

Etik Kurul / Ethical Committee: Hatay Mustafa Kemal Üniversitesi Tıp Fakültesi Etik Kurulu (13.01.2022/08).

INTRODUCTION

Peripheral artery diseases include occlusive or aneurysmatic diseases of aortic branches that develop on the basis of atherosclerosis (1). The femoropopliteal artery is frequently characterized by global and severe steno-obstructive atherosclerotic disease (2). The use of endovascular treatments in peripheral artery diseases increased, and the latest guidelines suggest endovascular treatments as a valid and safe treatment for highly symptomatic patients (Rutherford grades 4 to 6) with complex femoro-popliteal lesions (TASC C and D) (3, 4). This increasing trend leads to some problems. Although most patients can be successfully recanalized using the traditional contralateral or antegrade ipsilateral approach, 13-25% of long lesions still cannot be passed due to the inability to re-enter the distal true lumen (5). Some complex devices have been developed to overcome these challenging lesions via subintimal entry; however, because of the high cost, their widespread use is restricted.

There are two ways for approaching to the lesions; antegrade and retrograde, with the latter being used less frequently (6). Some studies have defined different variants of the retrograde intervention techniques, such as the subintimal approach, cannulation of the distal popliteal artery in neutral supine position, and tibial/pedal artery access (7).

In some cases, antegrade access may be difficult, the trans-popliteal retrograde method can be an alternative, as it is less expensive and prevents unsuccessful attempts (8). Although there is a risk of complications when the patient is turned over and there are other complications when trying to access the popliteal artery (8).

In some cases in patients with chronic totally occluded (CTOs) peripheral artery disease antegrade intervention could not be performed: In this report we wanted to share our results to suggest that a retrograde transpopliteal approach can be an alternative for CTO's.

MATERIALS AND METHODS

In this study patients with chronic totally occluded peripheral artery disease, which recanalization was provided with distal retrograde

popliteal intervention between September 2020 and 2022 were included. The arterial approach to be used was determined according to clinical findings and arterial imaging results. All angioplasties were planned at a weekly case meeting. A retrospective analysis of 89 patients was performed. All patients underwent intravenous digital angiography (DSA) or Computed Tomographic angiography before the procedure. The indications for applying angioplasty were severe claudication, ischemic rest pain, ischemic ulcer or tissue loss, gangrene and symptomatic peripheral arterial disease.

Processing technique

Procedures were performed under local anesthesia (5 ml of 1% lidocaine). All retrograde popliteal artery punctures were performed with the patient in the prone position, just above the knee joint. A 7 F 10 cm long sheath was placed retrogradely into the popliteal artery and 1 cc (5000 units) of heparin was given after placement of the sheath (**Figure 1**).



Figure 1: A: SFA Totally Occluded, B: Atherectomy

All punctures and sheath placements were performed with the aid of Duplex USG. Angiographic images were taken. Pivot XC with hydrophilic coating (0.035 inch, Invamed Ankara/Turkey) and a support catheter (Invamed Ankara/Turkey) were used to transluminally pass the lesion. After the lesion was passed and the transluminal transition was confirmed, the stent lesion was passed with the rotational atherectomy catheter TemREN Rotational atherectomy (Invamed Ankara/Turkey) and dila-

tation was performed using an appropriately sized drug (paxitaxel)-coated balloons (Extender, percutaneous transluminal angioplasty/Invamed Ankara/Turkey) catheter. After the procedure an angiogram was taken, balloon dilatation was repeated in patients with a residual stenosis of 30 percent or greater (**Figure 2**).



Figure 2 A: DSA before intervention, B: DSA after intervention

Catheters and guide wires were removed. Heparin infusion (1000 units per hour) was administered for 24 hours. The success rate of the procedure was defined by the presence of less than 30% stenosis (9). All patients were followed for 24 hours. In the presence of embolism in the extremity after the procedure, the patients were evaluated with Duplex USG and surgical procedure was performed if necessary. Following a 24-hour heparin infusion, 75 mg of clopidogrel and 100 mg of acetylsalicylic acid were started in all patients. All patients were invited for a follow-up control appointment on the 11th and 30th day postoperatively. Patients with recurrent or new complaints were re-evaluated with Duplex USG.

Ethical Committee

This study approved in 13/02/2022 by ethical committee of Hatay Mustafa Kemal University (24/01).

Statistical Analysis

Statistical analyzes were performed by a professional statistician using the SPSS 19.0 (SPSS Inc. Chicago, Illinois, USA) computer program. Data were expressed as a mean with standard deviation. Statistics of descriptive data were

presented as frequency, percentage ratio, and mean \pm standard deviation. The distribution of data was tested with Kolmogorov Smirnov. Non-parametric data were analyzed with Mann-Whitney U test and parametric variables were analyzed with Student-t test. Chi-square test was used for proportional variables when Fisher's test was not suitable. Descriptive variables were evaluated with Spearman rank correlation and variables were classified by Pearson correlation analysis. A p value of lower than 0.05 is considered significant.

RESULTS

A total 89 patients received treatment (55 males; 34 females, mean age 65.3 years). All patients had a total lesion in the superficial femoral artery, 7 of them also had an additional lesion in the common femoral artery, 11 patients had an additional iliac artery lesion.

All patients underwent atherectomy and appropriately sized balloon angioplasty. All patients underwent angiographic imaging after the procedure. More than 30% stenosis was not observed in any of the 82 patients. In one patient, the patient was taken to emergency surgery because the atherectomy catheter was stuck in the lumen of the occluded SFA lesion, and the procedure was considered unsuccessful. In 2 patients with isolated SFA lesion, 3 patients with CFA lesion and 1 patient with iliac artery lesion, less than 30% stenosis could not be achieved despite treatment. Balloon expander stent of appropriate size was applied to the patient whose iliac artery failed. However, stenting was not performed under the inguinal ligament, and stenting was accepted as a failure criterion in terms of statistical analysis. When the operation failure is evaluated; Although there was no significant difference between SFA and iliac arteries, the success of the procedure was statistically significantly lower in cases accompanied by a CFA lesion ($P = 0.04$).

All patients had total occlusion in at least 1 segment. The lengths of the total occluded lesions were detected to be between 2-21 cm (median 7.5 cm). When the lesion length of the procedural success was evaluated statistically, the

lesion length of the unsuccessful procedures was 11-21 cm (median 13 cm), compared to the successful ones, it was 2-20.5 cm (median 6 cm), and there was no statistically significant relationship between the lesion length and the success of the procedure. ($P = 0.055$) A patient with SFA lesion showed symptoms of embolism, embolectomy was performed under emergency conditions. In 1 patient a pseudoaneurysm was detected at the at the puncture site, and the patient got treated for it. In 1 patient an arteriovenous (AV) fistula was detected, this patient is invited for a follow-up.

DISCUSSION

Endovascular therapy for chronic complete occlusion of the femoropopliteal artery is usually administered via an antegrade ipsilateral common femoral artery (CFA) approach or retrograde contralateral CFA (10). In approximately 10% of patients with critical ischemia, treatment of femoropopliteal occlusions with the transfemoral approach is not possible, and in the presence of unsuccessful antegrade femoral intervention, the retrograde transpopliteal approach is a possible alternative (11,12). In a study in which retrograde intervention was performed by the popliteal route after unsuccessful antegrade femoral intervention, 94% procedural success was found (13). In our study, a procedural success rate of 93.25% was found. Overall, there is little data on transpopliteal vascular interventions compared to the classical transfemoral approach. Although there are studies showing that popliteal access can be performed in the prone (the chest down and the back up) position, the traditional approach is to provide popliteal vascular access by placing the patient in the supine (on the back) position (8, 14).

In our study, popliteal access was provided to all our patients in the prone position. When the patient is lying prone, access to the popliteal artery becomes difficult and often prolongs the procedure, especially in patients who are obese and have poor respiratory function (15).

There are concerns about the incidence of local complications after popliteal intervention. When the popliteal access is applied in the prone position, the possible risk of hematoma and pseudoaneurysm may be seen more than

in the supine position (14). In a study including popliteal access complications, hematoma and AV fistula were reported in patients (16).

Another study reported an incidence of as high as 14% of arteriovenous fistula formation; Peral nerve palsy secondary to puncture, artery dissection or thrombosis and hematoma has also been described (17, 18). In our study one AV fistula and one pseudoaneurysm was detected. Nerve damage wasn't seen in any of the patients.

There are studies stating that in patients with peripheral artery disease with ileo-femoral lesion, popliteal intervention is a great option for angioplasty and stenting, however at the same time, there are studies emphasizing it should not be preferred because of the risk of complications (19, 20). Considering the variability in the indications of treatment options and treatment strategies, only angioplasty results were reviewed in this study and the patient who showed the necessity of stenting was considered as a failed procedure.

In our study, iliac artery stenosis could not be solved in only one patient out of the eleven patients with iliac artery lesions, and balloon expander stent was applied in appropriate sizes. In studies examining the long-term results of angioplasty procedures performed with popliteal access, it has been shown that the access tract does not change the patency rates (10).

Our study includes relatively short-term results. After popliteal artery intervention, additional problems have been described due to the reverse direction of the access road for the purpose of surgical removal of emboli extending below the knee (21). In our study, symptoms of embolism occurred, so we performed embolectomy under emergency conditions.

In conclusion, retrograde popliteal endovascular methods are safe and effective alternative with similar success rates for patients have chronic totally occluded arteries in which anterograde intervention isn't possible.

REFERENCES

1. Beyaz MO, Ugurlucan M, Oztas DM et al. Evaluation of the relationship between plaque formation leading to symptomatic carotid artery stenosis and cytomegalovirus by investigating the virus DNA. Arch Med Sci Atheroscler Dis. 2019;4:19-24.

- 2.** Zemaitis MR, Boll JM, Dreyer MA. Peripheral Arterial Disease. 2022. In: StatPearls [Internet]. Last Update: May 23, 2023.
- 3.** Aboyans V, Ricco JB, Bartelink ML et al. 2017 ESC guidelines on the diagnosis and treatment of peripheral arterial diseases, in collaboration with the European Society for Vascular Surgery (ESVS). 2017;75(11):1065-160.
- 4.** Beyaz MO, Demir İ, Ulukan MÖ. Comparison of atherectomy, drug-eluting balloon, and combined treatment efficiency by near infrared spectroscopy. *Cir*. 2021;89(3):342-6.
- 5.** Met R, Van Lienden KP, Koelemay MJ et al. Subintimal angioplasty for peripheral arterial occlusive disease: a systematic review. *Cardiovasc Intervent Radiol*. 2008;31(4):687-97.
- 6.** Evans C, Peter N, Gibson M et al. Five-year retrograde transpopliteal angioplasty results compared with antegrade angioplasty. *Ann R Coll Surg Engl*. 2010;92(4):347-52.
- 7.** Kamper L, Haage P. Perkutane Zugänge zur endovaskulären PAVK-Therapie. Femoral, popliteal, pedal [Percutaneous access for endovascular therapy of PAOD. Femoral, popliteal and pedal]. *Radiologe*. 2016;56(3):223-32.
- 8.** Schmidt A, Bausback Y, Piorkowski M et al. Retrograde recanalization technique for use after failed antegrade angioplasty in chronic femoral artery occlusions. *J Endovasc Ther*. 2012;19(1):23-9.
- 9.** Stoner MC, Calligaro KD, Chaer RA et al. Society for Vascular Surgery. Reporting standards of the Society for Vascular Surgery for endovascular treatment of chronic lower extremity peripheral artery disease: Executive summary. *J Vasc Surg*. 2016;64(1):227-8.
- 10.** Wei LM, Zhu YQ, Zhang PL et al. Morphological characteristics of chronic total occlusion: predictors of different strategies for long-segment femoral arterial occlusions. *Eur Radiol*. 2018;28(3):897-909.
- 11.** Met R, Van Lienden KP, Koelemay MJ et al. Subintimal angioplasty for peripheral arterial occlusive disease: a systematic review. *Cardiovasc Intervent Radiol*. 2008;31(4):687-97.
- 12.** Silvestro M, Palena LM, Manzi M et al. Anterolateral retrograde access to the distal popliteal artery and to the tibioperoneal trunk for recanalization of femoropopliteal chronic total occlusions. *J Vasc Surg*. 2018;68(6):1824-32.
- 13.** Younes HK, El-Sayed HF, Davies MG. Retrograde transpopliteal access is safe and effective-it should be added to the vascular surgeon's portfolio. *Ann Vasc Surg*. 2015;29(2):260-5.
- 14.** Ye M, Zhang H, Huang X et al. Retrograde popliteal approach for challenging occlusions of the femoral-popliteal arteries. *J Vasc Surg*. 2013;58(1):84-9.
- 15.** Kawarada O, Yokoi Y. Retrograde 3-French popliteal approach in the supine position after failed antegrade angioplasty for chronic superficial femoral artery occlusion. *J Endovasc Ther*. 2010;17(2):255-8.
- 16.** Yanagita Y, Noda K. Incidence and risk factors of vascular complications following endovascular treatment of peripheral arterial disease via the popliteal artery. *Cardiovasc Interv Ther*. 2011;26(3):209-14.
- 17.** McCullough KM. Retrograde transpopliteal salvage of the failed antegrade transfemoral angioplasty. *Australas Radiol*. 1993;37(4):329-31.
- 18.** Yilmaz S, Altınbaş H, Senol U et al. Common peroneal nerve palsy after retrograde popliteal artery puncture. *Eur J Vasc Endovasc Surg*. 2002;23(5):467-9.
- 19.** Brountzos EN, Moulakakis KG, Avgerinos ED et al. Retrograde transpopliteal approach of iliofemoral lesions. *Vasc Endovascular Surg*. 2011;45(7):646-50.
- 20.** Yilmaz S, Sindel T, Lüleci E. Ultrasound-guided retrograde popliteal artery catheterization: experience in 174 consecutive patients. *J Endovasc Ther*. 2005;12(6):714-22.
- 21.** Saha S, Gibson M, Magee TR et al. Early results of retrograde transpopliteal angioplasty of iliofemoral lesions. *Cardiovasc Intervent Radiol*. 2001;24(6):378-82.