

Which Intervention Method Should be Chosen for Superficial Femoral Artery Balloon Angioplasty: Antegrade or Retrograde? A Single-Centre Experience

© Ercan Keleş

İzmir Bakırçay University, Çiğli Training and Research Hospital, Clinic of Cardiovascular Surgery, İzmir, Turkey

Abstract

Objectives: To determine which method is preferable for intervention in superficial femoral artery (SFA) lesions and has a lower risk of complications.

Materials and Methods: During the first six months of 2021, 153 patients undergoing peripheral angiography for an arterial origin were retrospectively reviewed. Thus, 97 peripheral angiographic procedures in 82 patients were included in this study. Complications after the procedure were evaluated.

Results: The median age of the patients was 62 years (interquartile range 41-89 years). Ninety-seven procedures were performed: 37.1% were antegrade procedures and 62.9% were retrograde procedures. There was no significant difference in patients who underwent surgery on both legs in terms of chronic disease ($p>0.05$). Dissection was observed in 3 patients undergoing antegrade SFA procedures. Although retrograde procedures were performed more frequently, no flow-restricting dissection was observed. Hematomas formed after angioplasty in 5 patients who underwent antegrade procedures. An arteriovenous (AV) fistula developed in 2 patients. AV no fistula was observed in patients who underwent retrograde surgery. However, four patients had pseudoaneurysms and two patients had hematomas. In all these patients,



Address for Correspondence: Ercan Keleş, İzmir Bakırçay University, Çiğli Training and Research Hospital, Clinic of Cardiovascular Surgery, İzmir, Turkey

Phone: +90 544 774 99 26 **e-mail:** mevertra@yahoo.co.uk **ORCID:** orcid.org/0000-0002-8866-3719

Received: 02.12.2021 **Accepted:** 21.08.2023

Cite this article as: Keleş E. Which Intervention Method Should be Chosen for Superficial Femoral Artery Balloon Angioplasty: Antegrade or Retrograde? A Single-Centre Experience. EJCM 2023;11(3):96-100.

DOI: 10.32596/ejcm.galenos.2023.2021-12-067



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puncture was performed below the gastrocnemius muscle. No hematoma or pseudoaneurysm was observed in any of the patients operated on over the gastrocnemius muscle. In both procedures, dissection was higher in patients with occlusion than in those without occlusion, which was statistically significant ($p < 0.05$).

Conclusion: Because retrograde procedures are performed against the direction of flow, it was observed that the flap was mostly closed in controls even if dissection occurred. Retrograde puncture via the gastrocnemius muscle may reduce the incidence of hematoma and pseudoaneurysms. The reason for not seeing fistulas in retrograde punctures could be the effective use of ultrasonography in this area. Retrograde intervention might be preferable in this case, especially because dissection is more common in occlusions.

Keywords: Antegrade, retrograde, balloon angioplasty

Introduction

Interventional radiological procedures to revascularize the lower limbs are usually performed via a puncture in the common femoral or popliteal artery (PA). The techniques employed include femoral artery (FA) antegrade puncture and PA retrograde puncture. Both techniques have advantages and disadvantages. These approaches present different technical challenges and may affect the success rate of the procedure⁽¹⁻³⁾. At the same time, the right intervention strategy can reduce the risk of complications⁽¹⁻³⁾. Although the use of ultrasonography is not common, it is one of the factors that reduces the risk of complications^(4,5). The aim of this study was to compare antegrade and retrograde interventions from the FA and evaluate their complications.

Materials and Methods

During the first six months of 2021, 153 patients undergoing peripheral angiography for an arterial origin were retrospectively reviewed. Patients without an superficial FA (SFA) lesion, contralateral procedures, and those who had previously undergone balloon angioplasty for an SFA lesion were excluded from the study. Patients who underwent procedures with an antegrade femoral artery or retrograde PA were included in the study. Patients with severe SFA lesions (more than 70% stenosis, including occlusions) were included in the study. The patients were diagnosed with SFA stenosis or occlusion

by lower extremity computed tomography angiography. Thus, 97 peripheral angiographic procedures in 82 patients were included in this study. Complications after the procedure were evaluated.

Procedure: After skin cleansing, antegrade or retrograde intervention was performed under local anesthesia, accompanied by Doppler USG. The guidewire was advanced and a 7F sheath was placed. Subsequently, the patients underwent an atherectomy. 5x100-150 mm and 6x100-150 mm (diameter and length) medicated balloons were used for dilation. Balloon inflation time was 90 s on average. The stent was not used in any patient. The same type of medical equipment was used in all patients. After the sheet was removed, pressure was applied with a fist for about 10 min by the angio nurse. In addition, pressure was applied to the entrance sites of the patients in the femoral or popliteal region with a sandbag for approximately 2 h. Antegrade and retrograde methods were not evaluated for early or late-period patency. Evaluation with another study is planned.

Ethical approval was obtained from İzmir Bakırçay University Non-Invasive Clinical Research Ethics Committee (approval no: 907/887, date: 08.03.2023).

Results

The median age of the patients was 62 years (interquartile range 41-89 years). Of the patients, 91.5% were male. Of the patients, 64.6% had hypertension,

12.2% had hyperlipidemia, 28% had diabetes mellitus, 41.5% had coronary artery disease, and 8.5% had chronic renal failure. Ninety-seven procedures were performed: 37.1% were antegrade procedures and 62.9% were retrograde procedures. There was no significant difference in patients who underwent surgery on both legs in terms of chronic disease ($p>0.05$). Dissection was observed in 3 patients with antegrade SFA procedures, severely restricting flow; in these patients, the flow was restored by inserting a stent. Although retrograde procedures were performed more frequently, no flow-restricting dissection was observed. Hematomas formed after angioplasty in 5 patients who underwent antegrade procedures. One of these hematomas was surgically removed, whereas the others later regressed. An arteriovenous (AV) fistula developed in 2 patients. Because the fistula tract was thin, thrombosis with pressure dressing was observed in one patient after some time. The other patient underwent surgery, and the fistula was closed. AV no fistula was observed in patients who underwent retrograde surgery. However, four patients had pseudoaneurysms and two patients had hematomas. In all these patients, puncture was performed below the gastrocnemius muscle. Two pseudoaneurysms were operated and the vessels were repaired. The other two regressed in the long term with pressure dressing. No hematoma or pseudoaneurysm was observed in any of the patients operated on over the gastrocnemius muscle. In both procedures, dissection was higher in patients with occlusion than in those without occlusion, which was statistically significant ($p<0.05$).

Discussion

In this study, we attempted to answer the question of whether we should prefer popliteal retrograde or FA antegrade intervention to reduce the risk of complications in the intervention of SFA lesions. We evaluated the complications that occurred.

Antegrade femoral intervention creates difficulties, especially in obese patients. Venous access can cause an AV fistula. At the same time, entries without ultrasonography

may be misleading and may result in profunda femoris entries. This may cause unnecessary profunda femoris damage, dissections, plaque removal, or thrombi in some patients. Insufficient pressure dressing and insufficient additional pressure after the procedure may lead to hematomas and pseudoaneurysms. According to our experience, ultrasonography is generally preferred in difficult cases because it is easier to intervene by palpating the pulse in the antegrade method. Therefore, arterial-vein access may be easier and an AV fistula may develop.

Fewer complications are observed if retrograde femoral intervention is performed above the gastrocnemius muscle. We observed in our study that the frequency of pseudoaneurysms was high, especially in interventions under the gastrocnemius muscle. In these patients, even with sufficient superficial pressure, the anatomical inlet cannot be closed, and hematomas and pseudoaneurysms can be easily observed. Therefore, according to our experience, we believe that punctures over the gastrocnemius muscle will be more reliable. The use of ultrasonography in retrograde procedures reduced the incidence of AV fistula. The use of Doppler USG in these patients requires experience. Education is important in this process. Patients with clean arteries without calcification of the PA should be recruited initially, especially for retrograde patients. As experience increases, sheet positioning will be better evaluated for patients with calcifications.

Indications for popliteal intervention were defined in 1988⁽⁶⁻⁸⁾. These include iliac or femoral occlusion (absence of a femoral pulse), severe calcification, combined iliac and femoral lesions, occlusion or elevation of the SFA split point, and severe obesity. It can also be used to avoid scar tissue in cases where femoral intervention cannot be performed⁽⁹⁻¹²⁾. Many studies have also revealed results regarding complications^(10,13).

PA treatment of iliofemoral lesions has been demonstrated to be a useful alternative to FA, increasing the number of FA occlusions considered technically feasible for angioplasty by approximately one-fifth^{14,15}.

In previous studies, it was observed that embolization and thrombus formation was less in popliteal intervention⁽¹⁶⁾. This can be explained by the retrograde method of insertion of the catheter and guidewire, potentially making it difficult for the embolus to travel distally. Although popliteal intervention is considered a good technique, some studies have highlighted concerns about the incidence of complications. The incidence of AV fistulas has been reported to be 14%⁽¹⁰⁾. In addition, arterial dissection or thrombosis at the entry site and personal nerve palsy secondary to hematoma have also been reported⁽¹³⁾. The reason why no fistula was observed in retrograde punctures in our study may be due to the effective use of ultrasonography in this area.

Conclusion

Because retrograde procedures are performed against the direction of flow, it was observed that the flap was mostly closed in controls even if dissection occurred. In those who did not close the flap, there was no serious interruption of peripheral blood flow. Retrograde puncture via the gastrocnemius muscle may reduce the incidence of hematoma and pseudoaneurysms. The reason for not seeing fistulas in retrograde punctures could be the effective use of ultrasonography in this area. Retrograde intervention might be preferable in this case, especially because dissection is more common in occlusions.

Retrograde intervention is safe with success rates and long-term outcomes comparable to anterior intervention. There was no increase in local complication rates following the PA when Doppler ultrasound was used to identify the popliteal vasculature. PA is a useful alternative technique for endovascular therapy if accessing the FA. This approach can be considered when treating occlusive, proximal disease when surgical intervention is not the primary treatment.

Ethics

Ethics Committee Approval: İzmir Bakırçay University Non-Invasive Clinical Research Ethics

Committee approved this study (approval no: 907/887, date: 08.03.2023).

Informed Consent: It was not necessary as it was a retrospective study.

Peer-review: Externally peer-reviewed.

Financial Disclosure: This research received no specific grants from any funding agency in the commercial or not-for-profit sectors.

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