

# Additional treatment to recanalization of chronic superficial femoral artery occlusion using peripheral rotational atherectomy system

Tratamiento adicional a la recanalización de oclusión crónica de arteria femoral superficial, con sistema de aterectomía rotacional periférica

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## ABSTRACT

The occlusive arterial disease of the superficial femoral artery is a multifactorial condition. Endovascular or surgical revascularization is the treatment of choice for stenosis or occlusion of the superficial femoral artery. It is indicated for patients presenting significant or disabling claudication symptoms that do not respond to lifestyle changes and pharmacological therapy.

We present the case of an 84-year-old patient with a history of diabetes mellitus who presented with intermittent claudication in the left leg and an ankle-brachial index of 0.6. Lower extremity angiography revealed severe chronic calcified occlusion of the left superficial femoral artery. A Jetstream-type atherectomy including Thruway wire was performed. The patient was monitored postoperatively at 24 hours and 20 days, showing satisfactory disease progression.

The Jetstream rotational atherectomy system for treating patients with occlusive arterial disease of the superficial femoral artery is a method demonstrating high success rates and low rates of repeat revascularization.

**Keywords:** claudication, peripheral arterial disease, femoral artery occlusion, Jetstream atherectomy.

## RESUMEN

La enfermedad oclusiva arterial de la arteria femoral superficial es una patología de etiología multifactorial. La recanalización endovascular o quirúrgica es el tratamiento de elección para la estenosis u oclusión de la arteria femoral superficial. Está indicada en pacientes que presentan sintomatología significativa o incapacitante de claudicación, que no responden al cambio de estilo de vida y la terapia farmacológica.

Se presenta el caso de un paciente de 84 años, con antecedentes de diabetes mellitus, que acudió por presentar claudicación intermitente en pierna izquierda, con un índice tobillo brazo de 0,6. Se realizó una angiografía de miembros inferiores que evidencia oclusión crónica severa calcificada de arteria femoral superficial izquierda. Se realizó una aterectomía con sistema tipo Jetstream incluyendo cuerda Thruway. Se realizó control del paciente a las 24 horas y 20 días posquirúrgicos, presentando adecuada evolución de la enfermedad.

El sistema de aterectomía rotacional tipo Jetstream para tratamiento de pacientes con oclusión arterial de arteria femoral superficial es un método que muestra altas tasas de éxito y bajas tasas de revascularización repetida.

**Palabras clave:** claudicación, enfermedad arterial periférica, oclusión de arteria femoral, aterectomía de Jetstream.

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## INTRODUCTION

Peripheral arterial occlusive disease can have acute or chronic presentation. Lesions in the superficial femoral artery are among the leading causes of intermittent claudication or limb ischemia<sup>1</sup>.

Etiology is multi-factorial, generally involving genetic predisposition, associated with risk factors including advanced age, smoking, diabetes mellitus, hypercholesterolemia, and hypertension<sup>1</sup>.

The prevalence of peripheral arterial occlusive disease in the United States in 2000 was 4.3%, with approximately 5 million people affected. Such indicator is expected to rise to 22% by 2040<sup>2</sup>.

Treatment for patients with peripheral arterial disease in the lower limbs aims to provide symptom relief and reduce the risk of disease progression and cardiovascular compli-

cations. Endovascular or surgical rechanneling is the treatment of choice for superficial femoral artery stenosis or occlusion<sup>3</sup>. It is indicated in patients with significant or disabling claudication symptoms who do not respond to lifestyle changes and pharmacological therapy.

## CLINICAL CASE

We present the case of an 84-year-old patient with a history of type II diabetes mellitus. He had a three-month history of intermittent claudication in the left leg, classified as Fontaine III-V. Physical examination revealed no ulcerative lesions, with an ankle-brachial index of 0.8 in the right leg and 0.6 in the left leg. Lower limb angiography showed severely calcified chronic occlusion of the right superficial femoral artery (**Figure 1**).

The procedure began with angiographic control. An antegrade puncture was performed, followed by the placement of a 7-Fr, 25-cm femoral introducer. Heparin was administered using saline solution with 7500 IU for continuous irrigation. Next, a 5-Fr hydrophilic vertebral catheter was introduced, supported by a 300-cm 0.018" hydrophilic guidewire, and the occluded area was successfully crossed.

A 4-mm × 120-cm peripheral balloon catheter was advanced and insufflated in a controlled way at 4 atmospheres for 120 seconds. However, diameter was not improved due to plaque rigidity, facing significant resistance, rupture, and recoil.

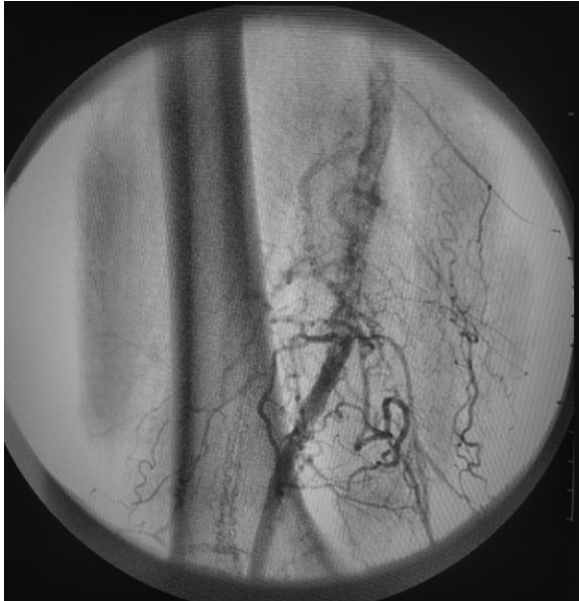
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**Figure 1.** Chronic occlusion of the mid-segment of the superficial femoral artery with abundant calcification and collateral circulation.



**Figure 2.** Advancement of the Jetstream XC peripheral rotational atherectomy system with aspiration and self-expanding blades.

Given this situation, a Jetstream (Boston Scientific) rotational atherectomy catheter was introduced over the 0.018" guidewire. Device blades were initially closed and then opened, successfully expanding the arterial lumen. Finally, a 5 × 150-cm drug-eluting self-expanding stent was implanted. The angiographic result was successful, and flow was restored with an adequate diameter in the superficial femoral artery (Figures 3 and 4).

The patient was assessed 24 hours after the procedure. He showed no complications at the puncture site and had an ankle-brachial index of 1.0 in the left leg. Assisted ambulation was achieved with good tolerance, and the patient was discharged. A clinical follow-up 20 days after the surgery classified the lower limb as Fontaine grade II, which is expected given the patient's age.

## DISCUSSION

We present a case of chronic peripheral arterial occlusion. These occlusions have a multi-factorial origin. They most commonly occur in lower limb arteries, and lesions in the superficial femoral artery are one of the main causes of intermittent claudication or limb ischemia<sup>1</sup>. Arterial occlusive disease can have acute or chronic presentation.

The site of arterial occlusion is key to the signs and symptoms. In the lower limbs, the most common symptoms are intermittent claudication, rest pain, and, as a sign, tissue necrosis<sup>3</sup>. The most affected lower limb arteries are primarily those below the inguinal ligament: the superficial femoral artery, the popliteal artery, and the infrapopliteal arteries, including the posterior tibial artery and the dorsal artery of the foot<sup>4</sup>.

Imaging diagnosis is fundamental, starting with Doppler ultrasound, which can help determine blood flow and locate the clot. It also serves to determine the ankle-brachial pressure index. Angiography is the gold standard for evaluation and is generally reserved for planning the intervention to resolve the occlusion<sup>5</sup>.

The treatment aims to relieve symptoms and reduce the risk of disease progression and cardiovascular complications<sup>1,5</sup>.

Endovascular or surgical rechanneling is the treatment of choice for superficial femoral artery stenosis or occlusion<sup>3</sup>. It is indicated in patients with significant or disabling claudication symptoms who do not respond to lifestyle changes and pharmacological therapy<sup>3,5</sup>.

Endarterectomy has been the treatment of choice for femoral artery occlusive disease. However, recent studies have shown comparable medium- and long-term success rates for endovascular surgery compared to open surgery<sup>6</sup>.

In our patient, we opted for Jetstream peripheral rotational atherectomy, including a Thruway guidewire, because occlusion type and location, surgeon expertise, and availability of materials made it a viable treatment option.

Atherectomy is a medical procedure involving the removal of atheromatous tissue from arteries to increase the lumen diameter. It can be classified in four categories: directional, orbital, excisional/aspiration, and laser atherectomy<sup>7</sup>. Rotational atherectomy devices include Rotablator, Pathway Jetstream PV, and Phoenix, which cut atheroma while preserving vascular tissue. Studies show high success rates and low rates of repeat revascularization with these devices.

The Jetstream atherectomy system is an endoluminal rotational cutter with active aspiration capabilities, approved in the United States for the treatment of lower limb obstructive peripheral arterial disease<sup>7</sup>. The technique involves proper use of the guidewire, appropriate sizing, and adequate speed in advancing the cutter while acquiring fluoroscopic imaging. This device achieves a significant reduction in endoluminal tissue volume, increasing the minimum luminal area while maintaining total vessel volume before and after treatment. The device can also simultaneously suction debris during the cutting process, an improvement that allows for more efficient aspiration<sup>8</sup>.

Using proper technique, the device appears to have a low rate of distal embolization and complications, resulting in a high procedural success rate within the first year, as reported by Shammass<sup>9</sup>.

Currently, there are different treatment options available, such as traditional percutaneous transluminal angioplasty (PTA) with an uncoated balloon for femoropopliteal artery



**Figure 3.** Angiographic control after atherectomy with the Jetstream XC peripheral rotational system with continuous aspiration and self-expanding blades.



**Figure 4.** Final angiographic control with stent placement, achieving appropriate diameter and flow.

disease. However, this has been questioned due to the demonstrated superiority of drug-eluting stents and drug-coated balloon devices, especially for short, calcified lesions, with patency rates below 80% at 5 months and around 50% at 3 years<sup>10</sup>.

Conventional bare-metal stents (BMS) were initially designed to address complications from balloon angioplasty, such as dissection and restenosis. A systematic review by Chowdhury<sup>11</sup> analyzed several randomized clinical trials, showing modest short-term (<2 years) benefit compared to other methods. That review included a meta-analysis of 11 randomized controlled trials that demonstrated improved patency at 1 year with BMS compared to uncoated PTA and better patency for long (>6 cm) lesions at 1 and 2 years<sup>12</sup>. However, more studies are needed to compare BMS with newer devices.

Drug-eluting stents (DES) treat occlusion by slowly releasing medication that inhibits excessive intimal growth after angioplasty. Newer-generation paclitaxel-coated DES have demonstrated clinical superiority both in the short and long term compared to PTA alone<sup>13</sup>. While there are few direct comparative studies, the 2018 Consensus Statement of the Society for Cardiovascular Angiography and Interventions (SCAI) recommend DES for most femoropopliteal lesions<sup>13,14</sup>.

Drug-coated balloons (DCBs) have shown superiority over uncoated PTA in terms of patency and clinically-driven lesion recurrence, according to various recent trials<sup>15</sup>. Initial concerns about adverse effects, such as fibrosis and aneurysms, have not been confirmed in clinical studies. Based on these findings, DCBs received a class I recommendation for most femoropopliteal lesions in the 2018 Consensus Statement of the SCAI<sup>14,15</sup>.

Expanded polytetrafluoroethylene-covered self-expanding nitinol stents are not recommended as initial therapy for most femoropopliteal lesions, especially for superficial femoral artery lesions. While they show potential improvements in patency compared to bare-metal stents<sup>7</sup>, their usefulness is limited due to concerns about stent thrombosis. The 2018 Consensus Statement supports their use in diffuse lesions, including stent restenosis and chronic total occlusion, with class IIa and IIb recommendations, respectively<sup>7,14,15</sup>.

The short-term outcome for our patient was satisfactory. There were no pre- or post-procedure complications, which led us to consider the treatment as appropriate for this pathology. The short-term results are being documented; however, further long-term studies are required to establish procedural long-term effectiveness.

## REFERENCES

- Hafiz S, Lotfollahzadeh S. Infringuinal Occlusive Disease. 2023 Jun 3. In: *StatPearls* [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan. PMID: 32809537.
- Selvin E, Erlinger T. 2004 Prevalence of and risk factors for peripheral arterial disease in the United States: Results from the National Health and Nutrition Examination Survey, 1999-2000. *Circulation*. 110 (6): 738-43.
- Krishnappa K, Rachaiah JM, Mariappa HM, Doddamadaiah C, Nanjappa MC. Endovascular Interventions to Superficial Femoral Artery Occlusion: Different Approaches, Technique, and Follow-up. *Heart Views*. 2020 Apr-Jun;21(2):65-74. doi: 10.4103/heartviews.heartviews\_34\_19.
- Smith D, Lillie C. Acute Arterial Occlusion. [Updated 2023 Jan 2]. In: *StatPearls* [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK441851/>
- Azuma N. The Diagnostic Classification of Critical Limb Ischemia. *Ann Vasc Dis*. 2018 Dec 25;11(4):449-457. doi: 10.3400/avd.ra.18-00122. PMID: 30636998; PMCID: PMC6326054.
- Goueffic Y, Della Schiava N, Thaveau F, et al. Stenting or surgery for De Novo common femoral artery stenosis. *JACC Cardiovasc Interv* 2017;10(13):1344-54.
- Kim SM, Kim LK, Feldman DN. Device Selection in Femoral-Popliteal Arterial Interventions. *Interv Cardiol Clin*. 2020 Apr;9(2):197-206. doi: 10.1016/j.iccl.2019.12.001. Epub 2020 Jan 29. PMID: 32147120.
- Dukic D, Martin K, Lichtenberg M, et al. Novel Therapeutic Concepts for Complex Femoropopliteal Lesions Using the Jetstream Atherectomy System. *J Endovasc Ther*. 2023 Mar 24;15266028231161246. doi: 10.1177/15266028231161246.

9. Shammam NW, Petruzzi N, Henao S, et al. Jetstream Atherectomy for the Treatment of In-Stent Restenosis of the Femoropopliteal Segment: One-Year Results of the JET-ISR Study. *J Endovasc Ther*. 2021 Feb;28(1):107-116. doi: 10.1177/1526602820951916.
10. Nguyen BN, Conrad MF, Guest JM, et al. Late outcomes of balloon angioplasty and angioplasty with selective stenting for superficial femoral-popliteal disease are equivalent. *J Vasc Surg* 2011;54(4):1051-7.e1.
11. Chowdhury MM, McLain AD, Twine CP. Angioplasty versus bare metal stenting for superficial femoral artery lesions. *Cochrane Database Syst Rev* 2014;(6):CD006767
12. Krankenberg H, Schluter M, Steinkamp HJ, et al. Nitinol stent implantation versus percutaneous transluminal angioplasty in superficial femoral artery lesions up to 10 cm in length: the femoral artery stenting trial (FAST). *Circulation* 2007;116(3):285-92.
13. Dake MD, Ansel GM, Jaff MR, et al. Durable clinical effectiveness with paclitaxel-eluting stents in the femoropopliteal artery: 5-year results of the zilver PTX randomized trial. *Circulation* 2016;133(15):1472-83.
14. Feldman DN, Armstrong EJ, Aronow HD, et al. SCAI consensus guidelines for device selection in femoral-popliteal arterial interventions. *Catheter Cardiovasc Interv* 2018;92(1):124-40.
15. Giacoppo D, Cassese S, Harada Y, et al. Drugcoated balloon versus plain balloon angioplasty for the treatment of femoropopliteal artery disease: an updated systematic review and meta-analysis of randomized clinical trials. *JACC Cardiovasc Interv* 2016;9(16):1731-42.