

Treatment of Peripheral Arterial Disease Using Rotational Atherectomy

The shift to endovascular therapy continues to grow. A case review and discussion.

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Peripheral arterial disease (PAD) is a major cause of morbidity in the United States, currently affecting 8 to 12 million Americans.¹ During the last 10 years, there has been a paradigm shift away from open surgery toward endovascular therapy. In the United States, the rate of endovascular lower extremity interventions has quadrupled for critical limb ischemia and doubled for claudicants. This has been accompanied by a reduction in the rate of major amputations and length of hospital stay, despite an increase in the burden of patient comorbidities.²

Endovascular therapy continues to have significant limitations. Balloon angioplasty of complex lesions and chronic total occlusions (CTOs) is associated with dissection, perforation, and distal embolization. Stents must be able to withstand significant biomechanical forces including compression, flexion, and stretching, which may lead to stent fractures, in-stent stenosis, and stent occlusion.³ Atherectomy offers the ability to debulk atherosclerotic plaque with minimal change in vessel diameter⁴ and reduce the need for subsequent stent placement.⁵

The Jetstream Atherectomy System (Bayer Radiology & Interventional, Indianola, PA) is a novel, front-cutting, catheter-based orbital atherectomy system that removes atherosclerotic plaque and thrombus in the peripheral vasculature while continually aspirating debris. We present a case in which the Jetstream atherectomy catheter was used adjunctively in a successful lower extremity revascularization.

CASE REPORT

A 79-year-old man presented with lifestyle-limiting left lower extremity claudication. His past medical history included severe nonreconstructable coronary artery disease, supraventricular tachycardia, dyslipidemia, chronic obstructive pulmonary disease, and tobacco abuse. On examination, he had a 1+ palpable left femoral pulse with an audible bruit on auscultation. The left popliteal, dorsalis pedis, and posterior tibial pulses were absent.

Percutaneous access was obtained in the right common femoral artery. Left lower extremity runoff demonstrated a large exophytic, calcified plaque in the common femoral artery with patent deep and superficial femoral arteries and three-vessel runoff to the foot (Figure 1A). Due to the patient's medical comorbidities, he was considered at high risk for open surgery, and an endovascular approach was taken. A 7-F Ansel sheath (Cook Medical, Bloomington, IN) was used to secure access to the left common femoral artery. An 0.014-inch wire was used to cross the lesion. Multiple passes of the Jetstream catheter were made with blades up and then blades down (Figure 1B). A subsequent arteriogram demonstrated significant residual plaque (Figure 1C). Therefore, a 0.014-inch wire was passed down into the tertiary branches of the deep femoral artery, changing the angle at which the catheter engaged the plaque and allowing for further plaque debulking (Figure 1D). A 7-X 40-mm balloon was inflated after atherectomy to "tack up" any residual plaque (Figure 1E). A completion arteriogram demonstrated complete resolution of the common

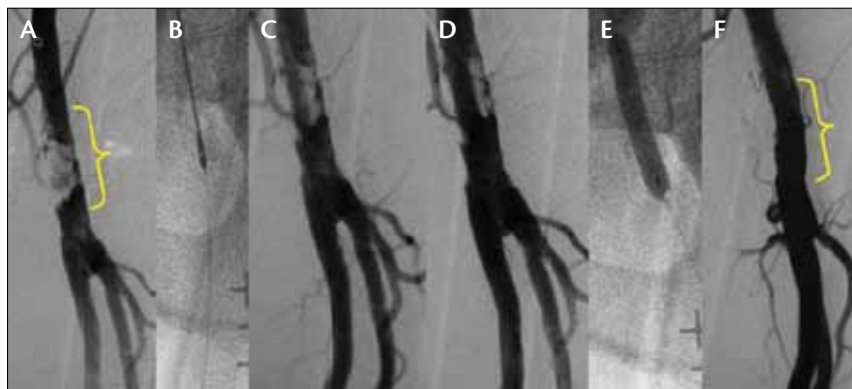


Figure 1. Initial arteriogram showing large exophytic plaque in the common femoral artery (A). Initial pass of the Jetstream catheter with the wire down the SFA (B). Arteriogram after initial attempt to debulk the lesion (C). Arteriogram after debulking the lesion with the wire down the profunda (D). Angioplasty of CFA lesion with a 7-X 40-mm balloon (E). Completion arteriogram showing resolution of stenosis (F).

femoral artery plaque, with a patent common femoral artery and preserved three-vessel runoff to the left foot (Figure 1F).

DISCUSSION

This case demonstrates the effectiveness of the Jetstream atherectomy catheter. The catheter was used to debulk a complex lesion in the common femoral artery without causing dissection or compromising distal runoff.

The Jetstream system consists of a sterile, single-use catheter and control pod, and a reusable, compact console that mounts to a standard IV stand. The catheter has a cutting tip that debulks and restores flow through both hard and soft plaque, and calcium, thrombus, and fibrotic lesions. Excised tissue and thrombus are continually aspirated from the peripheral treatment site through ports in the catheter tip to a collection bag located on the console. The distal portion of the catheter also possesses infusion ports that provide continuous infusion of sterile saline during the atherectomy procedure. Active aspiration is a safety feature that acts to minimize distal embolization. The cutting head on the Navitus catheters has two sets of blades. The smaller size is 2.1 mm when the device spins clockwise and is used on the initial pass or passes of the catheter to create a flow channel. If a larger flow channel is required, the blades expand to 3 mm when the device spins counterclockwise.

We selectively perform atherectomy in the treatment of peripheral vascular disease. It is our endovascular modality of choice in treating CTOs and bulky exophytic plaques. In these anatomic situations, angioplasty and stenting alone risk arterial dissection or perfora-

tion. The addition of atherectomy as an adjunctive procedure or a standalone therapy allows one to potentially avoid these complications. Atherectomy may also limit intimal hyperplasia, which is commonly seen when angioplasty is used alone. In this case, we were able to debulk a large exophytic common femoral artery lesion with the atherectomy catheter. Large-volume debulking is possible because the flow lumen created by this catheter is larger than the burr-sized lumen expectancy. This is thought to be related to the complementary role of aspiration during atherectomy.⁴ In addition, manipula-

tion of the wire into the superficial and deep femoral arteries allowed us to engage the plaque from different angles and maximize removal of atherosclerotic plaque. Avoiding stent placement across the inguinal ligament is of primary importance due to the high risk of kinking or occlusion. To obtain optimal results, we recommend short, back-and-forth movements with the catheter to ensure it engages the plaque and adequately debulks the lesion. We initially pass the catheter with blades down and then will repeat passage with the blades up. Multiple passes are often needed, and an audible slowing of the device is heard when the catheter engages difficult to remove, calcific plaque.

Calcified lesions and in-stent stenosis are often recalcitrant to balloon angioplasty or only respond to high balloon inflation pressures. In these anatomic situations, flow-limiting dissections or residual stenosis are common, and stents are often required. High inflation pressures set these lesions up for an aggressive intimal hyperplastic response. We have also used this device to successfully treat cases of stents previously placed in the SFA that have developed in-stent stenosis or occlusion, although the current US labeling does not include this use. Atherectomy can be used to remove intimal hyperplastic tissue and make the lesion more amenable to balloon angioplasty. It is also ideal in the crural vessels and the popliteal artery behind the knee, where avoiding dissection and stent placement is critical. In the included case, we were able to remove a large plaque burden and prevent distal embolization.

Results from the early multicenter PVD trial are promising.⁶ There were 210 lesions treated with a 99%
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success rate. The average lesion length was 2.7 cm. Thirty-one percent were total occlusions, 51% had moderate to high calcium scores, and 15% had postangioplasty restenosis. The clinically driven target vessel revascularization rates were 15% at 6 months and 26% at 1 year. The restenosis rate was 38.2% at 1 year based on duplex ultrasound. A post hoc analysis of this study showed that there were comparable results using the Jetstream atherectomy catheter in both diabetic and nondiabetic patients with similar major adverse event rates and clinically driven target lesion revascularization.⁷ The Jetstream System Endovascular Therapy Postmarket registry (JET) is currently enrolling patients in the United States. It will evaluate 6-month and 1-year patency with the Jetstream G3 and Jetstream Navitus catheters in long, occluded, diffuse, thrombotic, or calcified lesions in peripheral arterial disease of the common femoral, superficial femoral, or popliteal arteries.

CONCLUSION

The Jetstream atherectomy system offers a safe and effective mechanism to debulk complex lesions and potentially avoid distal embolization, dissection, stent placement, and intimal hyperplasia. Larger studies comparing the device with other endovascular modalities are required to validate early results. ■

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