Current Role of Atherectomy for Treatment of Femoropopliteal and Infrapopliteal Disease

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KEYWORDS

• Atherectomy • Restenosis • Revascularization • Femoropopliteal artery • Infrapopliteal artery • Distal embolization

KEY POINTS

- Atherectomy improves the acute procedural success of a procedure whether treating de novo or restenotic (including in-stent) disease.
- Intermediate follow-up results seem to be in favor of atherectomy in delaying and reducing the need for repeat revascularization in patients with femoropopliteal in-stent restenosis.
- Recent data suggest that avoiding cutting into the external elastic lamina is an important factor in reducing restenosis.
- The interplay between directional atherectomy and drug-coated balloons is unclear.

INTRODUCTION

Endovascular interventions continue to replace surgery as a first-line therapy for femoropopliteal (FP) and infrapopliteal disease.[1] Randomized trials have shown that patency improves with the use of self-expanding stents in the superficial femoral artery, but there are conflicting data as to whether this leads to reduction in target lesion revascularization (TLR) or improved symptoms and quality of life when compared with balloon angioplasty (percutaneous transluminal angioplasty, PTA).[2–6] Although stenting is appealing to many endovascular specialists because it can be performed with relative ease, higher speed, and predictable excellent angiographic results, the long-term outcome remains a problem with a high rate of restenosis and need for repeat TLR. Also, stent fracture continues to be seen, which may have an impact on restenosis and future therapies.[7]

The concept of an optimal approach for infrainguinal interventions using a no-stent strategy has been recently propelled with the advent of drug-coated balloons (DCB). The concept of changing vessel compliance (C) with atherectomy, protecting the distal vascular bed (P) and applying anti-restenotic drugs (R) to the treated segment, has become a main strategy to treat FP and infrapopliteal disease.[8] This "CPR" concept (Fig. 1) has revived interest in atherectomy as a viable tool to reduce dissection and bailout stenting and to accomplish optimal acute angiographic results[7] in preparation for the application of antiproliferative drugs. The randomized DEFINITIVE AR feasibility trial[9] points to the viability of this concept, which awaits further proof from larger registries and well-powered randomized trials.

Data on DCB have shown superior results to PTA in treating FP disease particularly in short- and intermediate-length lesions.[10–15] Severe calcification was excluded for the most part in these

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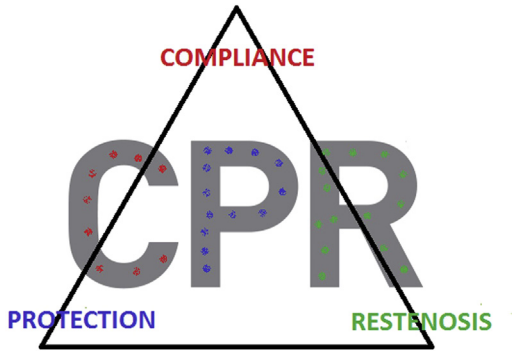

Fig. 1. CPR or the triad of improving Compliance, Protecting the distal vascular bed, and reducing Restenosis as part of an optimal strategy in treating infrainguinal peripheral arterial disease.

studies. In these "simple" lesions, DCB have emerged as a first-line therapy. However, these trials also excluded lesions with high residual narrowing or flow-limiting dissection following pretreatment with PTA. For instance, in the run-in phase of the Levant II trial, 11/56 (19.6%) of patients were excluded.[16] Pretreatment of these lesions, therefore, with atherectomy may improve the chance of avoiding stenting while improving outcome with DCB. The incremental benefit of atherectomy over DCB in these simple lesions, however, needs to be weighed against the added cost of atherectomy.

It is likely that atherectomy's value is in treating complex FP and infrapopliteal disease. There is no uniform classification for complex disease, but operators generally agree that severe calcium, thrombus, long lesions greater than 10 to 15 cm, and total occlusions constitute complex lesions. Both calcium and thrombus are highly prevalent in the FP artery and quite often underdiagnosed angiographically.[17–19] Calcium is likely to be found in atherosclerotic plaques in the FP arteries but also in the media (Monckeberg), particularly in patients with diabetes and chronic renal failure.[17]

Complex disease is quite often a predictor of flow-limiting dissection and stenting.[20] Also, in a small study, Fanelli and colleagues[21] have shown that severe calcium ($\geq$270° arc of calcium) reduces the effectiveness of DCB with a higher loss of patency at 1-year follow-up when compared with lesions with mild to moderate calcification. Furthermore, recent data from Tepe and colleagues[22] showed that bilateral calcification in FP disease on angiographic imaging is associated with a higher late lumen loss after DCB. In that study, bilateral calcification at the same lesion level had the most profound impact on late lumen loss instead of the depth of calcium (intimal, medial, or adventitial) or its length. Based on these findings, bilateral calcium on angiogram at the same lesion level or an arc of calcium of 270° or greater appear to correlate with worse outcomes after DCB. Finally, thrombus has a high affinity to paclitaxel, making it less available to the vessel wall and potentially may reduce its effectiveness.[23]

Atherectomy offers a way to modify complex disease by improving vessel compliance[24–26] and therefore reducing the need for high pressure balloon dilation and barotrauma, leading to a low incidence of flow-limiting dissection and need for stenting. Also, atherectomy may modify the overall milieu of complex plaque by allowing better drug penetration and diffusion into the vessel wall when compared with applying DCB without atherectomy.[27] Furthermore, atherectomy catheters with aspiration capacity (JetStream; Boston Scientific, Maples Grove, MN, USA) or with ablative potential (Excimer laser; Spectranetics, Colorado Springs, CO, USA) have the ability to remove thrombus, which may also have a positive effect on improving drug availability to the vessel wall. Whether these features of atherectomy lead to improvement in clinical outcomes is unclear, and data from future well-powered trials are awaited.

ATHERECTOMY FOR FEMOROPOPLITEAL DE NOVO AND NONSTENT RESTENOTIC DISEASE

Fig. 2 illustrates a proposed algorithm for the treatment of complex de novo and nonstent restenotic disease. This proposed algorithm is based on several registries and small randomized trials as well as the author's experience. Currently, there is no unified consensus on how to approach these lesions among operators.[28] The atherectomy device choice is highly lesion dependent (Fig. 3) but also influenced significantly by device availability and operator experience.

JetStream Atherectomy

The JetStream XC is a rotational cutter with aspiration capacity (Fig. 4). It has significantly been upgraded from its predecessor, the Pathway atherectomy device.[29] The JetStream XC has significantly more cutting and aspiration power and leads to a higher minimal luminal area (MLA) after treatment. The JetStream is suitable for all lesions. However, severely eccentric lesions may be best not treated with this device because of wire bias, particularly in the early experience of the operator. Also, the device is not to be used in iliac, renal, carotid, or coronary arteries as per the instructions for use label. JetStream is effective but off label for treatment

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