Kissing-Balloon Technique for Angioplasty of the Popliteal Artery Trifurcation

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The kissing-balloon technique, also termed the two-balloon technique, is a procedure designed for percutaneous transluminal angioplasty of arterial bifurcations. It was initially described for percutaneous transluminal angioplasty of the aortic bifurcation, which used simultaneous inflation of two balloons, one introduced through each common femoral artery, to avoid occlusion or embolization of the opposite common iliac artery [1]. Percutaneous transluminal angioplasty of such bifurcation lesions with a single angioplasty catheter is contraindicated because inflation of the balloon may displace the plaque laterally and occlude the contralateral iliac artery or result in distal embolization. We describe use of the technique for angioplasty of the popliteal artery trifurcation after antegrade puncture of the ipsilateral common femoral artery.

Materials and Methods

A 51-year-old, insulin-dependent, diabetic man was admitted for treatment of a 2 × 2 cm nonhealing ischemic ulcer of the left foot. The patient had a below-the-knee femoral-popliteal in-situ bypass graft placed 2 years before this admission. After diagnostic angiography, which showed a patent graft and high-grade stenoses at the tibioiperoneal bifurcation (Fig. 1A), the left common femoral artery was punctured in an antegrade fashion, and a 6-French sheath (Cordis, Miami, FL) was passed through the proximal portion of the in situ bypass graft. A Tegtmeyer guidewire angioplasty balloon catheter (TEGwire, Medi-tech, Watertown, MA) with a 20 × 3 mm balloon was advanced through the sheath and positioned across the anterior tibial artery stenosis. A 3.5-French Medtronic angioplasty catheter (Medtronic, Minneapolis, MN) with a 20 × 2.5 mm balloon was then advanced through the same sheath over an 0.018-in. steerable guidewire (Peripheral System Group, Mountain View, CA) and was placed across the stenotic origin of the tibioiperoneal trunk. Both balloons were simultaneously inflated (Fig. 1B). Subsequent arteriography showed a good angioplasty result at the bifurcation point, with good flow into the runoff vessels (Fig. 1C).

Discussion

Infrapopliteal atherosclerotic lesions are not always amenable to percutaneous transluminal angioplasty, particularly when the disease involves the popliteal artery trifurcation. In such cases, dilatation of one branch vessel with a single balloon may cause occlusion or embolization of the other branch vessel. This occurs because no support is present opposite the expanding balloon to contain the plaque and prevent it from fragmenting and causing distal embolization of the opposite vessel. With the double-guidewire technique [2, 3], a safety guidewire maintains access within the vessel opposite the angioplasty site. After dilatation of the first branch vessel, the angioplasty catheter can be removed and advanced over the safety wire to dilate the second branch vessel. However, the technique may not guarantee safe passage of the balloon catheter over the protecting guidewire should an occlusion of the second branch vessel occur during angioplasty of the first. In addition, a wire may not necessarily prevent embolization down the second vessel.

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With the kissing-balloon technique, the atherosclerotic plaque is trapped and compressed between the two balloons, which are inflated simultaneously. Because the plaque is not displaced, distal embolization to the contralateral branch vessel should not occur. When both angioplasty balloon devices are introduced through the same 6-French sheath, the morbidity and patient's discomfort inherent to a second arterial puncture are eliminated.

In our experience, the largest catheter shaft that easily fits side by side through a 6-French sheath in combination with a 0.035-in. guidewire is 3.5-French. Therefore, a 3.5-French angioplasty catheter is used in conjunction with a 0.035-in. TEGwire for percutaneous transluminal angioplasty of the infrapopliteal bifurcation. Angioplasty of popliteal and tibial vessels with the TEGwire has been previously reported [4]. The combination we describe may not fit all 6-French sheaths because inner-sheath diameter may vary among manufacturers. Combinations should be tested before catheterization.

The kissing-balloon technique is technically feasible for use in the diseased infrapopliteal bifurcating vessels. Recent refinements in balloon catheter technology should broaden the indications for infrapopliteal percutaneous transluminal angioplasty.

REFERENCES


Fig. 1.—A, Digital subtraction angiogram of left leg reveals high-grade stenoses at origins of tibioperoneal trunk (straight solid arrow) and anterior tibial artery (arrowhead), accounting for decreased velocities in leg with below-the-knee femoral-popliteal in situ bypass graft (curved arrow) (above-knee: 35 cm/sec; below-knee: 40 cm/sec). Ankle-brachial index, 0.54 on admission, had dropped from 1.0, 6 months before. Distal popliteal artery is patent (open arrow).

B, Radiograph shows kissing balloons. Note TEGwire angioplasty balloon guidewire (3 mm in diameter) across anterior tibial artery and 3.5-French angioplasty balloon catheter (2.5 mm in diameter) across tibioperoneal trunk.

C, Digital angiogram after angioplasty shows good flow into both vessels. Studies 1 week after angioplasty revealed left-graft velocities of 65 cm/sec above knee and 70 cm/sec below knee. Ankle-brachial index improved to 1.0 on a 1-month follow-up study.