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Percutaneous Transluminal Angioplasty of Stenotic Saphenous Vein Right Coronary Bypass Grafts Utilizing a Peripheral Balloon Dilatation Catheter Without a Guiding Catheter

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Effective angioplasty of stenosed saphenous vein coronary bypass grafts may be impossible with the standard-size coronary dilatation catheters because the large diameter of these grafts results in unacceptable balloon-to-vessel ratios. We avoided this problem by using a peripheral arterial dilatation catheter with an inflation diameter of 6 mm and obtained a satisfactory short- and long-term result in two patients in whom previous attempts with the largest coronary dilatation catheter (4 mm) had failed. This technique, which precludes the use of a guiding catheter, is suitable only for right bypass grafts.

Key words: saphenous vien coronary bypass graft stenosis, coronary angioplasty

INTRODUCTION

Successful angioplasty of stenosed saphenous vein coronary bypass grafts may be hampered by the size of these grafts [1]. Their diameters vary considerably from the size of native coronary arteries, up to 5–10 mm; in the latter instance, it may be impossible to effectively dilate a lesion because of the limitation in balloon size of the commercially available coronary dilatation catheters. In this report we describe two cases where peripheral dilatation catheters with 6-mm-diameter balloons were used without guiding catheters to successfully dilate saphenous vein bypasses to the right coronary artery.

CASE REPORTS

Case 1

A 67-year-old man had triple aortocoronary bypass graft surgery to the posterior descending branch of the right coronary artery, the left anterior descending coronary artery, and the first diagonal branch in October 1982. Saphenous veins were used for each of the three conduits. His angina reappeared 6 months after surgery, necessitating on two occasions a PTCA of the distal anastomosis of the right bypass graft. In September 1987, he developed crescendo angina, prompting reangiography. The left anterior descending and first diagonal bypasses were patent and undiseased, but a new significant and irregular stenosis had appeared in the angulation of the shaft of the right bypass graft with sluggish flow through this segment to the distal coronary tree (Fig. 1, upper panel). There was no evidence of restenosis at the previously angioplastied site. A PTCA of this shaft stenosis was attempted with a 4.0-mm USCI LPS balloon (Fig. 1, middle panel, Fig. 2). Two inflations were performed, the second for 60 sec at 10 atm, but a residual 50% diameter stenosis lesion remained with no improvement in distal angiographic flow (Fig. 1, lower panel). The diameter of the graft at the stenosis was estimated at 5.5 to 6.0 mm. A Medi-tech peripheral angioplasty catheter with a 6-mm inflated balloon diameter (Fig. 2) was advanced directly through the femoral artery sheath to the ostium of the graft. Dye injections through this catheter permitted adequate visualization of the graft (Fig. 3, top panel), which was used to direct a 0.014 J USCI guidewire across the lesion and to the distal coronary tree. The dilatation catheter was then advanced across the stenosis, and the balloon was appropriately positioned. Two inflations (Fig. 3, middle panel) were performed (6.0 atm for 30 and 45 sec). Chest pain developed after the second inflation. Angiography showed an excellent result at the dilatation site, with no residual stenosis or irregularity and much improved flow

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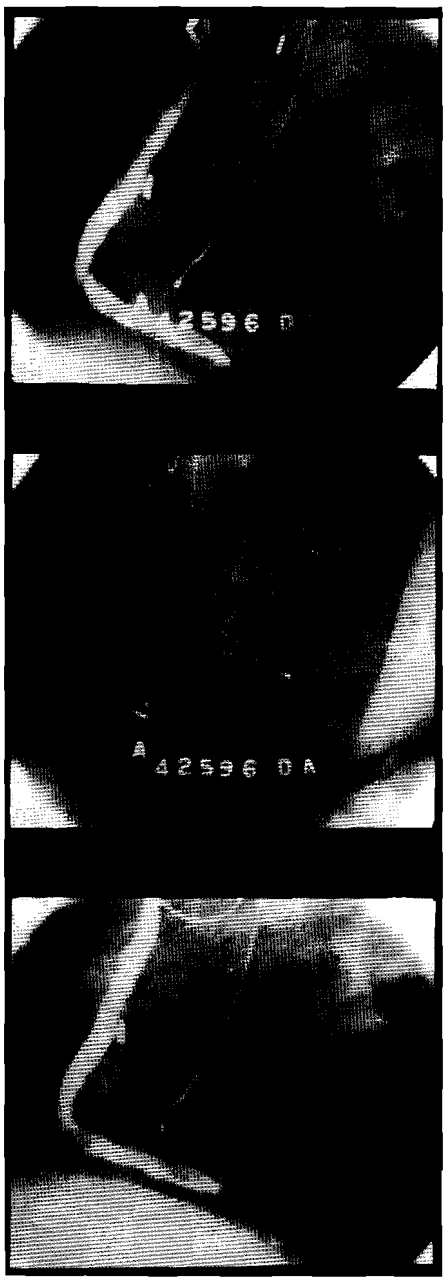


Fig. 1. Top: Saphenous vein bypass graft to the right coronary artery in a left anterior oblique 50 showing a stenosis in the midsegment at the angulation of the graft. Middle: Inflated 4.0-mm USCI LPS balloon at the lesion. Bottom: Immediately after inflation; the lesion has improved but a roughened narrowing persists.

distally (Fig. 4, lower panel), but an occlusion had appeared in the retrograde segment of the native right coronary artery. Streptokinase was administered into the graft at a total dosage of 60,000 units over 30 min with no resolution of the occlusion. His chest pain spontaneously abated and there was no evidence of myocardial necrosis. He has had no angina since, and reangiography 6 months later (March 1988) showed continued patency at the dilated site. (Fig. 4)

Case 2

A 71-year-old woman had saphenous vein aortocoronary bypass graft surgery to the left anterior descending and right coronary artery in 1981. She remained well until December 1985, when unstable angina appeared. Bypass angiography showed patency of the left anterior descending artery graft, but a 75% stenosis in the mid right bypass graft and a 60% stenosis of the proximal segment of the posterior descending branch were demonstrated. Both were successfully dilated through the graft, the former with a 4.0-mm USCI LPS balloon for 60 sec to 7 atm and the latter with a 3-mm USCI LPS balloon. The diameter of the midgraft at the stenosis was estimated at 6.5 mm and a residual 20% stenosis was present post PTCA. Her angina reappeared in February 1986, and in May 1986 angiography showed a restenosis of the bypass graft angioplasty site to 70% with continued patency of the posterior descending site. This was redilated in August 1986, again with a 4.0-mm USCI LPS dilatation catheter and this time with three inflations, the last for 60 sec to 11.5 atm. No residual lesion could be identified. Within 4 weeks, her angina reappeared but was initially controlled with medication. However, in January 1987 she presented with unstable angina, and a 70% stenosis was demonstrated in the right bypass graft at the previously dilated location. On this occasion, a 6-mm-diameter, 20-mm-long PTA Cook dilatation catheter was used with the same technique described for case 1. Two inflations were performed, the last for 45 sec at 4.5 atm, and an excellent angiographic result was obtained with no residual stenosis. Reangiography in August 1987 showed no evidence of restenosis at the PTCA site.

DISCUSSION

Although there has been a trend toward the use of arterial conduits in coronary bypass surgery because of favourable long-term results [2], anatomical accessibility necessitates the continued use of saphenous veins to bypass the right coronary and circumflex artery systems. Also, saphenous veins were used almost exclusively in

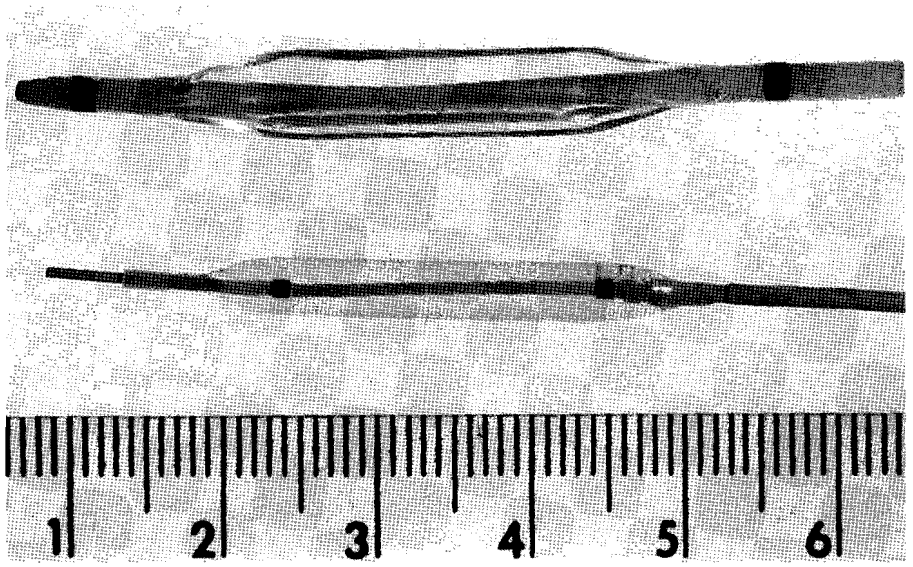


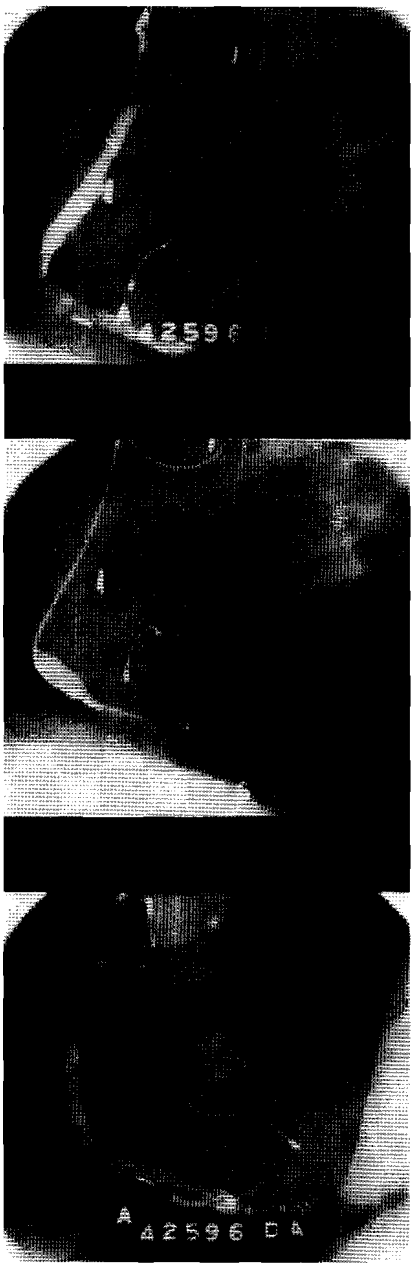
Fig. 2. Side-by-side comparison of the 6.0-mm Medi-tech peripheral dilatation catheter (above) and the 4.0-mm USCI LPS coronary dilatation catheter (below).

most centres in the 1970s. These grafts have a significant attrition rate, with a 60% to 70% incidence of occlusion or significant disease at 12 years [3]. These considerations suggest that coronary saphenous vein graft failure will be a continued and possibly even a growing management problem for both surgeons and interventional cardiologists. In the new National Heart, Lung and Blood Institute Registry the proportion of patients having at least one bypass graft attempted was 4.9%, compared with 3.3% in the old registry [4].

Angioplasty of saphenous vein grafts has been performed since 1981; through the years the procedural success has gradually improved in parallel with that found in native vessel PTCA, but the recurrence rate has been significantly higher than that of native vessel angioplasty [1,5]. Possible explanations include the different complexity, extent, and nature of disease in bypass grafts, compared with native vessels [6]; however, by multivariate analysis, Cote et al., found that the balloon/graft ratio was the only statistically significant predictor of immediate and long-term success [1]. They suggested using balloons large enough to achieve balloon/graft ratios of at least 1.1/1.0 [1]. However, this may be impossible in the case of large bypass grafts, which may have diameters well above 5 mm. The largest coronary dilatation catheter has a 4.0-mm inflated balloon diameter.

In this report we describe one approach to this problem, namely the use of a 6-mm-diameter balloon catheter normally used for peripheral work. Such a catheter is too large to advance through any of the currently available guiding systems. However, right saphenous bypass grafts are almost always anastomosed to the outer lateral wall of the ascending aorta with minimal angulation and course parallel to the aorta; in both of our cases it was possible to directly cannulate the ostium of the graft with the straight dilatation catheter. Also, the inner lumen of this catheter is so large that excellent angiographic visualization can be obtained, permitting safe advancement of the guidewire. In both cases a 4.0-mm balloon had been attempted initially. In the first case, this balloon produced an inadequate initial result; in the second, restenosis occurred twice after the use of this balloon. In both instances an excellent result without vessel roughening or obvious wall trauma was achieved with the 6-mm balloon, and continued patency has been documented angiographically at 6 months. In the first case, a complication occurred consisting of embolization of clot and/or atheroma post dilatation. This is known to occur after bypass graft angioplasty [7] but may even be more hazardous with a larger balloon. Preangioplasty anticoagulation might reduce this risk, especially in older diffusely diseased grafts.

Unfortunately, this technique is probably suitable only for saphenous vein bypasses to the right coronary artery. Bypasses to the left anterior descending and circumflex systems almost always arise from the aorta at angles that would preclude their cannulation and safe entry with a



straight naked dilatation catheter. However, the newer generation of guiding catheters have larger lumens and the newer generation of dilatation catheters have smaller profiles, so that compatability may be achieved. Another approach would be the simultaneous inflation of two smaller balloons side-by-side introduced either through one guiding catheter with the Bonzel Monorail system [8] or with two ultralow profile coaxial catheters or through two separate guiding catheters as a modication of the so-called kissing-balloon technique [9].

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Fig. 3. Top: The right bypass graft in the same projection as Figure 1. The angiogram was obtained by injecting through the end hole of a 6.0-mm Medi-tech peripheral dilatation catheter. Middle: The 6.0-mm Medi-tech balloon inflated at the lesion. Bottom: The angiogram obtained through the Medi-tech balloon catheter immediately following inflation showing complete resolution of the lesion.

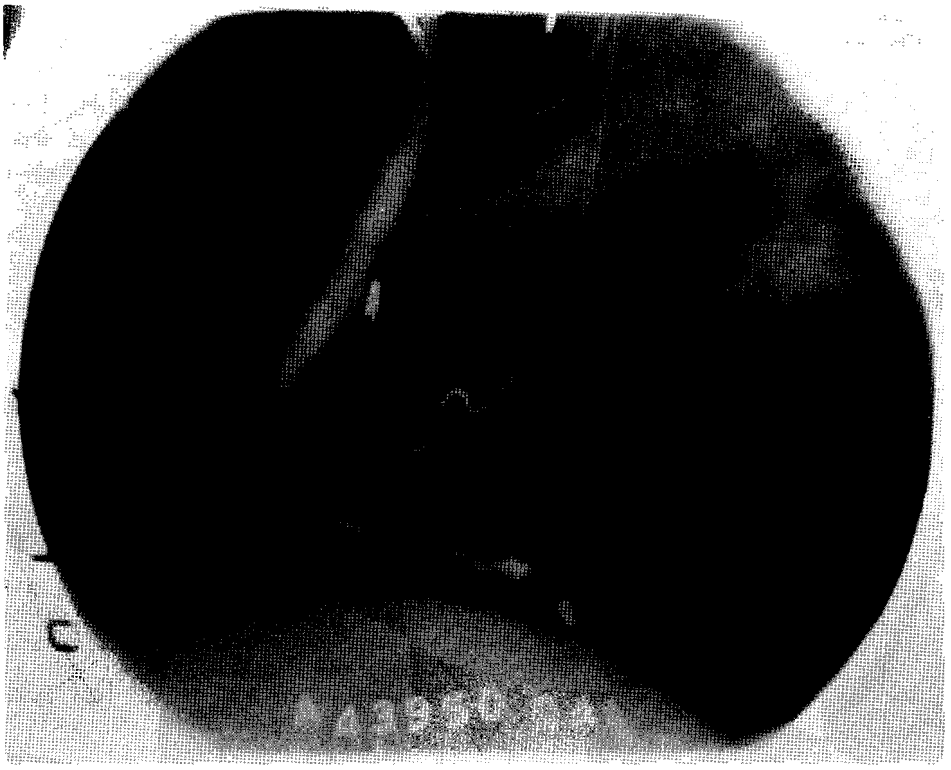

Fig. 4. The right bypass graft in the same projection as Figures 1 and 3 but 6 months post PTCA, showing continued patency of the dilated segment.

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