Case reports

Percutaneous treatment of early occlusion of a complex arterial coronary graft: a case report

Davide D'Andrea, Emanuela Tavasci, Carlo Savasta, Bruno Passaretti, Paolo Sganzerla

Cardiology Unit 2, Humanitas-Gavazzeni, Bergamo, Italy

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The internal mammary arteries are now widely used for surgical myocardial revascularization. Because of its excellent long-term patency rates, re-do surgery is rarely requested and transluminal percutaneous angioplasty of these arterial grafts is still relatively infrequent. This procedure is performed mainly at the distal anastomotic site but also at the origin of the vessel from the subclavian artery, frequently just to treat a local traumatic dissection due to the catheter. We here report the case of a successful angioplasty and stenting of the body of the graft for an early total occlusion of a complex, bifurcated arterial bypass to the left coronary system.

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Address:

Dr. Paolo Sganzerla

U.O. di Cardiologia 2
Humanitas-Gavazzeni
Via Gavazzeni, 21
24125 Bergamo
E-mail:
paolo.sganzerla@gavazzeni.it

Introduction

The internal mammary artery (IMA) is now considered the vessel of choice for patients who undergo surgical coronary revascularization, particularly of the left anterior descending artery (LAD) territory, in view of the fact that this vessel has been shown to have a superior long-term patency and a lower rate of reoperation and of major adverse cardiac events when compared to saphenous vein grafts[1]. This improved performance has been attributed to its apparent resistance to atherosclerotic involvement[2]. So the cardiac surgeon is compelled to use the left and right IMA and other arteries, such as the radial ones, more extensively performing ever more complex coronary grafts. Even if the majority of percutaneous interventional procedures of myocardial revascularization is still performed on the native circulation, the interventional cardiologist now has to cope not only with arterial conduits, their proximal tortuosity and the frequent graft-vessel dimension mismatch but also with complex and bifurcated grafts. Transluminal catheter interventions on mammary arterial grafts are performed mainly at the anastomotic site[3] and, less frequently, also at the origin of the vessel from the subclavian artery, often just to treat a local traumatic dissection due to the catheter[4]. On the contrary, transcatheter treatments of the body of the graft are quite rare. We here describe the case of a percutaneous transluminal coronary angioplasty (PTCA) performed on a complex, bifurcated and totally occluded arterial graft to the left coronary system with excellent immediate and mid-term results.

Case report

A 63-year-old hypertensive male patient with dyslipidemia was admitted to our hospital because of unstable angina. Coronary angiography showed severe stenosis of the left main stem bifurcation with a normal left ventricular systolic function. Two days later bypass surgery was performed with a left IMA anastomosis to an obtuse marginal branch. The right IMA was used as a free graft connected from the distal part of the left IMA to the LAD. On the fifth postoperative day, rest angina recurred with an upward shift of the ST segment in the anterior precordial leads. Repeat angiography showed total thrombotic occlusion (TIMI 0) of the middle left IMA graft, proximal to the anastomosis of the right IMA (Fig. 1); dye injection in the native left main disclosed retrograde perfusion of one branch of the complex arterial graft (Fig. 2).

Two ACS Hi-torque balance middle weight guidewires (Guidant, Santa Clara, CA, USA) were placed over the left and right IMA; after wiring, the resumption of a

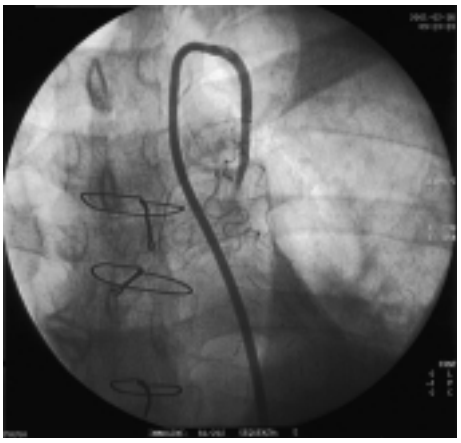

Figure 1. *Selective injection of the left internal mammary artery showing total occlusion of the graft without anterograde flow.*

Figure 2. *Antero-posterior image of retrograde filling of one branch of the arterial graft through injection in the native left coronary artery.*

slow anterograde flow disclosed a spiral dissection causing a 99% stenosis of the body of the left IMA without obvious evidence of a stenosis at the site of anastomosis on the LAD. Multiple distensions of a Worldpass plus balloon (2.5 × 20 mm, Cordis, Miami, FL, USA) at 8 atm were followed by implantation, to seal the dissection, of a Multi-link Tetra stent (3.5 × 33 mm, Guidant) at 12 atm which covered the proximal anastomosis of the right IMA, with recovery of a TIMI 3 flow. A critical stenosis of the ostium of the right IMA graft was then treated with the kissing balloon angioplasty technique through the struts of the stent (Fig. 3), with excellent final results (Fig. 4). The whole procedure was performed using a right femoral artery approach and an 8F internal mammary guiding catheter (Cordis) with intravenous administration of the glycoprotein IIb/IIIa inhibitor eptifibatide, aspirin and unfractionated heparin. Oral therapy at discharge included aspirin, ticlopidine, simvastatin and H_2-antagonists.

Four months later, the symptom-free patient was readmitted for a previously planned follow-up angiography; the exercise stress test did not reveal myocardial ischemia. Coronary angiography disclosed a regular patency of the graft and of the treated bifurcation with "physiological" intrastent neointimal hyperplasia (Fig. 5).

Discussion

It has been documented that the incidence of early occlusion and stenosis of the anastomosis of the IMA to the LAD is very low not only in case of conventional bypass[5] but also following minimally invasive direct coronary artery grafting[6]. The long-term patency rate of the IMA graft and its relative resistance to atherosclerotic involvement frequently render this vessel a simple passive conduit through which the interventional cardiologist can reach and treat the native circulation beyond the anastomosis without particular difficulty. In fact, PTCA in patients with IMA grafts is performed mainly at the distal anastomotic site[3] or far beyond in the native circulation.

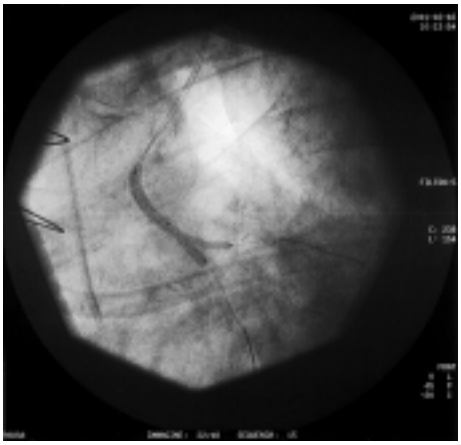

Figure 3. *Left anterior oblique cranial view of the kissing balloon final dilation.*

Figure 4. *Final result after stenting and kissing balloon dilation with good anterograde perfusion of the native vessels (left anterior oblique cranial view).*

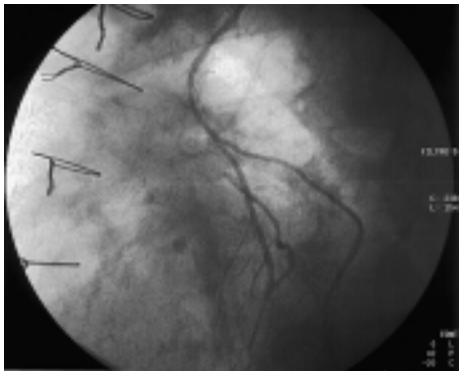

Figure 5. *The 4-month angiographic follow-up showing "physiological" intrastent neointimal hyperplasia and confirming the patency of both the arterial grafts.*

Some reports describe the percutaneous treatment of IMA grafts in unusual locations and clinical settings. Bedogni and La Vecchia[4] illustrated an elective stenting of a *de novo* ostial lesion 2 years after an anastomosis of the right IMA to the right coronary artery; local trauma to the vessel during an early postoperative catheterization was proposed to be one of the possible mechanisms of the development of stenosis. Jacq et al.[7] reported a small series of 5 patients with ostial stenosis of the IMA graft treated with PTCA and stenting. The primary success rate was satisfactory but there unfortunately was a relatively high incidence of restenosis potentially presenting as sudden death.

The case reported here has some unusual combined features. The graft vessel was totally occluded with TIMI 0 anterograde flow; only the injection in the native left main coronary artery allowed the operator, through retrograde opacification, to understand the complexity of the graft and the precise localization of its bifurcation. The timing of the acute occlusion and its anatomic location were inconsistent with an atherosclerotic origin of the problem: in fact, the weak anterograde flow, achieved simply by wiring the vessel, was sufficient to disclose a spiral dissection of the graft that could have led to a delayed vessel occlusion; moreover, there was no obvious anastomotic graft-LAD stenosis. Harvesting such a similar, complex graft may have led the surgeon to overstretch and stress the arterial conduits much more than usual, thus creating a site of weakness in the vessel wall which could have later given rise to a dissection. This not only influenced the blood flow in the main body of the graft but also determined the ostial obstruction of the secondary branch leading to a relatively complex procedure of bifurcation treatment with the kissing balloon technique through the struts of the long stent deployed to seal the dissection and reestablish an adequate anterograde flow. Although the interventional procedure involved a totally occluded vessel with the need to perform a kissing balloon dilation of a bifurcation, factors known to negatively influence the primary success rate and the mid-term outcome[8,9], it was carried out successfully and safely with good immediate and mid-term clinical and angiographic results. In this way, the risks associated with re-do bypass surgery were avoided.

The growing effort of the cardiac surgeon to achieve complete myocardial revascularization with arterial conduits will lead in the future to the performance of ever more complex and articulated coronary grafts. The interventional cardiologist will also be led to challenge its possible proximal tortuosity and natural narrowing of the vessel size not simply with arterial grafts but also with a particular and unnatural, surgeon-dependent anatomy. If the good short- and mid-term clinical and angiographic results of this type of complex procedure are confirmed in the future in relatively large series of patients, early PTCA will be the therapy of choice for patients presenting with early postoperative ischemic complications of surgical revascularization and the interventional cardiologist may "bail out" the cardiac surgeon. A potential surgical failure may hence be converted into a successful experience for the patient[10].

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