Case Report

Combined Use of Aspiration Catheter and Distal Embolisation Protection Device to Facilitate Angioplasty of a Totally Occluded Saphenous Vein Graft

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Angioplasty of totally occluded saphenous vein grafts is a very challenging procedure and the likelihood of distal embolisation and no-reflow is much higher than in any conventional angioplasty. The use of thrombus aspiration and distal protection devices, although not well studied in a large number of patients, has been shown to be quite effective in preventing such complications. In this case we report our satisfactory experience from the combined use of a novel aspiration catheter and a distal protection device for the treatment of a totally occluded saphenous vein graft.

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Angioplasty of a totally occluded saphenous vein graft (SVG) is a technically challenging procedure with many difficulties, due to the high incidence of a heavy thrombus and debris burden. Although a variety of medications and techniques have been used to overcome those problems, none of them seems quite effective. We report our experience from the combined use of a novel thrombus aspiration catheter, the Export Aspiration Catheter (EAC), and a distal embolisation protection device, Emboshield, to facilitate angioplasty of a totally occluded SVG.

Case description

A 65-year-old-male with hypertension, hyperlipidaemia and a history of coronary artery bypass 5 years before, presented to our hospital's emergency department with recent onset angina. Ten days previously he had reported a prolonged episode of angina on rest and since then he had experienced progressive angina on effort. Myocardial enzymes showed mild T-troponin elevation (4.5 ng/ml). He was given unfractionated heparin, a IIb/IIIa inhibitor (eptafibitide), and a few hours later he underwent coronary angiography, which revealed a patent left internal mammary artery to the left anterior descending coronary artery, a patent SVG to the first obtuse marginal and a totally occluded SVG to the right coronary artery (Figure 1), which was also occluded in its middle section. Based on the above findings we decided to perform angioplasty of the totally occluded SVG.

Because of the possibility of a heavy thrombus and debris burden in this totally occluded and degenerated vein graft we elected to perform a percutaneous coronary intervention assisted by a distal embolisation protection device and an aspiration catheter.

Device description

The EAC was first used as a part of the Guardwire temporary occlusion and aspiration system. It is a 135 cm long, dual lumen

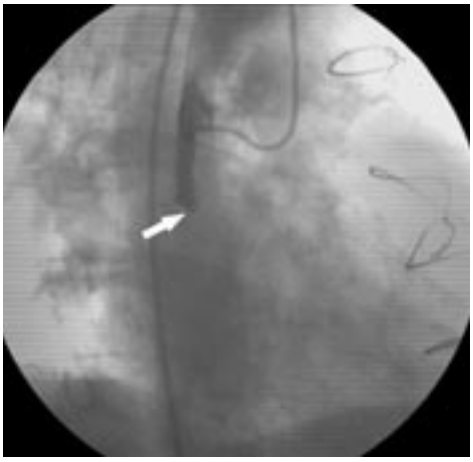

Figure 1. Right anterior oblique view of the totally occluded saphenous vein graft (arrow).

catheter with a distal radiopaque tip marker and proximal luer lock port. The proximal luer lock port is for connection of the aspiration line and aspiration syringe. It has a 0.040" diameter internal lumen that allows for aspiration and removal of particulate debris and it can accommodate any commercial 0.014" coronary angioplasty guidewire.

The EmboShield (MedNova Ltd.) is a temporary intravascular filtration system designed to capture atheromatous material released during coronary interventional procedures. The system is composed of three major components: 1) the filter guidewire, 2) a delivery catheter, and 3) a retrieval catheter. The filter assembly is located at the distal end of a 0.014" guidewire that is used to cross the lesion. The filtration element, made of polyurethane, has four proximal entry ports and multiple distal perfusion pores (100 to 150 μm) that allow blood flow to the coronary circulation. The filter is available in diameters of 3 to 6 mm.[1,2]

Procedure

Firstly, the SVG was cannulated with a 7 F Amplatz II right coronary guide catheter and a 0.014" intermediate guidewire was manoeuvred through the total occlusion without significant difficulty. Contrast medium was injected to document the TIMI flow status and again no flow was seen. The EAC was then advanced over the guidewire to the distal graft bed. Continuous aspirations were applied and the EAC was slowly advanced across the lesion as distally as possible without any significant resistance in the SVG's lumen. This manoeuvre lasted about 10 minutes until no material could be grossly visualised, at which point the aspirate was ejected on to a piece of gauze. A new contrast medium injection revealed TIMI 2 flow in the graft's lumen, which was full of thrombus and debris. A significant stenosis of 90% was seen at its distal anastomosis (Figure 2).

The EAC was then removed and stenosis predilatation with a Maverick 2 × 20 mm balloon (Boston, USA) was performed at 14 Atm. Immediately after balloon angioplasty, a second 0.014" guidewire from the Emboshield device was used to cross the stenosis (Figure 3). This second wire was used to introduce the Emboshield filter device into the vessel, distally to the predilated stenotic segment. Then the first guide-

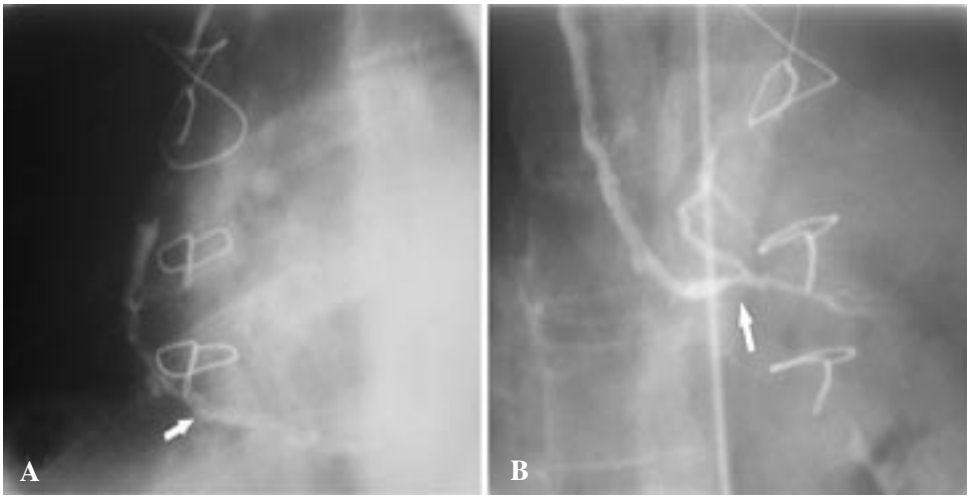

Figure 2. A: Left view of the saphenous vein graft (SVG). Its lumen is opacified after repeated aspirations with the EAC (arrow). B: Right view of the SVG. A significant stenosis is seen at its distal anastomosis (arrow).

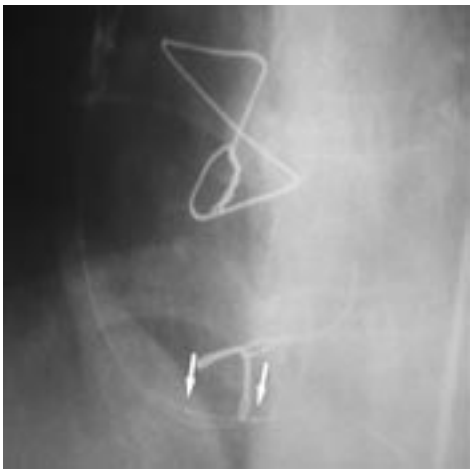

Figure 3. Emboshield guidewire and filter with 2 radiopaque markers (arrows) distally in the saphenous vein graft lumen.

wire was removed and 4 stents were deployed in turn: a Dexamet 3 × 18 mm at the SVG distal anastomosis, (Figure 4) a Bestent 3.5 × 20 mm (14 Atm) distally, a Bestent 3.5 × 15 mm (14 Atm) medially and a Bestent 4 × 20 mm proximally, with a very good final result.

A final angiogram revealed TIMI 3 flow in the SVG, with a 10% residual stenosis (Figure 5). After stent placement the Emboshield filter was also removed without any difficulty. During his rest hospitalisation the patient remained asymptomatic with no elevation in cardiac markers. He was discharged 2 days later on a clopidogrel and aspirin regimen.

Discussion

The outcome of all conventional techniques in angioplasty of totally occluded vein grafts has been reported to be poor.[3-6] Balloon angioplasty has been disappointing, while stenting has been performed with greater technical success but still with high rates of distal embolisation and no-reflow phenomenon.[7] The main reason for this poor outcome may be the high thrombus burden and the large soft plaque mass in the old vein grafts.

Although the mechanism that causes the no-reflow phenomenon is not completely understood, it seems that distal embolisation of macrodebris and thrombus plays a key role, leading to microvascular obstruction.[8,9] Based on that hypothesis, some new interventional techniques have been developed recently, such as embolic protection and thrombus aspiration devices.[10-13] However, in the setting of totally occluded SVGs none of them has proven ideal. More precisely, concerning embolic protection devices, the large quantity of thrombus and debris material that usually exists in the occluded SVGs easily causes filter overloading, with subsequent reduced perfusion or non-retained material and difficulty in withdrawing all captured material without dislodgement. On the other hand, thrombus aspiration devices can facilitate percutaneous interventions by removing intraluminal thrombus and debris but they do not provide distal embolisation protection.[14] Our hypothesis was that the combination of those two devices could better protect the graft from distal embolisation and the no-reflow phenomenon.

Indeed, in our case, using Emboshield for embolic protection and EAC for thrombus aspiration, we succeeded in fully opening the SVG without any signs of distal micro-embolisation or no-reflow phenomenon.

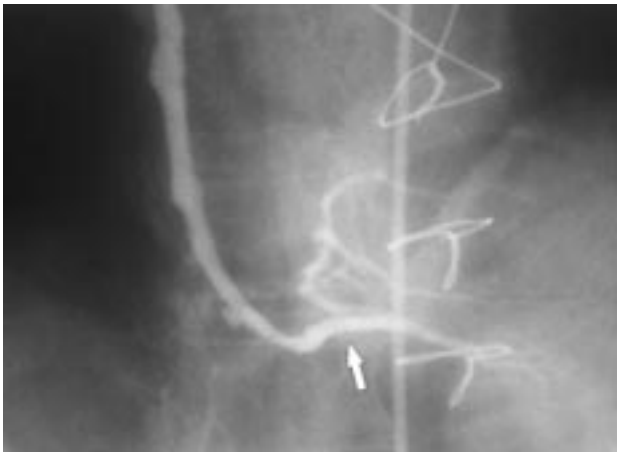

Figure 4. Right view of the saphenous vein graft after stent placement at the stenosis of the distal anastomosis.

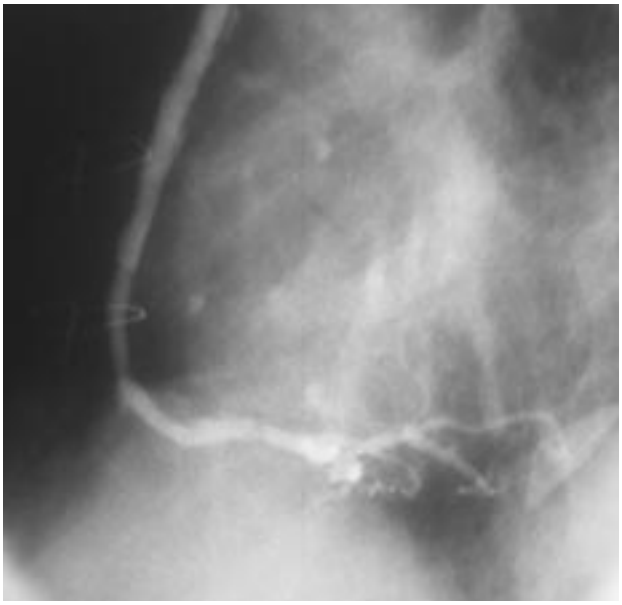

Figure 5. Final result after placement of four stents.

To our knowledge there is only one similar publication in the literature, describing two cases where two different devices were used with very satisfactory results.[15] In that study the embolic protection device used was the Guardwire, a system in which the temporary occlusion is performed with a latex balloon near the distal tip of the 0.014" wire. This design makes the wire stiff, so that it is difficult to gain access distal to the lesion. Furthermore, the deflated balloon profile, although only 0.036" in diameter, may still impede crossing of a tight stenosis and theoretically could contribute to distal embolisation. Moreover, the most important disadvantage of this device when compared with filter protection devices is that it does not allow anterograde blood flow during the procedure. This means that the operator needs to deflate the balloon periodically to test the results of the procedure, increasing the risk of distal embolisation.[16,17] Finally, the Guardwire requires careful and total thrombus removal with another device, since it does not have this capability (the balloon just protects in contrast to the filter).

As regards the thrombus aspiration device in the same study, the investigators used the AngioJet rheolytic thrombectomy system. Although it is an approved thrombectomy device it requires a skilled operator for setup and use, which is not always possible, especially in the setting of acute myocardial infarction outside normal working hours. Furthermore, this device is associated with a potential for arrhythmia induction, vessel trauma or spasm, or even distal embolisation.[18,19]

In contrast, when the EAC is used alone it is a trackable and manoeuvrable device, being compatible with any conventional 0.014" angioplasty guidewire. Furthermore, in previous published series no trauma of the vessel wall or loss of distal branches was noticed after its use.[20,21]

It should be noted that when the EAC is used to treat an old total occlusion with organised debris its ability to extract it may be limited, as it requires manual suction; however, in cases like the one we describe, where the thrombus in the lesion is recent, the aspiration is easier and more complete.

Conclusion

A variety of distal protection and thrombus aspiration devices have been used principally for SVG angioplasty. Their more widespread application is currently being held back by difficulties that are mainly technical. Future modifications in their design are expected to improve their effectiveness, while large randomised trials should help to broaden their use. Meanwhile, their combined application may overcome some technical difficulties associated with challenging interventions, such as angioplasty of a totally occluded SVG.

The combined use of the EAC and Emboshield is a feasible and effective technique for treating recently obstructed SVGs. While data from randomised clinical trials are still lacking, this combination allows easier and more complete thrombus and debris aspiration while protecting against distal embolisation.

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