Case Reports

Fourteen Month Follow-up Angioscopic Findings of a Sirolimus-Eluting Stent Implanted in a 15-Year-Old Saphenous Vein Graft

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SUMMARY

Saphenous vein grafts (SVGs) are common, as is their degeneration and early failure after coronary artery bypass graft surgery (CABG). Percutaneous SVG intervention with drug-eluting stents (DES) was associated with superior short-term clinical outcomes. However, SVG intervention compared with coronary intervention often results in distal embolisation and periprocedural myocardial infarction.

In this case, we discuss 9 and 14 month follow-up neointimal coverage of a DES implanted in a 15 year-old SVG and other morphological changes using angioscopy.

Key words: Saphenous vein graft, Angioscopy, Sirolimus-eluting stent

Saphenous vein grafts (SVGs) are used in various coronary artery bypass graft (CABG) operations. Approximately 50% of SVGs easily degenerate and occlude within 10 years. In particular, old SVGs have large, soft, and friable lesions comprised of atherosclerosis. Percutaneous SVG intervention with DES has demonstrated beneficial effects compared with bare-metal stents (BMS) in the short-term. Conversely, in a recent report, DES were associated with higher long-term mortality than BMS for SVG disease. Angioscopic neointimal coverage of sirolimus-eluting stents (SES) at 6-month follow-up has suggested delayed endothelialization in the coronary arteries. However, neointimal coverage of the SES in SVG has not yet been investigated. We demonstrated 9 and 14 month follow-up neointimal coverage of a SES implanted and morphological changes in a 15 year-old SVG using angioscopy.
CASE REPORT

A 71 year-old man who had undergone CABG 15 years earlier presented with angina pectoris. Ten years after grafting during a coronary angiogram, a moderate lesion was found in the SVG to the left anterior descending artery. This lesion underwent percutaneous coronary intervention (PCI) and was treated with a bare-metal stent (BMS; Radius; $3.0 \times 31$ mm). He had complete resolution of his angina for approximately 4 years, but the effort angina reoccurred.

Repeat coronary angiogram showed in-stent restenosis (ISR) (Figure 1A). Intravascular ultrasound (IVUS) image examination demonstrated a tight ISR of the BMS with severe neointimal hyperplasia (Figure 1B). PCI using a sirolimus-eluting stent (SES; Cypher; $3.0 \times 23$ mm) with distal protection achieved resolution of the angina (Figure 1C, D).

Figure 1. Coronary angiogram (CAG) showing saphenous vein graft (SVG) to the left anterior descending artery before the PCI. White arrow in (A) shows in-stent restenosis with BMS. A tight in-stent restenosis is noted in the BMS with severe neointimal hyperplasia in the intravascular ultrasound (IVUS) image (B). After the PCI with SES of SVG, CAG (C) and IVUS (D) exhibited good results.
Nine months after the PCI, follow-up studies were performed. An angiogram showed no ISR (black line in Figure 2A).

Coronary angioscopy showed mural red thrombi adjacent to the exposed and glittering struts at the proximal portion of the SES (Figure 2B). At the mid-portion, the struts were covered with a very thin neointima but could be seen (Figure 2C). At the distal-portion, both neoointima and partially erosive intima were visible around this strut (Figure 2D). Severe mural thrombi and yellow plaques were detected outside the distal end of the stent at the plain old balloon angioplasty (POBA) site (Figure 2E).

Fourteen months after the PCI, no ISR was observed on follow-up angiogram (Figure 3A). Angioscopy showed mural red thrombi adjacent to the covered struts with thin neoointima at the proximal portion of the SES (Figure 3B). At the mid-portion, nearly all of the struts were covered with thick neoointima or yellow plaques. (Figure 3C). At the distal-portion, both thin neoointima and partially ero-
sive intima were visible around this strut (Figure 3D). Severe mural thrombi were detected and healing outside the distal end of the stent was delayed (Figure 3E).

**DISCUSSION**

Plaque found in old SVG is lipid-rich, soft, friable, and more prone to rupture than plaques of the native coronary arteries. Therefore, SVG intervention is often associated with slow or no-reflow due to distal embolism and can lead to myocardial infarction. Consequently, treatment success has been limited by the high incidence of periprocedural complications.

In recent randomized trials, 4-year target vessel revascularization rates with SES were markedly reduced as compared with BMS in coronary arteries.Meanwhile, DES implantation for diffuse ISR was far superior to POBA, cutting balloon angioplasty (CB), and BMS due to the marked reduction of 6-month repeat-ISR and repeat-target lesion revascularization. Additionally, the rates of overall late and very late stent thrombosis through 4 years were not different between DES and BMS, however, between 1 and 4 years, the rates of stent thrombosis...
were higher for DES. 6

A randomized trial on stent implantation for SVG disease has shown the rate of any possible stent thrombosis in DES was higher than in BMS. One of the predictors for late and very late thrombosis may be SVG stenting. 3 However, the pathogenesis of stent thrombosis in SVG is still not fully understood. SVG are more prone to the progression of atherosclerosis than normal coronary arteries, and this may lead to an enhanced inflammatory and thrombotic reaction after implantation of DES because of the associated drugs and polymers.

In general, veins have a thin muscle media layer and thick adventitia layer, whereas coronary arteries have a well-developed media layer and thinner adventitia. These anatomical features allow veins to undergo “arterialization” when placed as a graft in the arterial system, with morphological changes that include intimal fibrous thickening and lipid deposition due to the abundance of foam cells.

Compared with native coronary arteries, SVG atherosclerosis tends to be diffuse, loosely adherent, and friable. Therefore, not only delayed endothelialization, but also plaque disruption and superimposed thrombi may be present more frequently in the sites of SES implantation in SVG as compared to native coronary arteries.

In our angioscopic studies, the angioscopic view in a SVG is quite different from that in a coronary artery. We have studied SES angioscopically and reported there were hardly any plaques or thrombi in the coronary arteries after a 21-month implantation. 8 In contrast with coronary artery stenting, SVG stenting has multiple yellow vulnerable plaques and red thrombi.

SES implantation for SVG disease may be one of the predictors of late and very late thrombosis because SVG lesions contain a considerable amount of lipids and thrombi, and treatment can often lead to chronic decreased blood flow velocity.

In our case, dual antiplatelet therapy was continued for 14 months. More long-term antiplatelet therapy could potentially benefit the late and very late thrombosis rates of SES implantation in SVGs.

Angioscopy may be a useful tool for evaluating the process of neointimal coverage in SES. Further careful long-term follow-up studies, especially for old SVG cases, are required to elucidate the changes in neointima and residual thrombi.
REFERENCES


