



OCT Characteristics of Saphenous Vein Graft Atherosclerosis

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CORONARY ARTERY BYPASS GRAFTING (CABG) REMAINS A FIRST-LINE TREATMENT FOR CORONARY ARTERY DISEASE, with good long-term clinical outcomes. Although left internal mammary grafts have high long-term patency rates, in current CABG practice the overwhelming majority of patients also require saphenous vein grafts (SVG) as bypass conduits. SVG occlusion following surgery remains a significant limitation of CABG. Serial angiographic follow-up studies demonstrate that approximately 10% of SVG occlude in the first year after which there is a continued attrition which accelerates as grafts age. However, the relationship between angiographic stenosis and SVG occlusion is less clear, since the majority of graft occlusions occur in grafts previously characterized as angiographically normal (1).

We performed elective angiography (n = 42) with optical coherence tomography (OCT) (n = 16) and intravascular ultrasound (IVUS) (n = 21) assessment of patent SVG in asymptomatic patients 3 years after surgery. All aspects of the study were approved by local and national ethical committee. Patients gave written informed consent prior to the procedure. Fifty-five percent of SVGs were occluded (patency rates: 93% left internal mammary artery, 73% right internal mammary artery, 36% radial conduit patency). All patent grafts imaged had variable fibrocellular neointima but no significant stenotic disease. OCT but not IVUS demonstrated findings consistent with thin-cap fibroatheroma (2) in 6 of 16 SVGs and luminal adherent thrombus in 4 of 16 SVGs. These novel features may be important markers of vein grafts vulnerable to future occlusion.

This analysis of SVGs assessed by angiography and endoluminal imaging with IVUS and OCT suggests that following contemporary surgery with appropriate concomitant secondary prevention therapy there remains significant loss of SVG conduits following CABG but with little development of stenotic disease in patent vein grafts after 3 years. OCT, but not IVUS, identifies clear features of atherosclerosis, including circumferential fibrous neointima, thin cap fibroatheroma, and adherent thrombus. Our findings suggest that high resolution imaging techniques such as OCT may begin to allow us insights into the causes of vein graft failure (Figs. 1, 2, and 3)

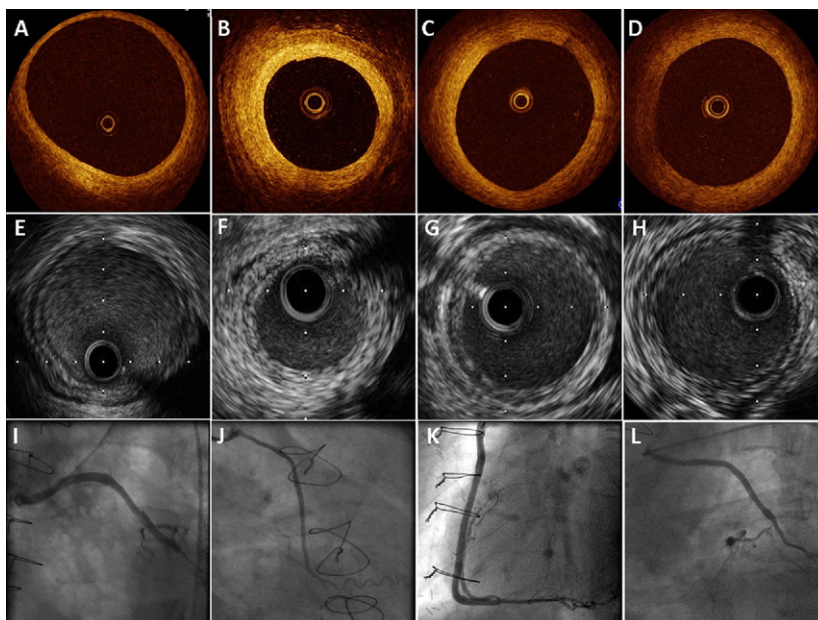


Figure 1. Neointima in Example SVG Shown Angiographically and With OCT and IVUS

Example images by optical coherence tomography (OCT) (A to D) and intravascular ultrasound (IVUS) (E to H) from saphenous vein grafts (SVGs) shown angiographically (I to L) for the same 4 patients. Typical findings were of a double layered appearance of the vein graft vessel wall due to neointima formation within the original vein graft wall. Neointimal thickness varied both between patients and within different segments and sectors of the grafts.

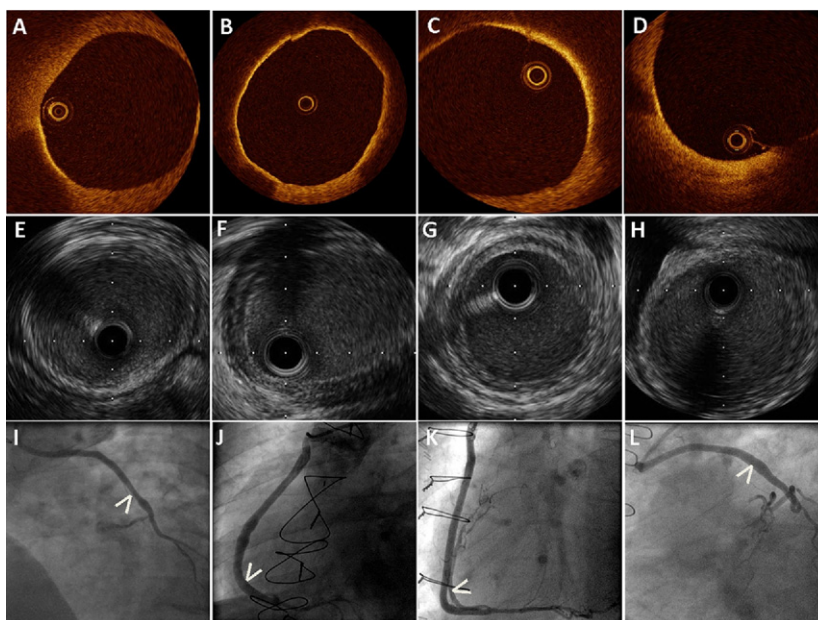


Figure 2. Vein Graft Atherosclerosis

Areas of thin-cap fibroatheroma (TCFA) identified by OCT (A to D) characterized by a thin bright cap at the luminal surface of the SVG vessel wall with effacement of usual defined features deeper in the vessel wall. This OCT feature has been described in native coronary arteries and correlated histologically with the TCFA overlying a lipid rich plaque and may be particularly associated with plaque of high macrophage content (2). OCT features of TCFA were identified in 6 of 16 SVGs assessed with 3 SVGs extensively affected and 3 showing isolated plaques only. Examples affecting either local segments (A, D) or almost concentric involvement (B) are shown. IVUS images from the same segments of the same SVGs do not show a clear definable abnormality (E to H). Angiographically (I to L) SVGs showed only minor irregularity without significant stenotic disease and no specific features at the site of TCFA on OCT (arrows). Abbreviations as in Figure 1.

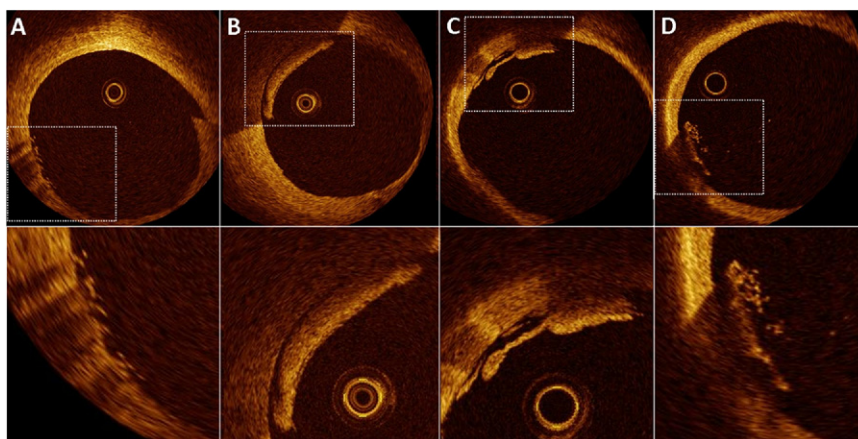


Figure 3. Luminal Adherent Thrombus

Bright free floating densities attached to the luminal surface are demonstrated from 4 different SVGs (A to D). These cast an optical shadow on deeper structures of the vessel wall and appear consistent with luminal thrombus. All patients were taking Aspirin. No IVUS or angiographic abnormalities were seen in the corresponding segments of the SVG imaged by these modalities. Abbreviations as in Figure 1.

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