ECG-gated multi-detector computed tomography for failure of conventional coronarography to detect intraluminal thrombus in saphenous vein graft

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The rate of saphenous vein graft (SVG) failure is ~40% at 5 years. Thrombus formation is largely involved in SVG disease and occurrence of acute coronary syndromes. There is no uniform angiographic definition of intracoronary thrombus, and even if the strictest angiographic criteria require the observation of definite, intraluminal, globular filling defects seen in multiple angiographic views, these images are not present in all cases. Numerous studies have demonstrated the poor sensitivity of angiography for detecting intracoronary thrombi (as low as 20%). The sensitivity is particularly low when the thrombus is located inside the lumen of the artery. The use of intravascular ultrasound enables the assessment of normal and pathological arterial segments, but does not distinguish between thrombus and ‘soft’ plaque. Moreover, the introduction of the IVUS catheter in a vessel containing a thrombus may be complicated by distal embolization. ECG-gated multi-detector computed tomography may be helpful in detecting the thrombus in SVGs, especially when the thrombus is intraluminal, surrounded by contrast, and consequently invisible with angiography. Maximum intensity projection (MIP) should not be used to detect intraluminal thrombus, as it has the same limitations as angiography (projection of a three-dimensional structure on a single plane).

A 71-year-old man was admitted to the intensive care unit with typical angina, a slightly elevated troponin level (4.5 μg/L; normal value <0.2 μg/L), and new V5–V6 negative T-waves on a 12-lead ECG. He had a history of surgical, coronary revascularization, with an internal mammary artery graft to the left anterior descending artery and two SVGs to the right coronary artery and the left obtuse marginal 5 years previously. A coronary artery angiography was performed with a digital flat panel detector and showed three patent grafts with no significant luminal narrowing in the post-anastomotic native vessels. A hypodense zone on the middle part of the graft to the obtuse marginal was observed in only one view (Panel A). To clarify this image, and given that the intravascular ultrasound system was not available in the cardiac catheterization laboratory at this time, a 16-slice computed tomography with retrospective ECG gating was obtained and revealed a very long intraluminal thrombus in the marginal graft. As with angiography, the thrombus was not observed with the MIP view (Panel B), but was well enhanced by multi-planar reformation in short- and long-axis views (Panels C and D). The patient was treated with therapeutic doses of low-molecular-weight heparin, clopidogrel, and aspirin and has remained free of symptoms at 1 year with total resorption of the thrombus. This case highlights the limitations of two-dimensional angiography and supports the development of computed tomography for the precise diagnosis of thrombus burden in SVGs.

Panel A: Angiogram of saphenous vein graft to left obtuse marginal (right anterior oblique view +10°) showing only hypodensity in its middle part. TIMI flow grade III.

Panel B: Multislice Spiral CT with MIP reconstruction in the same view than the angiogram showing any thrombus or filling defect in the graft.

Panels C and D: Multislice Spiral CT with multiplanar reformation showing the graft in long axis view (D) with a voluminous thrombus in the lumen. The short axis view (C) shows the thrombus centered in the lumen surrounded by contrast material.

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