Computed tomography angiography-guided recanalization of saphenous vein graft chronic total occlusion

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Abstract

Computed tomography (CT) angiography can augment conventional coronary angiography relative to length of vessel occlusion and quality of distal run-off. In this case report we describe the significance of CT angiography in the revascularization decision-making process of a patient following occlusion of both coronary artery bypass grafts.

Key words: computed tomography angiography, coronary artery bypass graft occlusion, percutaneous coronary intervention.

Introduction

Computed tomography (CT) coronary angiography has been shown to provide highly accurate diagnostic assessments of arterial and venous bypass graft stenosis [1-3]. We report a case that demonstrates the value of CT angiography in the revascularization decision-making process for a patient with an occlusion of both saphenous vein grafts (SVG).

Case report

A 56-year-old man with a history of type 2 diabetes mellitus, obesity (BMI = 30 kg/m^2), arterial hypertension, hyperlipidaemia, and myocardial infarction was admitted for angina pectoris. The patient underwent coronary artery bypass surgery in 2000; he received two saphenous vein grafts (SVG), one to the left anterior descending (LAD) artery and one to the right coronary artery (RCA). Coronary angiography revealed both totally occluded SVG (Figures 1, 2 A) and echocardiography showed dysfunction of the left ventricle (ejection fraction 40%, and severe hypokinesis of the anterior and inferior walls).

To properly evaluate the possible options (a second CABG or PCI), CT angiography was indicated to visualize the periphery of the occluded vein grafts and patency of the left internal mammary artery (LIMA). The investigation was performed on a Dual Source CT (Somatom Definition, Siemens, Germany) and revealed a 20 mm long occlusion in the SVG to the LAD; however, the remainder of the SVG appeared to be in good condition. The scan also revealed complete proximal occlusion of the SVG to the RCA (Figure 3) and the LIMA. On the basis of the CT angiography results, the planned strategy was to reopen the total occlusion of SVG to LAD and the native RCA.

A 6 Fr LCB guiding catheter was inserted into the ostium of the SVG to the LAD and the occlusion was crossed with PT Graphix wire (Boston Scientific Corp., U.S.A). The vessel was opened with a 1.1 × 12 mm NIC balloon (Schwaiger Medica, Switzerland) and the lesion was covered with a 3.5 × 28 mm drug-eluting (BioMatrix^{R}) stent (Biosensors International, Switzerland). TIMI 3 flow in the LAD periphery was successfully restored at the end of the procedure (Figure 2 B) without any evidence of distal embolization or slow flow. The attempt to open the native RCA was unsuccessful because it was impossible to cross the lesion. Total fluoroscopic time was 19 min and 160 ml of contrast dye was used. The patient was discharged in good condition the day after the procedure without clinical or laboratory evidence of myocardial necrosis. Myocardial perfusion scintigraphy (Tc-99m sestamibi) was performed 6 weeks after stenting, using a two-day protocol. Images along the horizontal long axis demonstrated decreased activity in the septal region and apex on stress, but without change during rest, which was consistent with a fixed perfusion defect. No evidence of ischaemia was revealed. The patient did not

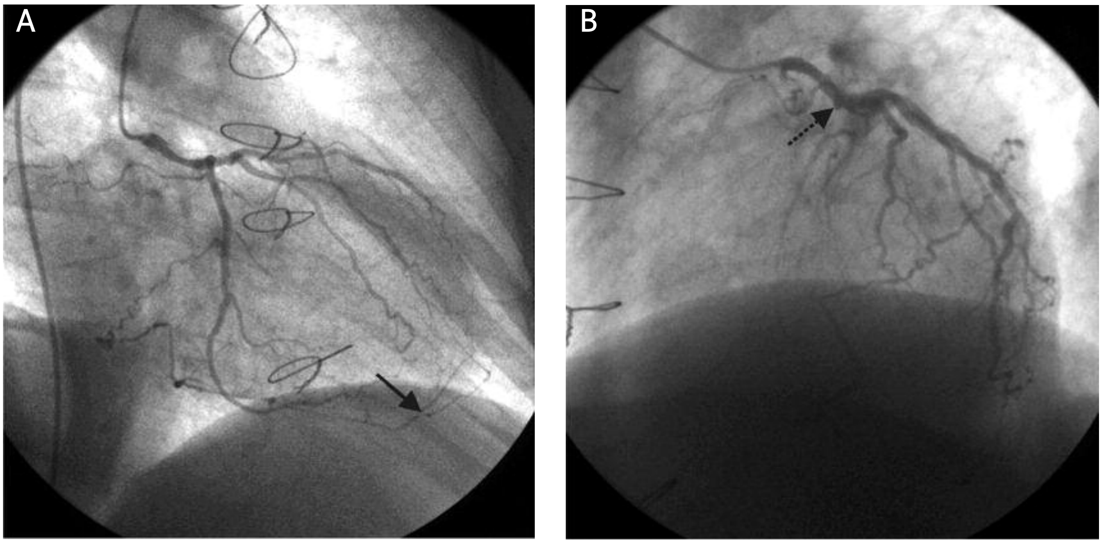

Figure 1. Coronary angiography (**A** – right anterior oblique 30°/0°, **B** – left anterior oblique cranial 45°/25°) with proximal occlusion of the left anterior descending artery (LAD) (B – dashed arrow). Good collateral filling of the LAD periphery and the right posterior descending artery can be seen (A – unbroken arrow)

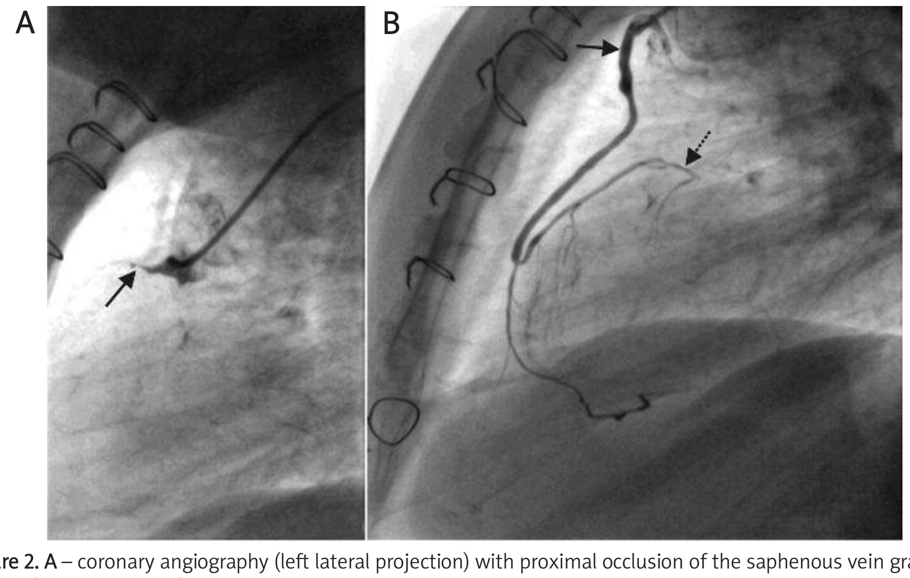

Figure 2. A – coronary angiography (left lateral projection) with proximal occlusion of the saphenous vein graft (SVG) to LAD (unbroken arrow). **B** – SVG to LAD after successful recanalization. The unbroken arrow points to the site of former SVG occlusion, dashed arrow points to the proximal part of LAD just below the native vessel occlusion

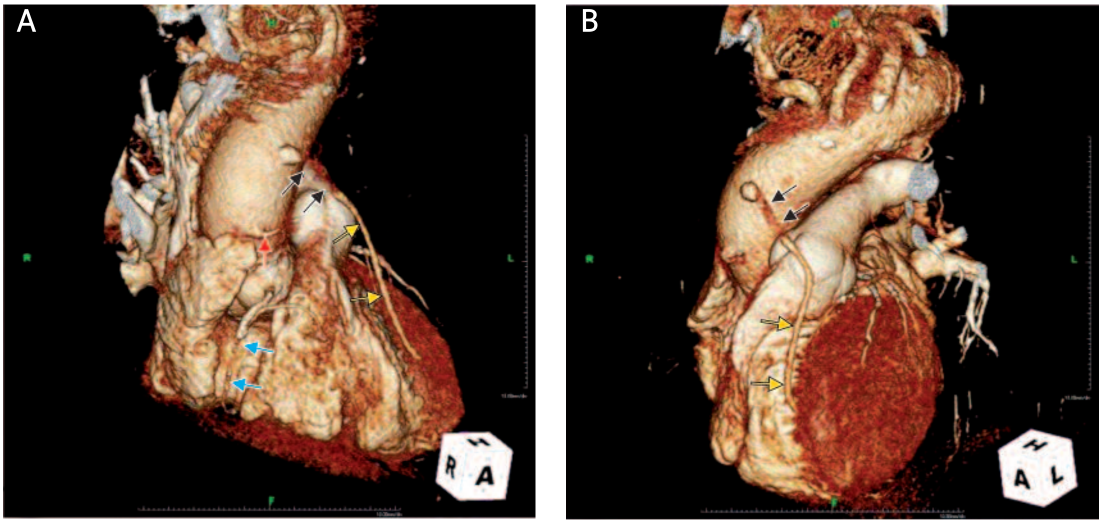

Figure 3. Computed tomography angiography revealed only a short occlusion of SVG to LAD (black arrows), the distal part of SVG without evidence of stenosis (yellow arrows), stump of SVG to the right posterior descending artery (red arrow) and the right coronary artery occlusion (blue arrows)

complain of any angina pectoris during follow-up. The function of the left ventricle did not improve. As a consequence, no further invasive interventions were planned and the patient was treated using a conservative (pharmacotherapy) strategy.

Discussion

In clinical practice, conventional coronary angiography represents the gold standard for coronary artery disease imaging. The limitation of coronary angiography is an inability to precisely assess occlusion length and evaluate collateral supply in the vessels distal to the occlusion. Computed tomography angiography enables comprehensive visualization of grafts and coronary arteries, including occlusion length and quality of distal run-offs. In this case we demonstrated that CT angiography is superior to conventional coronary angiography to reveal the periphery of an occluded SVG and that is why it can be a valuable instrument in evaluating treatment strategies.

For patients with SVG occlusions, it can be difficult to decide which revascularization strategy is best [4]. In this frequently older group of patients with increased morbidity, percutaneous revascularization has fewer procedural risks and may be preferred; on the other hand, there is a higher probability of complete revascularization associated with surgery. Even so, in a recent paper by Yap *et al.* [5], mortality of repeat coronary artery bypass grafting remains more than double that of first-time CABG (4.8% vs. 1.8%, $p < 0.001$). Moreover, the AWESOME trial [6], the first randomized trial comparing CABG to PCI in post-CABG patients, showed comparable 3-year survival rates in CABG and PCI groups (73% and 76% respectively, p = NS).

The advantage of CT angiography is its non-invasive nature. It allows integral evaluation of grafts and coronary arteries [1-3]. Moreover, it has been suggested that the occlusion length can be more precisely determined using CT angiography. Occlusion length > 15 mm and severe calcification identified by CT angiography have been shown to be independent negative predictors of PCI on chronic total occlusions (CTO) [7]. Computed tomography angiography accurately identifies the CTO route, evaluates both distribution and amount of calcified plaque and thus increases PCI success even in complicated and/or calcified lesions [8]. The disadvantage of CT angiography is increased radiation exposure and an additional 100 ml of contrast media; this is especially true when the diagnostic procedure is followed by an intervention. Nevertheless, new techniques for reducing radiation doses, such as ECG-pulsed modulation of the tube current [9], are continually developing.

In conclusion, we demonstrated the feasibility of using CT angiography to provide supplemental information regarding occlusion length and distal run-off compared to conventional coronary angiography, ultimately facilitating the decision making process and impacting the procedural success of SVG recanalization.

Acknowledgments

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