

Case Report

Imaging of a coronary artery bypass graft during coronary sinus venography

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Summary

Retrograde coronary sinus perfusion to maintain viability during cardiac surgery means that a connection via the capillary system to the coronary arteries, and potentially bypass grafts, may be possible. Coronary sinus (CS) venography prior to resynchronisation therapy in this patient with previous bypass grafting was associated with visualisation of these grafts.

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The use of the coronary sinus to enable maintenance of myocardial viability during cardiac surgery has been known for some time.¹ This means that retrograde blood flow from the coronary sinus to the myocardial micro-vascular bed and the coronary capillary system must be possible. Retrograde flow to the coronary arterial system may also be possible since this is clearly in continuity with the coronary capillary system. Continuity of blood vessels also means that coronary sinus (CS) venography in patients with severe coronary artery disease and previous coronary artery bypass grafting (CABG) may be associated with visualisation of parts of the arterial system of the heart, as well as their associated bypass grafts.

Case report

A 65-year-old man was referred to the Department of Electrophysiology for assessment for a biventricular ICD system. In 1995 he had suffered a large anterior myocardial infarction, complicated by ventricular fibrillation. In 2002 he underwent a CABG for triple-vessel disease with poor left ventricular (LV) function. He received a left internal mam-

mary artery (LIMA) graft to the left anterior descending artery (LAD), and vein grafts to the diagonal branch of the LAD, obtuse marginal branch of the circumflex artery and the posterolateral and posterior descending branches of the right coronary artery.

Following surgery he had numerous admissions for heart failure and had been assessed for transplantation, but was not placed on the waiting list. In view of the recurrent heart failure despite maximal medical therapy, evidence of an extremely broad QRS complex with an LBBB-type morphology, as well as clear intra-ventricular dyssynchrony on echocardiography, a biventricular pacing system with back-up ICD was thought necessary and a bridge to eventual transplantation.

During an otherwise unremarkable and successful implantation, a coronary sinus venogram was performed to delineate the venous anatomy before LV lead placement. An occluding balloon catheter (Attain Venogram Balloon Catheter, 6215, Medtronic Inc) was inserted through a guiding sheath, and after inflation of the balloon in the mid CS, a hand injection of contrast was given. At review of the angiogram after the procedure, it was noted that there was retrograde filling of arterial structures as well as of a vascular structure above the level of the aortic cusps, which was presumed to be a venous bypass graft, possibly that anastomosed to the obtuse marginal branch (Figs 1 and 2).

Discussion

Perfusion of a vascular bed, whether anterograde or retrograde, depends on determinants of flow, such as pressure gradients and resistance. The usefulness of retrograde coronary cardioplegia during cardiac surgery has been recognised for many years, particularly in cases where anterograde flow may be significantly impaired.^{1,2} It has been shown to restore blood flow to ischaemic tissue, reduce infarct size and improve left ventricular pump function in animal studies.³⁻⁵ This is especially true when coronary sinus ostial occlusion is also performed.⁶ Studies on hearts explanted at the time of transplant surgery have shown that retrograde blood cardioplegia administered into the coronary sinus is

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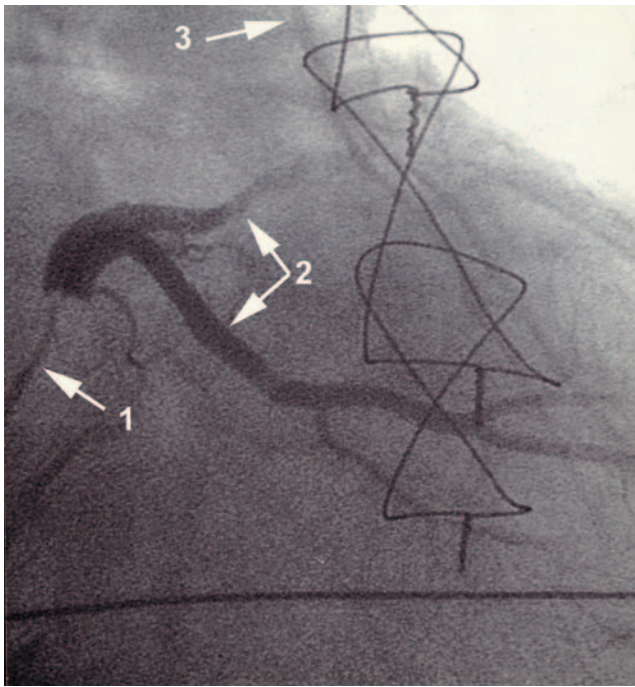


Fig. 1. Coronary sinus angiogram in anteroposterior view showing contrast delivered through the balloon catheter (1) filling the coronary sinus (2). There is subsequent late-phase filling of the coronary arterial system and then a venous bypass graft (3)

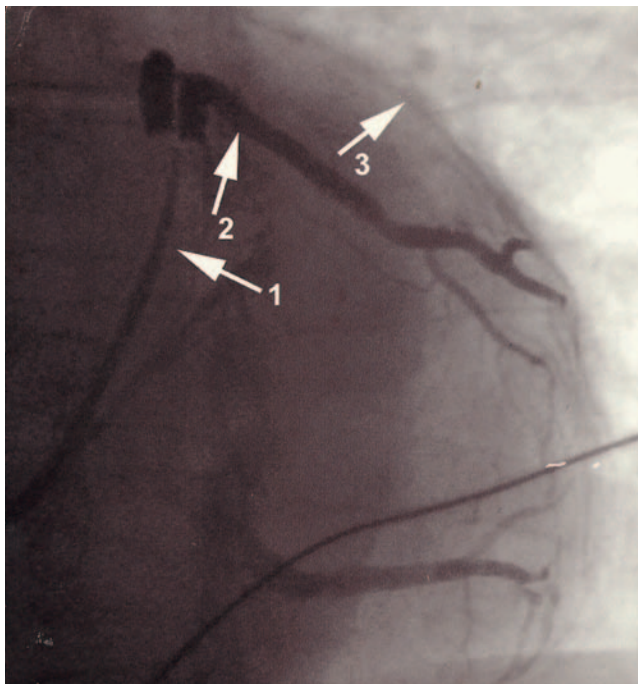


Fig. 2. Coronary sinus angiogram in left anterior oblique (35 degrees) view showing contrast delivered through the balloon catheter (1) filling the coronary sinus (2). There is subsequent late-phase filling of the coronary arterial system and then a venous bypass graft (3)

able to produce sufficient capillary blood flow to exceed the metabolic requirements of the left ventricle, septum, apex and posterior RV wall, although the blood supply to the rest of the RV is tenuous.^{7,8}

In this case, during occlusion CS angiography, the bypassed area of myocardium filled retrogradely from the coronary sinus, with associated retrograde filling of a venous graft. This suggests some impediment to anterograde flow in the graft as well as the native coronary arterial system. As far as we were able to ascertain, this is the first description of visualisation of part of the coronary arterial anatomy and an associated venous bypass graft during CS venography. Given what we know from the surgeons who have used this route for years to perfuse hearts during surgery, and that electrophysiologists frequently visualise the coronary sinus during electrophysiological studies and left ventricular lead implantations,^{9,10} there are undoubtedly others who have seen this phenomenon. Visualisation of the graft during venous injection could conceivably be seen after anastomosis of a graft to a venous structure, but this would be an arterio-venous connection and would be associated with significantly different angiographic features.

While late-phase coronary angiography has always been used to identify the course and position of the coronary sinus, the inverse has never previously been described.

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