

## IMAGING GAMUT

# A novel case of orthostatic myocardial ischaemia

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**Key words:** *postural myocardial ischaemia, Thallium scan, postoperative angina, coronary bypass.*

**Background** A 69-year-old man had a triple coronary bypass surgery with saphenous vein grafts to the left anterior descending (LAD), non-dominant right coronary artery (RCA) and the left circumflex (LCx) arteries, with excellent symptomatic relief. However, the patient was known to have very mild aortic stenosis that subsequently became severe with the patient reporting exertional angina.

During aortic valve replacement surgery, the vein graft to the RCA was found to be occluded, but the vein grafts to the LAD and the LCx were patent. Unfortunately, despite aortic valve replacement, the patient reported worsening angina. A repeat angiography again showed patent vein grafts with excellent flow. However, the LCx graft had a definite stenosis fairly proximally and the LAD graft showed a patch of irregularity without narrowing.

Another bypass surgery was performed and the left internal mammary artery (LIMA) was sutured to the LAD distal to the point of entry of the vein graft. The stenosis in the graft to the circumflex artery was bypassed with a vein segment giving the graft two ostia from the aorta.

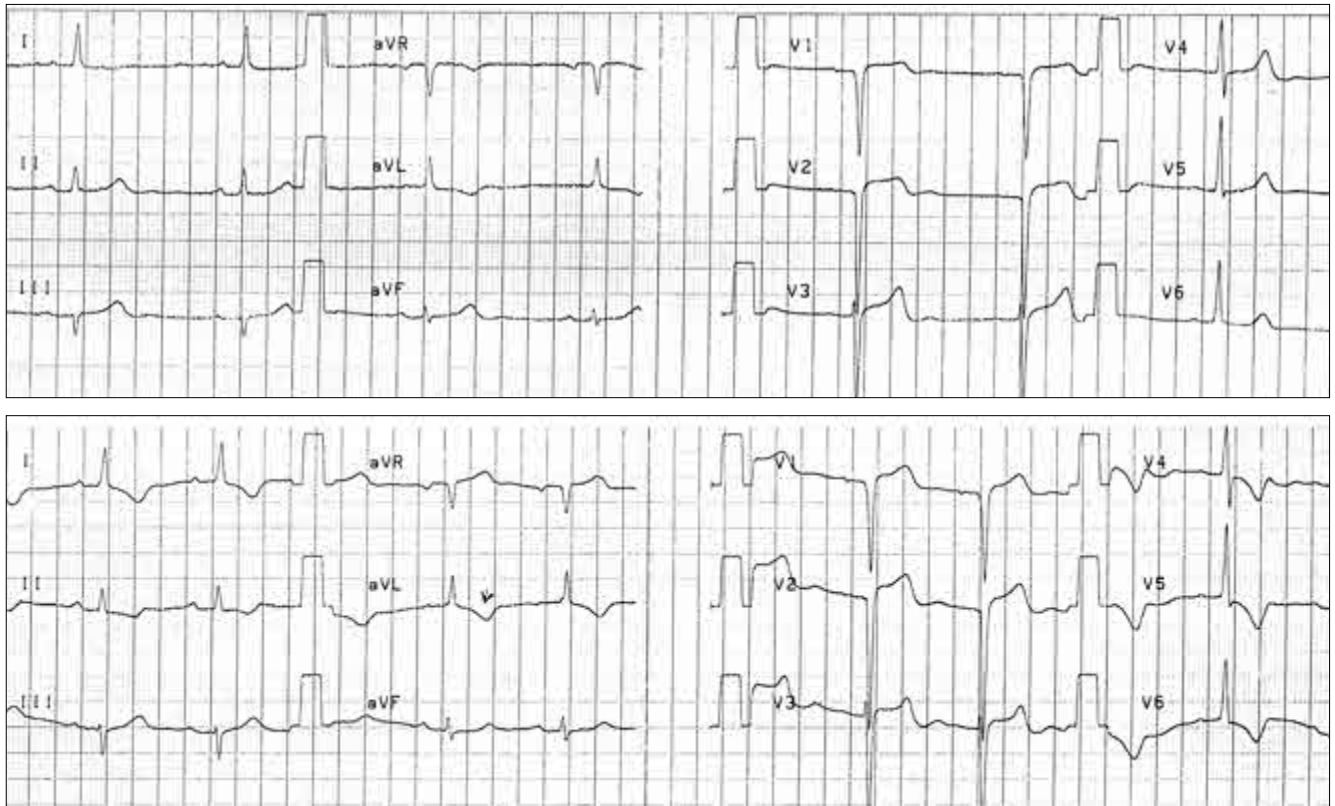
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Immediately following the third operation, the patient's symptoms changed dramatically. He made a rapid recovery and went home after about one week but quickly got in touch again to say that he now had angina on standing as well as on walking.

After a particularly bad bout of pain, the patient was admitted to the hospital and re-investigated with another angiogram that showed occlusion of RCA graft but the other two grafts were patent. It was initially thought that the patient's exertional angina was a result of coronary steal syndrome caused by non-ligated side branches of the LIMA graft [1-3]. Nonetheless, the patient's symptoms progressed with the pain steadily increasing in intensity on assuming the erect posture. However, he could walk without pain using an improvised trolley by positioning his chest horizontally on the trolley. His 12-lead ECG, acquired in the erect posture, showed progressive elevation of ST segments plus gradual prolongation of the QRS. Conversely, the ECG reverted back to normal, when the patient lied down and his angina abated. The patient was referred for myocardial perfusion scintigraphy for further investigation.

**Procedure** A baseline ECG was obtained with the patient in the supine posture, which showed a negative T wave in aVL with a biphasic T in lead I, but was otherwise normal (Figure 1A). The patient was next asked to acquire the posture which resulted in angina. The patient sat erect on the imaging table with his arms raised, which was associated with significant chest pain. <sup>201</sup>Tl-thallos chloride



**Figure 1** (Top) ECG obtained with the patient in the supine posture showing a negative T wave in aVL with a biphasic T in lead I but is otherwise normal; (Bottom) ECG obtained with the patient sitting erect with his arms raised with the patient experiencing maximal angina showing negative T waves in leads I, II, aVL & V4-V6 with 1-mm ST depression in leads V5 and V6

(75 MBq) was injected intravenously in this posture, and a second ECG obtained. The ECG now showed negative T waves in leads I, II, aVL, & V4-V6, with 1-mm ST depression in leads V5 & V6 (Figure 1, bottom row).

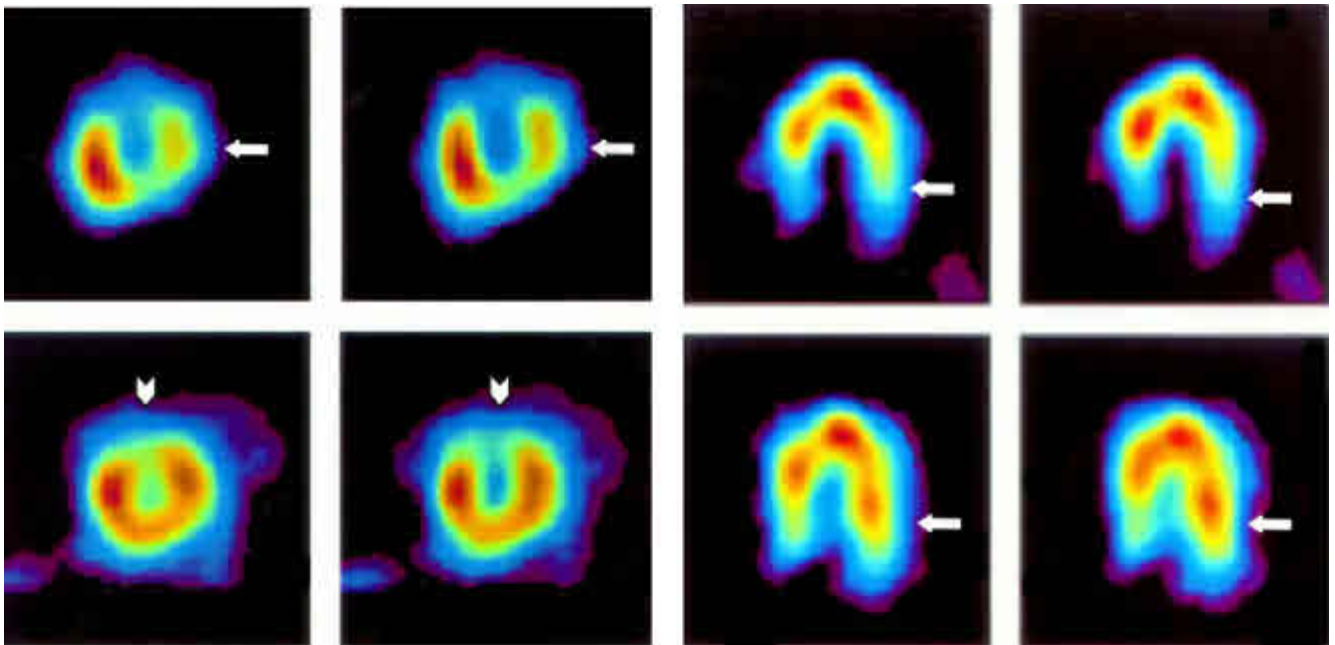
Myocardial perfusion scan was immediately performed. Delayed redistribution/reinjection SPECT scan was performed three hours later, 30 minutes after re-injection of 30 MBq of Tl-201 with the patient in the supine posture.

**Findings** Both studies showed a fixed perfusion defect involving the anterior wall. The first study showed moderately reduced uptake in the distal part of the lateral wall (Top row, Figure 2), which was seen to normalise on the re-injection rest scan (Bottom row, Figure 2).

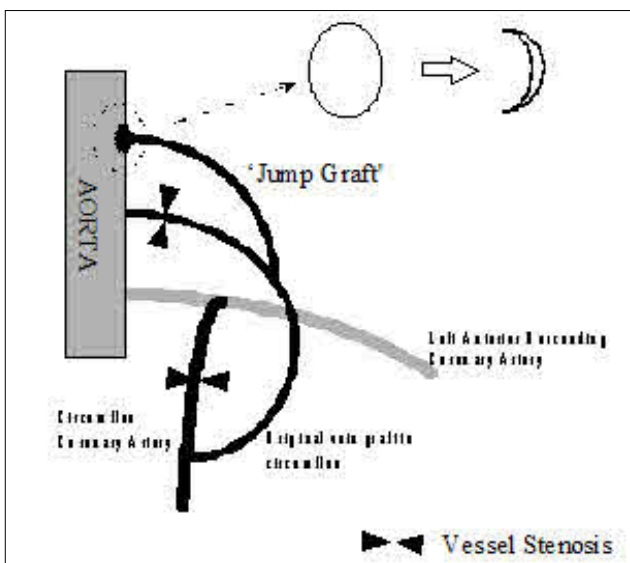
**Conclusion** The scan appearances were consistent with irreversible ischaemia in the anterior wall with significant posture-induced reversible myocardial ischaemia in the lateral wall.

In order to investigate the cause for the posture-related ischaemia in the lateral wall, intravascular ultrasound was performed, which showed the ostium of the jump graft to the circumflex changing from circular to semilunar during the cardiac cycle (Figure 3).

Subsequently, placement of an intravascular stent completely resolved the orthostatic symptoms. The combination of the functional myocardial perfusion assessment by Thallium



**Figure 2** Thallium scintigraphy demonstrating orthostatic myocardial ischaemia with two short axis images on the left and two vertical long axis slices on the right. Top row shows images from the first scan showing moderately reduced uptake in the lateral wall and the vertical long axis slices (arrows). The bottom row shows normal uptake in the region of the lateral wall on the second scan (arrows). Both studies showed a fixed perfusion defect involving the anterior wall (chevrons)



**Figure 3** Post operative anatomy of the circumflex coronary artery and grafts. A stenosis in the original vein graft is bypassed by a second "jump graft". The proximal anastomosis of the "jump graft" (with the aorta) changes configuration according to the cardiac cycle, as shown in the schematic

SPECT myocardial perfusion scintigraphy and the structural assessment by intravascular ultrasound, were complementary, allowing accurate diagnosis of the cause of the patient's symptoms.

**Comments** Coronary steal syndrome caused by non-ligated side branches of the LIMA graft is an occasional cause of post-surgical exertional angina in patients after coronary bypass surgery [1-3]. However, in this particular case, the patient complained of posture-related rather than exertional angina, which was found to be related to the change in the luminal diameter of the grafted vessel with the change in posture. This novel case of postural or orthostatic angina presumably has not been reported previously.

**References**

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