Surgical salvage of left internal mammary artery graft ostial stenosis

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The authors attest they are in compliance with human studies committees and animal welfare regulations of the authors' institutions and Food and Drug Administration guidelines, including patient consent where appropriate.

Disclosures: The authors reported no conflicts of interest.

The *Journal* policy requires editors and reviewers to disclose conflicts of interest and to decline handling or reviewing manuscripts for which they may have a conflict of interest. The editors and reviewers of this article have no conflicts of interest.

Received for publication March 1, 2022; revisions received May 10, 2022; accepted for publication May 25, 2022; available ahead of print June 1, 2022.

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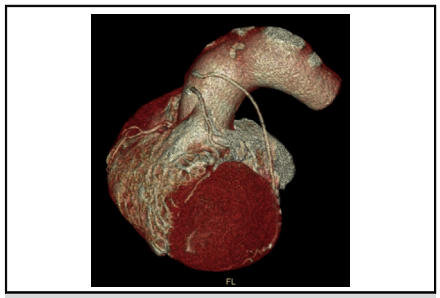
JTCVS Techniques 2022;14:119-21

2666-2507

https://doi.org/10.1016/j.xjtc.2022.05.018



Coronary CT angiogram showing salvaged LIMA graft as a free graft to the aorta.

CENTRAL MESSAGE

Late angiography may cause traumatic occlusive injury to LIMA graft inflow, inducing recurrent angina. Technical solutions include mobilization as a free graft and direct aortic inflow anastomosis.

CASE REPORT

A 62-year-old gentleman with coronary artery disease underwent minimally invasive single coronary artery bypass grafting 14 years ago via left anterolateral thoracotomy. The patient was asymptomatic until developing anginal symptoms 10 years later. Repeat angiography showed a widely patent left internal mammary artery–left anterior descending artery (LIMA-LAD) graft (Figure 1, *A*) and a new moderate lesion in the obtuse marginal artery (OM), which was treated medically. The patient was asymptomatic until current presentation with 2 weeks progressive angina.

During diagnostic angiography, the LIMA graft could not be cannulated at its origin from the subclavian artery. In addition, the lesion in the OM had progressed to be severely stenotic. (Figure 1, *B*). The LIMA-LAD graft was further assessed with cardiac computed tomography (CT). Imaging revealed the ostial LIMA occlusion but good reconstitution distally (Figure 2, *A*). Echocardiogram showed preserved ventricular function and no valvular disease, and preoperative CT scan showed no evidence of subclavian disease.

After unsuccessful percutaneous coronary intervention, surgical revascularization was the best option. Following full sternotomy, the LIMA was identified between the pulmonary artery and the apex of the left lung and dissected carefully from distal anastomosis to left subclavian vein and transected proximally. Excellent back bleeding confirmed patency of the graft and the anastomosis. The mobilized LIMA was of sufficient length for use as a free graft from the ascending aorta. The left radial artery (RA) was harvested simultaneously for OM bypass. Cardiopulmonary bypass was initiated via central cannulation and the heart was arrested with a single dose of del Nido cardioplegia in preparation for the procedure. The RA was anastomosed to the OM distally and then to aorta proximally. Finally, the mobilized free LIMA graft was anastomosed directly to the ascending aorta.

After completion of the procedure, the patient was weaned from cardiopulmonary bypass with no complications. Intraoperative transit time flow measurement showed good flow in both grafts. The patient had an unremarkable postoperative course and with complete resolution of anginal symptoms. Cardiac CT was repeated 8 weeks postoperatively and showed widely patent free LIMA-LAD and RA-OM bypasses (Figure 2, *B*).

DISCUSSION

Our patient presentation was unusual in both timing and location of stenosis. The majority of significant LIMA disease occurs distally or in the body of the vessel. The patient did not present with anginal symptoms until 14 years after the original coronary artery bypass grafting, despite the

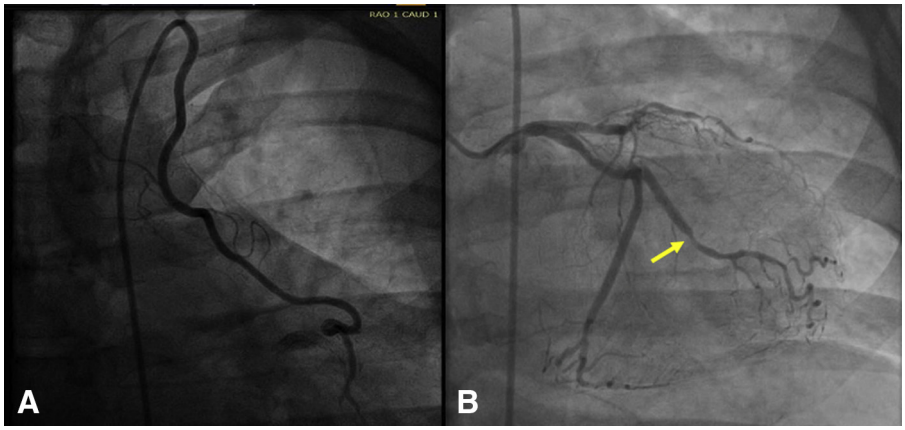


FIGURE 1. A, Coronary angiogram at patient presentation 3 years ago showing widely patent LIMA-LAD graft. B, Coronary angiogram at current presentation showing progression in the OM lesion. *LIMA*, Left internal mammary artery; *LAD*, left anterior descending artery; *OM*, obtuse marginal artery.

LIMA-to-LAD bypass being shown to be patent 10 years postsurgery. The etiology and incidence of ostial LIMA stenosis is unclear but is often iatrogenic.

After unsuccessful percutaneous coronary intervention, various surgical revascularization strategies for ostial LIMA occlusion have been reported, but none with recycling of the LIMA.[1-3] Candidate arterial conduits for redo surgical intervention in this patient included mobilization and recycling of the LIMA as a free graft, use of the RIMA, or another RA. With no evidence of distal disease, we decided the LIMA was the optimal conduit for bypass. Although technically challenging, free (aortocoronary) internal mammary artery (IMA) grafts performed correctly are a reliable, reproducible bypass option.[4] Its recycling allows for use of an already-mature arterial graft and saves cardiopulmonary bypass time by excluding the need for another distal anastomosis. Furthermore, late survival and need for repeat revascularization are not affected by using the IMA as a free graft versus in situ.[5] Of note, the RIMA is equal to the LIMA, both in situ and as a free graft, in terms of long-term graft patency, as long as it can comfortably reach the target without tension.[6,7] Our patient's anatomy favored recycling the LIMA, with proximal anastomosis at either the aorta or the proximal hood of the RA graft. It is our usual practice to use the aorta as an inflow source when using a free LIMA graft with the proviso that the aorta is soft and of normal caliber. Our patient's aorta met these criteria, serving as an excellent inflow source for our free LIMA graft.

Whenever possible, we strive for all arterial, preferably IMA bypass, and thus did not consider another RA or saphenous vein grafts. In addition, our patient's original operation was done through left minithoracotomy, and so mobilization of the LIMA was not as challenging as if the original

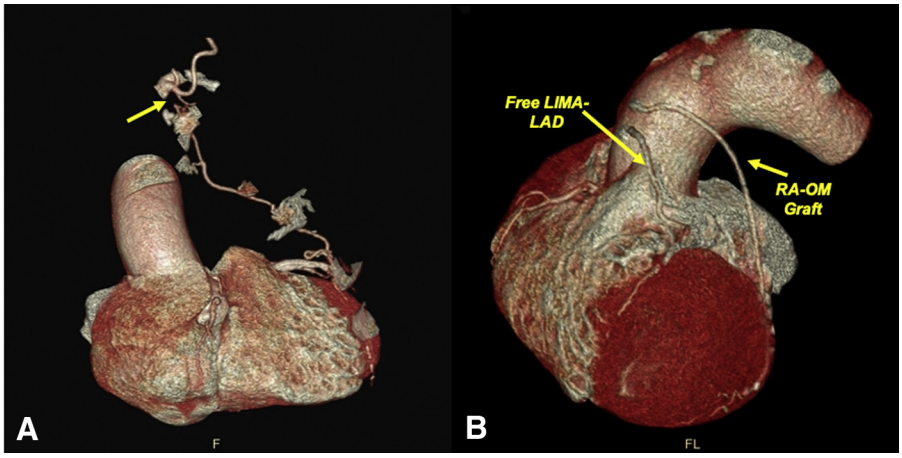


FIGURE 2. A, Cardiac CT imaging revealed the LIMA occluded at its origin, with good reconstitution distally. B, Cardiac CT repeated 8 weeks postoperatively after LIMA graft salvage showed widely patent LIMA-LAD and RA-OM bypasses. *LIMA*, Left internal mammary artery; *LAD*, left anterior descending artery; *RA*, radial artery; *OM*, obtuse marginal artery; *CT*, computed tomography.

operation were done through full sternotomy. Intraoperative transit time flow measurement is essential to verify graft patency, especially since the body of the graft may have been unknowingly accidentally damaged during extensive LIMA mobilization from the subclavian artery to the LAD anastomosis. Verifying satisfactory back bleeding after transection also helps confirm patency of the anastomosis and salvaged LIMA segment. Although mobilization and salvage of the LIMA graft in a reoperation is technically challenging, it served as an excellent option for this patient.

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