

Two-Vessel Off-Pump Coronary Artery Bypass Grafting by Left Thoracotomy in a Complex Reoperative Case

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ABSTRACT

An 83-year-old male with a history of three prior sternotomies, including coronary artery bypass surgery (CABG), presented with unstable angina. Cardiac catheterization showed left main and triple-vessel disease. The saphenous vein graft (SVG) to the right coronary artery was diseased but patent, and the SVG to the left anterior descending artery (LAD) was occluded. Preoperative evaluation showed a heavily calcified ascending aorta and minimum disease on the descending aorta. He successfully underwent a left thoracotomy 2-vessel off-pump CABG using the descending aorta for the proximal anastomosis. The left thoracotomy approach is a useful alternative to avoid complications associated with re sternotomy, especially in patients with a hostile chest, although visualization of the target vessels may be limited.

INTRODUCTION

The risks associated with redo coronary artery bypass grafting (CABG) are significantly higher than those with primary CABG [Nishi 2010]. Injury to patent grafts during re sternotomy, especially the left internal mammary artery (LIMA) graft to left anterior descending artery (LAD), could have catastrophic consequences [Gillinov 1999]. Left thoracotomy is an alternative technique for coronary revascularization to avoid such complications associated with re sternotomy. Situations such as calcification of the ascending aorta and previous mediastinitis favor the use of the left thoracotomy approach. Revascularization of the circumflex territory via a lateral thoracotomy has been reported previously [Baumgartner 1991]. However, reports of revascularization of the LAD combined with circumflex artery territory via left thoracotomy approach are rare [Azoury 2001]. We successfully performed an off-pump CABG by left thoracotomy in a

complex redo case, revascularizing the LAD and obtuse marginal branch (OM) in an 83-year-old-man who had CABG and aortic valve replacement (AVR) in the past with a heavily calcified ascending aorta.

CASE REPORT

An 83-year-old male presented with unstable angina, and had a history of multiple previous coronary interventions: CABG 20 years ago, redo CABG the following year due to graft failure, and an AVR with a mechanical valve 12 years ago. His symptoms continued despite pharmacologic management including intravenous heparin and nitroglycerin. Cardiac catheterization showed 70% stenosis of the distal left main, 80% stenosis of the mid LAD stent that was placed 6 months ago, 75% stenosis of the ostium of the left circumflex artery, and occlusion of the first OM and proximal right coronary artery (RCA). The previous saphenous vein graft (SVG) to the RCA was diseased but patent; however, the SVG to the LAD was completely occluded. An echocardiography showed normal left ventricular function.

Due to the location and nature of the lesions, along with a recent history of early stent restenosis, repeat catheter intervention was not considered to be suitable for him. Cardiac surgery was considered for possible surgical revascularization. A left thoracotomy off-pump CABG was planned, given his history of three prior sternotomies and a heavily calcified ascending aorta shown on his CT scan (Figure 1), yet minimal disease in the descending aorta.

Following double lumen endotracheal intubation, the patient was placed in a supine position to harvest the saphenous vein and left radial artery. After harvest site closure, the patient was repositioned to the right lateral decubitus position with the pelvis corkscrewed to permit femoral access. A left posterolateral thoracotomy through the fifth intercostal space was performed. The ventilation to the left lung was suspended, adhesions between the lung and the chest wall were dissected, and the descending aorta was exposed. The pericardium was opened longitudinally anterior to the phrenic nerve and the adhesions were dissected to visualize the first marginal artery and the LAD.

A small soft spot in the descending aorta was identified and Heartstring (Maquet Inc, Wayne, NJ, USA) was used to facilitate

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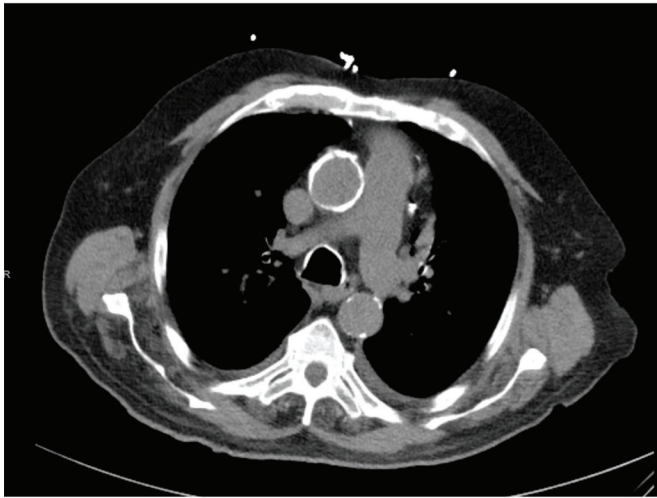


Figure 1. Preoperative CT scan of the chest shows severe calcification of the ascending aorta (left), and mild disease on the descending aorta.

the proximal anastomosis to the aorta without clamping. The anastomosis of the saphenous vein to the descending aorta was completed. The first marginal artery was stabilized with the suction-stabilizing device (Acrobat, Maquet Inc). An intracoronary shunt was used to preserve the distal perfusion during the coronary anastomosis. An end-to-side anastomosis using the saphenous vein to the OM was completed on the beating heart (Figure 2). The heart was repositioned to expose the LAD, and an end-to-side anastomosis was completed between the radial artery and the LAD. The radial artery was brought off of the side of the vein graft and sutured, as there was not enough length for the radial artery to reach the descending aorta. Once the grafting was completed, the left lung was reexpanded and heparin was reversed with protamine sulfate. Chest tubes were placed and the thoracotomy was closed in layers.

The postoperative course was complicated, with aspiration pneumonia leading to prolonged ventilator support and tracheostomy. The overall cardiac function was stable and coronary angiography prior to discharge confirmed patent grafts (Figure 3). The patient was transferred to a rehabilitation facility on postoperative day 17.

DISCUSSION

The left thoracotomy approach for redo CABG was first described in 1982 for bypass of the circumflex territory under hypothermic cardiopulmonary bypass and ventricular fibrillation [Cheung 1982]. Since the evolution of off-pump CABG, off-pump redo CABG via the left thoracotomy approach has been performed more often [Azoury 2001]. The left thoracotomy approach can avoid injury to previous grafts or to the heart during reentry. During re sternotomy, the risk of catastrophic hemorrhage is 0.5-1%, and the risk of the injury to a patent internal mammary artery graft is 5%. The associated mortality with these injuries is 19% and 9%, respectively [Follis 1999; Gillinov 1999].

Indications for the left thoracotomy approach include a

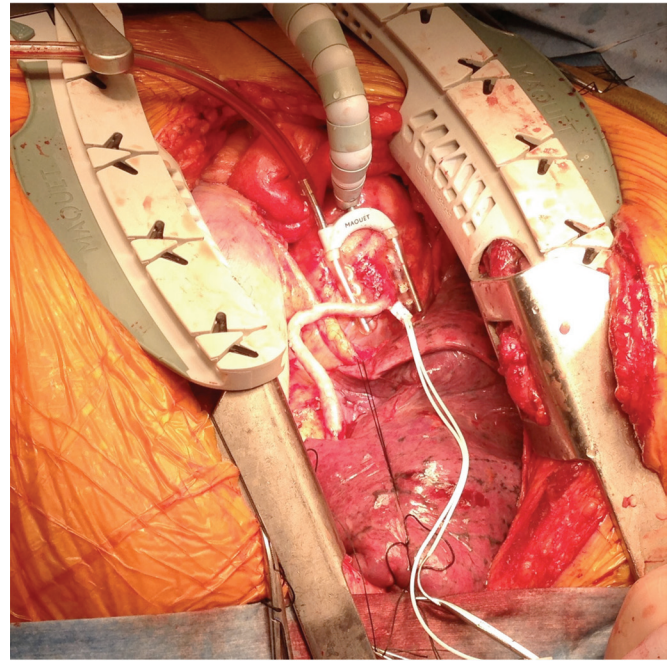


Figure 2. Intraoperative photograph of the saphenous vein graft to obtuse marginal branch of the circumflex artery.

calcified ascending aorta, history of mediastinitis, radiation, presence of a tracheostomy, or requirement of concomitant left lung surgery. Patients who had previous mitral valve replacement can be candidates for left thoracotomy approach due to the risk of left ventricular rupture while exposing the circumflex territory [Duarte 2007]. Using the posterolateral left thoracotomy approach, both LAD and OM are accessible. The distal LAD can be seen under the mammary line and the OM can be seen at the mid axillary line. Exposure of the target vessels is facilitated by the positioning of the patient and the use of the off-pump stabilizer. In our case, we did not experience hemodynamic instability during the anastomosis. The disadvantage of the left thoracotomy approach is the limitation of the exposure. In our case, the exposure of the OM was relatively straightforward (Figure 3) from the surgeon's position (left side of the patient), although somewhat more deep than usual. The exposure and stabilization of the distal LAD was somewhat difficult in our case due to the adhesions from prior surgery. Much of the anterior wall of the right ventricle had to be dissected in order to provide adequate visualization. A left thoracotomy approach is not appropriate for patients with a history of pleurodesis because the adhesions will make the exposure difficult. Those who have reduced pulmonary function may not be candidates for a left thoracotomy approach because it requires single lung ventilation, although the left lung can sometimes be retracted out of the way to permit partial ventilation. A preoperative lung function test is helpful to ensure tolerability of a thoracotomy. Severe calcification on the descending aorta may prohibit the use of the descending aorta as an outflow, as could

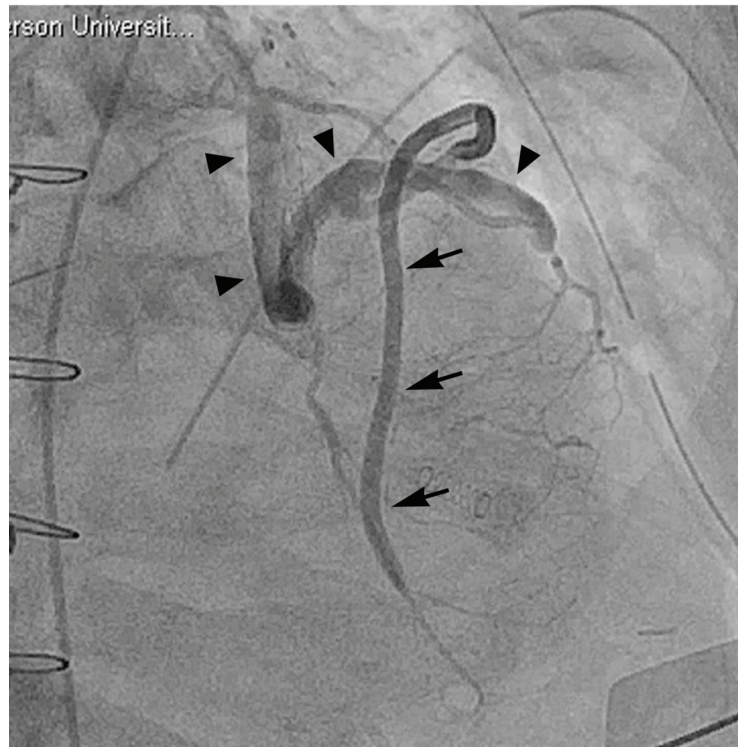


Figure 3. Postoperative catheterization demonstrates patent grafts. Arrowheads: SVG to OM; arrow: radial artery to LAD.

atherosclerotic debris; thus, preoperative imaging is necessary to plan the proximal anastomosis on the descending aorta [Baumgartner 1991]. In the case of a diseased aorta, avoidance of clamping is important. The use of the in-situ left internal mammary artery bypass is ideal to avoid the anastomosis on the descending aorta; however, in our case, it was previously used and occluded. Proximal anastomotic assist devices such as the Heartstring may also be used to avoid aortic clamping.

CONCLUSION

Redo CABG is a technical challenge, but we were able to successfully undergo a fourth-time redo CABG via the left thoracotomy approach and proximal anastomosis of the conduits in the descending aorta. This technique in select patients could be a useful and may reduce the complications related to redo sternotomy.

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