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Robot-Assisted Off-Pump Minimally Invasive Reoperative Coronary Artery Bypass Grafting: Case Report

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ABSTRACT

Background: Resternotomy for reoperative coronary artery bypass grafting (CABG) has become increasingly common with an aging patient population. Minimally invasive and robotic techniques permit us to perform these surgeries with reduced morbidity and mortality.

Case Report: A 67-year-old woman was taken to the operating room for repeat CABG. A free right internal mammary graft was endoscopically harvested using the da Vinci robotic operating system. A small left thoracotomy was then used to perform an off-pump bypass from the descending aorta to the hood of a diseased saphenous vein graft.

Conclusion: Robotic and minimally invasive cardiac surgery undergoes continuous refinement. As the incidence of reoperative surgery in patients with multiple previous interventions rises, surgeons will have to become increasingly creative with their choice of conduits, incisions, and the use of hybrid open and endoscopic techniques.

INTRODUCTION

Resternotomy for reoperative coronary artery bypass grafting (CABG) has become increasingly common with an aging patient population. In addition to the extra time and care required for dissection of adhesions, resternotomy is associated with increased morbidity and mortality [Christenson 1997]. Methods to reduce morbidity and mortality from resternotomy have focused on avoidance of cardiac injury or division of patent grafts through the use of alternative incisions [Morishita 2002], endoscopic guidance [Athanasiou 2002], or division of retrosternal adhesions under direct vision [Eddy 1991]. Here we report the use of the da Vinci robotic operating system to endoscopically harvest a free right internal mammary artery (RIMA) graft followed by reoperative off-pump CABG through a small left thoracotomy.

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CASE REPORT

A 67-year-old woman was admitted to an outside hospital where her illness was diagnosed as acute myocardial infarction and left lower lobe pneumonia. Six years earlier she underwent triple CABG using a left internal mammary artery (LIMA) to graft the left anterior descending (LAD) artery and saphenous vein to graft the first marginal and the posterior descending arteries. Cardiac catheterization revealed a widely patent LIMA graft adhered to the sternum and a proximal stenosis in the obtuse marginal vein graft. The patient was transferred to our medical center and taken to the operating room for surgical revascularization.

The patient was intubated with a double-lumen tube and positioned with the right chest elevated 30 degrees. A 1-cm incision was made in the fifth intercostal space 2 cm anterior to the anterior axillary line. After the pleural space was entered bluntly, the robotic endoscopic camera was inserted. Two more 1-cm incisions were made in the third and seventh intercostal spaces in line with the camera port site, through which the robot arms were inserted under direct video guidance. The RIMA was dissected free from the subclavian vein to its bifurcation. The phrenic nerve was visualized and not disturbed. After 5000 units of heparin were administered, the RIMA was clipped and divided proximally and distally and removed through one of the port sites. A chest tube was placed through the central port site, the other incisions were closed, and the patient was repositioned in a modified left posterolateral thoracotomy position.

A 10-cm left thoracotomy incision was made in the fifth intercostal space and adhesions between the lung, diaphragm, and pericardium were lysed. The pericardium was opened posterior to the phrenic nerve exposing the left atrial appendage and distal aspect of the previous saphenous vein graft to the oblique marginal target. An additional 10,000 units of heparin were given and a partial occluding clamp was placed on the descending aorta. A 5-mm punch aortotomy was made and the proximal anastomosis sewn (Figure 1). Next a suction stabilizer (OPVAC Synergy II; Estech, Danville, CA, USA) was used to stabilize the distal anastomotic site (Figure 2). The vein graft hood was opened longitudinally with brisk back-bleeding, and the distal anastomosis was sewn. Two pleural chest tubes were placed, intercostal anesthesia was administered, and the ribs, subcutaneous tissues, and skin were closed in standard fashion.

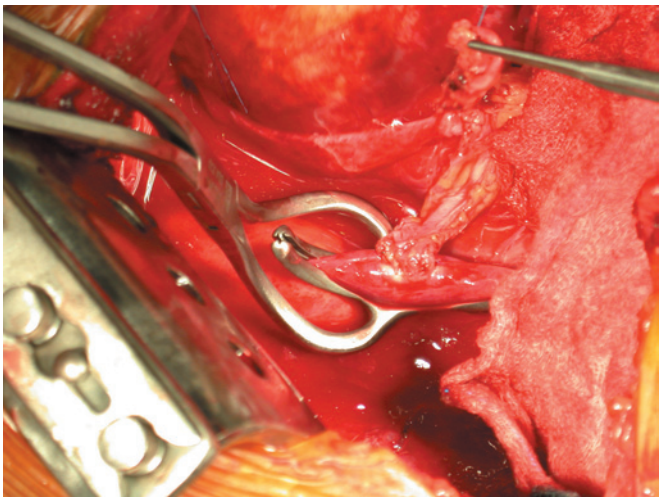

Figure 1. A partial occluding clamp placed on the descending aorta for the proximal anastomosis.

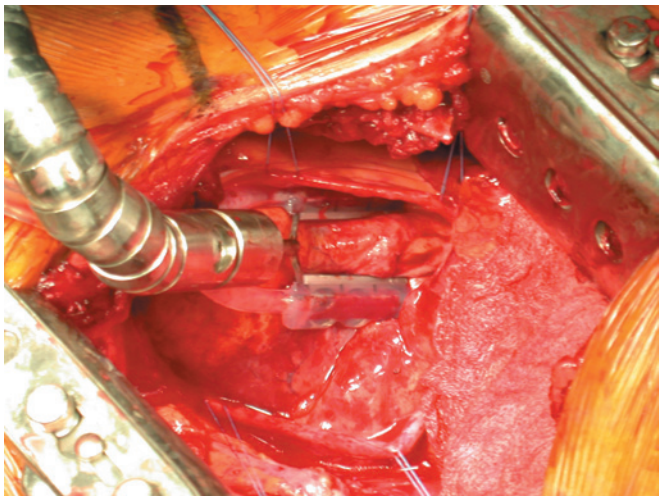

Figure 2. Completion of the distal anastomosis was facilitated by use of an off-pump suction stabilizer.

DISCUSSION

Available conduits for this case included saphenous vein, radial artery, and right internal mammary artery. Because a relatively short segment of vessel was needed and patency rates with RIMA grafts are as good or better than saphenous vein or radial artery grafts [Buxton 2003], we chose to use a free RIMA graft.

The feasibility of endoscopic harvest of both right and left IMAs has been well established. Indeed, descriptions of techniques for totally endoscopic bilateral IMA CABG now exist in the literature [Dogan 2002]. Use of the da Vinci robot to harvest the RIMA enabled us to avoid resternotomy, lessened the pulmonary insult of operating in both pleural spaces, and allowed a faster recovery time from smaller surgical incisions.

By limiting our dissection to the left chest we were able to avoid several potential hazards associated with reoperative CABG. The previous LIMA-LAD graft was left entirely undisturbed. Use of an off-pump technique with suction stabilization obviated the need for aortic arch dissection and femoral cannulation.

Robotic and minimally invasive cardiac surgery undergoes continuous refinement. As the incidence of reoperative surgery in patients with multiple previous interventions rises, surgeons will have to become increasingly creative with their choice of conduits, incisions, and the use of hybrid open and endoscopic techniques [Mihaljevic 2003].

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