

Minimally Invasive Axillary-LAD Saphenous Vein Bypass

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ABSTRACT

The left internal mammary artery (LIMA) is the arterial conduit of choice for minimally invasive coronary bypass to the left anterior descending (LAD). However, in redo cases when the LIMA is not available, the use of a saphenous vein graft as an extraanatomic bypass from the axillary artery to the LAD offers a lower risk alternative than conventional reoperative trans-sternal surgery [Knight 1997]. We report on three patients who underwent axillary-LAD saphenous vein bypass. At six months, follow-up by Duplex ultrasound showed patent grafts in all three patients.

INTRODUCTION

Minimally invasive direct coronary artery bypass (MID-CAB) has focused mainly on left anterior descending (LAD) coronary artery bypass. The left internal mammary artery (LIMA) is the conduit of choice in both primary and redo operations. However, in reoperative surgery the LIMA may not be available because of previous use, total occlusion, severe stenosis, or small caliber. A conventional reoperation entails morbidity related to both sternal reentry and cardiopulmonary bypass. MIDCAB offer benefits related to avoidance of cardiopulmonary bypass and extensive dissection of pericardial adhesions. The use of a saphenous vein graft in MIDCAB allows revascularization of the LAD without resorting to conventional reoperative surgery when the LIMA is not suitable or unavailable. In addition, the use of the axillary artery as an inflow virtually eliminates the risks of atheroembolization and dissection related to manipulation of the ascending aorta.

MATERIALS AND METHODS

Eighty-two patients underwent MIDCAB at the American University of Beirut over a two-year period. In three

patients who had undergone previous coronary artery bypass, saphenous vein was utilized to revascularize the LAD through a small left anterior thoracotomy as an extraanatomic bypass from the axillary artery. In two patients the LAD was the only culprit lesion. However the third patient also had a 90% circumflex lesion which was dilated percutaneously since she was considered to be at high risk for a conventional reoperative surgery. The clinical data relating to the three patients is summarized in (Table 1 ☉).

Procedure

Under general anesthesia and single lumen intubation, the entire chest, left neck, and supraclavicular area are prepped and draped. A 10-cm incision is made anteriorly in the fourth intercostal space. No cartilage is resected. As the pleural cavity is entered, the dissection is started, laterally mobilizing the lung away from the pericardium. The pericardium is incised over the distal aspect of the LAD, exposing the artery with gentle dissection. Traction sutures are placed in the pericardial edges. Because of pericardial adhesions, motion in the field is usually minimal. Heparin is administered at 100 units/kg body weight prior to snaring the LAD. Two pledgeted 4-0 polypropylene sutures are placed about 4 cm apart around the LAD and snared. If no hemodynamic changes or arrhythmias occur within the first five minutes of temporary occlusion, the LAD is stabilized with a mechanical device (CardioThoracic Systems Inc., Cupertino, CA). No pharmacological intervention is used to induce bradycardia.

A 6-mm arteriotomy is made and visualization of the lumen is facilitated using a CO₂ blower. A previously harvested saphenous vein segment is anastomosed to the LAD arteriotomy using two 7-0 running polypropylene sutures; one at the heel and the other at the toe. After the anastomosis is completed, the snares are released with brisk retrograde filling of the saphenous vein noted. The vein is gently irrigated with warm heparinized saline. A 6-cm counter-incision is made in the left lateral infraclavicular area through which the axillary artery is exposed. The saphenous vein is tunneled one interspace above the thoracotomy medial to the left lung and superficial to the chest wall underneath the pectoralis major and the infraclavicular incision. The vein graft proximal end is then sewn to the axillary artery using a running 6-0 polypropylene suture. A 7-mm flat chest tube is left in place for 24 hours. Heparin is not reversed if hemostasis is satisfactory.

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Table 1. Clinical Data of Patients

Patient	Age	Sex	Coronary Disease	Procedure	Reasons for Use of Saphenous Vein
1	64	Male	CABG 5 y previously; total LAD; 99% stenosis LIMA-LAD; patent saphenous vein to OM.	Axillary-LAD bypass	Prior use of LIMA; angioplasty of LIMA-LAD unsuccessful.
2	66	Female	S/P CABG twice at 2 and 10 y previously; total LAD; 90% lesion in saphenous vein graft to LAD; occluded LIMA; patent saphenous vein to RCA and OM.	Axillary -LAD bypass	Prior use of LIMA.
3	67	Male	S/P CABG 2 y previously; long 90% LAD lesion; occluded LIMA; 90% circumflex lesion; occluded saphenous vein to OM and RCA.	Hybrid procedure; angioplasty of circumflex; Axillary -LAD bypass.	Prior use of LIMA; LIMA occluded; high risk for conventional redo surgery.

CABG = Coronary Artery Bypass Grafting

S/P = Status Post

LIMA = Left Internal Mammary Artery

OM = Obtuse Marginal

RCA = Right Coronary Artery

RESULTS

All three patients were extubated in the operating room and were discharged on the third postoperative day. There were no arrhythmias and no transfusions needed. All three patients had patent grafts as evidenced by Duplex ultrasound, which demonstrated augmented diastolic flow. At six months, all were asymptomatic and had identical augmented diastolic flows on transthoracic Duplex ultrasound.

DISCUSSION

The use of the saphenous vein as an extraanatomic bypass from the axillary artery to the LAD coronary artery has been described by a few authors [Knight 1997, Machiraju 1998, Tovar 1998]. The principal indication for this procedure is LAD disease in patients who had a previous coronary bypass utilizing the LIMA and who are not candidates for angioplasty. Also, patients with a preoperative angiogram demonstrating an occluded or suboptimal LIMA should be considered for saphenous axillary bypass. Another subset of qualifying patients are those at high risk for conventional reoperative surgery. This technique may be well suited for special situations as well, such as patients who are Jehovah's witnesses.

Some concern has been raised regarding the subpectoral tunneling affecting long-term patency [Morishita, 1998, Sakakibara 1998], prompting one author to resect the medial head of the clavicle so that the course of the graft is mostly intrathoracic. The long-term patency of

peripheral vascular saphenous vein grafts has been satisfactory, and the concern regarding subpectoral tunneling should prompt close follow-up. In our three patients, all grafts were patent at six months indicating that mechanical compression may not be a significant factor in long-term patency, as seen with other peripheral vascular subcutaneous grafts. The axillary-LAD extraanatomic bypass nonetheless offers a low-risk alternative to conventional reoperative surgery by eliminating aortic manipulation and its consequences. Minimal dissection, avoidance of cardiopulmonary bypass, and early extubation also contribute to a smooth and quick recovery. Patency can be easily monitored by Duplex ultrasound.

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