

Reoperations in patients with patent left internal mammary artery

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In the past decade the rate of reoperative coronary bypass grafting has averaged 8%. In these patients adequate myocardial protection is often difficult because delivery of cardioplegia is frequently suboptimal when the internal mammary artery graft is patent. We describe a simple technique for performing cardiac reoperation in patients with a patent left internal mammary artery graft through a balloon catheter used for angioplasty and positioned in the left internal mammary artery graft. Our study included 3 patients and there were no operative deaths and complications.

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Introduction

As operative techniques evolve and survival after cardiac surgery improves, the number of patients who have repeat operation continues to rise.

These patients present two distinct technical problems; first, division of the sternum is primarily a blind procedure and carries an increased risk of injury of major cardiac structures in the presence of adhesions between the posterior table and the innominate vein, right ventricle and extracardiac conduits or grafts such as the left internal mammary artery (LIMA) graft; the prevalence of injury to a patent LIMA graft during reoperation is 5.3%¹; second, adequate myocardial protection is often difficult because delivery of cardioplegia is frequently suboptimal in the presence of a patent LIMA owing to cardioplegia "washout" in the LIMA territory. Various approaches to myocardial protection in the presence of a patent LIMA graft have been proposed². The most common strategy involves dissection and temporary occlusion of the LIMA, with subsequent aortic clamping and cardioplegic arrest. Another strategy is to establish moderate-to-deep hypothermia (20-22°C), apply aortic clamping and deliver cardioplegia whilst avoiding dissection of the LIMA pedicle³. Both these techniques are, in our opinion, dangerous.

Our technique used during reoperation of patients with a patent LIMA consisted of passing a "U" suture (4-0 polypropylene with an SH needle and with an interposed rectangular small Teflon-felt and a rectan-

gular piece of rubber) through the whole thickness of the myocardium, close to the anastomosis of the LIMA on the left anterior descending coronary artery (LAD); this suture was gently snared by a tourniquet at the time of cardioplegia delivery.

In 3 patients with a patent LIMA we used another simple technique for performing cardiac reoperation through a balloon catheter used for angioplasty and positioned in the LIMA graft. The following is a description of these cases.

Description of cases

Case 1. A 64-year-old woman with a history of fever, cough and dyspnea lasting 2 weeks was admitted to the emergency department; this patient had undergone elective coronary artery bypass graft (CABG) using the LIMA on the LAD and ventricular aneurysmectomy by the Jatene technique 10 years previously. We immediately decided to intubate the patient owing to her deteriorating respiratory status.

Chest radiography showed a falciform opaque mass of uncertain significance located in the base of the left lung.

Transthoracic echocardiography showed a voluminous spherical mass referable to a ventricular aneurysm or better pseudoaneurysm.

Chest computed tomography confirmed the presence of the pseudoaneurysm (Fig. 1).

Case 2. A 75-year-old male patient with pulmonary edema and acute mitral regurgi-

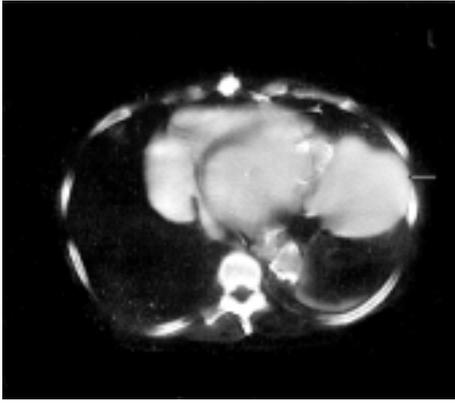


Figure 1. Chest computed tomographic scan with contrast shows a big spherical mass close to the left ventricle.

tation consequent to rupture of the chordae tendineae was admitted to our intensive care unit. Seven years previously, he had undergone myocardial revascularization using the LIMA to the LAD and a saphenous vein graft to the distal right coronary artery.

Case 3. A 67-year-old male with a history of angina and dyspnea was referred to our hospital. Six years previously he had been submitted to myocardial revascularization using the LIMA to the LAD, a saphenous vein graft to the first obtuse marginal branch and a saphenous vein graft to the distal right coronary artery.

All 3 patients underwent right- and left-sided heart catheterization, coronary arteriography and left ventriculography and all were found to have a patent LIMA.

All 3 patients were operated upon immediately following heart catheterization. In all subjects a balloon catheter, used for angioplasty, was positioned in the LIMA graft (Fig. 2).

Operative technique. Our technique consists of interrupting the blood flow to the LIMA graft by means of a balloon catheter used for angioplasty and positioned in the LIMA graft (Fig. 3) at the time of the heart catheter-

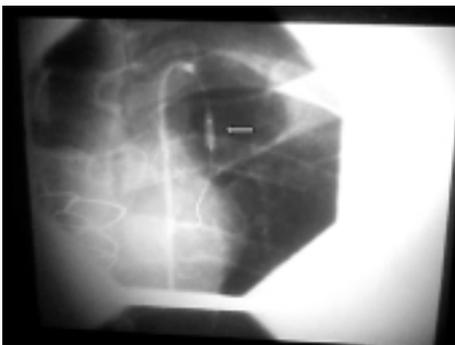


Figure 2. Heart catheterization and balloon catheter located in the left internal mammary artery graft.



Figure 3. A balloon catheter used for angioplasty located in the left internal mammary artery graft.

ization. This technique thus allows us to arrest the blood flow to the LIMA graft and, with antegrade and/or retrograde cardioplegia, to arrest and fully protect the heart and perform the operation.

A balloon catheter used for angioplasty (Worldpass plus 2.0 × 10 mm, Cordis, Johnson & Johnson Company, Miami, FL, USA) was positioned in the LIMA graft in the catheterization laboratory and the patient was transferred to the operating room for surgery.

As routinely done for reasons of precaution in case of reoperations, the femoral vessels were exposed. Access to the mediastinum was achieved through a median sternotomy. After dissection of the mediastinal structures, arterial cannulation was performed via the ascending aorta and a single two-stage right atrial cannula was used for venous drainage. A left ventricular vent was placed through the right superior pulmonary vein in cases 1 and 2.

The mean arterial pressure was maintained between 40 and 50 mmHg. The systemic body temperature was decreased to 27°C. Then, the ascending aorta was clamped. We simultaneously inflated the balloon catheter located within the LIMA graft to 4-8 atm and antegrade warm blood cardioplegia was administered through the aortic root at a pressure of 70 mmHg to achieve myocardial arrest; 300 ml of warm blood cardioplegia were administered at intervals of 20 min.

In case 1 we removed the Dacron patch positioned during the first operation and ventriculoplasty was performed according to the Caldeira and McCarthy technique⁴.

Case 2 underwent mitral valve replacement (29 mm Carpentier-Edwards Perimount plus, Edward Lifesciences, Irvine, CA, USA) and myocardial revascularization using a saphenous vein graft to the first obtuse marginal branch.

Case 3 underwent myocardial revascularization using saphenous vein grafts to the first and second obtuse marginal branches.

Using the balloon catheter located in the LIMA graft, cases 2 and 3 underwent CABG in the circumflex territory without mobilizing the LIMA pedicle because, in our opinion, this maneuver is hazardous; moreover, we achieved good circumflex exposure.

We deflated the balloon catheter at the end of the operations; the aortic clamp was released and cardiopulmonary bypass was discontinued. The entire system (balloon and wire) was removed when the chest was closed.

Post-bypass bleeding was minimal and in no case did it necessitate reinstatement of bypass.

The patients were transferred to the intensive care unit in stable hemodynamic conditions. The postoperative course was uneventful. In no case did postoperative cardiac catheterization reveal any alterations of the LIMA graft. Postoperatively, the serum levels of the myocardial enzymes, including the creatine kinase isoenzyme MB levels, remained within the normal range. There were no significant ST-segment alterations. The patients were discharged without complications. At follow-up, performed recently, all 3 patients were found to be completely asymptomatic.

Discussion

Since 1968, when Green first used the LIMA to bypass the LAD, the former has gradually become the conduit of choice for myocardial revascularization because it has been proved that early mortality and morbidity are low, the long-term patency rate is superior to that of saphenous vein grafts and late atherosclerotic lesions are rare⁵.

Redo-CABG surgery may be required as a result of graft disease, progression of native coronary atherosclerosis, or a combination of these factors⁶. Of these three indications, vein graft disease is by far the most common.

Several previous studies have noted an increased risk of mortality in redo-CABG patients with patent or diseased grafts⁷. Although the presence of a patent LIMA graft to the LAD decreases the morbidity and mortality of coronary reoperation, injury to this graft increases both⁸.

This report documents the results of 3 consecutive patients with a patent LIMA in whom a balloon catheter used for angioplasty was positioned in the LIMA to arrest the blood flow to this graft during redo surgery.

We found that selective LIMA cannulation using an angioplasty balloon catheter was not associated with any complication; moreover, we believe that the probability of LIMA damage by prolonged balloon inflation is very low because we inflated the balloon only to 4-8 atm. Cardiac catheterization was performed postoperatively and no alterations of the LIMA graft were discovered.

In conclusion, this method is a safe simple and effective technique of achieving excellent myocardial protection while minimizing potential injury to the patent LIMA graft. This technique is also useful for patients being transferred from the catheterization laboratory for emergency reoperation.

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