Case Report

Isolated Coronary Graft Perfusion Prior to Cardiopulmonary Bypass During Cardiac Reoperations: A Case Report

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ABSTRACT

A 67 year old male presented to our service with angina, syncope, and dyspnea on exertion. He had had a three vessel coronary artery bypass ten years ago and had been asymptomatic until this time. A repeat cardiac catheterization revealed aortic valvular stenosis, left carotid artery stenosis, and restenosis of the left circumflex, anterior descending, and right coronary artery vein grafts.

During sternal reentry, the left circumflex graft was inadvertently divided. Shortly thereafter, antero-lateral wall ischemia became evident on the electrocardiogram. The transesophageal echocardiogram revealed acute akinesis of the lateral ventricular wall. The divided graft was cannulated with a 3 mm vessel cannula and secured with a tie. The 4:1 blood cardioplegia system was flushed with a balanced electrolyte solution to remove all cardioplegia solution. Autologous washed red blood cells and homologous packed red blood cells were added to the pump prime. The blood cardioplegia system was used to deliver warm, oxygenated blood to the graft. Graft perfusion was performed for a total of 28 minutes prior to cardiopulmonary bypass. After completion of the surgery the patient was weaned from cardiopulmonary bypass without incident. He had an uncomplicated post-operative course and was discharged from the hospital in good condition.

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INTRODUCTION

Reoperations for myocardial revascularization present a challenge to all members of the surgical team. Reoperations are technically more demanding and have a greater risk than that of the first procedure (1-4). Sternotomy and dissection of the heart and great vessels during reoperative procedures can lead to life threatening complications such as laceration of the myocardium and damage to functioning vein grafts (2). A case is reported in which coronary graft perfusion was performed prior to the initiation of cardiopulmonary bypass (CPB) after accidental division of the left circumflex vein graft.

CASE REPORT

A 67 year old male presented to our service complaining of angina, syncope, and dyspnea on exertion. He had had a three vessel coronary artery bypass ten years ago and had been asymptomatic until the time of his admission. A repeat catheterization revealed aortic valvular stenosis, left carotid artery stenosis, 70% restenosis of the left circumflex and anterior descending artery vein grafts, and an 80% restenosis of the right coronary artery vein graft.

As a result he was scheduled for elective reoperative coronary artery bypass grafting, aortic valve replacement, and carotid endarterectomy. After completion of the carotid endarterectomy the chest was opened and dissection of the heart and great vessels was undertaken. During dissection, the left circumflex graft was accidentally divided where the vessel was affixed by adhesions to the old cannulation site. Initially, there were no changes noted in the S-T segments in lead V-2 and V-5. Three minutes later, there was an acute increase of 0.6 mm and 1.7 mm in the S-T segments noted in leads V-2 and V-5 respectively (Figure 1). The S-T segments elevation was not accompanied by any changes in hemodynamic status, although the transesophageal echocardiogram (TEE) revealed acute akinesis of the lateral ventricular wall. As a result of these changes, the surgeon asked if we could perfuse the graft with oxygenated blood.

The vein graft was cannulated with a 3 mm vessel cannula and secured with a tie. The 4:1 blood cardioplegia system was flushed with a balanced electrolyte solution to remove all cardioplegia solution and rewarmed to 37°C. Autologous washed red blood cells (225 ml) and homologous packed red blood cells (337 ml) were added to the prime, which consisted of 1,800 ml balanced electrolyte solution, 100 ml 25% albumin, and 10,000 units heparin. The prime was mixed by opening the recirculation line and running the pump. The 3/16th inch tubing for the crystalloid cardioplegia was removed from the raceway and clamped. The cardioplegia system was primed with blood up to the table line and through a multiple perfusion set. The system was deaired and connected to the vessel cannula. Graft perfusion was initiated at a flow rate of 40 ml/min and slowly increased to 60 ml/min.

After approximately two minutes of graft perfusion, the S-T segments and lateral wall motion returned to normal, as assessed by electrocardiogram and TEE. Graft perfusion was performed for a total of 28 minutes prior to CPB.

The patient was weaned from CPB after completion of the aortic valve replacement and coronary grafting without incident. He was transported to the intensive care unit on 5 mcg/kg/min of dopamine and 0.25 mcg/kg/min of sodium nitroprusside. A twelve lead electrocardiogram and cardiac isoenzymes were obtained post-operatively and showed no evidence of a myocardial infarction. He had an uncomplicated postoperative course and was discharged from the hospital in good condition.

DISCUSSION

The morbidity and mortality associated with reoperative coronary artery bypass procedures are higher than that of the first procedure (1-4). Optimal myocardium function depends on patent grafts for blood supply and damage can result in myocardial infarction (3). In a group of 138 patients reported by Van Damme et al, the incidence of damage to vein grafts during reoperation was 1.4% (5).

In this case, inadvertent division of the circumflex graft, and subsequent acute ischemic and contractile changes occurred at a time when cannulation and initiation of CPB was not possible. The surgeon decided to initiate graft perfusion instead

\[\text{Figure 1}\]

S-T segment trend of leads V-2 and V-5 prior to, and after coronary graft perfusion.

<table>
<thead>
<tr>
<th>Millimeters S-T segment change</th>
<th>Time (min)</th>
<th>Graft Divided</th>
<th>Graft Perfusion</th>
<th>On Bypass</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 5 9</td>
<td>4</td>
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<tr>
<td>1 0 2 9</td>
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a DLP Inc, Grand Rapids, MI 49501
b AVECOR Cardiovascular Inc., Plymouth, MN 55441
of repairing the vessel because of the inherent difficulty in repairing a vessel that has adhered to the aorta.

It took approximately three minutes to set up and begin graft perfusion. Cannulation and initiation of CPB would have taken much longer because we do not routinely expose the femoral artery and vein during reoperations.

Normal coronary blood flow in the healthy human heart is approximately 225 ml/min (6). The highest flow rate we could obtain during graft perfusion was 60 ml/min. The flow rate was limited by high back pressure in the cardioplegia system, which was related to the position of the vessel cannula and the lesion within the circumflex graft. Although, optimal flow rate to the antero-lateral portion of the myocardium was not known, we feel that the flow rate used was enough because ischemia and ventricular function improved immediately.

The technique described, allowed the surgeon to proceed with the case while oxygenated blood perfused the myocardium. Graft perfusion reversed the ischemic changes, prevented hemodynamic decompensation, and spared the patient a possible peri- or post-operative myocardial infarction.

REFERENCES