Salvage of left Cabrol limb occlusion by minimally invasive direct coronary bypass grafting

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Abstract

Two patients suffered from acute myocardial infarction (AMI) resulting from occlusion of left coronary perfusion graft limb after aortic root reconstruction by Cabrol or modified Cabrol technique. A 34-year-old male patient with Marfan syndrome received aortic root reconstruction by modified Cabrol technique due to aortic root aneurysm and acute type A aortic dissection. AMI occurred 3 months after operation. Another patient, a 72-year-old male with annuloaortic ectasia and aortic arch aneurysm received Cabrol procedure and aortic arch replacement. He suffered from AMI 7 months following operation. Occlusion of the left coronary graft limb was noted in these two patients on computer tomography and coronary arteriography. They were both saved by emergency minimally invasive direct coronary bypass grafting (MIDCAB).

Keywords: Cabrol procedure; MIDCAB

1. Introduction

Cabrol et al.\cite{1} described a technique to replace the aortic valve and ascending aorta by a composite valve graft using a Dacron tube to revascularize the coronary arteries. The Cabrol procedure has been shown to contribute to a sound anastomosis without tension and prevent late pseudoaneurysm.

However, a late complication of Cabrol procedure is graft limb occlusion. This complication may be a possible cause of late cardiac events such as sudden death and global myocardial infarction, which require urgent coronary revascularization\cite{2}.

Emergency revascularization of graft occlusion has previously been reported, and involves percutaneous transluminal coronary angioplasty with stent implantation\cite{3} or balloon angioplasty initially, followed by coronary artery bypass grafting\cite{4}.

We present two cases of late occlusion of left coronary graft limb after Cabrol or modified Cabrol procedure and subsequent emergency MIDCAB which were successful in both.

2. Case report

2.1. Case 1

A 34-year-old male patient with Marfan syndrome, aortic root dilatation and acute type A aortic dissection received aortic root replacement with composite graft by modified Cabrol technique. The largest diameter of aortic root was 5 cm and the dissection involved the sinus of Valsalva and right coronary artery ostium. The distal anastomosis was performed by open method under deep hypothermia and total circulatory arrest. Myocardial protection was kept by hypothermia, an initial direct antegrade cold blood cardioplegia perfusion via the coronary ostia and intermittent retrograde blood cardioplegia perfusion. The coronary artery ostia were mobilized as buttons. To release the tension of reimplantation anastomoses of coronary arteries, a segment of collagen impregnated woven double polyester velour tube graft (Hemashield, Meadox Medicals, Inc.)
10 mm in diameter was anastomosed to both coronary buttons in an end-to-end fashion as an interposition perfusion graft. This interposition graft was then connected to the aortic graft in a side-to-side fashion. The post-operative course was uneventful, and he was discharged 7 days after operation. The patient was followed-up at outpatient department with warfarin prescribed to keep international normalized ratio (INR) of prothrombin time (PT) at a level around 3. Unfortunately, he suffered from acute onset of chest pain and cold sweating 3 months later. Under the suspicion of progression of dissection, CT aortography was performed which revealed thrombosis of left Cabrol limb. Coronary arteriogram showed the same finding and there was no stenosis between the right limb graft and right coronary artery. That also revealed a dominant right coronary artery with two long posterior lateral branches for left ventricle.

The laboratory data revealed CK/CK-MB 969/72 U/l, and Troponine-T showed negative result. The patient received emergency MIDCAB with left internal thoracic artery (LITA) directly anastomosed to left anterior descending artery (LAD) via a small left anterior thoracotomy. The post-operative course was uneventful. At 11 months follow-up, the patient was free of symptoms and doing well.

2.2. Case 2

A 72-year-old male complained of shortness of breath for 3 months. The echocardiogram and CT aortogram showed congenital bicuspid aortic valve, aortic root and aortic arch aneurysm with severe aortic regurgitation. The largest diameter of aortic root, ascending aorta and aortic arch were 7.5, 6.4 and 5 cm, respectively. He received aortic root reconstruction with composite graft by Cabrol technique and total arch replacement. A segment of albumin-impregnated knitted polyester tube graft (Ultramax, Atrium medical corp.) 9 mm in diameter was used as Cabrol limb (Fig. 1). Myocardial protection was obtained by an initial antegrade cold blood cardioplegia perfusion via the coronary ostia and subsequent retrograde cold blood cardioplegia perfusion. The post-operative course was smooth and he was discharged 7 days after operation. He was followed-up at the outpatient department with warfarin prescribed to keep INR at a level around 2.5–3.5.

However, 7 months after operation, he suffered from epigastric discomfort, chest tightness, and dizziness. The ECG revealed ischemia change. The laboratory data showed a positive result for CK/CKMB: 520/58 U/l, and Troponine-T. Coronary angiography revealed total occlusion of left coronary artery. The right coronary artery was the dominant artery with three posterior lateral branches for left ventricle (Fig. 2A). Under the impression of left Cabrol limb occlusion, he received emergency MIDCAB with ‘H’ anastomosis by harvesting a segment of radial arterial graft as the interposition arterial conduit between LITA and LAD. The patient recovered well and was discharged smoothly. At 6 months follow-up, the patient remained free of symptoms. The coronary angiography 5 months after MIDCAB showed patent LITA, radial artery graft to LAD (Fig. 2B).

3. Discussion

For reconstruction of aortic root, the Cabrol procedure and modified Cabrol techniques contributed to a sound anastomosis without tension and prevented late pseudoaneurysm. However, there are some disadvantages of the Cabrol technique which include possible kinking of the interposition tube graft at the side-to-side anastomoses on the aortic conduit, angulation with occlusion at the coronary artery ostia, and graft thrombosis of the coronary arterial limbs due to misalignment at the ostium or low flow rate through the limb [5].
Some rare cases of life-threatening complications related to coronary reconstruction were reported. Sudden death and global myocardial infarction have been the main cause of late cardiac death after composite graft replacement [4].

Obstruction of left coronary ostial anastomosis is a rare late complication after composite graft replacement of the ascending aorta and the aortic valve with separate Dacron coronary grafts [3].

Two cases of emergency revascularization of graft occlusion after Cabrol technique have been reported. The case with Marfan’s syndrome developed tight stenosis in the left main coronary ostial anastomosis 7 months following composite graft replacement with separate Dacron coronary grafts. Percutaneous transluminal coronary angioplasty with stent implantation was performed to clear the stenosis. However, the procedure may be considered an option to use as a bridge of surgical revascularization [3]. Another patient underwent savenous vein graft interposition to reconstruct left coronary artery that was injured during dissection at the initial composite aortic root replacement operation. Vein graft disease occurred and became stenosed after 2 years. The patient was successfully rescued by balloon angioplasty, and underwent coronary artery bypass grafting [4].

CABG is definitely a rescue procedure. However, serious difficulties were encountered entering the mediastinum that was characterized by dense pericardial adhesion caused by the initial operation for aortic root, especially in the substernal and periaortic areas [6].

The primary indication for MIDCAB through a small left anterior thoracotomy is single-vessel coronary artery disease involving the LAD. Patients considered to be at high risk for standard CABG because of associated diseases and redo operation for LAD stenosis may also be candidates for this procedure [7]. MIDCAB with left internal thoracic artery directly anastomosed to LAD or H anastomoses with radial artery as an interposition conduit between LITA and LAD can thereby avoid median sternotomy providing a simple and effective option. To remove a short segment of costal cartilage, LITA can be approached easily. But it will be time-consuming to dissect a long segment of LITA when there is strong adhesion at the substernal area. By H-graft technique, s short segment of LITA and radial artery graft can be harvested simultaneously. The whole procedure becomes easy and fast. That is the reason we elect H-graft technique for the second patient. The ‘H’ graft procedure is an alternative to standard MIDCAB because of greater technical simplicity, avoidance of internal thoracic artery harvest, and excellent visualization with no chest wall retraction [8]. We successfully treated two patients with occlusion of left Cabrol limb by either standard MIDCAB or the H-graft technique.

Reliance on LITA as a single source of left coronary artery for patients with a dominant right coronary artery is a safe procedure of salvage in our experience.

References


