Combined Repair of Aortic Arch Aneurysm and Coronary Artery Bypass Grafting Via a Modified Clamshell Incision

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SUMMARY

A 58 year-old man presented with a large aneurysm of the aortic arch and severe coronary artery disease. He underwent combined repair of the aortic arch aneurysm and coronary artery bypass grafting via a modified clamshell incision using deep hypothermic circulatory arrest and retrograde cerebral perfusion. He made an uncomplicated postoperative recovery. The operative techniques are discussed with a review of the relevant literature.

KEY WORDS:
Aortic arch aneurysm, Clamshell incision, Deep hypothermic circulatory arrest

INTRODUCTION

The surgical repair of an aortic arch aneurysm remains a formidable surgical challenge despite advances in cardiac surgical techniques, peri and postoperative care [1]. This is particularly so when patients also have significant coronary artery disease [2]. The incidence of the combined presentation ranges from 16 to 30%[2]. Treating each disease entity individually or sequentially runs the risk of complications from the untreated part perioperatively and in the early postoperative period. It is much more logical to treat both conditions simultaneously to maximize immediate and long term outcome.

CASE REPORT

A 58 year old man presented with chest pain. Chest radiography showed a large aneurysm of the aortic arch. Computer tomographic (CT) scan confirmed a 8.1cm aneurysm of the distal aortic arch with normal ascending and lower descending aorta. Echocardiography confirmed good left ventricular function with an ejection fraction of 65% and normal valves. Coronary angiography performed via the right radial artery confirmed severe coronary artery disease with 90% right coronary, 70% left anterior descending and 60% circumflex coronary stenoses. Preoperative blood investigations showed mildly impaired renal function with serum creatinine of 120 umol/l (N 62-105). CT scan of the brain was normal.

Following full preoperative preparations, the patient was operated on under general anesthesia. To reduce postoperative bleeding, Aprotinin was used in a loading dose of one million KIU with another one million KIU in the pump prime followed by an infusion of 50ml per hour. Initially a bilateral anteriolateral thoracotomy and transverse sternotomy (clamshell incision) was performed via the third intercostal spaces. The distal aortic arch aneurysm was confirmed adherent to the left lung and pericardium. There were considerable pericardial adhesions limiting exposure of the heart. It was decided to extend the incision via a lower median sternotomy. This improved exposure of the heart tremendously.

After systemic heparization, aortic and bicaval cannulation was performed and cardiopulmonary bypass commenced. The patient's core temperature was cooled to 18 degree C. The heart was arrested with antegrade and retrograde blood cardioplegia. During cooling, the distal anastomoses of the vein grafts to the left anterior descending, diagonal and posterolateral branch were performed. Cerebral protectives included thiopentone, dexamethasone and mannitol were given before circulatory arrest. On achieving a core temperature of 18 degree C, aortic perfusion was stopped. Retrograde perfusion via the superior and inferior vena caval cannulas was commenced at a flow rate of 300ml per minute and a pressure of 30 mm Hg. The aneurysm was opened. This revealed the neck just distal to the left common carotid. The left subclavian artery was displaced distally by 3.5cm. A 8mm Gortex graft was anastomosed to the left subclavian artery. A 24 mm Unigraft was anastomosed to the distal aortic arch and upper descending aorta. Following this, the antegrade perfusion was recommenced and rewarming commenced. The subclavian graft was anastomosed to the aortic graft in an end-to-side fashion. The proximal ends of the vein grafts were anastomosed to the aorta with the cross-clamp in place. On removal of the cross-clamp, the heart reverted spontaneously to sinus rhythm. Cardiopulmonary bypass was discontinued with minimal inotropic support.

Postoperatively the patient's haemodynamics were good with minimal chest tube drainage and good urine output. There was delay in regaining consciousness however. On the third postoperative day, CT scan of the brain was performed. This showed no evidence of infarction or hemorrhage. The patient was awake enough to be extubated on the fourth postoperative day. His neurological status returned to full preoperative level by the fifth postoperative day. Apart from atrial fibrillation, his subsequently recovery was uneventful. The patient remained well on follow up six months following the surgery.

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DISCUSSION

Thoracic aortic aneurysms carry significant risk of mortality from dissection and rupture. Once a size of greater than 5cm is reached, most patients succumbed to their disease if left untreated.

Surgery on the aortic arch clearly carries with it the risk of mortality and cerebral injury. The basic technique of hypothermic circulatory arrest probably only allows a safe period of about 30 minutes before the risk of cerebral injury increases [3]. For more prolonged period this has to be supplemented with either antegrade or retrograde cerebral perfusion. Both antegrade and retrograde cerebral perfusion have been proven to confer benefits in clinical outcome[3-5]. In this patient, since the proximal aortic arch was not opened, selective catheterization of the innominate artery would have been difficult.

Concomitant coronary artery bypass grafting appears to increase the risk of surgery in patients undergoing aortic arch surgery[2]. However, with proper planning of the surgical procedure, and optimal myocardial protection, performing coronary artery bypass surgery should not necessarily extend the cardiopulmonary bypass time since the coronary artery surgery can be performed during initial cooling and later rewarming periods. As in the case of abdominal aortic aneurysm, tackling the coronary artery bypass first to be followed by delayed thoracic aortic aneurysm repair may lead to increased death from rupture. A combined approach offers a single stage solution to the patient's problems.

Complex surgery as in this case runs the risk of excessive bleeding. Aprotinin was used effectively in this case to reduce the postoperative bleeding without significant side effects. Recent observational studies appeared to show potential side effects on the renal, cardiac and neurologic systems. For high risk cases such as this, its usage is still generally accepted.

The clamshell incision has been found useful not only for bilateral single lung transplantation but also for operation on the aortic arch and descending thoracic aorta. However, in this patient, extensive pericardial adhesions limited the exposure of the heart requiring multiple coronary bypasses. Extension of the incision via lower median sternotomy improved the exposure tremendously, allowing free mobilization of the heart and manipulation for multiple coronary bypasses.

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