Case report -Aortic and aneurysmal
Beating-heart ascending aortic graft replacement in dilated cardiomyopathy

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Abstract

It is still a highly difficult choice with no definitive answer whether to perform cardiac surgery on cardioplegically arrested heart or to operate on a beating heart, especially for patients with dilated cardiomyopathy (DCM). A 73-year-old man, who had ascending aortic aneurysm and DCM with ejection fraction (EF) of 16.5% and the left ventricle (LV) dyssynchrony, underwent graft replacement of the ascending aorta and implantation of the LV lead for cardiac resynchronization. The operation was carried out on a beating heart using tepid hypothermic cardiopulmonary bypass under antegrade/retrograde coronary blood perfusion during graft-aorta proximal anastomosis. Postoperative course was uneventful, though brain natriuretic peptide (BNP) showed transient elevation.

Keywords: Aneurysm; Cardiomyopathy; Perfusion

1. Introduction

Graft replacement of the ascending aorta is usually performed on cardioplegically arrested heart. Reduced ejection fraction (EF) of left ventricle (LV) is one of the risks of cardiac operations [1]. Some reports recommend heart valvular surgery on a beating heart for patients with severely compromised ventricular function [2]. However, few cases have been reported about beating-heart surgery of the ascending aorta or aortic valve in patients with impaired LV, raising concerns about technical difficulties of surgical procedures and postoperative poor prognosis. This report describes a patient with low EF due to dilated cardiomyopathy (DCM) who underwent graft replacement of the ascending aorta on a beating heart, and patient’s postoperative course, as well.

2. Case report

A 73-year-old man was admitted to our hospital for cardiac resynchronization therapy (CRT) because he had been suffering from DCM for over 12 years with New York Heart Association (NYHA) functional class III. His symptom had been worsening with an optimal medication regimen including a diuretic, an angiotensin-receptor blocker as well as a beta blocker. Preoperative chest computed tomography showed severely dilated ascending aorta of 60 mm (Fig. 1a and b). Electrocardiographical rhythm was sinus of 90 bpm and QRS 142 ms with a left bundle branch block. The echocardiography revealed EF of 16.5% measured by biplane method. He had significant dyssynchrony with a septal to posterior wall delay of 132 ms by echocardiographic tissue synchronization imaging. Preoperative brain natriuretic peptide (BNP) was 208 pg/ml. Coronary angiography through radial approach showed no stenotic lesion and no suitable coronary vein for implantation of LV lead of CRT. The decision was made to perform ascending aortic graft replacement on a beating heart and implantation of LV lead for CRT. Staged operation was scheduled for CRT with RA and RV leads implantation.

After median sternotomy and pericardiotomy, cardiopulmonary bypass with tepid hypothermia of 34 °C was started using a two-staged venous cannula and bilateral axillary arterial lines because of marked thrombus formation in the abdominal aorta. An aortic cross-clamp was placed proximally to the innominate artery and retrograde coronary perfusion was started at the same temperature as that of body perfusion using a self-inflating coronary sinus perfusion cannula (Edwards Lifesciences, Irvine, USA). The coronary sinus and a retrograde cannula were monitored through transesophageal echocardiography by the anesthesiologists for prevention of dislodging during the procedure. Flow rate through coronary sinus cannula was kept between 250 and 350 ml/min and pressure 30–40 mmHg. The ascending aorta was opened transversely first, then longitudinally. Observation demonstrated retrograde flow from the right and left coronary arteries. The antegrade coronary flow was started with selective perfusion catheters (SumitomoBakelite, Tokyo, Japan; silicon type with wire at their end, bendable to a shape suitable for antegrade coronary perfusion) (Fig. 2), using the 6 mm sized branch of the arterial line. We used 4 mm cannulae, which were...
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Fig. 1. (a) Chest computed tomography showing ascending aortic aneurysm with maximal diameter of 60 mm and (b) its left anterior oblique image.

Fig. 2. Selective perfusion catheter (Sumitomo Bakelite, Tokyo, Japan) silicon type with wire at its end, bendable to a shape suitable for antegrade coronary perfusion.

Impaired myocardium for 30 min, during which permanent pacing electrode (Medtronic Minneapolis, USA) of CRT was placed on lateral wall of LV. Weaning from cardiopulmonary bypass was uneventful. Aortic cross-clamp time was 93 min but the heart had no arrest time. Cardiopulmonary bypass time was 146 min. We used inclusion technique for the graft. Low dose inotropic support was needed (continuous infusion at 3–5 μg/kg/min) for 12 postoperative hours. Weaning from mechanical ventilation was successful after 8 h of ventilatory support. The postoperative course was uneventful. The patient received CRT implantation on postoperative day 24. Intraoperative biopsy findings showed interstitial fibrosis and variation of myocyte size; those were compatible with DCM.

During the follow-up of 10 months, his NYHA was class II. Postoperative maximum value of creatine kinase-MB (CK-MB) was 16 IU/l and serial results of BNP 274 pg/ml (1 week), 250 (1 month), 89.5 (3 months) and 73.1 (6 months). Echocardiography showed LVEF of 23% (1 month), and 33% (6 months).

3. Discussion

Aortic root surgery has traditionally been performed with an arrested and cooled heart using cardioplegia. The EuroSCORE have addressed that low LVEF is one of the risk factors in the heart surgery [1]. When DCM patients, who often have a severely low cardiac function, need open heart surgery, cardiac arrest might increase risk of postoperative low cardiac output syndrome.

Whether to perform cardiac surgery on cardioplegically arrested heart or to operate on a beating heart is still a highly difficult choice with no definitive answer, especially for patients with DCM. Bolling and his colleagues have reported excellent results of mitral valve surgery on arrested heart in DCM patients [3]. However, beating-heart surgery has recently been recommended especially for patients with impaired cardiac function. Katircioglu and colleagues reported the usefulness and improved clinical results of beating heart mitral valve surgery in low EF patients [4]. Kaplon et al. also reported a successful case.
of multi-valve surgery on a beating heart having EF of 15% [5].

There may be, however, concerns about poor operative prognosis and technical difficulties of surgical procedures. Aortic surgery on a beating heart has been reported in some cases [6, 7], though its significance has not been established in patients with impaired ventricle such as DCM. Only retrograde coronary blood perfusion was performed during the last quarter of the proximal anastomosis in our case and no abnormal elevation of CPK-MB was observed. Laboratory examination revealed transient rise of BNP, which, however, fell below the preoperative value two months after CRT implantation, with no postoperative functional deterioration seen on echocardiography. This report describes the efficacy of ascending aortic surgery on beating heart condition. Based on our experience, we believe that beating-heart surgery should be a useful option for DCM patients.

References