AORTIC VALVE REPLACEMENT IN A PATIENT WITH EXTRA-ANATOMIC AORTIC AND SUBCLAVIAN BYPASSES

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The patient was 62-year-old male who successfully underwent an anatomic repair of aortic coarctation at the age of 15 and an extra-anatomic ascending aorta- to-descending aorta bypass (graft size 20 mm) and an extra-anatomic ascending aorta to the left subclavian artery bypass (graft size 10 mm) at the age of 49. As he grew older he started presenting clinical symptoms of aortic stenosis. The echocardiogram showed a bicuspid aortic valve with severe stenosis and a mean gradient of 65 mm Hg. Despite the high surgical risk, we decided to perform an open valve replacement with installing the CPB prior to re-sternotomy with a simultaneous cannulation of the axillary and femoral arteries by reason of interrupted descending aorta. The postoperative course was uneventful.

Key words: *coarctation, aortic valve replacement, extra-anatomic ascending aorta- to-descending aorta bypass, adults.*

INTRODUCTION

Coarctation of the aorta (CoA) accounts for 5–8% of all congenital heart defects with the risk of restenosis and late aneurysm formation after surgical reconstruction or balloon angioplasty [1, 2].

Bicuspid aortic valve is estimated to occur in 20–85% of these cases. These two conditions are often regarded as “two villain parts of a diffuse problem”, namely the generalized arteriopathy [3]. In addition, up to 30–40% of patients with previous coarctation repair have recoarctation or aneurysm formation and require reintervention [4].

Blalock and Park proposed the first surgical repair in 1944, describing a bypass from the left subclavian artery to the aorta to circumvent the area of narrowing. The single-stage approach with ascending-to-descending aorta bypass was originally described by Vijayanagar in 1980 [5]. This technique combined aortic valve replacement with a bypass graft from the ascending aorta to the retrocardiac descending aorta. In 2001, Conolly, et al. described a similar posterior approach with modification to the technique [6].

Clinical case

We report the case of a 62-year-old male patient who successfully underwent an anatomic repair of aortic coarctation in our hospital at the age of 15.

At the age of 49 the patient was readmitted to our center for the second time with a large aneurysm of the descending aorta and of the left subclavian artery. The diagnosis of the aneurysm was accidentally made via computer tomography following an occupational thoracic injury after a ladder fall. The echocardiogram showed normal left ventricular function without concentric hypertrophy. There were hints that the aortic valve may be bicuspid and a small degree of regurgitation was also present. A recurrence of the aortic stenosis could not be found. The patient was referred to surgical treatment. A surgical approach through median sternotomy with an extra-anatomic ascending aorta- to-descending aorta bypass (graft size 20 mm) and an extra-anatomic ascending aorta to the left subclavian artery bypass (graft size 10 mm) was proposed. The graft anastomosis with both ascending and descending aorta and subclavian artery were made on-pump with beating heart technique and partial aortic clamping. The graft connecting the ascending with the descending aorta was routed around the right side of the heart, anterior to the inferior vena cava, and was anastomosed to the descending aorta through an opening in the posterior pericardium. The postoperative course was uneventful.

The patient remained in good condition for about 13 years. At the age of 62 he started presenting clinical symptoms of aortic stenosis such as fatigue, especially during times of increased activity and shortness of breath, especially during exertion. The echocardiogram showed a bicuspid aortic valve with severe stenosis and a mean gradient of 65 mm Hg. Due to the previous operations there were some concerns that a conventional valve replacement via median sternotomy would involve high or prohibitive surgical risks, mainly extensive bleeding by graft injury and complex aortic cannulation and clamping. Therefore, a transapical transcatheter aortic valve implantation (TAVI) was discussed. The patient underwent various procedures to determine the TAVI-eligibility (computed tomography (CT), angiogram, and echocardiogram) and the results were presented and discussed in a multidisciplinary heart team. The assessment of the valve annulus showed a marginal large annulus size (29–30 mm mean, 28.5–30 mm area derived) which could lead to a relevant paravalvular regurgitation following after a TAVI procedure. Our patient presented no additional comorbidities, was young and physically fit and had a EuroScore <10%. Therefore, the transapical transcatheter aortic valve replacement was seen as a valid option but not as the surgical procedure of choice.

Despite the high surgical risk associated with a redo, we decided to perform an open valve replacement. The patient was heparinized and prepared for cardio-pulmonary bypass (CPB) using both the right axillary and right femoral arteries for arterial cannulation and the right femoral vein for venous cannulation prior to the median sternotomy (Fig. 1). We performed the redo sternotomy using an oscillating saw to limit the risk of tearing underlying structures. After an extensive cardio-pericardial adhesions liberation the two aortic grafts were exposed (Fig. 2). A left ventricular vent was placed. The ascending aorta was then cross clamped and incised between the two Dacron graft insertions. The severely dysplastic bicuspid aortic valve was excised and replaced with a mechanical valve in order to avoid recurrent re-operation (Fig. 3). The aortotomy was closed using a pericardial patch at the site of the non-coronary cusp of the aortic valve. The patient was weaned from CPB without any difficulties. The ventilation time after the surgery was eight hours and the ICU-stay 2 days. The postoperative course was mainly uneventful, a catheter ablation of an atrial flutter needed to be performed. Prior to discharge on postoperative day 15 the ECG showed a sinus rhythm. The echocardiography confirmed a normal valve function with transprosthetic gradients within range for this type of prosthetic valve (mean gradient 9 mm Hg, max gradient 18 mm Hg). Furthermore, a computer tomographic angiography

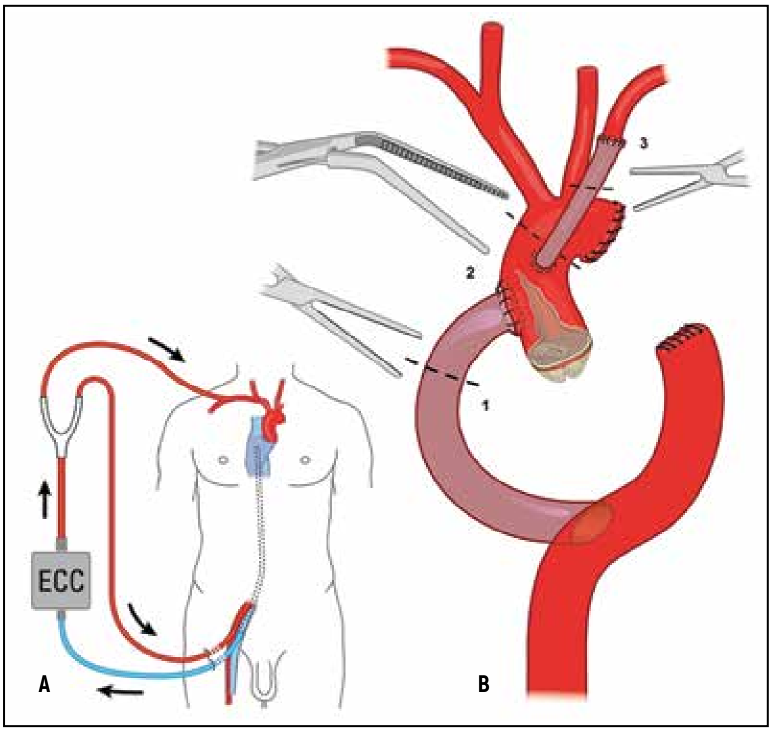

Fig. 1. Extrathoracic connection of the ECC to the patient (A) and the clamping of the bypasses (B) schematically (1 = extra-anatomic aortic bypass; 2 = ascending aorta; 3 = subclavian bypass)

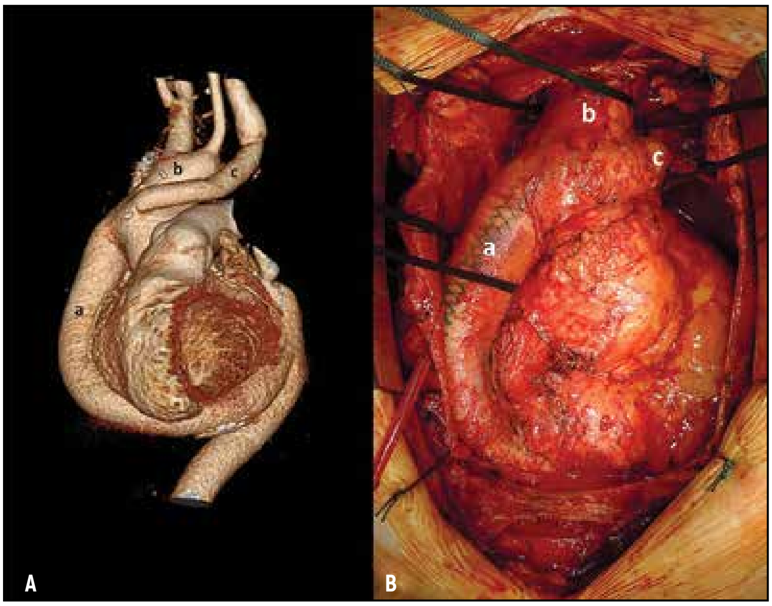

Fig. 2. Cardiac computed tomography (A) and intraoperative view (B) of the extra-anatomic and subclavian bypasses (a = extra-anatomic aortic bypass; b = interrupted thoracic aorta; c = subclavian bypass)

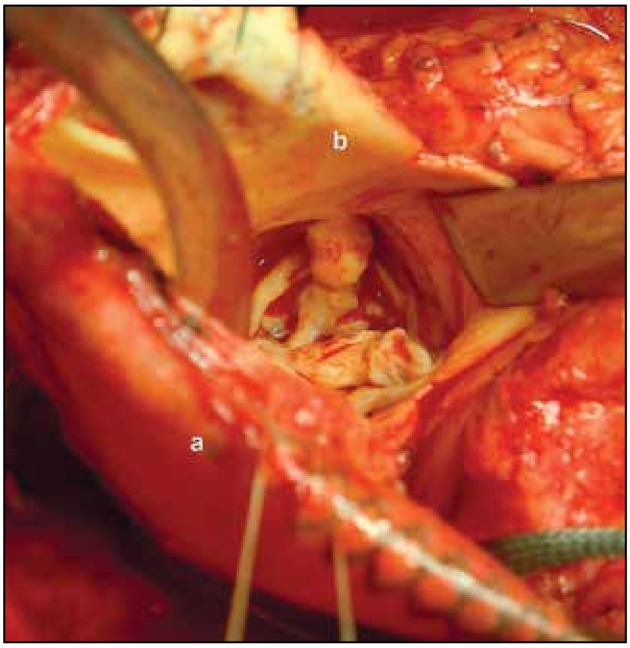

Fig. 3. Intraoperative view of the bicuspid aortic valve (a = extra-anatomic aortic bypass; b = subclavian bypass)

showed a normal graft patency of the two extra-anatomic bypasses.

DISCUSSION

Currently we are increasingly facing late onset of complications in adulthood after interventions for coarctation in early childhood. Some of these are related to the initial operation (recoarctation, aneurysm) and some to associated pathologies such as bicuspid aortic valve. In long-term follow-up approximately 11% of patients require reoperation, mainly due to bicuspid aortic valve [7, 8]. Calcifications of the bicuspid aortic valve becomes more common from the fourth decade and the significance of the aortic valve disease increases in cases of both aortic coarctation and bicuspid aortic valve compared to isolated bicuspid valve [9].

Despite the technical challenge, we presented a successful surgical approach via sternotomy to replace a bicuspid aortic valve in a patient with a history of aortic coarctation, which required two previous surgeries. The aortic valve replacement is performed mostly during the insertion of extra-anatomic bypass and to our best knowledge, another similar case has not yet been described in the literature. In our opinion, the main difficulty, graft injury, can be avoided while installing the CPB prior to re-sternotomy with a simultaneous cannulation of the axillary and femoral arteries in the case of interrupted descending aorta.

Conflict of interest: none declared.

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