

Case Report

Sub total aortic replacement using simultaneous Bentall and Elephant Trunk procedure

Mehreen Kisat,¹ Umer Darr²

Medical College, Aga Khan University Hospital,¹ Department of Cardiothoracic Surgery, Tabba Heart Institute,² Karachi, Pakistan.

Abstract

A 22 year old female with valvular heart disease, moderate mitral valve insufficiency, moderate aortic insufficiency, extensive aneurysmal dilatation of the entire ascending aorta and arch, and segmental dilatation of descending aorta underwent entire anterior aortic replacement. We performed aortic root and valve replacement with a composite graft, followed by coronary artery reimplantation using the Bentall and De Bono technique. Simultaneously, we carried out a graft replacement of the transverse arch and descending aortic aneurysms with a woven Dacron graft using the Elephant Trunk technique. The goal of this surgery was to correct or optimally treat the multiple sites of aortic disease. To the best of our knowledge, there is no reported case from Pakistan with extensive aortic grafting from root to descending aorta using the Bentall and Elephant Trunk technique simultaneously.

Keywords: Thoracic Aortic Aneurysms (MeSH).

Introduction

Non-cardiac vascular surgeries are performed less often in Asian populations, which may be explained by a lower prevalence of disease in this group.¹ The incidence of thoracic and abdominal aortic aneurysms has been rising in Western populations and is associated with patient age, gender, smoking status and obesity among other risk factors.² Recent data from the Centers for Disease Control and Prevention reports aneurysm disease to be the 18th most common cause of death.³ Demographics in developing countries have evolved with an increase in average life expectancy and hence, the prevalence of aortic aneurysms in Pakistan is expected to increase.⁴ However, there is a tremendous paucity of literature on aortic disease in Pakistan. We report the first successful surgical repair of the aortic root, transverse arch and descending aortic aneurysms with simultaneous Bentall and Elephant Trunk procedure.

Case Report

A 22 year old female (weight:48kg, height:157cm) with hypertension and valvular heart disease presented to the Emergency Room with shortness of breath (NYHA III), retrosternal chest pain and palpitations, and was referred for surgical evaluation. Investigations included, haemoglobin

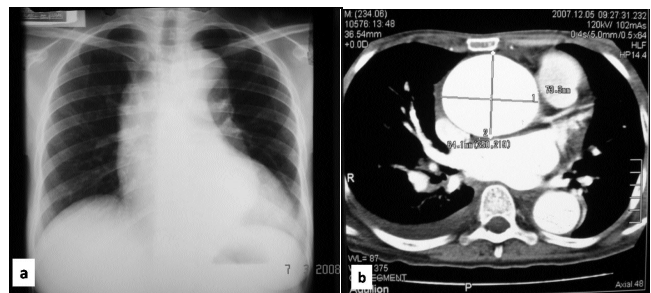


Figure 1: CT scan - (a): Anteroposterior x-ray of the chest while the patient was standing. The widest cardiac and mediastinal diameter are about 45% and 65% respectively. Thoracic aortic aneurysm is an important differential of mediastinal widening on a chest x-ray. (b): CT scan of the chest in axial section showing the ascending aorta anteriorly and the descending aorta posteriorly. The transverse and anteroposterior diameters of the ascending aorta are 7.3cm and 6.4cm respectively. The transverse diameter and anteroposterior diameters of the descending thoracic aorta are 3.6cm and 3.3cm respectively.

10.2g/dL and a haematocrit of 3.1%. Chest X-ray showed an enlarged heart size and aneurysmal dilatation of the aorta at ascending, descending and arch of aorta. While echocardiography had moderate to severe mitral regurgitation, moderate aortic regurgitation (Pressure gradient:185mm of Hg), left ventricular ejection fraction of 41% and mean pulmonary arterial pressure of 25mmHg.

On computed tomography aneurysmal dilatation of entire ascending aorta (maximum diameter: 7.3cm) and arch (maximum diameter:4.8cm) involving aortic cusps and segmental dilatation of descending thoracic aorta(maximum diameter:4.8cm)was seen.

Colour Doppler and Duplex scan of the carotids showed bilateral intimal wall thickening and bilateral aneurysmal dilatation of common carotid artery (CCA) with hyperdynamic flow. A plaque was also appreciated at the origin of CCA bilaterally. The right internal carotid artery (ICA) was tortuous and both the subclavian arteries were dilated.

Examination revealed and increased jugular venous pressure, bilateral basal crackles, and a pan-systolic murmur with maximum intensity at the apex radiating to the axilla. There were no obvious signs of Marfan's syndrome.

In the Surgical Procedure the ascending aorta and aortic arch were exposed through a median sternotomy. Cardiopulmonary bypass was instituted with right common femoral artery, and a single two stage venous cannula in the

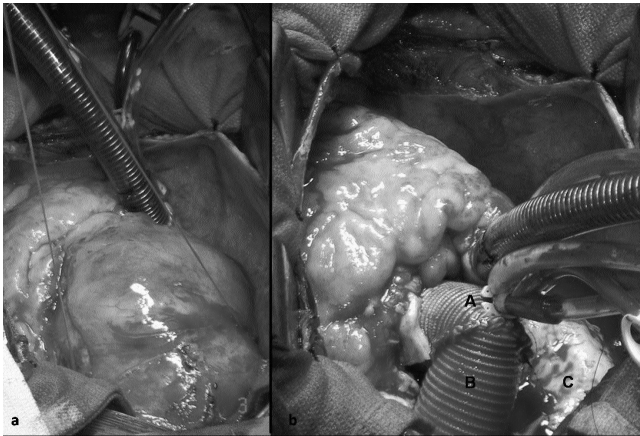


Figure 2: Intra operative pictures: LEFT (a): Intraoperative photograph of the arch of aorta aneurysm after the patient was put on cardiac bypass. RIGHT (b): Intraoperative photograph of the Bentall prosthesis (A) anastomosed to the distal end of the Elephant trunk (B) used to replace the thoracic aortic aneurysm. The opened pericardial sac (C) can also be appreciated.

right atrium. The systemic temperature was lowered and during this time, the composite graft was assembled by sewing a St. Jude bileaflet mechanical valve (size:23mm) to the Dacron tube. The ascending aorta was cross clamped and the heart was stopped with topical hypothermia and cold-blood cardioplegic solution. The heart was protected by giving intermittent retrograde cold-blood cardioplegia through the coronary sinus, supplemented with direct antegrade coronary artery flow after the aorta was opened up. The ascending aorta was opened up, the left coronary artery (LCA) and right coronary artery (RCA) buttons were preserved and the aneurysmal part was excised. The composite graft was secured to the aortic annulus with a series of pledgeted stitches. The LCA and RCA were reimplemented on the graft by using the Bentall technique. The coronary grafts were placed on the posterior and right side respectively to avoid kinking of the left limb and thrombosis of the left coronary ostium. The aneurysmal sac was then resected.

The patient was then placed in Trendelberg position and ice-packs were applied around her head. When the patient's temperature had been lowered to 18°C (measured nasopharyngeally and rectally) and EEG monitoring became isoelectric, she was put in circulatory arrest. A woven doublevelour Dacron graft was used as the elephant trunk. It was inverted upon itself and the free end of the graft was inserted into the descending thoracic aorta. Distal anastomosis was made by suturing the folded edge just proximal to the origin of the left subclavian artery. After the completion of the distal anastomosis, the elephant trunk was left in the descending aorta and the inner portion of the graft was retrieved into the operative field. A side hole was made in the retrieved portion of the graft and the preserved "island" of transverse arch containing the great vessels was sutured to

the graft. Following this reconstruction cardiopulmonary bypass flow was initiated and the graft was clamped. The patient was in deep hypothermic circulatory arrest for 64 minutes. We started to rewarm the patient and the proximal graft-to-graft anastomosis was done during this time. Histopathology demonstrated tissue from large blood vessels with areas of marked intimal thickening. Fibrosis and fragmentation of elastic fibers was also seen along with cystic degeneration of the media. Additionally, there was fibrosis of the adventitia with patchy lymphoid infiltrate and occasional ill defined granulomas. There was no evidence of tuberculosis or malignancy. The features were compatible with tissue from site of aortic aneurysm, most likely secondary to Marfan's syndrome. Further workup is required to exclude Marfan's conclusively.

Postoperatively, the patient's symptoms were relieved and there was no neurological deficit or dysfunction. She was discharged on the 7th postoperative day.

Discussion

There is limited literature from Pakistan on aortic aneurysm and repair surgery. A patient presenting with chest pain, but normal ECG and Troponin I levels should be screened for mediastinal widening by a chest x-ray to rule out an aortic aneurysm /dissection.

According to Crawford and his associates all diseased segments larger than 5 cm in external diameter are a surgical mandate in patients with aneurysms.⁵ A serial analysis of patients with thoracic aortic aneurysms by Coady et al,⁶ revealed a median size of 6.0 cm of ascending or arch and 7.2 cm of descending aneurysms for rupture or dissection. In patients with Marfan's syndrome, rupture or dissection occurred even at sizes less than 5.0 cm. Thus, the suggested size criterion for surgery in asymptomatic patients is 5.5 cm for ascending or arch aortic aneurysms, 6.5 cm for descending aortic aneurysms, and 5.0 cm for individuals with Marfan's syndrome or other inherited collagen vascular disorder⁶ On the other hand, symptomatic aneurysms should be resected regardless of size.⁷

A case series at a tertiary care hospital in Pakistan looked at the outcome of 12 cases of either aortic dissection (7 cases) or ruptured aortic aneurysm (5 cases). Four patients from each group underwent surgery, out of which one patient with aortic dissection and no patients with ruptured aortic aneurysms survived to discharge.⁸ In another study, Khan et al. looked at the outcome of 25 abdominal aortic aneurysms by dividing them into leaking AAA (8 patients) and non-leaking AAA (17 patients). All the patients in the non-leaking group underwent surgery, 3 of whom received a bifurcation graft and 4 received a tube graft.⁹

Extensive aneurysmal disease of the aorta can be

corrected by a two-stage elephant trunk procedure with low morbidity and acceptable mortality.^{10,11} In patients who undergo subtotal or total aortic replacement, the 5-year survival rate is 75%.¹² However, several deaths occur during the interval between the staged operations due to rupture of residual aneurysms, refusal of second operation, or deterioration of general conditions.¹³ Thus, the one stage total aortic replacement should be considered in some high risk patients.

In our case, we opted for the extension of the aortic valve, root, and arch replacement with a two-stage elephant trunk technique as the diameter of the downstream aneurysm (4.8cm) had not yet reached its surgical limit (6.5cm). Since the reported annual growth rate is 0.12cm/year for descending thoracic aorta (DTA) for patients who have undergone such aortic surgery, our plan is to repair the dilatation when patient becomes symptomatic or the diameter of the DTA approaches a surgical indication.⁶

Conclusion

Approach of simultaneously employing the Bentall and De bono technique followed by deployment of the elephant trunk should be considered in patients with diffuse aneurysmal disease.

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