Sutureless aortic valve prosthesis with supracoronary ascending aortic replacement as an alternative strategy for composite graft replacement in elderly high-risk patients.

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Abstract

Aortic valve disease is frequently associated with ascending aorta dilatation and can be treated either by separate replacement of the aortic valve and ascending aorta or by a composite valve graft. The type of surgery is depending on the exact location of the aortic dilatation and the concomitant valvular procedures required. The limited evidence for elective aortic surgery in elderly high-risk patient remains challenging and therefore alternative strategies could be warranted. We describe an alternative strategy for the treatment of ascending aortic aneurysm and aortic valve pathology with the use of a sutureless, collapsible, stent mounted aortic valve prosthesis.

INTRODUCTION

Valvular heart disease, mainly aortic valve pathology, is frequently accompanied by ascending aortic aneurysm. Indications for surgery depends on the underlying pathology. Increasing age, hypertension, smoking, genetics, atherosclerosis and connective tissue disorders are etiological factors that are associated with ascending aortic aneurysms. [1] Whether or not to replace the aorta and aortic valve depends on many factors, including patient age, aneurysm size, co-morbidities, type of valve prosthesis and surgeon-specific preference must be considered. Surgical mortality for isolated elective replacement of the ascending aorta, including the aortic root ranges in literature from 1.6 – 4.8% and is largely dependent on age and other well-known cardiovascular risk factors at the time of operation. [2] However, operative mortality for aortic aneurysm is significantly increased in the elderly patient group. [3] The risk in aortic surgery is highly dependent on the type of surgery, speed of repair, cross-clamp and circulatory arrest times. [4] Furthermore, several studies found a higher incidence of prolonged ventilation times, low cardiac output syndrome, multi-organ failure and postoperative infections in elderly patients compared to a younger age group.

The type of surgery is depending on the exact location of the aortic dilatation and the concomitant valvular procedures required. Current guidelines recommend aortic valve repair, using the re-implantation technique or remodeling with aortic annuloplasty, in young patients with aortic root dilation and tricuspid aortic valves. [5] However, in comparison to younger patients, little or none is known about quality of life after major aortic surgery in elderly patients. [6]

We describe an alternative strategy for treatment of ascending aortic aneurysm and aortic valve stenosis to simplify and shorten the surgical procedure.

CASE SERIES

A 76-year old female with a medical history of polymyalgia rheumatic with life-long corticosteroid usage, temporal arteritis, renal dysfunction and chronic obstructive pulmonary disease was referred to the department of cardiothoracic surgery after routine echocardiography revealed mild ascending aortic dilatation (48mm) and mild-to-severe aortic valve insufficiency. After initially conservative treatment, follow-up computed tomography unveiled an increase up to 55.8mm within 12 months with a mild dilated aortic root (35mm) and dilated aortic arch (40mm). **Figure 1**

An 81-year old female patient was referred to the cardiology outpatient clinic with palpitations and increasing dyspnea. As routine diagnostics with transthoracic echocardiography revealed a dilated ascending aorta, patient was discussed in our heart team. Medical history noted peripheral arterial disease, lung fibrosis and bilateral total hip replacement. Computed tomography showed an ascending aortic aneurysm of 65mm with a calcified tricuspid aortic valve. Additional measurements demonstrated a slightly dilated aortic root (33mm) and aortic annulus.

Figure 2

Both patients were discussed in our multidisciplinary team, consisting of a cardiologist, cardiothoracic surgeon and anesthesiologist intensivist. In both patients, an alternative surgical treatment was opted due to their advanced age and comorbidities. Normally, in the first patient a valve sparing root replacement with ascending aorta and aortic arc replacement would have been performed. Due to the valve calcification in the second patient, a Bentall procedure would have been performed. Considering the comorbidities, we opted for a surgical approach with the shortest cardiopulmonary bypass and crossclamp times without the need for anterograde selective cerebral perfusion and circulatory arrest.

Therefore, both patients were selected for supracoronary ascending aorta replacement and implantation of a sutureless biological aortic valve (Perceval S, LivaNova, London, UK).

Surgical Technique

After median sternotomy and cardiopulmonary bypass was achieved by standard ascending aorta cannulation and right atrial cannulation, the heart was arrested using crystalloid cardioplegia. Before aortatomy, the ascending aorta is palpitated to check for clacified aorta plaques. After aortatomy, the aorta is excised 1-2 millimeters above the coronary ostia and the native aortic valve is removed and the annulus is decalcified. Limited tissue above the coronary ostia potentially carries the risk of ostium blockage with implantation of the prosthesis. Therefore, the coronary ostia should be checked after implantation of the prosthesis and after implatantion of the aortic valve prosthesis to prevent perioperative myocardial ischemia. The ascending aorta was replaced with a Gelweave graft (Sulzer Vascutek, Refrewshire, Scotland). After reconstruction of the proximal anastomoses, the valve is adequality sized trough the prosthesis. As in normal sutureless valve implantation, three guiding sutures need to be placed 2 mm below the nadir of each cusp. The biological valve was deployed through the prosthesis. In some cases, depending on valve size and prosthesis length, the stent frame of the valve prosthesis will cover the proximal anastomoses. If the valve size is chosen adequately (tight fit) there is no need for fixation of the prosthesis with the guiding sutures. After implantation of the valve, the distal anastomosis is completed.

Figure 3

Postoperative Outcome

Cardiopulmonary bypass times and crossclap times were 95 and 57 minutes respectively in the first patient and 86 and 59 minutes in the second patient. Postoperative both patient were admitted to the intensive care unit for 2 days. Patients were discharged from the hospital in good clinical condition after 6 days and 9 days respectively. No complications occurced during hospitalization, however one patient experienced a postoperative delirum, which cleared over the days with medication. At follow-up echocardiography (4 weeks) one patient showed mild pericardial effusion which was evacuated through pericardiocentesis.

DISCUSSION

The current manuscript provides an alternative surgical strategy for treatment of concomitant aortic valve pathology and ascending aortic dilatation in elderly high-risk patients. The proposed operation can be performed with normothermic cardiopulmonary bypass without circulatory arrest and cross clamp times below 60 minutes. Both patients recovered adequately, and short term (2 years) CT follow-up showed adequate results. **Figure 4**

Aortic valve disease is occasionally associated with dilation of the ascending aorta. One possible cause of dilation is hemodynamic flow disturbance in the aorta beyond the stenotic valve and therefore not linked to genetic disorders. The decision whether or not to replace the aorta is multifactorial and should include the risk of dissection or rupture. Rapid progression of more than 0.5 mm/year and larger diameters are associated with increased risk of type A dissection or rupture, with a sharp increase of risk at a diameter >60 mm. [9]

Data on the increase in aortic dimensions after valve replacement shows that re-operation for an aortic root with a diameter of 40–50 mm during initial valve replacement is rarely necessary after a follow-up of 10 years and furthermore is accompanied by a very low incidence of dissection [10, 11] Therefore, argues against routine aortic root replacement during the time of aorta valve replacement, especially in elderly patients.

In literature, an increased risk of postoperative pacemaker implantation is observerd with the use of sutures aortic valve prosthesis.[7, 8] However, with increasing experience in adequate sizing, limited balloon dilation postimplantation a reduction in postoperative pacemaker implantation can be achieved, narrowing the gap between conventional aortic valve implantation. In the current approach in some cases, the expandeble stentframe of the Perceval prosthesis is positioned above the sutureline of the ascending aorta prosthesis. In case of bleeding of the proximal anastomosis one should be carefully with placement of additional sutures, as there is a potential risk of catching the valve leaflets or dislodgment of the stentframe. Therefore, thorough transesopheageal echocardiography should be performed before closure of the chest.

Additionally, recent studies suggest that surgery of the ascending aorta with or without combined procedures can be safely performed through an upper ministernotomy. Minimally invasive surgery reduces surgical trauma, length of mechanical ventilation and ICU stay, improves post-operative outcomes and has cosmetic benefits without compromising surgical results. [12] The proposed technique is simple and fast and might therefore ideally been performed through an upper hemi-sternotomy which could enhance postoperative recovery in elderly patients.

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FIGURE LEGEND

Figure 1: Preoperative CT reconstruction of 76-year old female with ascending aorta dilatation and aortic arch dilatation

Figure 2: Preoperative CT reconstruction of 81-year old female with ascending aorta dilatation

Figure 3: Intraoperative biological sutureless aortic valve implantiontation through an aortic prosthesis.

Figure 4: Postoperative result.