Valve-sparing aortic root replacement in a bicuspid aortic valve with papillary fibroelastoma

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Abstract

We present our surgical strategy in a patient with a bicuspid aortic valve Type I (R/N), aortic root aneurysm and papillary fibroelastoma on the aortic valve’s cusp. He underwent valve-sparing aortic root replacement (David V Procedure); we also removed the papillary fibroelastoma from the fused right- and non-coronary cusp. In this case, we used a 34-mm straight Dacron graft for root replacement and an aortic annulus downsized to 30 mm. We use Hegar dilatators for the intraoperative measurement of the aortic annulus. The subvalvular sutures are pledged U-sutures and our usual technique in bicuspid aortic valve is to take 2 on each commissure and 5 on each side so that we end up with 12. For the reimplantation of the aortic rim, we prefer a semi-circumferential suture with a small needle. We plicate the non-fused left cusp, which is our reference for the later reconstruction of the common right- and non-coronary cusp. The key strategy of our bicuspid valve reconstruction is aiming at a 180° non-fused commissure orientation and cusp plications. The coronary ostia and aortic root are marked intraoperatively with a radiopaque marker to facilitate postoperative diagnostics and any future interventions including later catheter-based valve interventions.

Keywords: Bicuspid aortic valve • David procedure • Papillary fibroelastoma

INTRODUCTION

The surgical strategy for patients presenting with aortic root dilation and a bicuspid aortic valve (BAV) has changed over the last decades. With its mechanical or biological prosthesis, the Bentall procedure has been the state-of-the-art for many years. Recent data suggest that valve-sparing aortic root replacement in BAV is a promising option with 90% freedom from redo surgery at 8 years. A BAV requiring cusp repair does not seem to be associated with more reoperations [1].

The BAV is one of the most common congenital malformations (1–2%) in the population [2]. Because of its structural difference to a tricuspid aortic valve, the valve apparatus tends to malfunction earlier. Sievers’ surgical classification of the BAV divided the valve’s morphology into 3 categories: Type 0, without raphe; Type 1, 1 raphe; and Type 2, 2 raphes [3].

A papillary fibroelastoma is a benign tumour attached to the heart valves located primarily on the aortic valve. Its prevalence among all cardiac tumours in humans is about 10% [4]. Resecting the fibroelastoma during valve-sparing aortic root replacement does not significantly prolong surgery as it is easily identified and resected, while the aortic valve is surgically exposed. This incidental finding altered this patient’s otherwise below-borderline indication for surgery towards an obvious need for surgery to treat the dilated root and eliminate the potentially embolic risk arising from the fibroelastoma.

We performed valve-sparing aortic root replacement (David V Procedure) including the removal of the papillary fibroelastoma and valve reconstruction via a 180° non-fused commissure orientation and cusp plication. After the procedure, trace aortic valve insufficiency was apparent. This reconstructive aortic surgical method offers young patients freedom from anticoagulation therapy. (Video 1)

Video 1: Valve sparing aortic root replacement in a bicuspid aortic valve with papillary fibroelastoma.
**SURGICAL TECHNIQUE**

We present the case of a 26-year-old man with an aortic root aneurysm measuring 50 mm, a BAV and papillary fibroelastoma of the aortic valve. In preoperative echocardiography, we noted moderate valve insufficiency in this Sievers Type I R/N BAV, and the fibroelastoma was confirmed. We performed a complete sternotomy and initiated cardiopulmonary bypass in standard manner. The aorta was clamped and blood cardioplegia applied in an antegrade and retrograde fashion. The ascending aorta was transected, and we inspected the aortic valve, detecting the suspected lesion on the common right- and non-coronary cusp facing towards the left ventricle. The papillary fibroelastoma was carefully resected with blunt preparation and we immersed it in water, where we observed the typical sea anemone phenomenon. The papillary fibroelastoma is usually attached to the ventricular side of the cusp and could be easily 'shaved off', so that the cusp stays intact and the function of the valve apparatus is saved.

In the following surgical steps, the coronary ostia were excised based on the surgical steps as shown in Fig. 1. Afterwards, we skeletonized the aortic root from the surrounding tissue. The proximal aorta’s rim was trimmed to make reimplantation easier during the subsequent procedure in Fig. 1A. This man's aortic valve had a raphe between the right- and the non-coronary cusp, which identified this valve as a Sievers Type I R/N BAV. The angle between both commissures was approximately 170°, making the repair of this valve more likely to succeed. We used pledged U-sutures for the subvalvular sutures. We used 2 on each commissure in BAV and 5 on each side, thereby ending up with 12 pledged sutures in Fig. 1B. The annulus diameter measured 33 mm with a Hegar dilator, and we decided to use a 34-mm graft marked on the most proximal part with a radiopaque marker. The subannular sutures were inserted into the graft in a manner that modifies the BAV commissure’s angle. The commissures are usually placed in an opposite position so that we end up with an 180° BAV. While tying down the subannular sutures, we inserted the Hegar with the appropriate size of the resulting annulus—in this case, a 30-mm Hegar. The aortic rim was reimplanted in standard fashion. We prefer a semi-circumferential suture with a small needle. Following reimplantation, we first plicate the non-fused left cusp, which is our reference for the later as in Fig. 1C. According to the free margin on the reference left coronary cusp, the common right- and non-coronary cusp is plicated so that the free margin length is the same as the length of the left coronary cusp. The beauty of the 180° orientation inside the graft is that the result of a nearly symmetrical bicuspid valve. The operation is followed by reimplantation of the coronary ostia. We marked these with a radiopaque marker as in Fig. 1D.

The distal anastomosis was augmented with autologous aortic tissue strips laid around the distal part of the ascending aorta.

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**Figure 1:** The surgical steps of the BAV reconstruction and the removal of the papillary fibroelastoma. (A) The ‘shave off’ of the benign tumour, which was found on the ventricular side of the fused right- and non-coronary cusp. (B) The positioned 12-pledged U-sutures (2 on each commissure) and 5 on each side. (C) The plication of the common right- and non-coronary cusp with reference to the already plicated left coronary cusp. The arrow shows the left coronary cusp. (D) The completed repair of the BAV with the plications of the 2 aortic valve cusps.

**Figure 2:** Intraoperative marking with a radiopaque marker (A) coronary ostia and (B) neo-aortic root.
with mattress sutures. As with most valve-sparing procedures, we use a separate ascending aortic graft (David V variant), facilitating the reimplantation step and creating a neo-sinotubular junction. Usually the graft’s size is identical to that of the aortic annulus. In this case, we used a 30-mm graft that was sutured end-to-end with the distal aorta and root graft thereafter. The operation was completed in a standard fashion with proper de-airing and weaning from cardiopulmonary bypass.

**DISCUSSION**

Valve-sparing aortic root replacement in BAV is an established alternative to the Bentall procedure that usually ensures midterm freedom from redo surgery. In this patient, we performed the standard David V procedure including removal of a papillary fibroelastoma and valve reconstruction using a 180° commissure orientation and cusp plications. There is usually no recurrence after removing the papillary fibroelastoma of the aortic valve as well as by the other benign heart tumors. However, the literature related to this topic is scarce [4, 5]. As we do in all patients undergoing the David procedure in our clinic, we marked the most proximal part of the neo-aortic root and coronary ostia with a radiopaque marker (Fig. 2). This simplifies further diagnostics, e.g. in case of suspected coronary ischaemia during coronary angiogram; the mark can be referred to later during transcatheter aortic valve implantation as well.

**Conflict of interest:** none declared.

**REFERENCES**


