



Severe aortic valve insufficiency with a ‘normal’ appearing aortic root: reimplantation (David) procedure

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In *Video 1*, we present a case of severe aortic valve insufficiency (AI) with a normal appearing aortic root, repaired with valve-sparing root replacement reimplantation technique, also known as the David procedure (1). Valve-sparing root replacements were originally developed to treat patients with aortic root pathology and normal functioning aortic valves. Over the past 30 years, we have learned that the reimplantation technique (2) provides the most complete, robust, and durable annuloplasty and repair of the aortic valve.

Clinical vignette

A 54-year-old male with a history of hypertension, dyslipidemia, obstructive sleep apnea, and a thoracic aortic stent implanted for a type B aortic dissection one year ago, presented to hospital with symptoms of congestive heart failure and was found to have severe AI, left ventricular (LV) dilation, and dysfunction (ejection fraction 49%). A transesophageal echocardiogram (TEE) suggested an aortic root diameter of 4.1 cm and a trileaflet aortic valve with possible left coronary cusp prolapse. A cardiac computed tomography (CT) demonstrated no coronary artery disease. A long-axis view of the aortic valve demonstrated a non-dilated aortic root with a complex AI jet, and the short-axis view showed a trileaflet aortic valve with good cusp mobility. The aortic root diameters were measured between 3.9 and 4.1 cm with a dilated ventriculo-aortic junction (VAJ) diameter of 27 mm.

Surgical technique

Following median sternotomy, distal aortic and right atrial cannulation and retrograde cardioplegia, a transverse aortotomy was performed and 4-0 prolene commissural retraction sutures were placed. Valve inspection revealed a trileaflet aortic valve with thickening of the free margins of all three cusps. The cusps were mobile with no obvious fenestrations or calcification. Inspection of the left cusp suggested some degree of prolapse, with bending of the cusp and the presence of a fibrous band. Inspection of the aortic root revealed normal quality tissue, except in the area of the VAJ under the right coronary cusp. The geometric heights of the left, right, and non-coronary cusps measured 18, 21, and 20 mm, respectively. A 6-0 prolene suture was used to retract the ventricular surface of the cusps and the thickened portion of the leaflets was shaved off with a #11 blade to improve cusp mobility. External dissection of the aortic root was performed to enable access to the VAJ at which level the annuloplasty needs be performed. We started with the non-coronary sinus, dissecting down to the level of leaflet insertion. The sinus was resected, leaving behind a 5–7 mm rim of aortic tissue. A similar dissection was performed after harvesting the right coronary button, followed by the left coronary button. The pulmonary artery and right ventricle were detached from the aortic root. A deep dissection (3) was performed by going through the aorto-pulmonary ligament, which is the white fibrous tissue followed by yellowish fat tissue underneath and then into

the muscle. This deep dissection enables a circumferential and robust annuloplasty, which could otherwise be difficult to perform with the coronary arteries intact.

The height of the interleaflet triangle, measured at the left/non-commissure, was 26 mm and reflected the optimal diameter of the new sinotubular junction (STJ)—a 26 mm Valsalva graft was chosen accordingly. The proximal suture line was then performed using 2-0 braided pledgeted sutures. The sutures followed a single plane, connecting the nadirs of the three cusps, except in the region of the membranous septum where the suture line was elevated by a few millimeters to avoid the conduction tissue. These sutures serve as the annuloplasty of the VAJ. The Valsalva graft was prepared by removing the cuff and making a small indentation at the right/non-commissure, reflecting the external dissection limit. Due to the reduced geometric height of the left coronary cusp in this case, the inter-commissural distance around this cusp was reduced to facilitate cusp mobility. Sutures were then passed through the base of the graft, and the graft was tied into place around the native aortic root. The commissural posts were then implanted within the graft using 4-0 polypropylene sutures. The entire valve was then reimplanted following the crown shape of the aortic annulus, placing the prolene sutures from the outside of the graft to the inside and through the aortic wall and then back outside through the Dacron graft. It is important to take suture bites close to the leaflet insertion, to anchor the valve and maintain its geometry. The effective height of all three cusps was assessed. The left cusp was found to be lower than the others, and a central free margin plication was performed to elevate it. The coronary buttons were then reimplanted, and cardioplegia was given to pressurize the tube graft while performing a TEE to assess valve competency. In this case, we observed a small residual AI jet arising from the left/non-commissure. Re-inspection of the valve revealed residual thickened, excess cusp tissue in this region, which was shaved off. A sub-commissural annuloplasty suture, or Cabrol suture, was added to improve leaflet coaptation. Next, we performed the distal aortic anastomosis, de-aired the heart, and unclamped the aorta. Post-bypass TEE showed no residual AI and an excellent leaflet coaptation. The mean gradient was slightly elevated at 12 mmHg, as was the LV outflow tract gradient at 5 mmHg, reflecting a high stroke volume state. The AV area was calculated at 2.0 cm².

Comments

A valve-sparing root replacement with the reimplantation technique provides circumferential reduction and support of the VAJ and the STJ. It enables symmetric or asymmetric remodeling of the aortic annulus and can accommodate different geometries, as seen in bicuspid aortic valves. It provides both internal and external support of both components of the aortic annulus, the VAJ, and STJ. This annular reduction and tailoring facilitate the necessary cusp repair. In summary, a valve-sparing reimplantation procedure is the most robust form of annuloplasty of the aortic valve and is an indispensable tool which can be applied, even in normal appearing aortic roots, to facilitate preservation and repair of aortic valves (4).

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

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