Masters of Cardiothoracic Surgery

David procedure through an upper ministernotomy

Tomas Holubec, Mustafa Al-Obaidi, Thomas Walther, Arnaud Van Linden

Department of Cardiovascular Surgery, University Hospital Frankfurt and Goethe University Frankfurt, Frankfurt/Main, Germany

Correspondence to: Assoc. Prof. Tomas Holubec, MD, PhD. Department of Cardiovascular Surgery, University Hospital Frankfurt and Goethe University Frankfurt, Theodor-Stern-Kai 7, 60596 Frankfurt/Main, Germany. Email: tomasholubec@email.cz.

Submitted Dec 15, 2022. Accepted for publication Mar 28, 2023. Published online May 11, 2023.
doi: 10.21037/acs-2022-avs2-174
View this article at: https://dx.doi.org/10.21037/acs-2022-avs2-174

Clinical vignette

An asymptomatic 58-year-old patient was referred to our department for aortic root aneurysm of 51 mm with progression of 2 mm in one year. Preoperative evaluation using a computed tomography (CT) scan confirmed the aortic root aneurysm and ruled out any coronary artery disease. A transthoracic echocardiography showed a tricuspid aortic valve (AV) with moderate regurgitation. Valve-sparing aortic root replacement (VSARR) with AV reimplantation (David procedure) (1) was therefore scheduled. In standard cases, we perform the David procedure in minimally invasive [minimally invasive cardiac surgery (MICS)] fashion via upper ministernotomy into the third right intercostal space (ICS) with percutaneous cannulation of the right femoral vein.

Surgical techniques

Preparation

After induction of general anesthesia and standard anesthesiologic preparation, the patient is placed in supine position, prepped and draped with both groins exposed.

Exposition

The operation begins with the venous femoral puncture before heparin is administered. The Seldinger guidewire is advanced into the upper caval vein under transesophageal echocardiographic (TEE) observation. Afterwards, an upper ministernotomy skin incision measuring about 6–8 cm in the third right ICS is performed. After opening the pericardium and administration of heparin, a long venous 25-Fr HLS cannula (Getinge AB, Göteborg, Sweden) is placed over the guidewire under TEE control, with the tip being placed in the upper caval vein. The aortic arch is cannulated using a short arterial 19-Fr HLS cannula (Getinge AB, Göteborg, Sweden) using Seldinger technique. The cardiopulmonary bypass is established, and the patient cooled down to 34 degrees Celsius.

Operation

After cross-clamping and opening the aorta 1,000 mL of selective antegrade Del Nido cardioplegia is administered. The aorta is transected about 1 cm above the sino-tubular junction and the aortic root is dissected and mobilized in the noncoronary sinus.

A 4-0 polypropylene pledgeted suture is placed in each commissure just above the cusp junction. These three sutures are pulled tightly allowing a proper valve analysis. The geometric height of each cusp is measured as this should be at least 17 mm for tricuspid valve (2) and the valve cusps are now checked for any pathology.

The annulus (virtual basal ring) is measured using Hegar dilators for choosing the appropriate graft size. Generally, the largest passable Hegar dilator plus 2 mm, or 1 mm in the case of an odd number size, determines the size of the graft. The second way of sizing the graft is to measure the distance from the virtual basal ring plane to the top of the left/non-coronary commissure (3).

After dissection of the left coronary button, the sinus is resected whilst leaving about 4–5 mm remnant of the aortic wall tissue. Further external dissection of the aortic root and the basal ring plane is performed. Deep dissection is very important, especially in the area of left/right commissure towards the pulmonary trunk. Here, the dissection into the muscular cushion is mandatory to reach the virtual basal

ring plane (3). Now the right coronary button is dissected, and the right sinus of Valsalva is resected in the same manner.

The 2-0 sutures are placed into the basal ring, inside-out and horizontally. We start in the non/left commissure and head towards the left/right commissure with two sutures in between, ending up with nine sutures. The suture at the right/non-coronary commissure is placed from outside the aortic root to avoid injury of the membranous septum and/or atrioventricular node.

After previous sizing, a 30-mm Cardioroot Woven Aortic Graft (Getinge AB, Göteborg, Sweden) is selected. The prosthesis is prepared and trimmed. The basal plane sutures are placed in the Cardioroot graft just below the bulged part of the graft. After passing the three commissural 4-0 sutures through the graft at the corresponding place and lowering the graft onto the basal ring, all sutures are tied gently.

The three commissural sutures are passed through the graft directly at the level of the "neo" sino-tubular junction. Now, we perform a visual analysis of the AV followed by a systematic analysis measuring the effective height and performing a water sealing test.

The reimplantation of the valve using three 5-0 polypropylene running "over-and-over" sutures is performed whilst suturing the aortic wall remnants onto the graft tissue.

The coronary buttons are reimplanted in the typical fashion, using 5-0 running sutures. After coronary reimplantation, the distal anastomosis between aorta and graft is performed using 4-0 running sutures. The left ventricle is properly de-aired before tying the sutures. After administration of "hot-shot" over three minutes, the aortic clamp is removed. Standard weaning from the cardiopulmonary bypass is performed. For venous decannulation, a deep transcutaneous 1 polypropylene U-suture is placed.

Completion

Epicardial pacemaker wires are placed on the heart (atrium and ventricle) and tunneled with the two chest drains (32 and 24 Fr) into the subxiphoid area. Pericardium and ministernotomy are closed in the standard fashion.

The intraoperative course was uneventful with cross-clamp time of 91 minutes and cardiopulmonary bypass time of 104 minutes.

Postoperative course

The postoperative TEE showed a symmetrically reimplanted AV with high level of coaptation and no residual aortic regurgitation.

The stable patient was extubated three hours after surgery. He showed an uneventful postoperative course and was discharged home on the sixth postoperative day.

Comment

The MICS has been already very well established in mitral valve and AV and/or root replacement surgery. The invasiveness of any cardiosurgical procedure is defined by the following factors: access, use of cardiopulmonary bypass, and even valve-sparing can be considered another factor of reduced invasiveness (4). Therefore, minimally invasive David procedure via an upper ministernotomy is an excellent example of MICS. Nevertheless, AV repair and VSARR are complex and demanding procedures and therefore still not routinely performed in MICS, yet technically feasible and safe (5).

Up until now, 115 patients have been operated with this or very similar technique receiving successful AV reimplantation at our department with no 30-day mortality.

In summary, the AV repair and VSARR are still limited to a few centers with high experience in MICS and valve-sparing technique; however, precise selection of patients and preoperative planning, especially CT, could help further spread of these techniques.

Acknowledgments

Funding: Production of this video was funded by Getinge AB, Göteborg, Sweden.

Footnote

Conflicts of Interest: TH and AVL disclose receiving consultancy fees and honoraria from Getinge AB, Göteborg, Sweden; however, not specifically for this work. The other authors have no conflicts of interest to declare.

References

1. David TE, Feindel CM. An aortic valve-sparing operation for patients with aortic incompetence and aneurysm of the ascending aorta. J Thorac Cardiovasc Surg 1992;103:617-21; discussion 622.
2. Schäfers HJ, Schmied W, Marom G, et al. Cusp height in aortic valves. J Thorac Cardiovasc Surg 2013;146:269-74.
3. Jahanyar J, de Kerchove L, El Khoury G. Bicuspid aortic valve repair: the 180°-Reimplantation technique. Ann Cardiothorac Surg 2022;11:473-81.
4. Holubec T, Salem R, Walther T. What Exactly Is Minimally Invasive?. Ann Thorac Surg 2023;115:1325.
5. Shrestha M, Kaufeld T, Shrestha P, et al. Valve-sparing David procedure via minimally invasive access does not compromise outcome. Front Cardiovasc Med 2022;9:966126.

Cite this article as: Holubec T, Al-Obaidi M, Walther T, Van Linden A. David procedure through an upper ministernotomy. Ann Cardiothorac Surg 2023;12(4):380-382. doi: 10.21037/acs-2022-avs2-174