Masters of Cardiothoracic Surgery

Mini-access David Procedure with endoscopic assessment of aortic valve competency: the "Snorkelling" technique

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Clinical vignette

A 58-year-old man was referred with an incidental finding of an aortic root aneurysm. He had no significant medical history. Computed tomography (CT) aortogram demonstrated an isolated aortic root aneurysm (aortic annulus 28 mm, aortic root 53 mm, sinotubular junction 53 mm). Transthoracic echocardiogram demonstrated a dilated aortic root and a tri-leaflet aortic valve with mild aortic regurgitation (AR). The left ventricular (LV) ejection fraction was preserved. Cardiac catheterization demonstrated mild non-obstructive coronary artery disease only. Given the patients' age, structurally normal-appearing valve and borderline annular dimension, minimally-invasive aortic valve reimplantation was planned. The minimally invasive approach was based on surgeon and patient preference.

Surgical technique

Preparation

Following induction of anesthesia, routine monitoring lines were placed. A routine sterile field was established, and antibiotics were administered.

Exposition

An upper hemi-sternotomy (UHS) was performed via a 5-cm midline skin incision from the manubriosternal joint to the level of the 3rd intercostal space. An L-shaped hemi-sternotomy was performed terminating to the left side, using a standard reverberating sternal saw. The pericardial well was formed using traction sutures secured to the skin edges. The femoral vessels were exposed and purse string sutures using 5-0 polypropylene were placed in the right common femoral artery and vein. The patient was systemically heparinized with an activated clotting time (ACT) target of >450. The femoral artery was cannulated directly with a 22-Fr Elongated One-Piece-Arterial Cannula. The femoral vein was cannulated using the Seldinger technique. After the guidewire was identified in the superior vena cava under trans-esophageal echocardiographic (TEE) with a bi-caval view, a multi-stage venous cannula (25 Fr) was introduced. Cardiopulmonary bypass was instituted. The patient was cooled to 32 degrees celsius. The aorta was cross clamped and diastolic arrest was induced using Custodial cardioplegia delivered via the aortic root.

Operation

The aorta was transected above the sinotubular junction and further cardioplegia was delivered via the coronary ostia. Commissural tractions sutures were placed. A 12-Fr Medtronic DLP™ paediatric intracardiac sump (Medtronic, Minneapolis, MN, USA) was used to vent the LV though the aortic valve. The valve was inspected to ensure suitability for preservation. The aortic root was mobilized externally below the annular level. Six sub-annular pledgeted sutures (2-0 Ethibond Excel) were placed below the cusp nadirs and the commissures. The aortic root was sized by measuring the height of the non-left commissure post, from the level of the basal ring (1). A 30-mm Vascutek® Gelweave Valsalva™ Graft (Terumo Aortic, Sunrise, FL, USA) was chosen.

The sub-annular sutures were passed through the collar portion of the Valsalva graft. The commissures were positioned inside the graft and the sub-annular sutures were hand-tied. The commissural posts were resuspended to their full height within the graft using a 4-0 polypropylene suture that was placed under traction. A ‘water test’ was performed to assess for gross evidence of prolapse. The Dacron graft was filled with saline and observed for a falling water level, indicating incompetence. A hemostatic running suture line was completed along the remnant aortic wall to the Dacron graft. Bovie electrocautery was used to form the neo-ostia and the coronary buttons were secured with running 5-0 polypropylene sutures.

Schäfers’ caliper was used to measure the cusp height at the central point, while radial traction was placed on the commissural posts. A ≥9 mm cusp height was considered adequate. A 10-mm 30° endoscope and the cardioplegia line with a Luer lock connector were introduced side-by-side into the Dacron graft. Two vascular clamps were used to pinch off the Dacron graft tightly against the endoscope and cardioplegia line (*Video 1*). The root was pressurized with Custodial cardioplegia to a line pressure of 80 mmHg. The valve was assessed using endoscopic vision. Specific attention was paid for coaptation occurring along each cusp edge, equal relative cusp height, central and symmetrical coaptation and evidence of cusp retraction. The endoscopic valve assessment depicted subtle right coronary cusp prolapse. The central portion of the right coronary cusp free edge was plicated with a single central 5.0 polypropolene suture. The valve was reassessed endoscopically. Re-warming was commenced. The distal aortic anastomosis was performed using a double layer 3-0 running polypropolene suture. The heart was deaired, the aortic cross clamp was removed, and the patient was weaned from cardiopulmonary bypass.

Comments

Aortic valve-sparing root surgery offers outstanding long-term outcomes for patients (2). Development of aortic insufficiency is uncommon post valve re-implantation, with freedom-from-reoperation up to 94.2% at 20 years (2). Early development of AR may be ascribed to technical errors, in particular, failure to recognize and correct for subtle cusp prolapse. In addition to pre-existing incompetence, induced prolapse caused by reduction of inter-commissural distance during root reconstruction is common. This manuscript describes how to directly inspect the aortic valve competency in a pressurized aortic root, mimicking physiological conditions. This paper refers to the endoscopic assessment as the “Snorkelling” technique.

Advantages

The “Snorkelling” technique allows for direct visual assessment of the valve in a root pressurized to 80 mmHg, to mimic diastole. The position of the commissural posts is more accurately represented with the graft distended to its full configuration. In the author’s experience, visual assessment under pressurization helps to detect subtle prolapse that may not be causing aortic incompetence. Cusp valve prolapse can be difficult to recognize, in particular, if more than one cusp is involved. The “Snorkelling” technique reveals both the presence and the mechanism of residual incompetence. This information can facilitate an efficient and effective repair. It is unclear what degree of subclinical prolapse will progress to regurgitation. During endoscopic valve assessment, the authors observed that the prolapsing cusp opposed abnormally on the non-prolapsing cusps, leading to collapse of the non-prolapsing cusps and causing the point of central coaptation to be eccentric. Abnormal mechanical stress at the commissures and coaptation edges caused by the prolapsing leaflet may contribute to early deterioration (3,4). The use of central free margin plication reduced distortion of the neighboring cusps and improved symmetry.

Caveats

Endoscopic assessment does not replace echocardiographic assessment or effective height measurement. It should be considered an additional tool.

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Footnote

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

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