Tricuspid valve surgery in patients with concomitant left-sided valve disease

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Clinical vignette

Case 1

A 73-year-old female was admitted to our hospital with symptomatic (New York Heart Association class III) severe mitral regurgitation (MR) and persistent atrial fibrillation. In addition to the MR, preoperative echocardiography revealed moderate functional tricuspid regurgitation (TR) with dilatation of the tricuspid annulus (24.2 mm/m^2). The patient underwent minimally invasive mitral valve (MV) and tricuspid valve (TV) repair, left atrial cryoablation, and left atrial appendage closure.

Case 2

A 61-year-old female with Barlow's disease presents with severe primary MR and TR. Echocardiography showed leaflet thickening and prolapse in both valves, preserved left ventricular ejection fraction (73%) and right ventricular function (tricuspid annular plane systolic excursion >20 mm), and left atrial dilatation (65 mL/m^2 biplane). The patient underwent MV and TV repair in a minimally invasive fashion.

Surgical techniques

Preparation

After anesthesia induction and placement of a transesophageal echocardiography (TEE) probe, a 16F arterial cannula (FemFlex, Edwards Lifesciences, Irvine, CA, USA) is placed via the right internal jugular vein for superior vena cava (SVC) drainage. This is performed routinely in patients requiring minimally invasive TV surgery.

Exposition and cannulation

Minimally invasive approach via right thoracotomy in the 4th intercostal space using either two-dimensional (2D) (under direct vision) or three-dimensional (3D) video assistance is the standard access at Leipzig Heart Center. In patients with severely reduced biventricular function, significant pleural adhesions, moderate or greater aortic regurgitation, or those requiring concomitant aortic or coronary surgery, median sternotomy is performed.

In minimally invasive valve surgery, cardiopulmonary bypass is established by means of percutaneous cannulation

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of the femoral artery and vein using the Seldinger technique. For venous cannulation, a wire is advanced into the SVC under ultrasound guidance. Afterwards, a 22–25F femoral venous cannula is advanced into the right atrium, with constant confirmation of the correct wire position using TEE. As mentioned above, the use of additional SVC drainage is a standard technique at our center for TV procedures. Alternatively, if using single femoral venous drainage, alternative venous cannulae, for example, a cannula with separate drainage openings in the inferior vena cava (IVC) and SVC (e.g., RAP Femoral Venous Cannula, LivaNova, London, UK) may be considered. Arterial cannulation is performed in the same way using a 16–22F cannula (FemFlex, Edwards LifeSciences).

Operation

The pericardium is opened about 3 cm anterior to the phrenic nerve. The camera port and the transthoracic aortic clamp are placed via separate small incisions in the 3rd and 2nd intercostal spaces, respectively. Next, the atrial retractor holder is placed parasternally in the 4th intercostal space. The MV is routinely approached via an incision in the Waterston groove. A more detailed description of our minimally invasive MV surgery setting has been provided previously (1). After the MV surgery is performed, the left atrial incision is closed with a running 3-0 Prolene suture. The superior and inferior venae cavae are then snared or occluded with large bulldog clamps. The TV is visualized using a direct incision of the right atrium from the right atrial appendage towards the IVC. TV surgery may be performed using an on-pump beating heart approach to reduce cross-clamp time, particularly in patients with right ventricular dysfunction. However, we frequently perform TV assessment and annular suture placement on an arrested heart in order to increase accuracy.

Case 1

Typically, secondary TR can be repaired using a semi-rigid ring or a flexible band. The use of suture annuloplasty (i.e., De Vega technique) has been completely abandoned at our institution. We rarely use rigid rings due to an increased risk of ring dehiscence. In the current patient, a 30 mm Tri-Ad^{TM} Adams 2.0 annuloplasty ring (Medtronic, Minneapolis, MN, USA) was placed using standard sutures without felt pledgets. Although depicted in this video, ring sizing is not performed routinely: a 28–30 mm band or ring is used in patients with body surface area (BSA) <1.9 m^2, and a 32–34 mm device in those with BSA ≥1.9 m^2. The repair is followed by a sealing probe test to ensure TV competency. Finally, the right atrium is closed with a running Prolene 4-0 suture.

Case 2

In cases of severe leaflet prolapse, the "clover leaf" technique is a simple and elegant solution. Originating from the edge-to-edge concept initially developed for the MV repair, this method involves stitching the central parts of the free edges of all three TV leaflets with one or two 5-0 Prolene sutures.

The 5-0 Prolene suture is simply inserted through the most central portion of all three TV leaflets (approximately 3–5 mm from the free edge), and then all three leaflets are tied together. If there is any concern about tissue quality, another Prolene suture may be added to reinforce the repair. We always combine this technique with an annuloplasty device, although with a larger size than the above-described technique (in this patient, a 36 mm Tri-Ad^{TM} 2.0 ring). Plication of the septal leaflet using the Kay-plasty technique is also a useful alternative in some patients with residual TR post-annuloplasty, but should not be combined with a clover leaf repair in order to avoid TV stenosis.

Completion

The patient is weaned from cardiopulmonary bypass and the final assessment of the valves is performed by TEE. Venous decannulation is carried out by removing the venous cannula and applying temporary compression of the groin. For arterial decannulation, various percutaneous vascular closure systems can be used. The thoracotomy is then closed in a standard fashion.

Comments

Despite the growing attention to valvular heart disease and its minimally invasive treatment, TV pathology remains one of the least addressed valvular pathologies. Approximately 15% of patients do not undergo concomitant TV repair during the index left-sided valve surgery despite having a surgical indication (2). The latest ESC/EACTS guidelines for the management of valvular heart disease recommend concomitant TV repair in patients with severe TR [Class I, Level of Evidence (LOE) B]. It should also be considered in patients with moderate secondary TR (Class IIa, LOE B), and may be considered in mild secondary TR with relevant

(≥40 mm or >21 mm/m^2) tricuspid annular dilatation (Class IIb, LOE B) (3).

Herein, we describe two concomitant TV repairs in two different clinical settings: secondary TR treated with an annuloplasty ring, and primary TR addressed using the "clover leaf" technique in combination with annuloplasty. We demonstrate that even in cases with severe TV pathology, relatively simple technical solutions are available, offering excellent long-term outcomes (4). Addressing relevant TR or annular dilatation at the time of left-sided heart valve surgery is crucial to prevent progression of TR, reduce the risk of reoperation due to TR, and prevent right ventricular remodeling and dysfunction (5).

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Footnote

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