

Classic resectional technique for mitral valve repair: triangular resection via right anterior thoracotomy

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Clinical vignette

The patient is a 32-year-old male with chest discomfort and exertional dyspnea of 8 months duration. He denied lower extremity edema or orthopnea. Examination revealed a soft holosystolic murmur. Echocardiography demonstrated preserved cardiac function (ejection fraction 60%) with a myxomatous mitral valve. There was P2 prolapse with a very eccentric anteriorly-directed mitral regurgitation jet. Severe mitral regurgitation was demonstrated with systolic flow reversal in the pulmonary veins as well as a regurgitant volume of 67 mL and regurgitant fraction of 53%. Due to the patient's young age, no cardiac catheterization was performed. After lengthy discussion with the patient, an attempted valvular repair was planned. If a valve replacement was required, a mechanical valve would be selected due to his young age and relative health.

Surgical technique

Preparation

The operation may be performed via sternotomy, hemi-sternotomy, paramedian sternotomy or right anterior thoracotomy (1). Standard sternotomy and thoracotomy are the approaches utilized at our institution. A thoracotomy was selected for this patient according to his wishes. With this technique, all patients at our institution undergo general anesthetic with a single lumen endotracheal tube, central venous access with pulmonary artery sump catheter, an arterial line and intra-operative transesophageal echo cardiography. A double lumen tube has not been found to be necessary. The arms are tucked at the side. A roll is placed under the patient's right side resulting in an approximate 30-degree elevation.

Exposition

The surgical approach may be either via sternotomy, hemi-sternotomy, paramedian sternotomy or right anterior thoracotomy. In this thin patient with a BMI of 21, his body habitus was deemed amenable to a thoracotomy. If a patient has had previous sternotomy or thoracotomy, then the alternative technique is used for reoperation.

Operation

An oblique incision is made at the right groin and the dissection is carried down to the femoral vessels. Of note, these may also be accessed by a percutaneous approach, although that is not our practice. The right side is selected because of a more linear approach to the inferior vena cava (IVC). Arterial and venous cannulas are placed with the Seldinger technique and transesophageal echocardiography (TEE) guidance. With this approach, vacuum-assist must be utilized on the venous circuit to optimize drainage with the smaller sized single venous cannula from the femoral vein.

A right anterior thoracotomy is made at approximately the level of the inframammary crease. A soft tissue flap is then raised superiorly and the fourth intercostal space is entered. Self-retaining soft tissue retractors are utilized. The table is raised and the patient is rotated to the left to optimize visualization. The pericardium is opened anterior to the phrenic nerve. Stay sutures are utilized for exposure. An aortic root vent is placed at the ascending aorta for antegrade cardioplegia and de-airing. It has not been found to be necessary to have a coronary sinus cardioplegia catheter, with the stipulation that the aortic valve must be intact. Sondergaard's groove is developed. A minimally

invasive aortic cross clamp (Cosgrove Flex Clamp) is used and placed distally to the antegrade cardioplegia catheter.

The left atrium is opened. A left atrial elevator is placed percutaneously from a right parasternal position. Stay sutures may be used on the left atrial free wall and/or the atrial annulus to obtain better visualization and exposure. The valve is visualized and the abnormality identified. In this case, a triangular resection of P2 is performed. The posterior leaflet is re-approximated with interrupted prolene sutures. The valve is tested with irrigation and excellent coaptation is noted. A rigid annuloplasty ring is selected after sizing and sutured into position using horizontal mattress sutures.

Completion

The left atriotomy is closed following de-airing using running prolene sutures. TEE confirms appropriate repair with no regurgitation and excellent coaptation of the mitral valve leaflets. A single small-bore thoracostomy tube is placed. Temporary pacemaker wires are placed at the right ventricle. The thoracotomy is closed in the standard fashion. The femoral vessels are decannulated in the standard fashion and pursestring sutures are utilized to re-approximate the access sites.

Comments

Consistent with findings reported in the literature, our experience with over 100 mitral procedures performed via a mini right thoracotomy is that overall OR procedure length is equivalent to that for open procedures, despite cardiopulmonary bypass and cross clamp times that are approximately 30% longer than for open procedures. The operative mortality rate over the course of our experience has been 0% and outcomes, including transfusion rate and length of stay, have been equivalent or superior to those experienced with open procedures.

At our institution, both median sternotomy and right anterior thoracotomy are offered to patients, with the thoracotomy utilizing a minimally invasive approach and still attaining equal repair results compared to sternotomy cases. Mitral valve repair has been demonstrated to be a safe technique with durable results (1-4). In our institution, the resectional technique (most commonly triangular) is always supplemented with an annuloplasty ring. This has been demonstrated to result in improved long-term outcomes (1,2,4). A triangular repair is a less technically complex approach than a quadrangular resection with sliding annuloplasty but with comparable results (3). It can be utilized at either the anterior or posterior leaflet (3).

The anterior thoracotomy will allow easier exposure

without risking the original grafts (1,4) especially in redo-sternotomy patients and patients who have had prior CABG with grafts that are at risk of injury with the redo-sternotomy approach.

Furthermore, access via thoracotomy is impeded in the obese patient. A higher rate of conversion to sternotomy has been noted (4). This population may be best approached by sternotomy. Concerns have been noted regarding an increased incidence of systolic anterior motion (SAM) with the triangular resection. This has not been identified in our patient population or in other study groups (3).

Another caveat is that anesthesiologists must be trained in the use of a right internal jugular vein pulmonary artery sump in order to perform optimal left heart drainage with the thoracotomy approach. This is however easily taught and the skill mastered rapidly.

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Footnote

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

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