

HOW I DO IT

How I do it the mitral valve replacement in functional mitral regurgitation.

Ovidio A. García-Villarreal, MD

Consultant in Cardiac Surgery. Monterrey, MEXICO.

When mitral valve repair is not the best option to surgically treat functional mitral regurgitation, the prosthetic replacement becomes particularly important. However, the technique used for this effect is slightly different from the conventional one. Preserving ventricular function as much as possible is of paramount importance. We present herein the surgical technique step by step to preserve both anterior and posterior subvalvular structures of the mitral valve.

Key words: Functional mitral regurgitation; Mitral valve; Mitral valve insufficiency; Prosthesis valve replacement

Cuando la reparación valvular mitral no es la mejor opción para tratar quirúrgicamente la insuficiencia mitral funcional, el reemplazo protésico mitral cobra especial importancia. Sin embargo, la técnica utilizada para este efecto es sensiblemente diferente de la convencional. Preservar la función ventricular tanto como sea posible cobra singular importancia. Presentamos aquí la técnica quirúrgica para preservar ambas estructuras subvalvulares anterior y posterior de la válvula mitral.

Palabras clave: Regurgitación mitral funcional; Válvula mitral; Insuficiencia valvular mitral; Reemplazo valvular protésico.

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Nowadays, an intelligent selection based on stringent preoperative echocardiographic criteria can be made, to match the best candidates for a mitral valve (MV) repair or MV replacement, in the context of secondary or functional mitral regurgitation (FMR). When MV repair is not the best option, a replacement is considered. However, since FMR is the result of a ventricular myocardial disease, in which the MV is distorted three-dimensionally, special emphasis should be given to preserve the full subvalvular apparatus (that is, the leaflets, chordae tendineae and papillary muscles), in order to avoid any further left ventricle impairment after MV replacement.

The purpose of this technical article is to describe how to preserve the entire MV subvalvular apparatus, during MV replacement for FMR.

SURGICAL TECHNIQUE

The operation is made by mini-invasive cardiac surgery through a mini-right thoracotomy, or a conventional midline sternotomy. Whichever the selection, cardiopulmonary bypass, aortic cross-clamping and cardioplegia are used. Di-

fferent approaches for MV procedure can be selected. Superior septal approach, providing excellent exposure of the MV, is highly recommended for cases with small or medium left atrial size [1,2]. The MV is then analyzed to assess the lesions.

After a decision has been made in favor of MV replacement, the next step is the preparation to preserve both components of the subvalvular apparatus. Special precautions should be taken to avoid any subaortic stenosis or prosthesis malfunction. In this context, the technique to preserve both subvalvular structures is slightly different from the conventional one preserving just the posterior ones.

The first thing to be done is the exposure of the entire MV to obtain a frontal view of the structure (Fig. 1). After careful analysis, the most commonly observed defect is a tethering between P2-P3, as a Carpentier's type IIIb mechanism. The leaflets are completely normal. Then, both commissures are identified and marked by landmark 3-0 polypropylene sutures.

With the anterior leaflet fully exposed, a transverse incision is made on its surface, one centimeter away from the MV native annulus. It is important to start the incision just below the posterior trigone and then extend it transversely to just below the anterior trigone, working from right to left in the surgeon's field of view (Fig. 2).

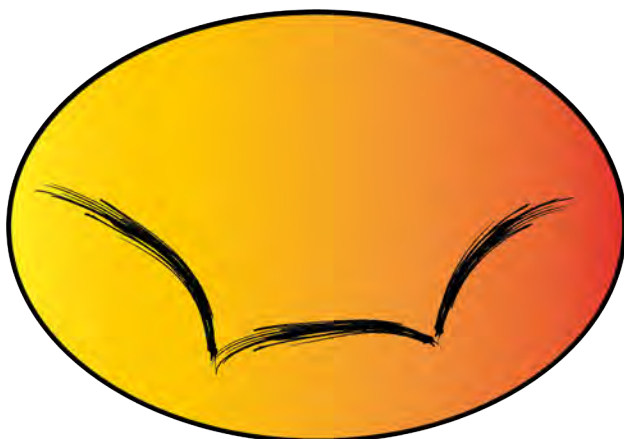


Figure 1. General aspect of the mitral valve.

A second incision is made from the last point (below anterior trigone), following the direction of the free edge of the anterior leaflet, preserving 8-10 mm of tissue in width. This is continued until reaching the initial site of the transverse incision (below the posterior trigone). In this way, the anterior leaflet tissue is resected as a D-shape (Fig 3). Of note, the remnant tissue of the MV adjacent to the free edge of the anterior leaflet contains only the primary chords. Secondary chords are excised as far as possible, preferably at the level of

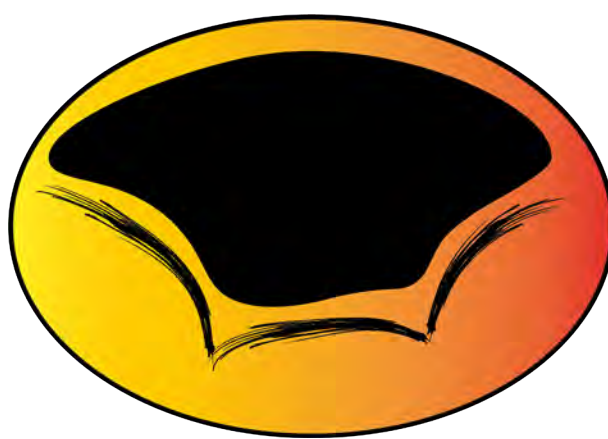


Figure 3. Anterior leaflet tissue is resected as a D-shape. All secondary chords are included in the resected tissue.

their emergence on the heads of the papillary muscles.

Furthermore, a few sutures are placed all along the D-shaped inferior edge passing from inside to outside, using interrupted 2-0 ethibond or prolene stitches, buttressed with te-

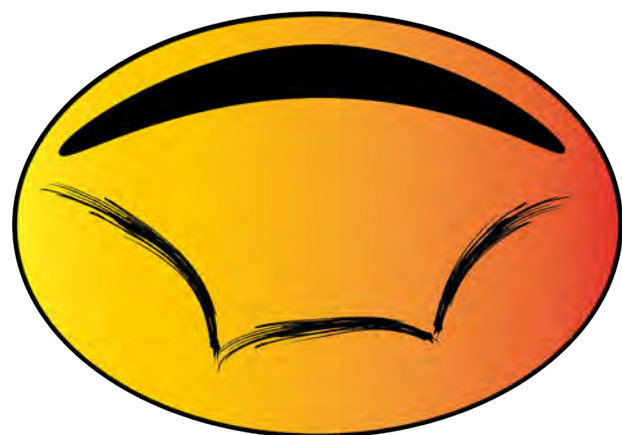


Figure 2. Transversal incision on the anterior leaflet of the mitral valve separated 1 cm away from the native annulus.

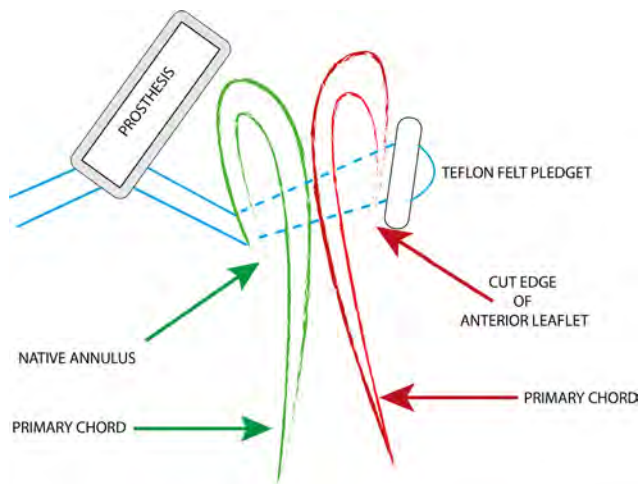


Figure 4. Schematic view of the suture's placement in the anterior free edge of the mitral valve. In red color the remnant of the anterior leaflet after tissue resection. In green color the intact posterior leaflet in situ. Red arrow indicates the cut edge of the anterior leaflet. Green arrow indicates the posterior leaflet insertion on the native annulus of the mitral valve. Each stitch is passed through the anterior free edge of the anterior leaflet, posterior leaflet, and emerges on the atrial surface of the MV native annulus. Finally, the both arms of the suture are placed through the prosthesis cuff.

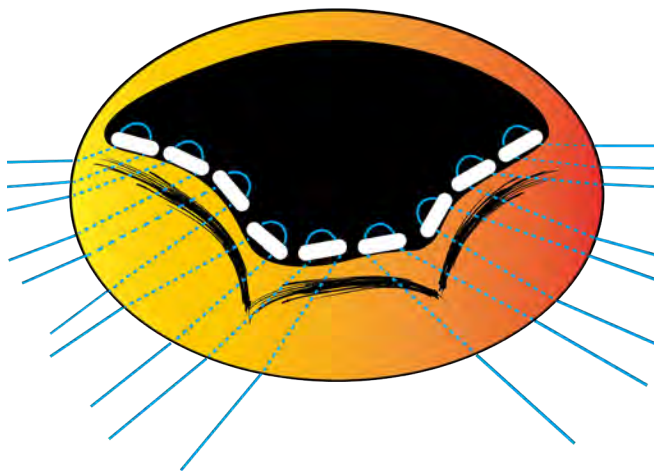


Figure 5. Overview after every stitch has been placed on the anterior free edge of the anterior leaflet.

flon felt pledgets. Each stitch is passed through the anterior free edge of the anterior leaflet, followed by the in situ posterior leaflet, emerging on the atrial surface of the MV native annulus, just 1-2 mm outside (Fig. 4). The first point is placed at the hinge just below the posterior trigone. The suture emerges at the level of the MV posterior commissure. By the same token, the next three sutures are then placed. This is followed by performing the same procedure on the left side (Fig. 5).

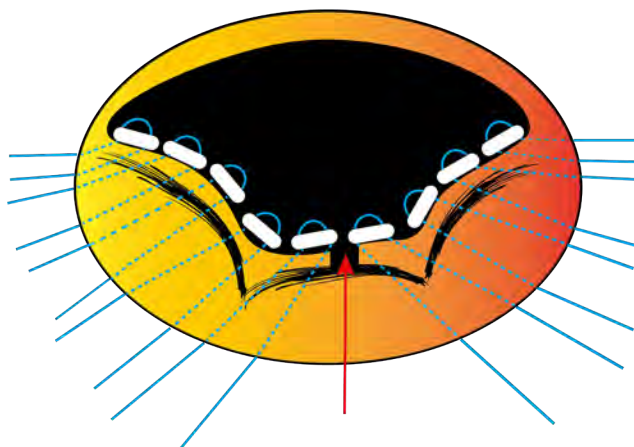


Figure 6. Splitting the tissue band of the remnant free edge of the anterior leaflet at the midline before pulling up the sutures.

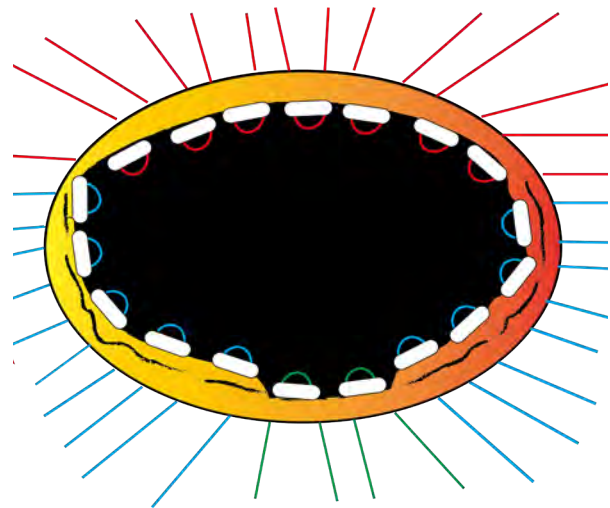


Figure 7. General overview after all sutures have been placed. Of note, in green color the additional two sutures on the posterior leaflet after obtaining additional space by splitting the aforementioned tissue band. In red color, stitches on the anterior aspect of the MV native annulus through the previously incised anterior leaflet.

It is highly recommended to split the tissue band at the midline before pulling up the sutures (Fig. 6). This maneuver allows more space for the prosthesis insertion. Additional sutures should be placed between both groups of the others on the posterior native ring (Fig. 7).

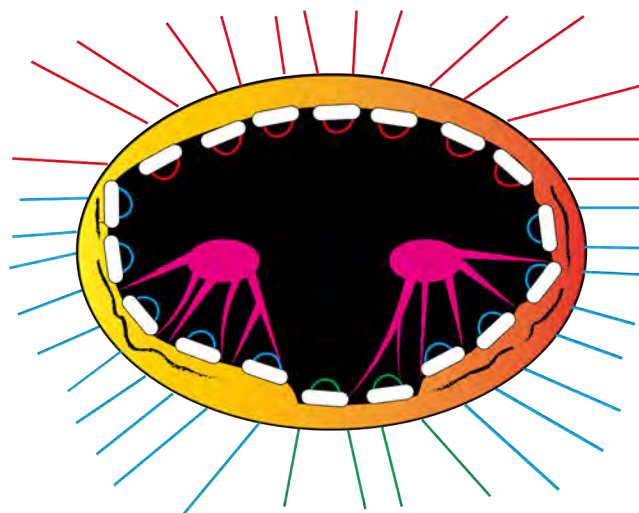


Figure 8. All anterior and posterior subvalvular structures are finally located far away from the left ventricle tract outflow.

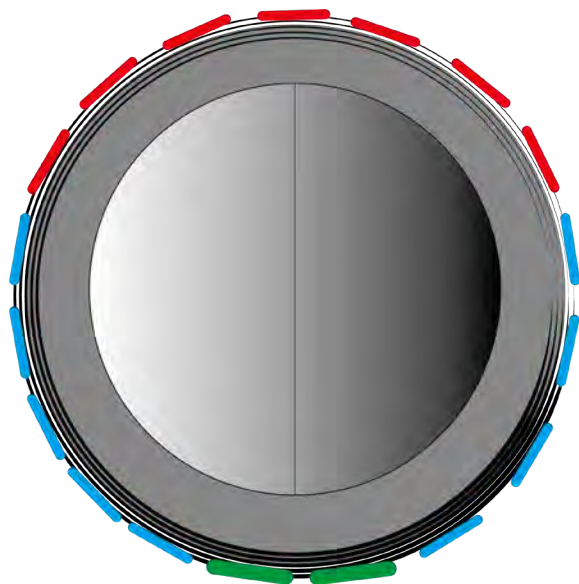


Figure 9. Prosthesis installed. In red color, sutures on the anterior native annulus; in blue color, sutures on both subvalvular apparatus; in green color, sutures only on the posterior leaflet.

Thereafter, the rest of the circumference is complemented by placing the sutures on the anterior native MV annulus. These above are processed in the same way as the other ones, working from inside, toward the atrial surface of the MV annulus. The final goal of this special technique is summarized by observing that the anterior and posterior subvalvular appa-

ratus are far away from the left ventricle outflow tract (Fig. 8).

The prosthesis is installed by passing every single one of the sutures through the prosthesis cuff. Knotting must first be done by quadrants, starting first at 6, then at 0, 3 and 9 o'clock, respectively, followed by the remainder (Fig. 9). Current customary orientation of the prosthesis is used. The rest of the procedure is performed as usual.

In FMR, maintaining the LV function is of paramount importance. The physiological effect of preserving both structures has been previously described. Diligence must always be exercised to preserve both the posterior and anterior subvalvular structures, in cases of MV replacement for FMR. The surgical technique described here is substantially different to the conventional and classic one, which only addresses the posterior leaflet. This aforementioned technique enables preservation of both subvalvular apparatus components, with low risks of subaortic obstruction and prosthesis malfunction.

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