How-to-do-it

Tent-shape technique: another procedure to repair P2 of posterior leaflet of mitral valve

Samer Kassem a,*, Ghassan A. Moasis b, Paolo Biglioli a

a Department of Cardiovascular Surgery, Centro Cardiologico Monzino I.R.C.C.S., University of Milan, Milan, Italy
b Department of Cardiac Surgery, Assad University Hospital, University of Damascus, Damascus, Syria

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Abstract

In this report, we describe a new procedure to repair the prolapsing high mid-scallop of the mitral valve (MV) posterior leaflet (P2) with detailed consideration of the anatomy and physiology of the MV. A new artificial chord is implanted in the body of the P2 at the same height of non-prolapsing P1 and P3, and the remaining part of the prolapsing P2 is anchored to the artificial chord taking the shape of a tent.

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1. Introduction

Since the traditional techniques for mitral valve (MV) repair by Carpentier [1], mitral valvuloplasty has become the surgical treatment of choice for MV insufficiency. Mitral posterior leaflet (PL) prolapse has been corrected, with excellent long-term results, by leaflet resection followed by both annulus placation and sliding leaflet plasty [2,3]. However, there is an increasing interest in artificial chordae implantation to correct MV regurgitation caused by PL prolapse. When involving a high P2 due to localized degenerative mitral disease (a spectrum of lesions ranging from fibroelastic deficiency to moderate Barlow disease) [4], we propose a simple technique to repair the MV without leaflet resection (respect, not resect). The goal of our approach is to ensure a good co-aptation surface by creating a new smooth and wide edge of the PL, thus minimizing the risk of systolic anterior motion (SAM).

2. Surgical technique

Transesophageal echocardiography (TEE) is performed before cardiopulmonary bypass is established. Antegrade and retrograde cold-blood cardioplegia, CO2 insufflation of the operative field, and moderate hypothermia (32 °C) are routinely used. An accurate valve analysis is performed: the P2 height is assessed, the ruptured or redundant chords are identified, and papillary muscles are inspected to identify the suitable muscle for chordal attachment. To facilitate visualization of the subvalvular apparatus, the elongated chordae of P2 can sometimes be resected. Thereafter, the two needles of a 5/0 polytetrafluoroethylene (Gore-Tex, W.L. Gore & Associates, Newark, Delaware, USA) suture, supported by a felt pledget, are passed through the tip of the appropriate papillary muscle with a forehanded technique, so the new chord arises from the papillary side that faces the posterior ventricular wall. The Gore-Tex is tied loosely. Then, many loose reverse knots are tied (making small loops), as it is required that the whole length of the knots reaches the mid-expected length of the new chord. The length of second- or third-order chordae of the non-prolapsing portion of P2 or the non-prolapsing A2 of the anterior leaflet can be used as a reference point to measure the expected length of the new chord. The two needles are subsequently passed through the body of P2 from the ventricular to the atrial side at the same height of non-prolapsing P1 and P3 of the posterior leaflet (point A, Fig. 1). The suture is left untied. The appropriate length of the new chord is estimated by injection of saline solution into the left ventricular cavity with a considerable pressure. The Gore-Tex suture is then tied onto a strip of pericardium, maintaining both the edge of the anterior leaflet (A2) and the point A (the anchor for the new chord in the body of P2) at the same level. Next, the anchor for the edge of the excess portion of P2 (point B, Fig. 1) is determined on the new chord (one of the multiple small
loops). The distance between the anchor for the edge of P2 (point B) and the anchor for the new chord on the leaflet (point A) should be equal to or less than the length of the excess portion of P2. In addition, in case of high risk of SAM, it is advisable that the anchoring for the P2 edge on the new chord should be toward the papillary muscle. One suture of 4/0 Cardionyl is inserted in the appropriate small loop (anchor for the edge of P2; point B, Fig. 1) and tightly tied. The two arms of the suture are then passed through the thickened P2 free edge and knotted over a pledget of pericardium (Fig. 2). Valve competency is then checked by fluid testing.

The repair procedure is completed by implantation of the annuloplasty ring of choice.

From July 2009 to May 2010, we applied our technique in eight patients with severe mitral insufficiency due to isolated

![Fig. 1. The new chord is attached to the suitable papillary muscle. Many loose reverse knots are tied (making small loops) so that the whole length of the knots reaches the mid expected length of the new chord. The two needles are passed through the body of P2 from the ventricular to the atrial side at the same height of non-prolapsing P1 and P3 of the posterior leaflet (point A). The anchor for the edge of the excess portion of P2 (point B) is determined on the new chord. One suture of 4/0 Cardionyl is inserted in the appropriate small loop.](image1)

![Fig. 2. The Gore-Tex suture is tied onto a strip of pericardium after an estimation of the chord length (point A). The two arms of the 4/0 Cardionyl suture are then passed through the thickened P2 free edge and knotted over a pledget of pericardium.](image2)
prolapsed P2. After MV repair, all patients were asymptomatic. Transthoracic echocardiography confirmed no regurgitation on short-term follow-up.

3. Comment

In MV repair surgery, there is an increasing inclination to keep intact both the mitral annulus and the native tissues of leaflets [5].

The tent-shape technique respects the anatomy of MV, and the physiologic mobility of MV and the physiologic mobility of the posterior leaflet. If the condition of adjacent leaflets P1 and P3 is normal or even thinned out with a translucent aspect, our technique is indicated to avoid traditional sliding annuloplasty and tearing leaflet. Moreover, this procedure can also be used when annular calcification could complicate MV repair.

We believe that the tent-shape technique minimizes the risks of SAM by bringing down the excess portion of P2 into the ventricular cavity, far away from the left ventricular outflow. The P2 tent shape behaves as an airbag, ensuring a good coaptation during the systolic cardiac phase without causing a shortening of the distance between the MV co-aptation point and the septum. Ultimately, if this technique does fail, the preserving of a continuous veil of the PL provides another chance to repeat the MV repair with different techniques.

In conclusion, the early results of this technique appear to be satisfactory; however, more cases and longer follow-up times are needed to confirm this preliminary data.

References