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A novel technique of utilizing artificial chordae for repair of mitral valve prolapse

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Mitral valve repair provides excellent long-term results and superior survival compared with those of valve replacement in the management of mitral regurgitation and should be considered whenever possible.¹ Despite the existence of a variety of standardized techniques of surgical repair, it is performed in only one half of the cases.² Technically, repair of posterior leaflet prolapse (PLP) is less complex, with excellent long-term results, compared with those of anterior leaflet prolapse (ALP) or bileaflet prolapse. In either case, the feasibility and durability of mitral valve repair remain highly dependent on surgical experience.³

We propose a new approach to extend repair techniques to extensive and complex valve prolapse. From September 2006 to February 2007, 9 patients with severe mitral regurgitation caused by severe ALP or PLP underwent valve repair with an artificial chordae system device. Preoperative cardiac magnetic resonance imaging and/or perioperative transesophageal echocardiography determined the ideal chordae length required to manufacture the device, which was constructed perioperatively.

Clinical Summary

During chest opening and cardiopulmonary bypass installation, the chordae system is manufactured according to preoperative measurements. The device is composed of 2 sets of 4 artificial chordae (4-mm polytetrafluoroethylene sutures; Gore Tex, WL Gore & Associates, Flagstaff, Ariz) attached to a 3-mm strip of knitted

polyester (Bard Sauvage, Tempe, Ariz) 18 mm wide, leaving 4 mm between each chorda (simulating the edge of the cusp). In the other extremity, 1 single point is fused and from that 2 stitches arise with 2 needles at the extremity (Figure 1).

The device is applied by suturing the strip to the free edge of the prolapsed leaflet by continuous suture. Each array is anchored to the tip of the correspondent papillary muscle by only 1 stitch. Systolic stress is therefore evenly distributed over both papillary muscles and across the free mitral edge. Two lengths (22 and 25 mm) of the chordae system were used in our series to repair ALP in 6 patients and PLP in 3 patients. A prosthetic annuloplasty ring was inserted in all patients. Nine-month follow-up echocardiograms showed no mitral regurgitation in 7 patients and mild mitral regurgitation in 2 patients.

Discussion

Correction of mitral insufficiency from PLP is frequently feasible with established repair techniques. On the other hand, repair of ALP is associated with a higher risk of reoperation, and with bileaflet prolapse the success rate of achieving repair has been reported to be as low as 40%, with some authors advising in such cases to replace the valve directly.³

Figure 1. The device reproduces the chordae system. The number of chordae and their length can be adapted to surgical needs.

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Arrigo Lessana is co-owner with Dr Scorsin of a patent on the device described in this report.

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We present a novel approach to treat complex or difficult mitral leaflet prolapse. It is easily reproducible and based on the simplification of 2 well-established techniques: chordal transfer for treatment of ALP⁴ and conventional replacement of chordae tendineae with polytetrafluoroethylene sutures.⁵ It alleviates surgical interference with valve components, chordal length manipulation, or annular plication and preserves the natural anatomy and integrity of the mitral valve. The artificial chordae system homogeneously fixates the entire prolapsed leaflet at an ideal distance from each of the 2 papillary muscles, thus equilibrating the systolic stress without delicate measurements or complicated knotting of individual artificial chordae. The encouraging results in this short series are to be confirmed with long-term follow-up studies.

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A new surgical technique for ventricular septal rupture closure after myocardial infarction

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In this study we propose a new surgical approach to correct ventricular septal rupture based on juxtaposition of the left and right ventricular free walls of the ruptured region to reinforce patch closure and avoid residual shunt.

Clinical Summary

From May 2002 through August 2006, 5 patients with diagnoses of myocardial infarction who had ventricular septal ruptures were submitted to surgical treatment with this new surgical approach, 4 with anterior myocardial infarction and 1 with posterior myocardial infarction. Two patients were in cardiogenic shock at the time of the operation, 1 was hemodynamically stable, and the other 2 were in New York Heart Association functional class III with severe pulmonary edema. Other important preoperative data are presented in Table 1.

The condition of the first patient was the motivating factor in the development of this approach. The patient was operated on to close the ventricular septal rupture and presented with a residual

shunt with hemodynamic instability. In the reoperation we performed juxtaposition of the walls because of the great difficulty of this case determined by the intense friability of the septum.

Surgical procedures were done with cardiopulmonary bypass, cold blood antegrade cardioplegia, and topical cooling. After making a left ventriculotomy in the infarcted area and localizing the ventricular septal rupture, a pericardial patch was placed over the rupture region, and sutures were made more distally to reach the normal myocardial wall.

An interrupted suture started on the right ventricular free wall (which was closed) around 1.5 cm from the anterior interventricular sulcus (or projection of the left anterior descending artery) passing behind the rupture, stitching the pericardial patch in the most inferior portion of septum, and then passing through the base of the anterior papillary muscle of the mitral valve and going to the free wall of the left ventricle, which was also supported with other Teflon bars. We applied 4 to 5 stitches in the same manner.

When these stitches were tied, the free wall of the right ventricle and the free wall of the left ventricle were put close together over the rupture region and over the pericardial patch, closing the ventricular septal rupture by means of juxtaposition of the ventricular free walls over the pericardial patch.

A second line of sutures was executed, stitching the edge of the ventriculotomy and exteriorizing the pericardial patch. In this way we closed the left ventricle with separate stitches supported by Teflon bars. Finally, a running suture with 4-0 Prolene sutures was placed over the ventriculotomy to guarantee good hemostasis.

This technique is characterized by 2 suture lines: one superficial line to close the left ventriculotomy and the superior part of the pericardial patch and another deeper line that juxtaposes the right and left ventricular free walls over the rupture region and pericardial patch (Figures 1 and 2).

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