Editorial comment on mural shortening suture annuloplasty for mitral valve repair

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Aybek and coworkers¹ have produced a serious evaluation of the midterm results of the mitral annulus shortening suture annuloplasty technique, in which the mural annulus is shortened by a suture that engages the fibrous attachment of the posterior leaflet to the atrium and ventricle from one trigone to the other. In 82% of cases, the pathologic condition was degenerative. The remaining 18% had rheumatic, ischemic or endocarditis etiologies. Inevitably, the efficacy of the annuloplasty per se is obscured by the multiple other procedures used in achieving the repair.

Aybek and coworkers previously compared short-term clinical and hemodynamic results between patients treated with the mural annulus shortening suture and with the Carpentier-Edwards ring. There were similar corrections of insufficiency but lower transvalvular gradients and wider mitral valve opening areas with the suture annuloplasty. Clinical and echocardiographic follow-up of the patients treated with mitral annulus shortening suture has been continued to 77 months, with interesting results.

The excellent initial relief of symptoms and relative freedom from reoperation for recurrent mitral regurgitation have been maintained. The New York Heart Association functional class, a mean of 3.0 at the time of the operation, was still 0.8 at 5 postoperative years. The left ventricular end-diastolic diameter was 56 mm before the operation, 50 mm at discharge, and 49 mm at 5 years. The results compare favorably with other similar series with various commercial annuloplasty rings. Had clinical results been the criterion for judging the worth of the mural annulus shortening annuloplasty technique, the conclusion would have been that it performed very well. However, Aybek and coworkers also performed an echocardiographic measurement of the dimension of the annulus; this had undoubtedly increased.

On examination of the small number of cases coming to reoperation, the mechanism of failure was not found to be inadequate anchoring of the suture at the trigones or disruption of the suture from the tissues of the atrioventricular-valvular junction. Instead, it was a straightening of the initially zigzag conformation of the polytetrafluoroethylene suture. This had happened despite the presence of scar tissue around the suture. The original hope had been that fibrous incorporation of the suture would have encouraged the growth of a new fibrous annulus. The conclusion must be that the force exerted by the dilating annulus in early diastole in these patients with degenerative disease is sufficient to cause the suture to work its way partially through the fibrous tissue of the annulus. Clearly, the more pronounced the zigzag, or the larger the angle of insertion of the suture relative to the annulus, the greater the diastolic stress on the weaker muscular tissues of the atrium will be and the greater the elongation of the shortened annulus resulting from straightening of the suture will be. The smaller the angle of insertion of the suture relative to the annulus, the closer the suture will be to the natural fibrous annulus and the less will be the potential for annular re-enlargement by straightening of the suture.

The fact that the annulus did in fact return toward its initial dimension without an accompanying deterioration in clinical status, with no change in left ventricular end-diastolic diameter and with only a minimal change in grade of mitral regurgitation (see Table 3 in Aybek and coworkers' article¹), raises an interesting question. Advocates of annuloplasty have hammered home the point that reduction of the

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annulus is an essential part of the repair of mitral insufficiency. Advocates of rigid or minimally deformable rings have commonly used the term *remodeling* to emphasize that they are returning the annulus toward some optimal shape. I emphasize that all annuloplasty techniques currently in use, whether with suture, fabric, fixed or natural organic tissue, polymer, or metal, have in common the function of reducing the diastolic dimension of the annulus to around a normal end-systolic level and fixing it there. The use of flexible annuloplasties leaves open the possibility of annular contraction to a smaller than usual end-systolic dimension but holds no more possibility of diastolic expansion than is provided by a piece of steel. Could it be that annuloplasty is in fact not needed in every case of repair of degenerative mitral regurgitation? If the organic leaflet or chordal causes of incompetence have been corrected, the load of mitral regurgitation removed, and the patient operated on early enough for left ventricular function to be, or to return to, normal after the procedure, then mechanical fixation of the annulus in a systolic dimension may not be necessary. The originally achieved annular dimension might then slowly increase without adversely affecting the repair. This suggests the possibility that there are cases in which annuloplasty is not essential for a satisfactory long-term result. More follow-up is needed and has indeed been promised by Aybek and coworkers. The necessary condition for a repair without annuloplasty would be a precise preoperative confirmation of normal ventricular function.

In 3 patients, functional occlusion of the circumflex coronary artery occurred in the vicinity of the P1 part of the posterior leaflet.¹ Although Aybek and coworkers¹ described an anomalous course of the circumflex in 1 case and an extensive commissuroplasty in another, they attributed this complication specifically to suture annuloplasty. In fact,

kinking of the circumflex artery associated with annuloplasty was first described by Denton Cooley after annuloplasty with a C-shaped polytetrafluoroethylene band inserted with multiple interrupted sutures. I have seen a kink produced by the insertion of a full ring in a patient whose annulus was particularly dilated before the operation. In that case, an extensive localized plication of the annulus had been performed at the base of a posterior quadrangular excision before insertion of the annuloplasty ring. It seems clear that spacing of sutures such that a disproportionate shortening of a part of the annulus is produced can cause kinking of a circumflex artery regardless of the annuloplasty technique.

Suture annuloplasty techniques have been described for many years, especially from developing parts of the world where their low cost has been an important attraction. There are many methods of achieving annuloplasty and many different and strongly held opinions on which method to use. There is generally scant supporting evidence for these opinions, for the simple and obvious reason that repair of organic mitral valve disease invariably involves multiple procedures and is operator sensitive, making comparisons and randomization difficult. Aybek and colleagues have performed an important service with their careful studies and good follow-up. They have demonstrated excellent correction of the insufficiency in the short term, with good medium-term results. A concern about redilatation of the annulus remains.

Reference

1. Aybek T, Risteski P, Miskovic A, Simon A, Dogan S, Abdel-Rahman U, et al. Seven years' experience with suture annuloplasty for mitral valve repair. *J Thorac Cardiovasc Surg.* 2006;131:99-106.