Annular Compression Stitch for Quadrangular Resections in Mitral Valve Repair

Omer Dzemali, Peter Kleine, Anton Moritz

Department of Thoracic and Cardiovascular Surgery, University Hospital, Frankfurt am Main, Germany

Background and aim of the study: **Quadrangular resections for posterior mitral leaflet prolapse create a defect that requires readaptation of the annulus as well as the leaflet cut edges. A variety of techniques has been described to narrow the posterior mitral annulus. Herein is described a simple compression stitch that allows compensation of annular size reduction even for large resections of the mural leaflet.**
Methods: **The annular compression stitch consists of four bites: the first stitch is placed from the atrium into the ventricle; the second takes a piece of ventricular myocardium parallel to the mitral ring; the third returns the needle into the atrium some millimeters outside the opposite cut edge of the mitral leaflet; and the fourth stitch grabs atrial myocardium parallel to the previous ventricular stitch. Tying the knots compresses the annulus to an extent that allows reanastomosis of the two leaflet cut edges.**
Results: **This new technique was used in 212 patients undergoing mitral valve repair. Intraoperative outcome was excellent, and after a mean follow up period of 2.5 years no reoperation was needed due to failure of the annular compression stitch.**
Conclusion: **The new compression stitch simplifies the repair, avoids the creation of a trench, and allows readaptation of the two mural leaflet edges without tension, even in large posterior resections.**

The Journal of Heart Valve Disease 2006;15:132-135

Quadrangular resections for posterior mitral leaflet prolapse create a defect that requires readaptation of the annulus as well as the leaflet cut edges. A variety of techniques has been described to narrow the posterior mitral annulus. Carpentier et al. suggested a figure-of-eight stitch (1,2), but this creates a trench that must be covered by a second suture (Fig. 1a). The suggested pledgetted mattress sutures (Fig. 1b) lead to annulus folding, especially in extensive resections of the P2 segment, and may contribute to disturbed posterior myocardial contraction (3).

Herein is described a technically simple compression stitch that allows annular size reduction even after large resections of the mural leaflet. Due to elasticity of the local tissue the excess length may be compensated by compressing the ring and adjacent myocardium. In this way no significant folds or wrinkles develop, and the leaflet cut edges can be reanastomosed directly or, if necessary, following a sliding plasty. In the case of large resections two sets of stitches may be necessary, as is the case with the original U-stitch described by Carpentier.

Address for correspondence:
Peter Kleine MD, Department of Thoracic and Cardiovascular Surgery, University Hospital, Theodor-Stern-Kai 7, 60590 Frankfurt am Main, Germany
e-mail: P.Kleine@em.uni-frankfurt.de

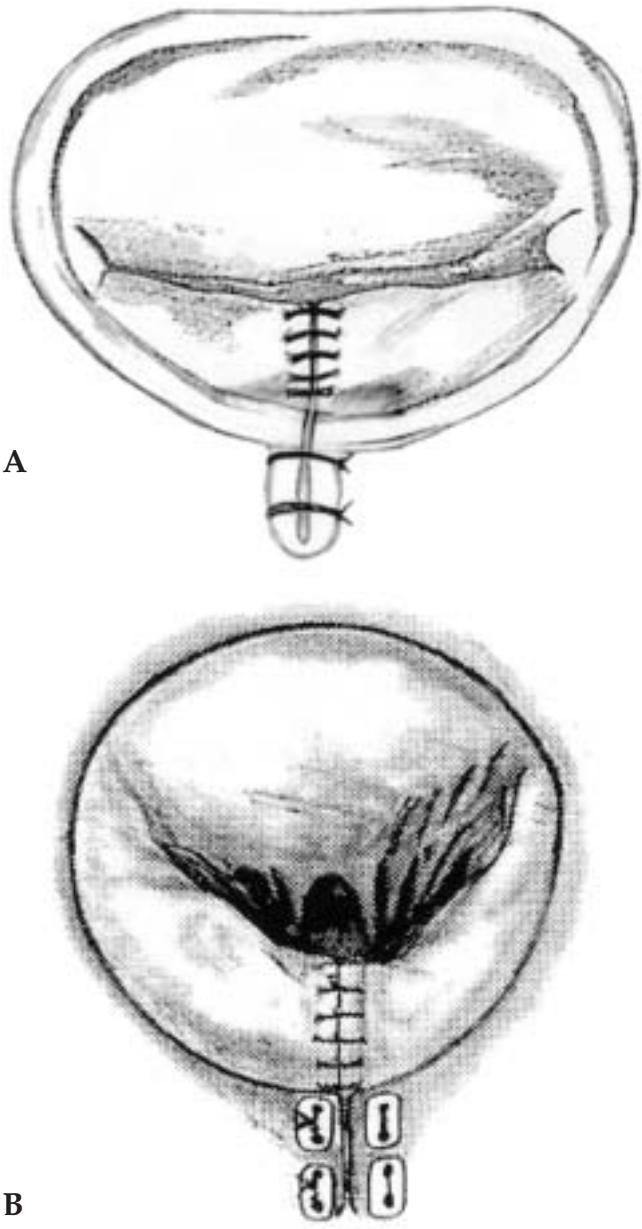
Materials and methods

After complete excision of the prolapsing part of the mural mitral valve leaflet, a 15- to 25- mm-wide gap often develops at the level of the annulus. Before readaptation of the leaflet cut edges, annular reconstruction is achieved by using a compression stitch, with a 2/0 Ethibond suture being passed through the annular gap in four steps:

The first stitch is placed from the atrial to the ventricular side, some millimeters outside the basis of one of the two leaflet edges (Fig. 2a). This stitch must include a sufficient amount of annular tissue to avoid secondary tears.

The second stitch catches the usually somewhat fibrotic subannular tissue of the mural ventricular wall between the two mural leaflet cut-edges.

The third stitch returns the needle into the atrium some millimeters outside the opposite cut edge of the posterior mitral leaflet through the fibrotic annular tissue, again deep enough to prevent suture tearing.



A

B

Figure 1: a) Closure of the annular gap by figure-of-eight stitch leads to the creation of a trench, which must be covered by additional stitches. B) Closure with U-stitches creates a fold of the posterior myocardium.

The final stitch takes a bite approximately parallel to the second (ventricular) stitch, but catching the atrial wall in the space between the mural resection edges (Fig. 2b).

Tying the knot now compresses the ring and underlying mural as well as atrial myocardium to an extent that allows direct reanastomosis of the leaflet cut edges, without tension (Fig. 2c). If the mural leaflet height exceeds the necessary dimension, a triangular resection is performed and the leaflet bases are reanastomosed to the ring with a double running suture analogous to the sliding plasty technique as described by Carpentier (1,2). In extended resections the necessary compression can only be achieved with two sets of compression stitches. Frequently, it is necessary to dissect the base of the neighboring mural leaflet off the ring in preparation of a sliding plasty. Small folds may develop from the compressed ring tissue; these are either caught in the suture of a small sliding plasty (which is used very liberally) or they may simply be oversewn to avoid any local leak.

The described technique was used in 212 patients undergoing quadrangular resection of the mural mitral leaflet for mitral insufficiency (MI), and the clinical outcome evaluated. Each patient underwent transesophageal echocardiographic evaluation of the intraoperative result, and transthoracic echocardiography (TTE) prior to discharge. Follow up examinations were performed annually, and included TTE.

Results

A total of 167 operations was performed as a minimally invasive procedure, either through a small right thoracotomy (Chitwood technique; n = 133) or a partial upper sternotomy (n = 34). Readaptation of the leaflet cut edges was possible in all patients, even with large quadrangular resections of the whole P2 segment. A second valve repair procedure due to failure of the mural resection was not necessary in any patient. Dehiscence of the resection line was not observed during intraoperative echocardiography.

Echocardiography performed prior to discharge revealed an absence of MI in 151 patients (90.4%), mild MI (grade I+) in 12 patients (7.1%), and moderate MI (grade II+) in four patients (2.5%). During the follow up period (mean 3.5 years; total 512 patient-years), reoperations were required in three patients (1.8%), though none of these was related to the mural resection. One patient presented with annuloplasty ring dehiscence six weeks postoperatively, and this was successfully corrected. A second patient suffered from progressive heart failure with recurrent MI after two years, and ultimately underwent biological valve replacement. The third patient demonstrated anterior prolapse four years after the first mitral valve repair, but this was corrected during the reoperation by artificial chorda implantation. No re-repair of the posterior leaflet was necessary at the time of reoperation.

Discussion

The typical repair of mural leaflet prolapse includes quadrangular resection, closure of the resultant gap at

J Heart Valve Dis
Vol. 15. No. 1
January 2006

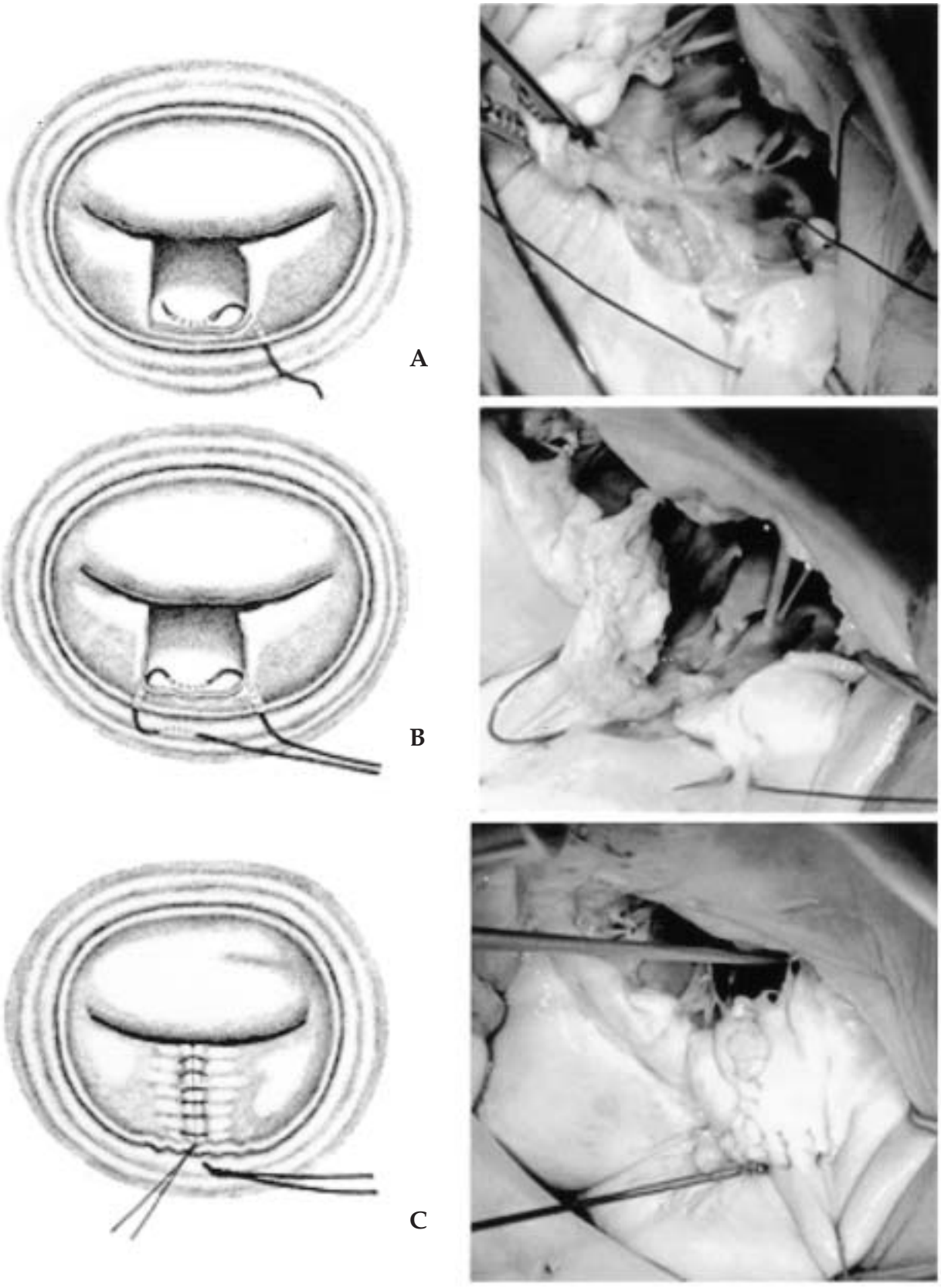


Figure 2: Compression stitch to close the annular gap. The four stitches (a-c) (for details, see text) lead to an approximation of the two leaflet cut edges. Tying the knot compresses the ring to an extent that allows leaflet reanastomosis without tension.

the posterior annulus, and readaptation of the two leaflet cut edges followed by flexible or rigid annuloplasty. For closure of the annular defect, several technical solutions have been proposed (1-6), but all are associated with drawbacks such as possible leaks or impairment of local contraction (7,8).

The annular compression described here is simple, and avoids the creation of a trench or of any non-physiologic outward folding of the posterior ventricular wall. The procedure proved to be especially helpful as it safely avoids ventriculoatrial leaks. Furthermore, the two cut edges of the mitral leaflet and the basis of the posterior ring are pushed slightly inwards the mitral annulus, so that the leaflet reanastomosis as well as any eventually necessary triangular resection can be performed easily and under optimal vision. The present authors have used every available type of annuloplasty after local compression, whether suture annuloplasty, prosthetic rings or bands. The present clinical outcome in more than 200 patients was excellent, and none of the observed complications could be related to the technique of annular compression. The proposed technique was compatible with two different minimally invasive approaches, namely a lateral thoracotomy and a partial upper sternotomy.

References

1. Carpentier A. Plastic and reconstructive mitral valve surgery. In: Kalmanson D (ed.). The Mitral Valve. Publishing Sciences Group, Acton, Mass, 1976
2. Carpentier A, Deloche A, Dauptain J, et al. A new reconstructive operation for correction of mitral and tricuspid insufficiency. J Thorac Cardiovasc Surg 1971;61:1
3. Gillinov M, Cosgrove DM. Modified quadrangular resection for mitral valve repair. Ann Thorac Surg 2001;72:2153-2154
4. David TE. Reconstructive procedures in heart valve disease. Can J Cardiol 1988;4:308-310
5. Kay JH, Zubiate P, Mendez AM, Carpena C, Watanabe K, Magidson O. Mitral valve repair for patients with pure mitral insufficiency. JAMA 1976;236:1584
6. Carpentier A. Cardiac valve surgery - 'The French correction'. J Thorac Cardiovasc Surg 1983;86:323-337
7. Yacoub M, Halim M, Radley-Smith R, Mykay R, Nijveld A, Towers M. Surgical treatment of mitral regurgitation caused by floppy valves: Repair versus replacement. Circulation 1981;64(Suppl.II):210-216
8. David TE, Armstrong S, Sun Z, Daniel L. Late results of mitral valve repair regurgitation due to degenerative disease. Ann Thorac Surg 1993;56:7-12