

the LV apex to the LV outflow tract. The patient had an uneventful recovery and was discharged in good condition, receiving 60 mg of propranolol and 120 mg of nifedipine daily.

Comment. A transatrial approach for resection of subaortic muscular obstruction was first reported by Lillehei and Levy⁵ in 1963. In their report, the approach was through a left thoracotomy and left atriotomy under induced ventricular fibrillation. In this report, we introduced this technique through the standard median sternotomy and cardioplegic arrest. Temporary detachment of the anterior mitral leaflet through the left atrium facilitated a wide view of the subaortic and the lower portion of the septum. This method also provides a direct approach to the anterior mitral leaflet, chordae, and papillary muscle. In our case the plication of the anterior mitral leaflet was easily performed, and myectomy and myotomy to the papillary muscle and hypertrophied muscle mass close to the apex were easily done as well. Furthermore, mitral annuloplasty could be performed during and after reattachment of the anulus. There was no risk of structural injuries to either the mitral or aortic valve or anulus.

We propose that subvalvular myectomy combined with mitral valve remodeling can be done through this approach. The mitral interventions consist of plication of the leaflet and additional myectomy to the papillary muscle and adjacent apical muscle mass. These procedures provide relief from systolic anterior motion, which has a major role in LV outflow tract obstruction, and help to increase the intraventricular space at the level of papillary muscle and apex. In our case, a postoperative angiogram showed complete disappearance of systolic motion of the mitral component and a significant decrease in the pres-

sure gradient between the midportion of the LV and the subaortic route. However, the volume of the ventricle itself continues to be restricted, possibly because the muscle resection was suboptimal. Future growth of the LV cavity can be expected after reduction of the outflow obstruction. Of course, this hypothesis must be validated by future assessment of the patient.

This is a single case report. The procedure requires further evaluation with more patients and long-term assessment. However, we believe that this technique may be useful for those with a small aortic anulus and for infants and children. Importantly, this approach can provide an adequate operative view for those with diffuse-type HOCM with various degrees of pathologic changes of the mitral valve, giving an opportunity to perform combined procedures suitable for the variations of the anatomic and physiologic derangement.

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A NONNARROWING TECHNIQUE FOR IMPLANTATION OF THE DURAN FLEXIBLE RING

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Prosthetic ring annuloplasty is a common procedure in both mitral and tricuspid valve repairs. The question of the optimum form of annuloplasty ring, however, whether rigid, semirigid, or entirely flexible, is still controversial. Although in a recent clinical study Okada and associates¹ showed that flexible rings perform better under exercise conditions, the narrowing effect of the Duran flexible ring has been considered a disadvantage in comparison with

remodeling annuloplasty with the rigid Carpentier ring.² This report describes a nonnarrowing technique for Duran flexible ring annuloplasty.

Technique. At operation, the left atrium is entered just posterior to the interatrial groove and anterior to the pulmonary veins. The mitral valve is examined, and traction in the middle portion of the free edge of the anterior leaflet allows visualization of the trigones. An appropriately sized ring is selected according to the intertrigonal distance. Two 3-0 polypropylene double-armed sutures are placed in both trigones, and an additional suture is placed in the middle part of the posterior anulus. Stitches in the trigones are placed through the two ring markers (Fig. 1, *Step 1*). A running 3-0 polypropylene suture is used to seat the flexible ring along the intertrigonal area. The stay suture in the middle part of the posterior anulus is used as a key reference for reduction of the dilated

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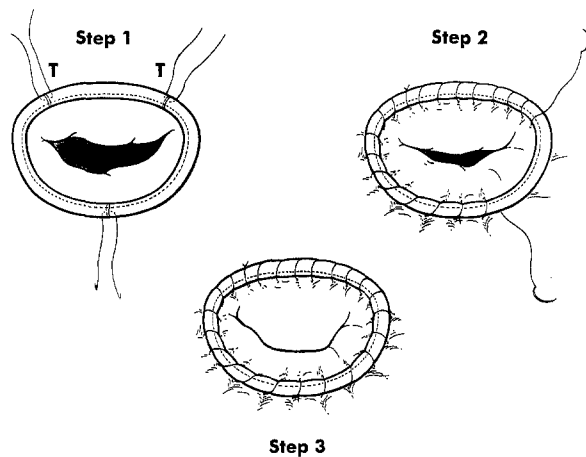


Fig. 1. Mitral valve annuloplasty with Duran flexible ring secured by a running suture. *T*, Trigone.

mitral anulus. The suture placed in the anterior trigone is then run clockwise to join the stay suture (Fig. 1, *Step 2*), and the suture in the posterior trigone is run counter-clockwise to be tied with the other stitch (Fig. 1, *Step 3*). The atriotomy is closed and air is vented from the heart. The patient is weaned from bypass, and proper functional results are assessed by transesophageal echocardiography before the cannulas are removed.

Discussion. Annuloplasty with flexible rings is a safe and stable reconstructive procedure ($89.9\% \pm 3.2\%$ free from mitral structural deterioration at 16 years³) in which preservation of spatial motility and configuration of the anulus allows a more physiologically natural valve repair with improvement of ventricular function. The results obtained with rigid versus flexible annuloplasty rings inserted using interrupted sutures are different. The rigidity of the Carpentier ring prevents deformity, whereas when the Duran flexible ring is sutured to the anulus by interrupted U-stitches multiple plications of the Dacron polyester fabric occur (Fig. 2). This process causes narrowing of the prosthetic ring and is a potential cause of valve stenosis. Although a decreased valve area usually has no clinical significance, plication of the annuloplasty ring determines a reduction of at least one or two sizes in the selected device. The residual stenotic effect without early hemodynamic repercussion, together with progression of the underlying disease, may be a predisposing factor toward valve stenosis necessitating late reoperation. The incidence of thromboembolic episodes detected in our series, which is slightly higher than that reported by others using the Carpentier ring,³ could be attributed in part to the distortion of the Dacron ring.

The rationale for the technique described here was based on different factors. On the one hand, some patients in whom Duran flexible rings had been inserted required valve-related operations as a result of hemolysis with or without prosthetic dehiscence; on the other, patients who underwent reoperation for mitral restenosis showed absence of endothelium in the areas in which the ring was folded. Analysis of our experience with rheumatic mitral valve

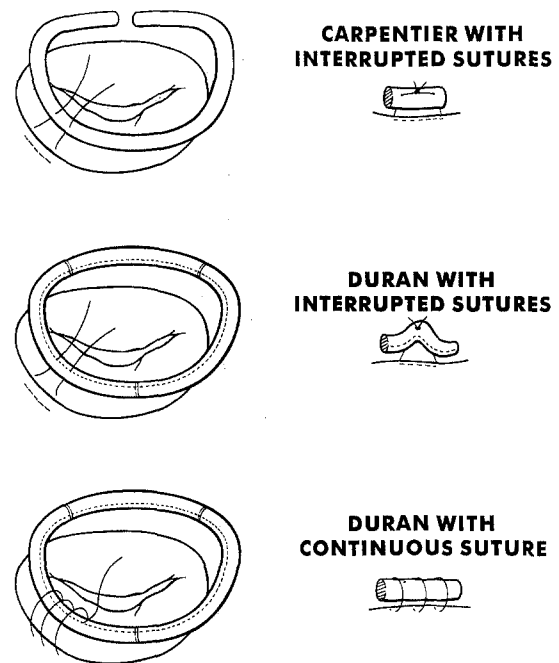


Fig. 2. Different results produced by interrupted U-sutures in Carpentier (no deformity) and Duran (plication) ring annuloplasties. Duran flexible ring with a running suture is also shown (no deformity).

disease reveals that as many as 14.7% of the patients evaluated echocardiographically showed a valve area of less than 1.5 cm^2 .³ In recipients of cryopreserved mitral homografts, the annular suture line has been reinforced with a Duran flexible ring inserted by means of a continuous over-and-over suture, with annuloplasty used to support the repaired valve⁴ rather than to achieve a reduction in size of the native anulus. This modification resulted in remodeling of the anulus without stenosing folds or plications (Fig. 2). Other authors have also used running sutures to insert annuloplasty rings, such as the adjustable Puig-Massana ring or a flexible ring constructed from transverse sections of knitted Dacron polyester fabric.⁵ In case of failure of mitral valve repair, explantation of the annuloplasty ring is simplified to cutting a single suture.

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