

Despite the major advances in thoracic aortic surgery with DHCA, there are still major clinical challenges, including this thrombotic syndrome in the face of standard-of-care anticoagulation. Further collaborative research should advance our understanding and management of this thrombotic syndrome in the future.

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An innovative technique for the relief of right ventricular trabecular cavity obliteration in endomyocardial fibrosis

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Endomyocardial fibrosis (EMF) mainly affects persons from Africa, South America, and Asia.¹ The pathogenesis of this condition remains unknown. In advanced forms, EMF produces marked disability and carries a poor prognosis. Although there is consensus about the potential value of surgical intervention in symptomatic patients, there is still debate regarding the exact timing and the surgical technique to be used.^{2,3}

EMF is characterized by endocardial fibrosis affecting the inflow tract and the apex of 1 or both ventricles, commonly involving the atrioventricular valves. The right ventricle is affected in most cases.⁴ In severe forms, marked reduction of ventricular volume is thought to be due to the presence of a plug of fibrous tissue involving both the trabecular part and the apex.⁵

We here describe a new mechanism for apical obliteration of the right ventricle in EMF. The concept was used to evolve and apply a new surgical technique to increase ventricular volume, improve contractile function by releasing the myocardium and making use of viable myocardium in the obliterated area, and correct the tricuspid regurgitation.

This technique was conceived after detailed echocardiographic examination showed a layer of endocardial fibrosis forming an artificial floor to the right ventricle and isolating the trabecular part from the rest of the ventricular cavity (Figure 1, A).

After establishing cardiopulmonary bypass with moderate hypothermia, cold blood antegrade cardioplegia was used for myocardial protection. A wide longitudinal right atriotomy was performed to expose the tricuspid valve, which was usually markedly dilated, allowing wide access to the right ventricle. The distribution and extent of pathologic involvement of the tricuspid valve apparatus and right ventricular cavity were carefully defined.

In patients with obliteration of the trabecular part of the right ventricle described in this article, white glistening fibrous tissue 2 to 3 mm in thickness was found lining the inflow tract and extended down into the cavity of the right ventricle to the level of the junction of the inflow and trabecular parts. The fibrotic process produced a relatively thin layer that formed an "artificial floor" to the right ventricle, separating the inflow cavity from the obliterated muscular trabecular part. The fibrotic process spared the tricuspid leaflets and chordae.

Endocardial resection was started near the tricuspid annulus by retracting the leaflets of the valve. If the latter was fused in some areas, it was mobilized if at all possible. After the development of a cleavage plane by means of sharp dissection, a combination of sharp and blunt dissection was used to excise the thick, fibrous endocardial lining. This process was continued into the ventricular cavity, ensuring preservation and mobilization of the tricuspid valve chordae and papillary muscles. The membrane covering the entry into the trabecular part was removed (Figure 1, B), exposing the fused muscular tissue underneath it. This was followed by recreating a cavity inside the trabecular part by mainly separating the fused trabeculae but, if necessary, also excising some muscular tissue, taking care not to perforate the ventricular wall.

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Received for publication April 2, 2007; accepted for publication April 20, 2007.

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J Thorac Cardiovasc Surg 2007;134:1070-2

0022-5223/\$32.00

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doi:10.1016/j.jtcvs.2007.04.062

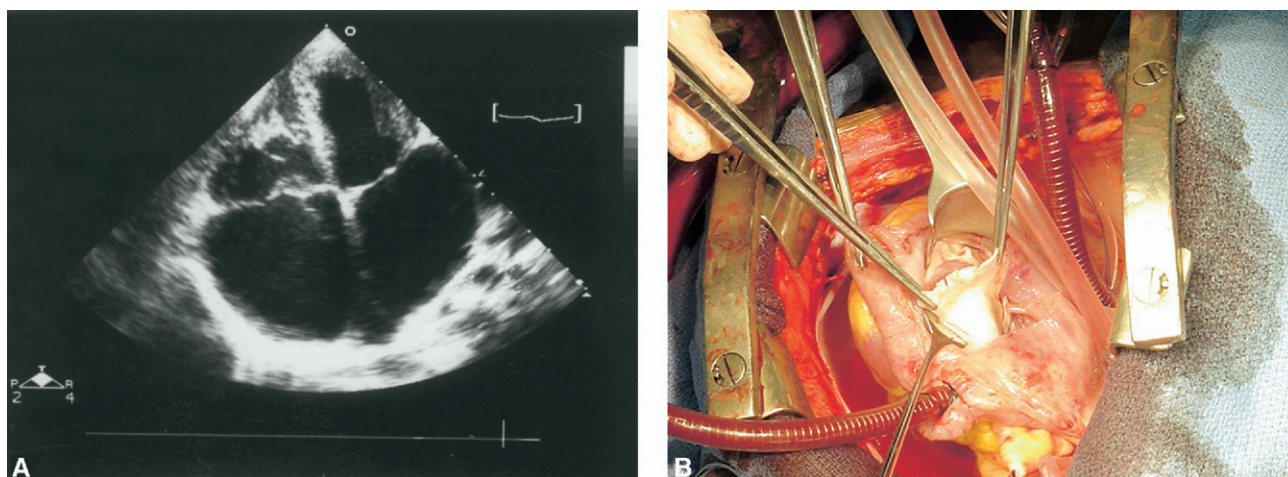


Figure 1. A, Echocardiogram showing obliteration of the trabecular part of the right ventricle in a case of bilateral endomyocardial fibrosis. Notice fibrosis in the apex of the left ventricle and dilatation of both atria. B, Through sharp dissection, a plane of cleavage is created, allowing the separation of the fibrous tissue from the myocardium. Excision of the fibrotic tissue is done as a block, revealing a healthy myocardium underneath it.

Table 1. Clinical and preoperative data of the 4 patients operated on with the technique

Patient no.	Age (y)	Sex	NYHA class	Diagnosis	Associated procedures	CPB (min)	AXC (min)	Hospital stay (d)
1	14	F	III	REMF	TR	93	65	6
2	11	M	III	BEMF	TR, MR, LVE	124	84	10
3	9	F	IV	BEMF	TR, MR	92	61	7
4	8	M	III	REMF	TR	66	0	9

No aortic clamping was used in patient 4, who had undergone a previous Glenn procedure. *NYHA*, New York Heart Association; *CPB*, cardiopulmonary bypass; *AXC*, aortic crossclamp; *F*, female; *REMF*, right-sided endomyocardial fibrosis; *TR*, tricuspid repair; *M*, male; *BEMF*, bilateral endomyocardial fibrosis; *MR*, mitral repair; *LVE*, left ventricular endocardial resection.

In patients with complete fusion of the leaflets and chordae to the mural fibrosis, freeing of the tricuspid valve apparatus was performed. Reconstruction of the tricuspid valve with 2 bands of polytetrafluoroethylene* tubes was used in all patients.

Clinical Summary

Between February 2003 and June 2006, 4 patients with right ventricular trabecular cavity obliteration were treated by means of this operation. The clinical characterization of these patients and the procedures used are summarized in [Table 1](#). There was no early or late mortality. Pericardial tamponade occurred in 2 patients. Patients were kept on low doses of diuretics, aspirin, and angiotensin-converting enzyme inhibitors for 6 months. At a mean follow-up of 18 months (range, 9–48 months), all patients are asymptomatic. A two-dimensional echocardiogram showed an increase in right ventricular cavity dimensions to nearly normal levels with improvement in systolic function, acceptable compliance in all, and mild tricuspid regurgitation in 1 patient. Magnetic resonance imaging analysis in 1 patient confirmed these results.

*Gore-Tex tube, registered trademark of W. L. Gore & Associates, Inc, Newark, Del.

Discussion

A new mechanism for right ventricular trabecular cavity obliteration in EMF is described. A surgical technique for its relief was developed and used with very encouraging results in terms of restoration of both structural and functional changes of the right ventricle. There was no evidence of recurrence over the relatively short follow-up period. We hope that familiarity with this technique will help to stimulate early diagnosis and timely treatment of EMF before shrinkage of the right ventricle occurs and thus have a favorable effect on the prognosis of this potentially fatal disease.

We thank the Magdi Yacoub Institute and the Chain of Hope-UK for their financial support of surgical missions to Mozambique and Drs Beatriz Ferreira and Gavin Wright for their help.

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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

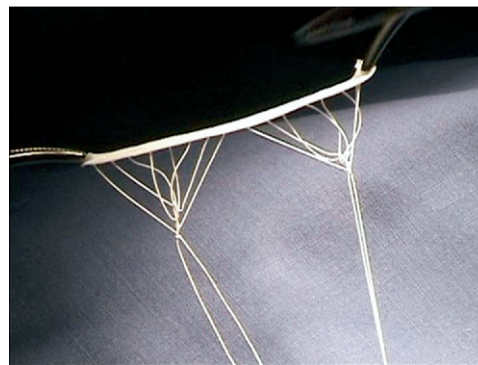


Figure 1. The device reproduces the chordae system. The number of chordae and their length can be adapted to surgical needs.

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Received for publication May 6, 2007; accepted for publication June 1, 2007.

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

J Thorac Cardiovasc Surg 2007;134:1072-3

0022-5223/\$32.00

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doi:10.1016/j.jtcvs.2007.06.012