External Aortic Annuloplasty Ring for Valve-Sparing Procedures

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Two different surgical approaches have been suggested for aortic valve-sparing surgery. The Yacoub remodeling technique reduces the sinotubular junction and creates 3 neosinuses of Valsalva by using a scalloped Dacron (DuPont, Wilmington, DE) tube in the supravalvular position [1]. Alternatively, David and Feindel [2] proposed reimplantation of the aortic valve within a cylindrical tube that supports both the annulus and the sinotubular junction but compromises the aortic annulus dynamics and sinuses of Valsalva [3–5]. My colleagues and I suggest combining the advantages of both approaches by adding an external subvalvular prosthetic ring annuloplasty to the remodeling procedure.

Technique

From May to August 2003, 5 patients with a mean age of 42.2 years (range, 32 to 49 years) were operated on for aneurysm of the aortic root. Three had Marfan's syndrome, 1 had a bicuspid valve, and 1 was an emergency operation for annuloectasia. Preoperative patient characteristics are summarized in Table 1.

After assessment of suitability for a valve-sparing procedure (a pliable, noncalcified bicuspid or tricuspid valve), resection of the sinuses of Valsalva and extensive external dissection down to the base of the aortic annulus were performed (as for a reimplantation procedure). The external aspect of the aortic wall at the level of each commissure was dissected free from the right ventricular outflow tract (LVOT), from the pulmonary artery, and from the roof of the left atrium.

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Six size 2.0 coated and pledgeted sutures (Ethibond; Ethicon Inc, Somerville, NJ) were placed inside out as U stitches on a circumferential plane around the LVOT (Fig 1). The sutures were placed 2 mm below the lowest point of insertion of each cusp and at the base of the interleaflet triangles below each commissure. By using a scalloped Dacron tube, the remodeling technique was performed to replace the aortic root above the valve leaflets (Fig 2). Before reimplantation of the coronary buttons, the subvalvular stitches were passed through the flexible prosthetic aortic ring, which was pulled down externally and tied separately in the subvalvular position below the suture line of the neoaortic root (Fig 3). Reimplantation of coronary ostia buttons was then performed (Fig 4). Sizing of the prosthetic ring was determined by the native annulus diameter measured with intraoperative transesophageal echocardiography. The selected ring diameter was at least 2 mm smaller than the native annulus (mean, 25.6 mm; range, 24 to 28 mm). The surgical technique was similar in all cases. The remodeling technique was adapted to the asymmetry of the aortic root of each patient (height of the commissures and size of the sinuses). The technique was identical for the tricuspid and bicuspid valves.

There were no hospital or late deaths at a maximum follow-up of 4 months (mean, 3.2 months). All patients were New York Heart Association class I, in sinus rhythm, and free of hemorrhagic or thromboembolic events. Control at discharge showed excellent results without marked aortic insufficiency (Table 1). Transvalvular gradients did not increase despite a dramatic reduction in the annulus diameter because of the difference between the external ring and the internal LVOT diameter.

Comment

Recent publications show a trend toward the reimplantation technique because it stabilizes the annulus [6]. This is particularly important if the aortic annulus is primarily dilated, as in Marfan's syndrome. Although the reimplantation technique seems to achieve more satisfactory results, it compromises the sinuses of Valsalva and is a more demanding surgical procedure [3–5]. The addition of a measured subvalvular prosthetic ring an-

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Table 1. Preoperative and Postoperative Echocardiographic and Computed Tomography Scan Characteristics

	Echocardiography			Computed Tomography		
Variable	AI 0–4+	EOA (cm^2)	Gradient (mm Hg)	Annulus Diameter (mm)	Sinus of Valsalva Diameter (mm)	Sinotubular Junction Diameter (mm)
Before operation	2 (0–3)	5.8 (5–6.5)	6 (5.6–6.3)	29.8 (27–34)	59.3 (49–80.2)	54.9 (47–68)
After operation	0.2 (0–1)	2.5 (1.8–3)	6.6 (5–8)	21.6 (21–22)	33.1 (29–36)	27.6 (27–30)
p Value (Student's t test)	<0.01	<0.001	NS ($p > 0.5$)	<0.001	<0.01	<0.001

Data are expressed as mean (range).

AI = aortic insufficiency; EOA = effective orifice area.

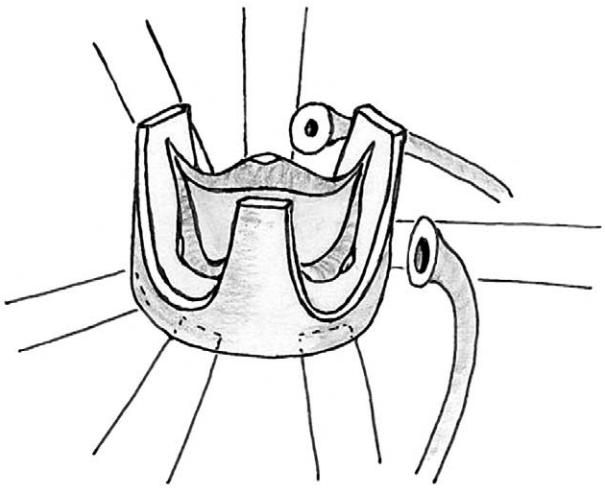

Fig 1. Subvalvular annuloplasty stitches.

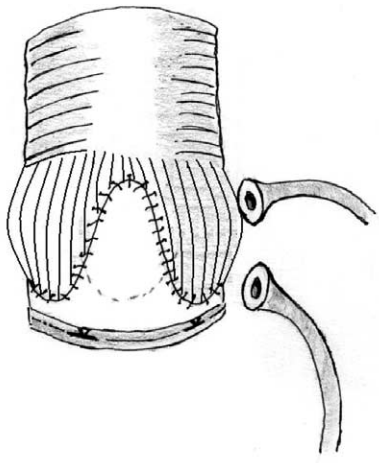

Fig 3. Implantation of the aortic prosthetic ring annuloplasty in the subvalvular position.

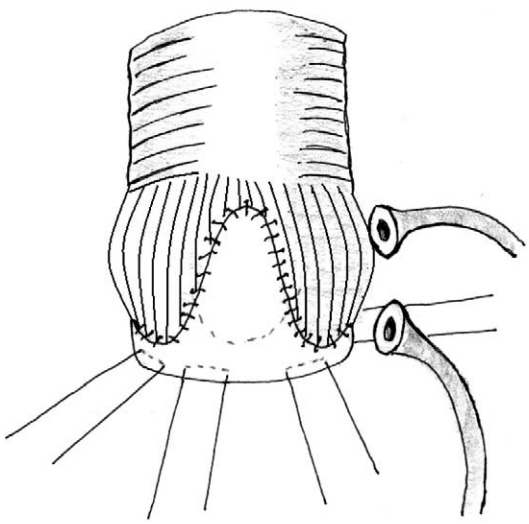

Fig 2. Replacement of the aortic root by using the remodeling technique.

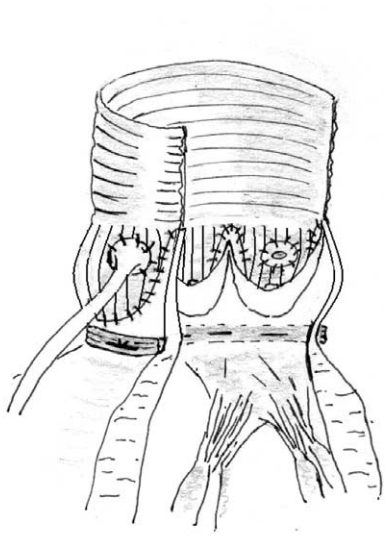

Fig 4. Remodeling procedure associated with a subvalvular prosthetic ring annuloplasty after reimplantation of the coronary arteries.

nuloplasty to the supravalvular remodeling of the aortic root seems to achieve the goals of both surgical approaches. This external ring should also provide more durable support to the diseased annulus than would a circumferential LVOT suture. This proposed technique, which is simple and reproducible, supports the sinotubular junction and the annulus; respects the aortic annulus anatomy, interleaflet triangles, and sinus of Valsalva dynamics [5, 7]; and has provided good initial results.

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