The Importance of Interleaflet Triangles for Aortic Valve Competence in a Marfan Patient with Dilated Aortic Sinuses

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We report a case of advanced aortic sinus aneurysm without the aggravation of aortic valve regurgitation after a simple reduction procedure for dilated aortic root base and sinotubular junction (STJ) in a Marfan patient with annuloaortic ectasia and severe aortic valve regurgitation. The aortic valve competence was well preserved by limited change of distances among the interleaflet triangles after reduction of the dilated aortic root base and STJ in the Marfan patient, although the sinus dilatation was aggravated.

Keywords: aortic valve, marfan syndrome, dilatation/pathologic, reconstructive surgical procedures

Introduction

The high mortality among persons with untreated Marfan syndrome almost exclusively results from cardiovascular complications such as acute aortic dissection or rupture. \(^1\) We performed a simple reduction of a dilated sinotubular junction (STJ) and aortic root base without the use of a composite graft in a Marfan patient with severe aortic valve regurgitation, \(^2\) and retrospectively examined what could arrest the aggravation of aortic valve regurgitation despite the aortic sinuses severely dilating with time.

Case Report

In January 2004, a 40-year-old female Marfan patient with annuloaortic ectasia and severe aortic valve regurgitation was admitted due to acute dissection in the proximal descending and abdominal aorta. On computed tomographic (CT) imaging, the aortic root dimension was found to be 6.3 cm (Fig. 1a), the aortic arch was 2.6 cm, and the descending aorta was 3.7 cm. On echocardiographic imaging, the aortic valve had severe regurgitation due to poor central leaflet coaptation but had good movement without leaflet thickening or prolapse. Through a clamshell incision, the proximal descending aorta was replaced with an 8.0-cm-long, 20-mm vascular graft. The dilated aortic root base was reduced to 22 mm by placing two inner and outer Teflon felt strips on the aorto-mitral fibrous continuity (from the nadir of the left aortic valve leaflet to the membranous septum) with five interrupted mattress 2–0 Dacron sutures. \(^2\) The length of the muscular portion of the aortic annulus (from the membranous septum reaching up to the middle of the left cusp in a counterclockwise direction) was 35 mm and was used as reference diameter of the annulus. The dilated fibrous portion with the noncoronary annulus displaced downward was plicated to be 35 mm in length.

The STJ was reduced to 24 mm by placing two inner and outer Teflon felt strips 5.0 mm in width with 18 interrupted mattress 4–0 Dacron sutures. \(^2\) The length of the muscular portion of the aortic annulus (from the membranous septum reaching up to the middle of the left cusp in a counterclockwise direction) was 35 mm and was used as reference diameter of the annulus. The dilated fibrous portion with the noncoronary annulus displaced downward was plicated to be 35 mm in length.

The STJ was reduced to 24 mm by placing two inner and outer Teflon felt strips 5.0 mm in width with 18 interrupted mattress 4–0 Dacron sutures, and the ascending aorta was replaced with a 24-mm vascular graft. Postoperative echocardiography revealed trivial aortic valve regurgitation. At the second postoperative...
week, the aortic sinus dimension was 5.2 cm (Fig. 1b) and the distance sum among the interleaflet triangles (ILTs) was 9.7 cm (Fig. 2a) on follow-up CT imaging. At the 55th postoperative month, the sinus dimension had increased to 5.9 cm (113% compared to the second postoperative week; Fig. 1c), and the distance sum among the ILTs had increased to 10.3 cm (107% compared to the second postoperative week; Fig. 2b). At the 96th postoperative month, the sinus dimension had further increased to 6.8 cm (131% compared to the second postoperative week; Fig. 1d), but the distance sum among the ILTs had not nearly increased as 10.4 cm during the next follow-up period of 41 months (108% compared with the second postoperative week; Fig. 2c).

The aortic valve showed mild regurgitation (1+) on the follow-up transthoracic echocardiography. In March 2012, 98 months after the first surgery, the patient underwent a modified button-Bentall operation with a 30-mm Valsalva tube graft (Terumo Cardiovascular Systems Corp., Ann Arbor, Minnesota, USA) and a 21-mm On-X bileaflet mechanical valve (On-X Life Technologies Inc., Austin, Texas, USA) for the advanced aortic sinus aneurysm but not for the aortic valve regurgitation. In the operating field, the aortic valve and the aortic sinuses were markedly dilated, thin and edematous, but the ILTs looked intact, and the aortic root base and STJ were 23 mm and 25 mm in dimension, respectively, without dilatation. The postoperative course was uneventful, and on postoperative CT imaging, the aortic root dimension was 4.0 cm and the imaginary ILTs’ distance sum of 10.4 cm in the new aortic root graft was the nearly same as in the preoperative aortic root (Fig. 2d).

**Discussion**

The definitive surgical option for Marfan patients with annuloaortic ectasia is composite graft replacement or reimplantation procedure. The composite graft replacement deprives the aortic root of its dynamics and requires anticoagulation with a mechanical valve. In Marfan patients with aortic root aneurysm and fair valve leaflets, the technique of reimplantation of the aortic valve has been more confidently used because it provides more stable valve function than remodeling of the aortic root.
Inter Leaflet Triangles in Dilated Aortic Sinuses

With the reimplantation procedure, the aortic valve is preserved, but the aortic sinuses and the aortic root base lose their conformational changes like expansion and reduction during the cardiac cycle. Significant aortic valve insufficiency is also potential problem after aortic valve–sparing operations for aortic root aneurysm. Therefore, appropriate patients and procedures should be selected for excellent outcomes. In our patient, the aortic valve regurgitation was readily managed with a partial reduction of the aortic root base (plication in the fibrous portion) and a circumferential reduction of the STJ, but the dilated sinuses were not enough reduced. Eight years later, the untreated aortic sinuses were markedly dilated in the fixed aortic root base and STJ, but dilatation of the ILTs and aggravation of the aortic valve regurgitation were insignificant. The dilated aortic sinuses were bulged between the post-like ILTs. Because the ILTs maintained their contour with insignificant dilatation, the valve coaptation was insignificantly affected despite severe sinus dilatation. The second definitive surgery was easily performed due to loose adhesion as a vascular graft was not used in the previous aortic root surgery. If some reduction procedure for the dilated aortic sinuses had been performed, in addition to the reduction of the aortic root base and STJ, dilatation of the aortic sinuses would have been less aggravated. At reoperation, no more sinus reduction or plication procedures were indicated because the markedly dilated sinuses were too thin to catch the suture stitches. Even after reoperation (button-Bentall operation) for dilated aortic sinuses had been performed, the imaginary ILTs’ distance sum of the new aortic root graft was similar to the preoperative one. In our Marfan patient, aortic valve competence could be kept with insignificant ILTs’ dilatation after a simple reduction of the STJ and aortic root base, allowing for the delay of composite graft replacement that may require anticoagulation. In addition to reduction of the aortic root base and STJ in patients with annulooaortic ectasia, an additional reduction plasty for the dilated sinuses may be considered to prevent or more delay the progressive sinus dilatation.

Disclosure Statement

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References