Rupture of fibrous bands associated with aortic root dilatation

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A case with fibrous bands suspending 3 aortic valve cusps is presented. In this case, the progression of the aortic root dilatation, which occurred more markedly at the sinotubular junction (STJ) level, seemed to increase the tension on the fibrous bands and eventually resulted in the rupture of the fibrous bands worsening in the severity of aortic regurgitation (AR). This report describes the relationship between the serial changes in the size of the aortic root and the fate of the fibrous bands of the aortic valve.

Clinical Summary

A 75-year-old male patient, who had undergone a stent implantation in the left circumflex artery, visited our hospital for a follow-up examination. An echocardiogram disclosed grade II AR and grade I tricuspid regurgitation. The diameter of the aortic annulus was 21 mm, the sinus of Valsalva was 46 mm, and the STJ was 34 mm. The left ventricular dimension and function remained within the normal limit. Three years later, the patient presented with palpitations and

dyspnea. Echocardiography showed grade IV AR, grade III tricuspid regurgitation, and grade II mitral valve regurgitation. The aortic root was more dilated: The aortic annulus was 23 mm, the sinus of Valsalva was 51 mm, and the STJ was 43 mm. The aortic valve demonstrated a trembling chord-like structure on its free margin (**Figure 1**), and the noncoronary cusp had prolapsed, which had not been recognized in any previous echocardiographic examinations. The diameter of the sinus of Valsalva was 53 mm on computed tomography. We successfully performed an aortic root replacement using a bioprosthetic valve and tube graft, and a tricuspid valve repair. During the operation, the aortic valve was tricuspid, and each cusp had 2 fibrous bands on both commissural sides (**Figure 2**). Four fibrous bands at the commissure between the left coronary cusp and the noncoronary cusp, and between the noncoronary cusp and the right coronary cusp, had completely ruptured (**Figure 2**). The remnants of the ruptured fibrous band were located 2 cm above the commissure (**Figure 2**). The patient recovered after the operation, and the preoperatively dilated left ventricular chamber normalized.

Discussion

Rupture of a fibrous band has been reported in association with a bicuspid aortic valve^{1,2} but has rarely been observed in a tricuspid aortic valve.^{3,4} The function of a fibrous band observed in an aortic valve has not been clearly elucidated. A fibrous band could preclude the normal closing of a conjoined cusp of a bicuspid aortic valve, eventually resulting in AR.² On the other hand, the rupture of a fibrous band causes AR not only in a bicuspid aortic valve¹ but also in a tricuspid aortic valve.^{3,4} Furukawa and colleagues⁵ proved that the outer deviation of the commissure associated with dilatation of the STJ caused AR. Therefore, in the case presented, the dilatation of the sinus of Valsalva and the STJ seemed to be the principal cause of the mild AR observed 3 years before this operation.

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Figure 1. Transthoracic echocardiogram showing a fibrous band (arrow) trembling in both diastole (A) and systole (B). Ao, Aorta.

Figure 2. Operative view of the aortic valve (A). Ruptured fibrous band on the noncoronary cusp (arrowhead). Remnant of the fibrous band on the ascending aorta (arrows). Resected aortic valve (B). Each cusp has 2 fibrous bands on both commissural sides. Asc Ao, Ascending aorta; NCC, noncoronary cusp; RCC, right coronary cusp; LCC, left coronary cusp.

Thereafter, the fibrous bands ruptured in association with the increased aortic root dilatation, especially at the level of the STJ. As a result, the progression of the aortic root dilatation, which occurred more markedly at the STJ level, therefore increased the tension on the fibrous bands and eventually resulted in the rupture of the fibrous bands worsening in the severity of AR. This report described, for the first time, the relationship between the serial changes in the size of the aortic root and the fate of the fibrous bands of the aortic valve. Moreover, rupture of a fibrous band results in AR in a tricuspid aortic valve, as observed in previous reports^{3,4} and the present case. Thus, these facts demonstrate that a fibrous band in a tricuspid aortic valve functions with such a supporting structure similar to the function of the chordae in the mitral valve. The function of the fibrous bands described in this report also suggests the possibility and efficacy of cusp suspension procedures for repairing a prolapsed cusp presenting AR.

References

1. Becker AE, Duren DR. Spontaneous rupture of bicuspid aortic valve. An unusual cause of aortic insufficiency. *Chest*. 1977;72:361-2.
2. Misawa Y, Hasegawa T, Oyama H, Sudo H, Hasegawa N, Kamisawa O. Congenital bicuspid aortic valve with regurgitation—a rare case showing a fibrous band between the conjoined cusp and the ascending aorta. *Nippon Kyobu Geka Gakkai Zasshi*. 1993;41:2156-9. Review. Japanese.
3. Kaneko T, Taniguchi K, Obayashi T, Murai N, Aizaki M, Tanaka T, et al. Aortic regurgitation due to ruptured fibrous band in the noncoronary cusp: a case report. *J Cardiol*. 1996;27(Suppl 2):79-83. Japanese.
4. Nakajima M, Tsuchiya K, Naito Y, Hibino N, Inoue H. Aortic regurgitation caused by rupture of a well-balanced fibrous strand suspending a degenerative tricuspid aortic valve. *J Thorac Cardiovasc Surg*. 2002;124:843-4.
5. Furukawa K, Ohteki H, Cao ZL, Doi K, Narita Y, Minato N, et al. Does dilatation of the sinotubular junction cause aortic regurgitation? *Ann Thorac Surg*. 1999;68:949-54.