Successful Bicuspid Aortic Valve Repair Using External Aortic Annuloplasty

Hiroki Yamaguchi, MD, PhD, Tatsuya Nakao, MD, PhD, Tasuku Kadowaki, MD, Hiromasa Nakamura, MD, Noriyuki Tokunaga, MD, PhD, Masataka Yoda, MD, PhD, and Masami Takagaki, MD, PhD

Department of Cardiovascular Surgery, New Tokyo Hospital, Chiba, Japan

A 33-year-old man presented with severe aortic insufficiency because it avoids long-term prosthesis-related complications – [1–4]. AI in BAV patients is commonly caused by dilated, elliptically shaped, ventriculoaortic junctions (El Khoury type I) or by cusp diseases (El Khoury type II) [2]. Cusp repair alone may not be adequate, and aortic root replacement or annuloplasty should be considered [2, 3].

External aortic annuloplasty was initially reported in valve-sparing aortic root remodeling [5] and has been widely accepted [6]. We applied this concept to our BAV patient with AI because of the isolated dilatation of the ventriculoaortic junction and cusp prolapse (El Khoury types Ic and II). External ring annuloplasty combined with cusp repair provided excellent results.

The patient was a 33-year-old man diagnosed with severe AI due to BAV. Transthoracic echocardiography showed left ventricular (LV) dilatation with an end-diastolic diameter of 64 mm, mildly depressed LV function with an ejection fraction of 0.48, normal aortic root with a sinotubular junction of 29 mm, and a ventriculoaortic junction of 29 mm. His aortic valve was bicuspid, with a median raphe on the conjoint cusp showing severe eccentric AI. The conjoint cusp was made of the right and left cusps (type I, L/R, I by the classification system of Sievers and Schmidtke [7]). Although he remained asymptomatic, he was considered a surgical candidate for elective aortic valve repair because of severe AI with LV dilatation and dysfunction.

After induction of anesthesia, intraoperative transesophageal echocardiography (TEE) confirmed the same BAV morphology as shown by transthoracic echocardiography, with a ventriculoaortic junction of 29 mm, an aortic valve area of 5.8 cm², coaptation depth of less than 2 mm with a gap, and severe eccentric AI extending out of the gap (Fig 1A). An echocardiographic variable suggested by Pettersson and colleagues [1], termed the tissue normality index (TNI): [TNI = (diastolic cusp area – systolic cusp area)/diastolic cusp area], was calculated to estimate cusp pliability. The TNI was 0.63 for his non-coronary cusp.

A standard median sternotomy was performed, and aortic and bicaval cannulations were used to perform cardiopulmonary bypass. The ascending aorta was clamped and transected 1 cm above the sinotubular junction. Selective antegrade cardioplegia was administered, and complete diastolic arrest was obtained. The aortic valve showed 2 cusps with different morphologies. The non-coronary cusp was looked normal (reference cusp), with a geometric height of 20 mm. The conjoint cusp was made of the right and left cusp fusion with a raphe, and the geometric heights of the cusps were 18 mm and 20 mm, respectively. The free margin of the conjoint cusp was elongated, which caused prolapse. The ventriculoaortic junction was dilated to 29 mm.

We decided to perform external aortic annuloplasty combined with cusp repair. Both coronary arteries were freed and taped (Fig 2A). Six 2-0 Ti-Cron (Covidien, Mansfield, MA) pledgeted mattress sutures were placed circumferentially from inside out in the subvalvular plane (Fig 2B) below the naids of each cusp and at the base of each interleaflet triangle. Special care was taken not to place the stitch into the membranous septum between the

---


right and noncoronary cusps. The mattress sutures were used to secure a 28-mm Gelweave (Terumo, Tokyo, Japan) graft strip (width, 7 mm) to the ventriculoaortic junction externally (Fig 2C).

The ventriculoaortic junction diameter after annulo-plasty was 22 mm. The raphe between the left and right cusps was divided completely and sutured using 6-0 Surgipro (Covidien) interrupted sutures (Fig 2D), and a pair of small pericardium was used at its edge for reinforcement. This technique successfully created a good bicommissural valve. The ascending aorta was anastomosed. Antegrade cardioplegia was administered, which caused expansion of the aortic root without LV dilatation. The aorta was declamped, and the heart returned to sinus rhythm quickly.

The patient was weaned from cardiopulmonary bypass uneventfully. His TEE showed a ventriculoaortic junction of 22 mm, an aortic valve area of 2.68 cm², and a
coaptation depth of 8 mm with trivial AI (Fig 1B). The patient’s postoperative course was smooth, and he was discharged on postoperative day 14.

Comment

Our concept of BAV repair is based on previously reported principles [1–4] for transformation into a good bicommissural valve. In our patient, a prolapse of the conjoint cusp was observed by free margin elongation. The high TNI (0.63) of the reference cusp, which was reported to be most informative of the ability for it to be repaired [1], also supported our decision to repair. Complete detachment and closure of the raphe successfully created a good bicommissural valve, as planned. However, ventriculooaortic junction dilatation reduced the coaptation height to less than 2 mm. We then chose external annuloplasty to reduce the ventriculooaortic junction and increase the coaptation depth. Long-term recurrence of AI after BAV repair is a serious problem, especially in young patients. Our procedure theoretically reinforces coaptation of the valve by increasing its depth, which is expected to provide long-term durability of the repair.

Three techniques for aortic annuloplasty—subcommissural suture annuloplasty and internal and external ring annuloplasty—have been reported. In vitro comparison of the techniques [8] showed that the external and internal ring techniques had greater potential for reduction of the ventriculooaortic junction diameter. The external ring technique also provided paravalvular remodeling, in contrast with the internal ring technique. BAV is known to involve changes in the aortic root. Although the aortic root appeared normal in our patient, we chose external annuloplasty because of the expected paravalvular remodeling.

External ring annuloplasty combined with cusp repair provided excellent BAV repair. This approach is suitable for BAV patients whose ventriculooaortic junction is dilated without root dilatation.

We thank Enago for the English language review.

References


Open Surgery Repair for Superior Vena Cava Syndrome After Failed Endovascular Stenting

Huadong Li, MD, Xionggang Jiang, MD, and Tucheng Sun, MD

Department of Cardiovascular Surgery, Union Hospital, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, China

Thrombosis is a rare cause of superior vena cava (SVC) syndrome. We report a 37-year-old man hospitalized because of swelling of the face and neck. A computed tomography angiography showed a thrombotic obstruction of SVC. The patient was treated by percutaneous transluminal balloon angioplasty of the SVC and placement of a stent. The symptoms disappeared, but the patient was hospitalized again after 3 months for the same complaints. Computed tomography angiography showed thrombosis in the stent in the SVC. The SVC was replaced with a prosthetic blood vessel. The patient’s postoperative recovery was uneventful, and SVC syndrome did not occur during 2 years of postoperative follow-up.


Superior vena cava (SVC) syndrome (SVCS) is the clinical manifestation of SVC obstruction, with severe reduction in venous backflow to the right atrium. William Hunter first reported SVCS in 1757. Most cases are caused by compression of the SVC due to malignancies such as lung cancer, lymphoma, or metastasis of solid tumors [1]. Other, less common causes include benign tumors, aortic aneurysm, thyroid enlargement, and fibrosis of the mediastinum [2]. Intravascular thrombosis is an extremely rare cause of SVCS. We present a patient with SVCS due to thrombosis caused by nonmalignant disease.

Accepted for publication July 22, 2013.

Address correspondence to Dr Sun, Department of Cardiovascular Surgery, Union Hospital, Tongji Medical College, Huazhong University of Science and Technology, 1277 Jiefang Rd, Wuhan 430022, China; e-mail: suntucheng@126.com.