Use of the Konno Procedure in an 80-year-old Woman with Aortic Stenosis, a Narrow Left Ventricular Outflow Tract, and a Small Aortic Annulus

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This report describes a technique for repairing an aortic stenosis in an elderly patient with a small aortic annulus and a narrow left ventricular outflow tract. Preoperative echocardiography in an 80-year-old woman showed severe aortic stenosis with a narrow outflow tract: the aortic valve area was 0.48 cm², the aortic annular diameter was 14 mm, and the left ventricular outflow tract diameter was 14 mm. The Konno procedure was used to enlarge both the small aortic annulus and the left ventricular outflow tract, and a 19-mm Carpentier-Edwards bioprosthetic valve was implanted. The patient’s postoperative course was uneventful. The left ventricular mass decreased from a preoperative value of 236 g to 96 g, 3 years after surgery. Only a few reports have described the use of the Konno operation in adult patients. In the present case, the Konno operation was demonstrated to be a good option for aortic stenosis accompanied by a small aortic annulus and a narrow left ventricular outflow tract, even in an elderly patient.

Keywords: small aortic annulus, Konno procedure, aortic annular enlargement

Introduction

The presence of an aortic stenosis (AS) in conjunction with a small aortic annulus is not a rare occurrence and is traditionally treated by aortic valve replacement (AVR), using a small prosthetic valve or Nicks procedure. For an extremely small aortic annulus, however, the Nicks procedure may not be adequate to enlarge the annulus by 4 mm to 6 mm, to a size that is able to accommodate a prosthetic valve. Here, we describe the case of a successful repair using the Konno procedure in an elderly patient with an extremely small aortic annulus and a narrow left ventricular outflow tract (LVOT).

Case Report

An 80-year-old woman with a body weight of 38 Kg, a height of 132 cm, and a body surface area of 1.17 m² had a systolic murmur and complained of exertional dyspnea. Chest radiography showed cardiomegaly with a cardiothoracic ratio (CTR) of 60%. Electrocardiography revealed sinus rhythm, with a heart rate of 60 beats per minute, and left ventricular hypertrophy. Echocardiography revealed severe AS with a maximum transvalvular gradient of 89 mmHg, a valve opening area of 0.48 cm²,
a valve orifice diameter of 14 mm, and a LVOT diameter of 14 mm (Fig. 1).

Surgery was performed through a median sternotomy. Cardiopulmonary bypass (CPB) was instituted after aortic and bicaval cannulation. Under systemic hypo-thermia at 30°C, cardiac arrest was established with hypothermic antegrade crystalloid cardioplegia. The ascending aorta was incised longitudinally in order to easily perform both the Konno procedure and the AVR. The aortic annulus and the valve cusps showed thickening and moderate calcification; the measured aortic annular size was 14 mm, corresponding to the preoperative echocardiographic estimation. The aortotomy was extended to the right and left commissures, and the right ventricular outflow tract was incised to the proximal end of the aortotomy. The interventricular septum was then incised from the right and left commissures and extended by 3 cm diagonally, 5–10 mm below the pulmonary orifice, to avoid injuring the septal branch of the coronary artery and the left bundle branch of the cardiac conduction system (Fig. 2a). A teardrop-shaped velour patch with glutaraldehyde-treated bovine pericardium was used to enlarge the annulus, and a 19 mm Carpentier-Edwards bioprosthetic valve (Edwards Lifesciences, Irvine, California, USA) was implanted (Fig. 2b). The right ventricular outflow tract was covered and enlarged using glutaraldehyde-treated bovine pericardium. The patient was weaned from CPB without difficulty.

Postoperative hemodynamics were evaluated by echocardiography 1 week after surgery. The peak pressure gradient had decreased to 24 mmHg, the effective orifice area was 1.2 cm², and aortic regurgitation was not observed (Fig. 3). The patient recovered well and was discharged 14 days after surgery, without complications. The left ventricular end-diastolic diameter and left ventricular end-systolic diameter decreased from their preoperative value of 44/24 mm to 37/20 mm after surgery. The preoperative value 47% for the patient’s left ventricular fractional shortening and her mild tricuspid regurgitation did not change. Pulmonary valve regurgitation was not observed after surgery.

Additionally, postoperative arrhythmias, including atrial fibrillation, were not observed in the early postoperative period, and a Holter electrocardiogram did not reveal any significant arrhythmia, 1 year after surgery. Her CTR decreased to 48% (by 1 year after surgery) of the preoperative value within the first postsurgical year, and the patient’s left ventricular mass had decreased from a preoperative weight of 236g to 96g (Fig. 4), within 3 years.
Discussion

A patient with a body surface area of 1.17 m² will typically have a left ventricle-aortic junction diameter of 17–18 mm; however, our patient’s annulus was only 14 mm in diameter. The smallest commercially available prosthetic valve at present is 19 mm in diameter; therefore, the aortic annular size in the patient was too small to accommodate a traditional prosthesis. An alternative surgical method in such cases involves a concomitant annular enlargement or apicoaortic bypass; the latter is reportedly a good option for elderly patients with small aortic annuli, but the natural pathway from the left ventricle is not preserved with this method. Furthermore, Takemura reported that 7 elderly patients who underwent apicoaortic bypasses, due to small annuli, did not experience any regression in their left ventricular masses. In adult patients, the Nicks or Manou- gian procedure is also commonly employed to enlarge the aortic annulus. In our practice, the Nicks procedure has been performed in many patients with aortic diameters smaller than 19 mm. However, similar to the findings reported by Peterson and Lesenno, we have noted that these techniques are able to enlarge the annulus by only 2–3 mm. In order to use these techniques in the present case, a prosthetic valve smaller than 18 mm would have been required. Bilateral enlargement of the aortic valve ring, reported by Yamaguchi, would be appropriate if the present patient had only needed an annular enlargement. However, due to the patient’s exceptionally small LVOT diameter (14 mm), LVOT enlargement and the Konno procedure, with a bioprosthesis, was chosen.

Results of the Konno procedure have been reported from several institutes. Cobanoglu performed 21 Konno operations involving the use of mechanical valves in patients aged 1.7–25.7 years, with a 10-year survival rate of 90% ± 7%. Suri reported 53 Konno operations involving the use of 40 mechanical valves, 10 homografts and 3 xenograft prostheses. Patients were between 1 and 65 years of age, and the 10-year survival rate was 86%. This report included 41 reoperation patients who had undergone 70 previous cardiovascular interventions. The most frequent reason for the Konno operation was to correct multilevel LVOT obstructions with complex subaortic tunnel stenosis and valvular anomalies with annular hypoplasia. The perioperative complications of permanent heart block, heart failure due to biventricular incisions, and pulmonary valve regurgitation were described in the series. In the present patient, good LV contractability was maintained, and neither arrhythmia nor right ventricular dysfunction occurred after surgery. These outcomes suggested that directing the interventricular incision to avoid the septal coronary artery branch and the conduction system, and creating the minimal incision (length) required to implant an appropriately-sized aortic valve, were important factors in retaining ventricular function. Sakamoto had described 63 Konno operation with mechanical valves in patients between 1 to 37 year of age; the 10-year survival rate was 91.9%. Prior to the current report,
a 65-year-old patient was the oldest person reported having undergone the Konno operation. To the best of our knowledge, our 80-year-old patient is now the oldest individual to undergone a Konno procedure.

**Conclusion**

The Konno procedure was successfully used in a patient with severe aortic stenosis, a narrow LVOT, and a small annulus. The Konno operation is a good option in this clinical situation and appears to be safe, even in elderly patients.

**Disclosure Statement**

The authors have no conflicts of interest to disclose.

**References**