Incorporating a pediatric concept into tricuspid valve endocarditis: One and a half ventricle repair

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Tricuspid valve (TV) endocarditis is usually associated with intravenous drug abuse and sometimes with congenital heart disease. Valve repair is the preferred procedure when possible, but extensive infection with valvular destruction would preclude this possibility. TV replacement carries a generally poor long-term prognosis, with debate continuing concerning the choice of a bioprosthetic or mechanical valve.¹ Valve excision alone is another recommended operation of choice²; however, some surgeons experienced a second operation for artificial TV implantation in most instances. We suggested a one and a half ventricle repair procedure for intractable TV endocarditis.

Technique

Operations were performed during cardiopulmonary bypass and bicaval cannulation, with the superior vena cava (SVC) cannulated at the innominate veins. If all 3 leaflets were impossible to preserve because of the extension of infection, we performed adequate debridement of the infected tissue, including leaflets, chordae, papillary muscles, and sometimes part of the annulus. Several horizontal mattress sutures were placed on the TV annulus of the anterior and posterior leaflet, and therefore the annulus was plicated. The diameter of the TV was reduced to 22 to 26 mm by using a valve sizer for reference. The Z value was around -3 or -4 by the body surface area. Then the SVC was amputated at the junction of the right atrium, and the cephalic end of the SVC was anastomosed to the right pulmonary artery as a bidirectional Glenn shunt (Figure 1). The patient was then weaned off cardiopulmonary bypass.

Clinical Data

We have applied this technique in 4 consecutive patients with intractable TV endocarditis (Table 1) in the past 5 years. All had positive blood cultures and were undergoing combined antibiotic treatment. Three of them underwent operation in urgent condition.

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All 3 leaflets were destroyed, except in patient 3, who had part of the posterior valve preserved. After the operation, they all received a full course (6 weeks) of antibiotic treatment for specific culture result. The severity of tricuspid regurgitation improved from 4+ to 2.8 ± 0.6 , and the functional class also improved from 3.9 ± 0.3 to 1.3 ± 0.3 (I = 1 to IV = 4). Only patient 1 was undergoing diuretic therapy because the marked tricuspid regurgitation persisted postoperatively.

Discussion

Infected endocarditis at the TV alone is rarely indicated for surgical intervention, except in intractable right-heart failure and huge

Figure 1. The bidirectional Glenn shunt was performed after excision of the infected tricuspid valve (TV) and reduction of the tricuspid annulus.

TABLE 1. Clinical data of tricuspid valve endocarditis with one and a half ventricle repair

Patient no.	Age (y)	Preoperative status	Size of vegetation	Involved area	TR preoperatively (postoperatively)	Postoperative SVC (RA)	Functional class preoperatively (postoperatively)	Rhythm preoperatively (postoperatively)
1	20	Septic shock, ventilator use, multiple lung abscess, pneumothorax	2.5 × 2 cm	3 leaflets, P, C, A	4+ (3+~4+)	22 (12)	IV (I~II)	Af (S)
2	28	Shock, right lower lobe abscess	3 × 4 cm	3 leaflets, P, C, A	4+ (3+)	20 (10)	IV (I)	Af (S)
3	22	Multiple lung abscess	3 × 3 cm	2 leaflets (anterior, septal), P, C	4+ (2+)	18 (12)	III~IV (I)	S (S)
4	18	Ongoing shock, right lung abscess	4 × 2 cm	3 leaflets, P, C, A	4+ (3+)	16 (9)	IV (I)	S (S)

TR, Tricuspid regurgitation; SVC/RA, superior vena caval/right atrial pressure 24 hours after the operation (in mm Hg); P, papillary muscle; C, chordae; A, annulus; 3+, moderate; 4+, severe; Af, atrial fibrillation; S, sinus rhythm.

vegetation with ongoing or possible pulmonary embolism. Tricuspid endocarditis is highly associated with drug abuse, which increases the complexity of decision making. Difficulty in discontinuity of drug abuse would increase the incidence of recurrent infected endocarditis in the prosthetic TV. In addition, most of the drug abusers are young, and the bioprosthesis usually degenerates sooner in the younger group than in the aged group. This is the reason why we hesitated to implant bioprostheses in this patient group.

It is reasonable to incorporate the pediatric concept (bidirectional Glenn shunt) in this group with severe regurgitation after total excision of the TV. This one and a half ventricle repair sometimes was applied in congenital heart disease, such as Ebstein anomaly and hypoplastic right heart syndrome.³ The bidirectional Glenn procedure diverged SVC flow into the pulmonary artery to provide volume unloading for the right ventricle.

Reduction of the annulus of the TV is also important to reduce regurgitation. For the first case of this protocol (patient 1), we reduced the annulus to 26 mm (Z score of -2 for her), and moderate-to-severe regurgitation was found on postoperative echocardiography. She experienced prolonged intubation and needed oral diuretic therapy. Since then, we reduced the annulus to a Z size of -3 to -4 or less, and the postoperative course was uneventful for the other 3 patients. In hypoplastic right heart syndrome single ventricular circulation reconstruction was recommended when the Z value of the TV was less than -4.⁴ From our experience, the patients seemed to tolerate well when the Z value

was -4 or less because the right ventricle size was normal and without diastolic dysfunction in our group (TV endocarditis), and therefore they could tolerate a small TV annulus without signs of tricuspid stenosis.

Our strategy can offer an observational period to ascertain whether the patient abstains from drug abuse. After confirming the patient quit abuse, we can implant the prosthetic valve in the TV if right ventricular failure becomes severe.

In summary, the pediatric concept of one and a half ventricular repair can be successfully applied in the total tricuspid valvectomy for the intractable tricuspid endocarditis and provides an acceptable hemodynamic condition and several advantageous options for further therapy.

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