

Three Surgical Cases of Isolated Tricuspid Valve Infective Endocarditis

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Tricuspid valve infective endocarditis (TVIE) is rare in Japan, though many reports of it in intravenous drug users are found in other countries. We experienced 3 surgical cases of isolated TVIE in 2 nonintravenous drug users and 1 intravenous user, and we presented successful results. The surgical options for TVIE are vegetectomy and valvulectomy, valve repair, and valve replacement, which are controversial in regard to hemodynamic consequences in right-sided low-pressure system and long-term prognosis. We report the 3 surgical cases of isolated TVIE. (Ann Thorac Cardiovasc Surg 2010; 16: 134–138)

Key words: infective endocarditis, tricuspid valve, tricuspid valve repair, tricuspid valve replacement

Introduction

Tricuspid valve infective endocarditis (TVIE) is rare and accounts for 5% to 10% of infective endocarditis.¹⁾ Its causes are congenital heart disease, insertion of a central venous catheter, placement of a pacemaker or implantable defibrillator, a history of intravenous drug use, and hemodialysis. The reasons why TVIE is rare are thought to be because in the right-sided system congenital heart disease is infrequent; the tricuspid and pulmonary valves are not strained because of low pressure; and oxygen saturation is low.¹⁾ Nevertheless, reports of TVIE are growing because of the increasing frequency of drug-user patients.²⁾ Clinically, in contrast to left-sided endocarditis, pulmonary embolism occurs in 75% to 100% of TVIE patients.³⁾ In our cases, a pulmonary embolism occurred in every one. Although TVIE is successfully treated medically in about 75% of patients, conservative treat-

ment is not always effective, and surgical treatment is required in approximately the remaining 25%.¹⁾ We report on 3 surgical cases of TVIE.

Case 1

A 22-year-old woman complained of high fever about 2 weeks after an induced abortion. After medical treatment for about 2 weeks, she was referred to our hospital because of general fatigue and dyspnea. On admission, her systolic arterial pressure was 74 mmHg and heart rate was 120/min. She was in shock. Blood tests showed an inflammatory reaction with a white blood cell (WBC) count of 23,000/ μ l and a C-reactive protein (CRP) level of 24.68 mg/dl. Echocardiography showed tricuspid regurgitation (TR) grade 3 to 4 and mobile vegetation, 30 × 20 mm, on the tricuspid valve. Chest computed tomography (CT) demonstrated multiple infiltrates with cavities in both lung fields, which suggests the presence of multiple pulmonary embolisms and lung abscesses. She was diagnosed with isolated TVIE and septic shock and underwent emergency surgery.

It was performed in the standard manner, on arrest with cardiopulmonary bypass (CPB). When the right atrium was opened, a large vegetation was found attached to the posterior leaflet and part of the anterior leaflet of the tricuspid valve. Because infection involved the chordae and papillary muscle, resections were performed on the

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Received November 25, 2008; accepted for publication February 26, 2009

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posterior leaflet, on part of the anterior leaflet, and on the subvalvular apparatus with infection (Fig. 1). A tricuspid valve replacement (TVR), using a 27 mm Mosaic bioprosthesis (Medtronic, Inc., Minneapolis, MN), was performed. Her postoperative course was uneventful. She remains well about 4 years after surgery with no recurrence of endocarditis.

Case 2

A 43-year-old man had a decayed tooth that was untreated. He complained of high fever for about 2 months. Echocardiography showed TR and vegetation on the tricuspid valve. He was diagnosed with isolated TVIE and underwent medical treatment. He was referred to our hospital because of persistent vegetation. Physical examination was normal. Blood tests showed an inflammatory reaction with WBC count $24,100/\mu\text{l}$ and CRP level 7.55 mg/dl . Echocardiography showed a TR grade of 3 and mobile vegetation, $27 \times 19 \text{ mm}$, on the tricuspid valve. Chest CT demonstrated multiple infiltrates in both lung fields and multiple pulmonary embolisms. He underwent sequential medical treatment in our hospital. Lastly, he underwent surgery in the active stage because of repeated pulmonary embolism during medical treatment.

The operation was performed in the standard manner, on arrest with CPB. When the right atrium was opened, a large vegetation was found attached to the anterior leaflet of the tricuspid valve. Moreover, local perforation was seen in the anterior and posterior leaflets, and the septal leaflet was detached from the annulus with torn chordae (Fig. 2). Because the infection involved all leaflets, a total resection of the tricuspid valve was performed. The TVR was performed by using a 31 mm Carpentier-Edwards pericardial bioprosthesis (Edwards Lifesciences, Irvine, CA). His postoperative course was uneventful. About 8 months after surgery, he remains well with no recurrence of endocarditis.

Case 3

A 22-year-old woman had a history of intravenous drug use, drug overdose, and wrist cutting. She complained of fever, cough, and appetite loss for about 2 weeks. Echocardiography showed TR and vegetation on the tricuspid valve. Isolated TVIE was diagnosed, and she underwent medical treatment. She was referred to our hospital because of persistent vegetation. Physical examination was normal. Blood tests showed a normal inflammatory

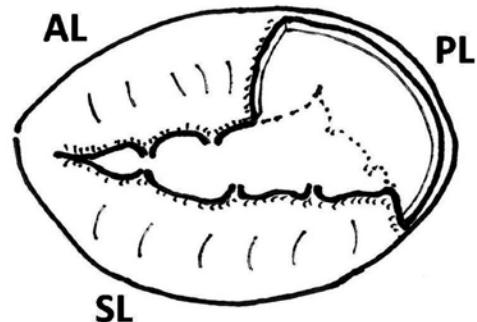
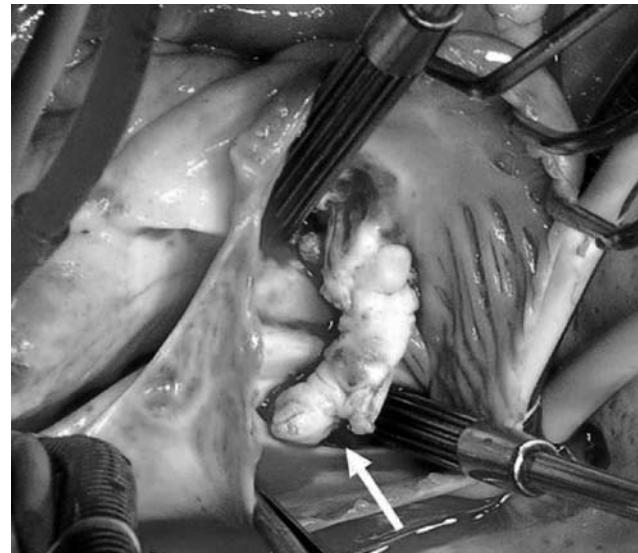


Fig. 1. Case 1.

A: A large vegetation (arrow) attached to the posterior leaflet and part of the anterior leaflet of the tricuspid valve.

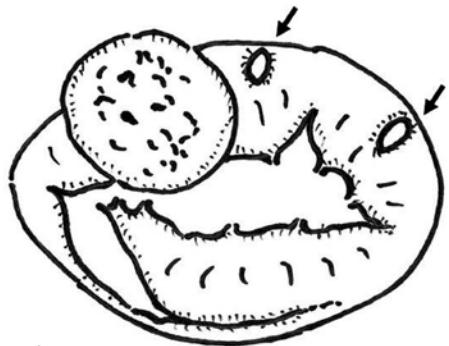
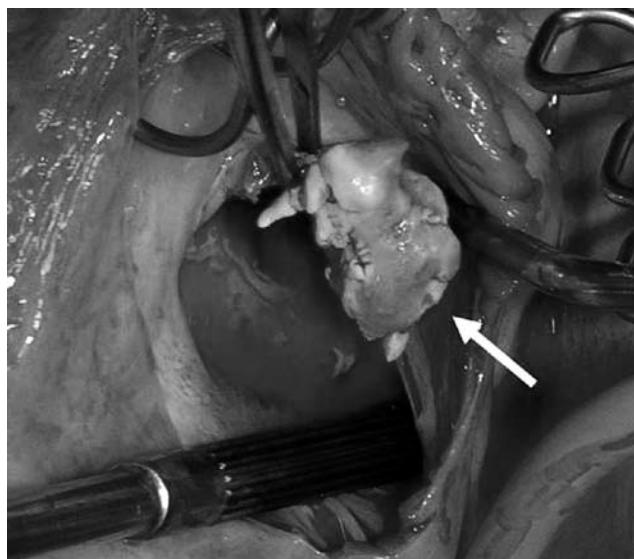
B: Resections of the posterior leaflet, of part of the anterior leaflet, and of the subvalvular apparatus with infection were performed.

AL, anterior leaflet; PL, posterior leaflet; SL, septal leaflet.

A
B

reaction with a WBC count of $6,800/\mu\text{l}$ and a CRP level of 0.15 mg/dl . Echocardiography showed TR grade 1 and mobile vegetation, $14 \times 10 \text{ mm}$, on the tricuspid valve. Chest CT demonstrated multiple infiltrates in both lung fields and multiple pulmonary embolisms. She underwent an operation in the healed stage.

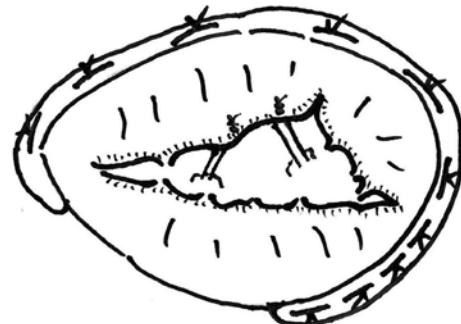
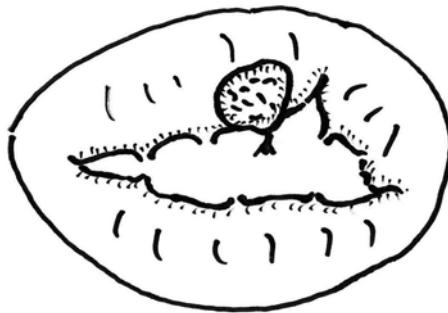
It was performed in the standard manner, on arrest with CPB. When the right atrium was opened, a vegetation was found attached to the anterior leaflet of the tricuspid valve, and torn chordae were seen. Because the infection was localized, only a resection of the vegetation was performed. Tricuspid valve repair, using 2 artificial chordae (CV-4, autologous pericardium), and ring annuloplasty, using a Carpentier-Edwards ring (Edwards Lifesciences,



A
B

Fig. 2. Case 2.

- A:** Shown is a large vegetation (arrow) attached to the anterior leaflet of the tricuspid valve.
B: A local perforation was seen in the anterior and posterior leaflets (arrows), and the septal leaflet was detached from the annulus with torn chordae.



A
B
C

Fig. 3. Case 3.

- A:** A vegetation (arrow) is attached to the anterior leaflet of the tricuspid valve.
B: A vegetation and torn chordae were seen, and the infection was localized.
C: Tricuspid valve repair, using 2 artificial chordae, and a ring annuloplasty were performed.

Irvine, CA), 32 mm, were then performed (Fig. 3). Her postoperative course was uneventful. She remains well about 4 months after surgery with no recurrence of endocarditis.

The 3 cases are summarized in Table 1.

Discussion

The treatment for TVIE applies basically to left-sided endocarditis. After the diagnosis of TVIE, medical treatment with antibiotics is indicated. Whenever possible, medical treatment should be continued until signs of infection disappear for 4 to 6 weeks.

The operative indications for TVIE in the active stage are uncontrolled right ventricular dysfunction because of massive TR, uncontrolled infection, repeatedly occurring

pulmonary embolism, and the presence of mobile vegetation of more than 10 mm.^{1,3)} In our cases, emergency surgery was indicated because of septic shock in case 1. Surgery during the active stage was indicated because of repeated pulmonary embolism in case 2. Surgery during

Table 1. Summary of cases

Case no.	Age/Sex	Preoperative state	Etiology	Organism	Pulmonary embolism	Surgical method	Pathology	Postoperative TR	Postoperative state
1	22/F	Active (sepsis)	Unknown (induced abortion)	MSSA	+	Replacement	Bacterial endocarditis	None	Alive at 4 years
2	43/M	Active	Decayed tooth	GPC	+	Replacement	Bacterial endocarditis	None	Alive at 8 months
3	22/F	Healed	Intravenous drug use	MSSA	+	Repair	Bacterial endocarditis	Trivial	Alive at 4 months

TR, tricuspid regurgitation; F, female; M, male; MSSA, methicillin-susceptible *Staphylococcus aureus*; GPC, gram-positive coccus.

the healed stage was indicated because of successful medical treatment in case 3.

In surgical treatment for TVIE, a complete debridement of infected tissue and a reduction of TR are important to prevent the recurrence of endocarditis and right ventricular dysfunction after surgery. The surgical options are vegetectomy and valvulectomy, valve repair, and valve replacement.

Vegetectomy and valvulectomy have the benefit of using no prosthetic material, but they result in right ventricular dysfunction because of massive TR after surgery and require reoperation in more than 20% of patients.^{2,4,5)} Lange et al. reported that these procedures are better than valve replacement in controlling infection in intravenous drug users.⁵⁾

Multiple strategies of valvuloplasty for TVIE are supported by the growing number of successful reports on mitral valve repair in active endocarditis,^{3,5,6)} and midterm outcomes of valvuloplasty have been reported. Lange et al. reported that valvuloplasty for 11 cases (7 isolated) of TVIE resulted in good outcomes in the follow-up period of 29 ± 18 months after surgery.⁵⁾ Gottardi et al. reported excellent midterm outcomes in valvuloplasty for 18 of 22 cases (17 isolated) of TVIE; No operative deaths occurred, and late mortality and reoperation was zero in the follow-up period of 53 ± 18 months after surgery.²⁾ Regarding valvuloplasty, Konstantinov reported a case of total resection and complete reconstruction of all the leaflets of the tricuspid valve with autologous pericardium and artificial chordae in acute infective endocarditis,⁷⁾ and the long-term outcome is interesting.

Valve replacement with either a biologic or mechanical valve exposes the patient to valve-related complications and the risk of recurrent endocarditis. No report with regard to the outcome of valve replacement for TVIE has been found. Mangoni et al. reported poor outcomes with isolated TVR in 15 patients with tricuspid valve disease whose operative mortality was 20% and median survival only 1.2 years.⁸⁾ But

Tokunaga et al. reported excellent long-term outcomes with isolated TVR in 31 patients with tricuspid valve disease whose operative mortality was 6.5%. The actuarial survival and freedom from valve-related events were 75.6% and 84.9%, respectively, 15 years postop.⁹⁾ Kaiser et al. reported long-term outcomes for valve replacements in 346 patients with right- or left-sided infective endocarditis; operative mortality was 12%; and survival at 10 and 15 years after surgery was 56% to 66% and 42% to 54%, respectively.¹⁰⁾ Is valve replacement optimal treatment for TVIE patients? And are mechanical valves or biologic valves better in regard to thrombosis or durability in the right-sided low pressure system? These questions are controversial and have not been completely answered.

Although it is standard procedure that operations are performed under CPB, some patients with TVIE cannot tolerate it because of severe lung injury as a result of pulmonary embolism. Lee et al. reported an off-pump tricuspid valve operation for isolated TVIE¹¹⁾ that should be considered in some specific situations.

In conclusion, tricuspid valve repair is now the most desirable surgical option for patients with TVIE. In case 1, valve repair should be considered. The patient was in preoperative septic shock, and it was necessary to shorten the operation time as much as possible; thus valve replacement was indicated. In case 2, valvuloplasty was difficult because infection involved all 3 leaflets and the subvalvular apparatus; thus valve replacement was indicated. Lastly, valvuloplasty in some cases is actually difficult to perform.

Conclusion

We report 3 surgical cases of isolated TVIE. Tricuspid valve repair is a desirable surgical option for TVIE with regard to freedom of recurrence of endocarditis and valvular competence. It is important to select the optimal surgical option for each individual's presentation.

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