Original Article

Surgical Treatments for Infective Endocarditis Involving Valve Annulus

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Objective: The early and late results of infective endocarditis (IE) with annular involvement were studied by focusing on surgical findings and operative procedures.

Materials and Methods: Fifteen adult patients with a mean age of 56 years were reviewed. Eight had native valve endocarditis (NVE), and 7 had prosthetic valve endocarditis (PVE). The diseased valve was mitral in 6 patients, aortic in 8, and mitral plus aortic in 1. Twelve patients were operated on during the active phase of IE. *Enterococcus, Staphyrococcus, Streptococcus,* and *Stenotrophomonaus Maltophilia* were predominant in bacterial examination. The mean follow-up period was 37 months.

Results: Active vegetation was observed in 63% of total patients. In NVE patients, valve replacement was performed in all 8 after complete debridement and annular patch reconstruction. One patient with hemodialysis died of heart failure. In PVE patients, valve deficiency was observed in all and active perivalvular abscess in 4. Conventional valve replacement was performed in 4 patients, and 3 of them died after surgery. Three patients who underwent aortic root translocation or Ross procedure survived. The hospital mortality of NVE and PVE surgery was 3% and 43%, respectively. There were no significant correlations between operative results and perioperative factors. During the follow-up period, late recurrent endocarditis did not occur, and one patient died of noncardiac diseases.

Conclusion: For NVE, good operative results were obtained after complete resection of infected valve annulus and valve replacement. For PVE, new surgical treatments, such as the translocation method or Ross procedure, should be induced for further improvement of surgical results. (Ann Thorac Cardiovasc Surg 2009; 15: 378–381)

Key words: infective endocarditis, valve annulus, surgery

Introduction

Favorable surgical results of infective endocarditis (IE) have been reported.[1] However, the indication of surgery[2] and appropriate operative procedures for IE with valve annulus involvement are still controversial. We reviewed our operative results in patients with valve annulus involvement and discuss the selection of operative procedures.

Materials and Methods

We reviewed the cases of 15 adult patients who had undergone surgery for IE since 1999 at Teikyo University Hospital, Japan. The mean age of patients was 56, ranging from 36 to 77, including 14 males and 1 female. Eight patients had native valve endocarditis (NVE), and the remaining 7 patients had prosthetic valve endocarditis

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Table 1. Patients' demographics

No. of patients		15	
Male/female		14/1	
Age (in years)		56 ± 13 (range: 36–77)	
Valve: Native valve endocarditis (NVE)		8	
Prosthetic valve endocarditis (PVE)		7	
Timing of operation			
Active IE/healed IE		12/3	
Diseased valve			
Aortic 8, mitral 6, mitral + aortic 1			
Preoperative condition			
Cardiac failure/circulatory collapse		7	
Renal insufficiency		5	
Sepsis		3	
Cerebrovascular morbidity		1	
Meningitis:		1	
Bacterial examination (blood, tissue)			
Enterococcus	3	Acinetobacter	1
Staphyrococcus (MRSA)	2	Candida	1
Streptococcus species	2		
Stenotrophomonas Maltophilia	2	Unknown	5

IE, infective endocarditis; MRSA, methicillin-resistant *Staphyrococcus* aureus.

Table 2. Operative findings, operative procedures and results

Operative findings		
1) NVE (n = 8)		
Vegetation:	6 cases	(75%)
Perforation of valve leaflet:	2	(25%)
Changes of valve annuls:		
Mild	1 (Debridement)	
Moderate to severe	7 (Annular reconstruction)	
2) PVE (n = 7)		
Vegetation:	4 cases	(57%)
Valve deficiency	7	(100%)
Annular abscess	4	(57%)

Operative procedures & hospital deaths		
1) NVE	No. of cases	Hospital deaths
Valve replacement	8	1
2) PVE		
Valve replacement	4	3
Aortic root translocation	2	0
Ross procedure	1	0

NVE, native valve endocarditis; PVE, prosthetic valve endocarditis.

(PVE). Diseased lesions were located in the mitral valve (MV) in 8 patients, the aortic valve in 6, and the mitral plus aortic valves in 1. Twelve patients (75%) were operated on during the active phase of IE, and the other 3 received surgery during the healing phase of IE. All patients met the Duke criteria for endocarditis. Preoperatively, cardiac failure or circulatory collapse was observed in 7 patients, renal insufficiency in 5, sepsis in 3, and cerebrovascular morbidity and meningitis in 1. *Enterococcus, Staphyrococcus, Streptococcus*, and *Stenotrophomonas Maltophilia* species were predominant in bacterial examination (Table 1). In all cases, intravenous antibiotics were continued for at least 6 weeks, monitored by serial C-reactive protein (CRP) measurements.

All patients had follow-up observation after hospital discharge. Follow-up was complete in all patients, and the mean follow-up period was 34 ± 34 months, ranging from 3 to 89 months.

Statistical analysis was conducted with SAS version 5.0 software (SAS Institute, Inc., Cary, NC). Continuous data were expressed as the mean ± standard deviation (SD). The Student's t-test, the chi-square test, and the Logistic Regression analysis were used for statistical analysis, and a p value of less than 0.05 was considered to be significant.

Results

In NVE patients, active vegetation was observed in 6 (75%) and perforation of valve leaflets in 2 (25%). Changes of MV annalus were moderate to severe in 7 out of 8 NVE patients (88%), and a reconstruction of valvular annulus using autologous pericardial patch was required in 8 out of 10 lesions after aggressive debridement of necrotic and infected tissue. Annular change, which seemed to be reparable, was mild in a patient. In PVE patients, active vegetation was observed in 4 (57%). Partial valve dehiscence was observed in all 7 patients and annular abscess in 4.

In NVE patients, prosthetic valve replacement was performed in all 8 cases, including 5 mitral and 4 aortic valves. In the PVE patients, conventional prosthetic valve replacement was performed in 4, including 2 mitral and 2 aortic valves. Aortic root translocation procedure was performed in 2 patients and Ross procedure in 1 (Table 2).

In the NVE patients, only 1 died after MV replacement plus cardiopulmonary artery bypass grafting (CABG). This patient had diabetes mellitus and chronic renal failure requiring hemodialysis preoperatively. Hospital mortality was 13% in patients with NVE. In PVE, 3 out of 4 patients who underwent conventional valve replacement died of heart failure after surgery. Three patients who underwent aortic root translocation or the Ross procedure

Fig. 1. Operative findings of Ross procedure.
Left: excised autologous pulmonary conduit.
Right: the aortic root was replaced by pulmonary autograft (arrow).

(Fig. 1) and 1 after conventional valve replacement survived. Hospital mortality in PVE patients was 43% and higher than in NVE; however, there were no significant differences. Preoperative factors such as active IE, cardiac failure, renal failure, sepsis, or brain morbidity did not influence the operative results. In the follow-up study with a mean period of 34 months after surgery, a patient died of cerebral infarction. Recurrent endocarditis did not occur, and there were no redo cardiac operations.

Discussion

MV repair is strongly recommended in cases of active IE because of a risk of the infection of prosthetic materials, according to the ACC/AHA 2006 Guidelines.[3] Superficial infection without valve destruction is the best candidate for valve repair.[4] Annular abscesses and calcified or rheumatic MV disease were reported as two independent risk factors associated with reoperation in multivariate analysis.[5] Ruttmann et al.[6] completed MV repair in 50% of total patients with active IE, and they performed repair of the mitral annulus with pericardium in 11.8% of patients in the repair group. For annular reconstruction, either autologous pericardial patch[7] or bovine pericardium[8,9] have been recommended. We used autologous pericardial patches for the annular repair in all patients. We did not perform MV repair in patients with annular destruction and selected valve replacement, with good postoperative outcome. Mihaljevic et al.[10] reported that patients with advanced endocarditis and annular destruction required valve replacement. We think active annulus repair, which is considered an especially difficult challenge, may increase the percentage of repair. However, we believe that unstable preoperative hemodynamics leads to the decision to perform valve replacement immediately, rather than complicated valve repair, to avoid prolonged operation time for life salvage. Thus MV repair in patients with valve annulus involvement should be performed only when technically feasible.

In aortic valve endocarditis with annular destruction, the aortic valve repair requires complex operative techniques. Cabrol et al.[11] reported that complex aortic root repair could provide excellent long-term results even in patients with severe infectious lesions of the valvular rings. However, the repair of the aortic valve with annular abscess is not generally easy. In aspects of valve replacement, an availability of homograft has been reported. Despite the severity of tissue damage, cryopreserved homograft constitutes a safe and reproducible surgical treatment of aortic endocarditis with annular involvement.[12] According to the report by Grinda et al.,[13] operative mortality after homograft implantation was 5% in 104 cases with aortic valve endocarditis. An additional advantage of the homograft aortic valve for PVE is that this device has the flexibility to enable its use even in extensive aortic root destruction, including left ventriculo-aortic discontinuity.[14]

In PVE, annular extension of the infectious process is common and carries a substantial prognostic significance in determining the immediate and late results of the surgical treatment of PVE. Advanced destruction of the annular

tissues requires complex reparative techniques for treatment.[15] According to reports by Tugtekin et al.,[16] preoperative heart failure and *Staphylococci* infection were predictors in PVE. In our series, 3 out of 7 PVE patients died of heart failure after surgery. To prevent recurrent infection, homograft is recognized as an ideal material, and excellent surgical results have been reported.[13,14] However, in Japan it is not always easy to obtain homograft, though a limited number of tissue banks have been established in some hospitals. As a second-line treatment, we adopted an aortic root translocation method, or the Ross procedure. This procedure is sometimes time-consuming, especially in redo surgery; however, a pulmonary autograft is ideal for the reconstruction of a destroyed aortic root. Joyce et al.[17] successfully performed the Ross operation on nine patients with aortic annular destruction without mortality or serious complications.

Conclusion

Good operative results in NVE patients were obtained after a complete resection of infected valve annulus and valve replacement. In PVE cases, new strategy, such as the translocation method or the Ross procedure, should be necessary for the further improvement of surgical results.

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