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Retrospective Analysis of Surgically Treated Infective Endocarditis Cases

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ABSTRACT

Background. Prosthetic valve endocarditis (PVE) and native valve endocarditis (NVE) both cause high rates of morbidity and mortality and are significant health problems in our community. Optimal timing of the surgical intervention depends on the hemodynamic stability of the patient. In the present study, we retrospectively evaluated the clinical status, bacteriology, morbidity, and mortality parameters of infective endocarditis cases that were treated surgically.

Methods. Thirty patients (20 male and 10 female) who underwent cardiac valve surgery between April 2001 and December 2006 were included in the study. The mean (SD) age of the patients was 36.5 ± 5.42 years. Thirty-five surgical operations were conducted on 30 patients. We evaluated the patient demographic, etiologic, and surgical data retrospectively with respect to mortality and morbidity.

Results. The mean time to develop PVE was 13 months. We recorded a mortality rate of 16.6% (2 deaths in NVE operations and 3 deaths in PVE operations). Repeat surgeries were performed in 2 aortic valve cases and 3 mitral valve cases in which paravalvular leakage was noticed in the prosthetic valves.

Conclusion. Despite significant medical and surgical advances, both NVE and PVE still continue to be causes of high mortality and morbidity rates in cardiac surgery.

INTRODUCTION

Native valve endocarditis (NVE) and prosthetic valve endocarditis (PVE) constitute a significant health problem in the modern era. Epidemiologic studies have demonstrated PVE incidences ranging between 1.4% and 3.1% during the first year after surgery and increasing to 3.2% to 5.75% during the first 5-year period. The risk of developing infective endocarditis (IE) is highest during the first 6 months following surgery and subsequently declines by 0.2% to 0.35% per year [Arvay 1988; Horskotte 1995; Rutledge 1998].

The most frequent predisposing factor for the development of IE in Third World countries reportedly is rheumatic heart disease. In countries where rheumatic heart disease has been relatively controlled, the most frequent cause of IE is mitral valve prolapse (30%-50%) [Korzeniowski 1998]. Aortic and mitral valve involvement in IE can follow an insidious path as well as a rapid course in which valvular failure, progressive cardiac failure, and systemic embolization may develop and produce a fatal outcome. In the present study, we report our retrospective evaluation of 30 cases in which surgery was chosen to treat NVE and PVE.

MATERIALS AND METHODS

A total of 729 valvular surgical operations were carried out in 523 patients (246 men and 277 women) between April 2001 and December 2006. Thirty-five of these operations in 30 cases were performed because of IE. Twenty of the patients were male. The mean (SD) age of the patients was 36.5 ± 5.42 years (range, 4-73 years). We considered each valvular operation separately. The diagnosis of IE was made according to the Duke criteria [Durack 1994]. Routine blood biochemistry, microbiology, and serology tests were performed for each patient during the preoperative period, and at least 3 sets of blood cultures were collected before the administration of antibacterial therapy. All of the patients were evaluated via transthoracic echocardiography and by transesophageal echocardiography in some cases. EuroSCORE values were calculated for the patients. In all cases, the patients were empirically administered 6×10^6 U crystallized penicillin intravenously every 6 hours and 80 mg gentamicin intravenously every 12 hours. In cases in which the blood cultures grew microorganisms, specific treatment regimens were followed in accordance with the susceptibility pattern of the organism. The patients were prepared for surgery according to their hemodynamic features. Blood cultures were positive for *Candida* sp in 2 cases (*C albicans* and *C famata*) and for *Aspergillus fumigatus* in 1 case. In these cases, amphotericin B was added to the antimicrobial treatment regimens.

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Surgical Methods

Median sternotomy was performed in all patients. In addition, aortic and bicaval cannulation, blood cardioplegia, cardiopulmonary bypass, debridement of diseased tissues, excision, and replacement or repair of the diseased valve were carried out in all cases. A transesophageal echocardiography probe was placed intraoperatively in repair cases. Cardiac manipulations were minimized before the cross-clamp was placed. All infected and necrotic tissues were radically removed very close to the borders with healthy tissues. In replacement cases, the prosthetic or native valve was completely removed. During debridement, the surgical tools were replaced. In 3 cases, the surgical intervention was carried out on the beating heart with inflow occlusion. The patients in 2 of these cases underwent tricuspid valve replacement, and 1 patient underwent both tricuspid posterior leaflet resection and bicuspidization.

RESULTS

Among the predisposing factors, we noted suboptimal mouth and dental hygiene (8 cases), diabetes mellitus (8 cases), long-term catheterization (2 cases), hemodialysis (1 case), and postsurgical emphysema associated with an earlier surgery. Twenty patients underwent operation for NVE, and 15 patients underwent their operation for PVE. Three of the patients in the PVE group had early-period endocarditis. The average time for developing PVE following surgery was 13 months (range, 45 days to 23 years). The mean EuroSCORE was 14.4 ± 2.1 (range, 10-20) for PVE and 11.3 ± 1.7 (range, 8-17) for NVE. One patient underwent reoperation 3 times, and 2 patients underwent operation twice subsequent to the development of endocarditis. The chief complaint at admission was high fever and weakness. Heart murmur, high erythrocyte sedimentation rates, and high C-reactive protein values were noticed in all cases (Table 1). Blood cultures grew fungi in 3 cases, whereas the results of microorganism cultures were negative for 15 patients (Table 2).

Echocardiographic analyses revealed valvular failure in all cases, vegetation in 28 cases, and cordal rupture in 4 cases.

Table 1. Clinical and Laboratory Data*

	Patients, n
Murmur	30
Fever	24
Skin lesions	4
Splenic abscess	2
Cranial septic embolism	1
ESR ↑	35
CRP ↑	35
Vegetation	28
Anemia	15
Leukocytosis	12
Leukopenia	2

*ESR indicates erythrocyte sedimentation rate; CRP, C-reactive protein.

Table 2. Results of Blood Cultures*

Culture findings	NVE, n	PVE, n
No growth	11	4
α-Hemolytic streptococcus	3	3
Staphylococcus epidermidis	1	3
Staphylococcus haemolyticus	—	2
Staphylococcus aureus	1	1
Salmonella spp	1	—
Brucella melitensis	1	—
Peptostreptococcus magnus	1	—
Candida albicans	1	—
Candida famata	—	1
Aspergillus fumigatus	—	1

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

There were 5 cases of paravalvular dehiscence (on a prosthetic aortic valve in 2 cases and on a prosthetic mitral valve in 3 cases). The mitral valve was the most frequently affected site in both PVE and NVE cases (21/35 cases, 60.0%). Endocarditis of the right heart was determined in 3 cases. In 8 cases, paravalvular dissemination and abscess formation were noted. Perforation and failure were prominent on valve leaflets in 7 patients with NVE. The echocardiographic findings of valve involvement are summarized in Table 3.

Five bioprosthesis valves were placed in PVE cases (1 tricuspid, 2 mitral, and 2 aortic valves). In 4 cases, mitral annular reconstructions were carried out with bovine pericardium. Valve-repair procedures were performed on 2 mitral valves and 2 tricuspid valves (Table 4).

Five patients (2 in the NVE group and 3 in the PVE group) died during the operation or in the postoperative period. Blood cultures from one of the deceased patients in the NVE group grew *Staphylococcus haemolyticus*, whereas cultures from the other patient were negative for the growth of microorganisms. Blood cultures revealed *S aureus* in one of the deceased PVE patients and *A fumigatus* in the other. Cultures from 1 patient in this group were negative for microorganisms. In the PVE group, mortality was due to low cardiac output, during the operation in 1 case and in the early postoperative period in the other 2 cases. In the NVE group, the 2 deaths were due to septicemia, developing in the early postoperative period in one case and in the late postoperative period in the other.

Table 3. Echocardiographic Findings: Valve Involvement*

Involved Leaflet	NVE, n	PVE, n
Mitral	10	6
Aortic	7	4
Tricuspid	2	1
Mitral + aortic	1	4

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

Table 4. Surgical Data*

	NVE, n	PVE, n
AVR	7	4
MVR	9	6
AVR + MVR	—	2
AVR + MVR + tricuspid Kalangos Bioring annuloplasty	—	1
AVR + mitral band annuloplasty	1	—
AVR + MVR + PVR	—	1
TVR	1	1
Tricuspid posterior leaflet resection and bicuspidization	1	—
Mitral Kalangos Bioring annuloplasty	1	—

*NVE indicates native valve endocarditis; PVE, prosthetic valve endocarditis; AVR, aortic valve replacement; MVR, mitral valve replacement; PVR, pulmonary valve replacement; TVR, tricuspid valve replacement.

DISCUSSION

Bacterial, viral, or fungal infections of endocardial surfaces are collectively termed *infective endocarditis*. Vegetation consisting of inflammatory cells, microorganisms, thrombocytes, and fibrins are the characteristic findings for IE. The majority of NVE and late PVE cases are caused by viridans streptococci (50%-70%), *S aureus* (25%), and enterococci (10%). In early PVE, *S epidermidis* and *S aureus* are the most common organisms [Ramsdale 2004]. In the present study, we observed a similar trend in which *Streptococcus* and *Staphylococcus* species were the organisms most often isolated in NVE and PVE, respectively.

In our study, 24 of the patients initially complained of fever (68.5%). Fever is the most frequent nonspecific symptom in PVE and NVE [Horstkotte 2004]. In our series, there were 2 cases of splenic embolism and one of cerebral embolism. The most common extracardiac complication resulting from IE is embolism [Steckelberg 1991]. Infective material originating from valvular vegetations can land on any of the major vasculature structures. Especially, formidable complications can be encountered in the kidneys, the spleen, and the central nervous system. Autopsy findings have confirmed a high rate of involvement of major organs (kidney, 60%; spleen, 44%; brain, 40%; coronary vasculature, 30%) [Humphrey 1985; Weinstein 1986; DiSalvo 2001].

Our results demonstrated the mitral valve to be the most frequently infected site (16 cases). The literature has reported aortic valves to be the most commonly infected sites, followed by mitral valves [Saleh 2004]. The primary approach for treating aortic valve infections is reportedly valve replacement, whereas the preferred approach for mitral and tricuspid valve infections is valve repair [Doukas 2006]. In our series, valve-repair procedures were performed in 4 patients with NVE.

Surgical intervention in cases of active IE carries a high risk for the patient; however, immediate intervention might be a life saver in cases of resistance to medical treatment and with serious valve destruction [Balasubramanian 2005]. The following conditions are cited among the class I indications for surgical intervention for NVE: development of coronary heart failure despite medical treatment, aortic or mitral valve failure accompanied by high end-diastolic pressure in the left ventricle, IE caused by fungal organisms or highly resistant microorganisms, cardiac blockage, annular or aortic abscesses, and conditions leading to destructive and penetrative lesions. In PVE, prosthetic valve dehiscence, progressive regurgitation and obstruction, and abscess formation are considered to be among the chief factors indicating a surgical intervention [Bonow 2006]. The optimal time for surgical intervention is when the patient is able to tolerate the operation hemodynamically. We preferred the approach of emergent surgical intervention only in patients who were resistant to medical treatment. In patients responsive to medical treatment, we delayed surgical intervention until we achieved a satisfactory improvement in the patient's general condition. In the meantime, we carried out a thorough echocardiographic and microbiological follow-up. Emergency surgery is indicated in cases in which mobile vegetation, vegetation larger than 10 mm, septal abscesses, progressive valvular failure, or intracardiac fistula is detected [Vlessis 1996]. In our series, all of the patients were treated medically after blood culture results were obtained. The surgery was planned during the medical treatment and the follow-up period; however, we performed expedient surgeries in 4 PVE patients with paravalvular leakage and in 1 patient with positive blood cultures for *C famata*. There were 5 patient deaths (16.6%) in our series (3 in the PVE group and 2 in the NVE group).

Although the clinical, laboratory, and operative findings obtained in our study are in agreement with those in the recent literature, the number of fungal endocarditis cases in our study was higher than in other serial studies of IE cases.

Debridement of infected tissues without leaving any residues behind is an important parameter for successful surgical intervention. In addition, selecting the appropriate valve for replacement is another critical decision to be made in these approaches. The recurrence rates in the early postsurgical period for aortic homografts and pulmonary autografts are lower than those for mechanical and bioprosthetic valves.

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