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Surgical Treatment of Paraannular Aortic Abscess

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ABSTRACT

Background. Aortic valve endocarditis with paraannular abscess remains a challenging problem in the surgical treatment of native and prosthetic valve endocarditis. The purpose of this study is to evaluate the long-term outcome of surgical intervention for aortic paraannular abscess.

Methods. From January 1989 to November 2004, 32 consecutive patients (24 men, 8 women) were studied. Mean age was 50.6 ± 16.2 (range, 17-80) years. Twenty-four had native valve endocarditis and 8 had prosthetic valve endocarditis. Eight of 24 patients who suffered from native valve endocarditis had bicuspid valve endocarditis. The predominant microorganism was *Streptococcus viridans*. No microorganisms were identified in 11 patients. Most patients were desperately ill at the time of surgery. Repair was performed by aggressive eradication of infected tissue and reconstruction of the defect with autologous pericardium (n = 24), bovine pericardium (n = 3), Dacron patch (n = 4), and primary closure (n = 1).

Results. Although postoperative complications were common, early mortality occurred in only 4 patients (12.5%). Operative survivors have been followed for 5 months to 16 years (mean, 92.7 months). There were 2 late deaths but all were noncardiac deaths. Five patients (15.6%) underwent reoperation at a mean of 55.4 months after the initial surgery. The actuarial survival at 1, 5, and 10 years was 87.4% ± 5.9%, 83.2% ± 6.9%, and 79.1% ± 7.7%, respectively. The freedom from reoperation at 1, 5, and 10 years was 88.7% ± 6.2%, 79.8% ± 8.1% and 75.4% ± 8.8%, respectively.

Conclusion. These data suggest that aggressive surgical intervention and meticulous antibiotic therapy for aortic valve endocarditis with paraannular abscess yields a high success rate with relatively low mortality and good long-term results.

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INTRODUCTION

Surgical intervention plays an important role in the treatment of aortic valve endocarditis, especially when it is difficult to eradicate the infection with antibiotics alone. Early surgical treatment has been emphasized in these patients and favorable results have been demonstrated in recent reports [Pompilio 1998; Jault 1997]. However, extension of the infectious process into the annulus and adjacent structures still remains a challenging problem. In patients with an aortic root abscess, the annular structure can be extensively destroyed, thus resulting in aortic insufficiency and hemodynamic compromise relatively early in the course of the disease. Furthermore, radical debridement of all infected tissue is technically demanding, requiring restoration of the anatomic integrity and functional stability simultaneously. The purpose of this study is to evaluate the long-term outcome of surgical intervention for aortic paraannular abscess.

MATERIALS AND METHODS

Between January 1989 and November 2004, 32 consecutive patients underwent operation for an aortic paraannular abscess. Patients were included in the study only if a paraannular abscess was identified either preoperatively or intraoperatively. Their medical records were reviewed retrospectively to evaluate the operative findings, hospital course, and long-term outcome.

Mean age of the patients was 50.6 ± 16.2 years (range, 17-80 years). There were 24 men and 8 women. Twenty-four patients had native valve endocarditis and 8 had prosthetic valve endocarditis. Eight of 24 patients who suffered from native valve endocarditis had bicuspid valve endocarditis. In patients with prosthetic valve endocarditis, the mean interval between the first and second operations was 87 ± 42 months (range, 6-146 months). Most patients were desperately ill at the time of surgery. Thirteen patients (40.6%) were classified by the New York Heart Association (NYHA) as functional class III, and 6 patients (18.5%) were classified as class IV. Eight patients (25%) were operated on while they were in cardiogenic shock and 3 patients (9.4%) while they were in septic shock. Ten patients (31.3%) suffered from 1 or more systemic emboli before operation (3 cerebral, 9 peripheral). Preoperative heart block was diagnosed in 6 cases

Table 1. Preoperative Characteristics in Patients with Paraaortic Abscess

Variable	Value
No. of patients	32
Age	50.6 ± 16.2 (range, 17-80)
Sex	
Male	24 (75%)
Female	8 (25%)
Native valve endocarditis	24 (75%)
Congenitally bicuspid aortic valve	8 (25%)
Prosthetic valve endocarditis	8 (25%)
Bioprostheses	5
Mechanical prostheses	3
Echocardiograph	
Sinus rhythm	24 (75%)
Atrial flutter/fibrillation	2 (6.3%)
Complete heart block	6 (18.8%)
New York Heart Association class	
I and II	13 (40.6%)
III	13 (40.6%)
IV	6 (18.8%)
Cardiogenic shock	8 (25%)
Septic shock	3 (9.4%)
Septic embolism	12 (37.5%)
Cerebral	3
Peripheral	9

(18.8%). Transthoracic Doppler echocardiography was performed preoperatively in all patients, with the diagnosis of paraannular abscess made in 10 patients (31.3%). Echocardiographic findings revealed vegetations in 20 patients (62.5%) and moderate to severe aortic insufficiency in 18 patients (65.6%). The clinical characteristics of these patients are shown in Table 1.

The causative microorganisms were isolated from preoperative blood cultures or intraoperative specimens in 21 patients, and the predominant organism identified was *Streptococcus viridans* (Table 2). No microorganisms were identified in 11 cases. All but 9 patients received antibiotics preoperatively for 1 to 6 weeks (mean 2.7 ± 1.5 weeks).

Table 2. Microorganisms Responsible for the Infection*

Microorganism	Native Valve	Prosthetic Valve	Total
Streptococcus viridans	7	2	9 (28.1%)
Streptococcus mitis	1	1	2 (6.3%)
MRSA	2	0	2 (6.3%)
MRCNS	1	1	2 (6.3%)
MSCNS	2	0	2 (6.3%)
Staphylococcus hemolyticus	1	0	1 (3.1%)
Peptostreptococcus magnus	0	1	1 (3.1%)
Salmonella	0	1	1 (3.1%)
Enterococcus faecalis	0	1	1 (3.1%)
Culture-negative endocarditis	9	2	11 (34.4%)

*MRSA indicates methicillin-resistant *Staphylococcus aureus*; MRCNS, methicillin-resistant coagulase negative *Staphylococcus*; MSCNS, methicillin-sensitive coagulase negative *Staphylococcus*.

Operative Technique

All operations were performed through a median sternotomy with the use of cardiopulmonary bypass and cold blood cardioplegia. After excision of the infected native or prosthetic valve, meticulous care was taken to remove possible extensions of the infection until healthy and firm tissue was encountered. All infected or necrotic tissue surrounding the valve was radically resected regardless of whether the conduction system was endangered or large defects were created. With the exception of 1 patient in whom the annular defect was closed with direct sutures, the destroyed annulus was subsequently reconstructed with autologous pericardium in 24 patients, bovine pericardium (Supple Peri-Guard pericardium; Bio-Vascular Inc., St. Paul, MN, USA) in 3 patients, and Dacron patch (W.L. Gore & Associates, Newark, DE, USA) in 4 patients.

Aortic valve replacement was performed in 31 patients, whereas aortic valve repair was possible in 1 patient. A mechanical valve was implanted in 24 patients and a biological valve in 7 patients. Simultaneous mitral valve replacement was also performed in 7 patients. Cryopreserved allografts were not used in any of the patients. Coronary artery bypass grafting was additionally needed in 1 patient and tricuspid annuloplasty in 1 patient. Table 3 summarizes the surgical procedures performed, the types of valves implanted, and materials used for reconstruction of the defects.

In the operative field, a paraannular aortic abscess was confirmed in all patients, including those who had been considered to be free of abscess preoperatively. The annular structures were circumferentially involved or all 3 cusps

Table 3. Type of Surgical Procedure Performed*

Surgical procedure	No. of Patients
Type of operation	
Valve replacement	31
AVR	23
AVR + MVR	7
AVR + PVR	1
Valve repair	1
Type of heart valves	
Mechanical prostheses	24
Bioprostheses	7
Type of material used for reconstruction	
Autologous pericardium	24
Bovine pericardium	3
Dacron	4
Additional procedures	
Coronary artery bypass	1
Cabrol procedure	1
Tricuspid annuloplasty	1

*AVR indicates aortic valve replacement; MVR, mitral valve replacement; PVR, pulmonic valve replacement.

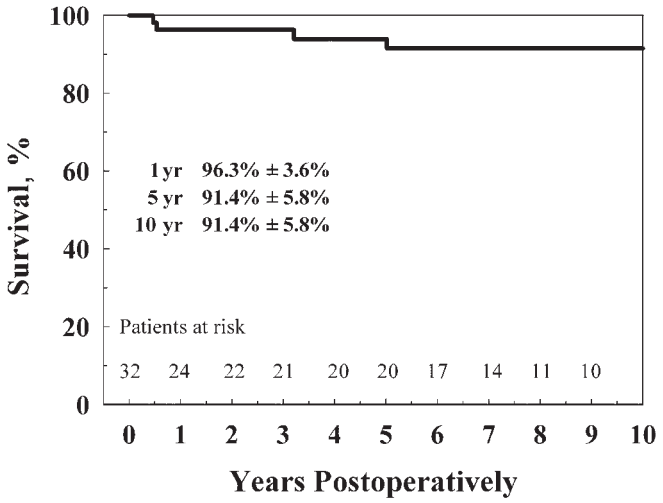

Figure 1. Actuarial survival.

were destroyed in 7 cases. Aortoventricular discontinuity and ventricular septal defects were identified in 14 patients (43.8%) and 5 patients (15.6%), respectively. Among patients with prosthetic valve endocarditis, annuloaortic dehiscence was observed in 3 patients. Postoperatively, antimicrobial therapy was continued for 1 to 7 weeks (mean, 3.75 ± 1.6 weeks).

Follow-up was complete for all patients. Mean follow-up was 92.7 ± 63 months for survivors, with a cumulative follow-up of 2,594 months. All data were analyzed with SPSS version 10.0 (SPSS, Chicago, IL, USA). Descriptive statistics included the mean and standard deviation for continuous variables and frequencies, and percentages for categorical variables. Late outcomes were analyzed with the Kaplan-Meier method.

RESULTS

Early mortality occurred in 4 patients (12.5%). The causes of death included cardiac failure in 1 patient, persistent sepsis with multiple organ failure in 1, preoperative intracranial hemorrhage in 1, and aortic dissection having originated from cannulation in 1. Twenty-six patients (81.3%) experienced 1 or more of the following complications: low cardiac output syndrome in 9 patients, acute renal failure in 6, mediastinal bleeding in 3, thromboembolic events in 3, septicemia in 2, and mediastinitis in 1. Complete heart block requiring a permanent pacemaker occurred in 4 patients (12.5%). An intraaortic balloon pump was required due to low cardiac output syndrome in 6 patients (18.5%) and a ventricular assist device was needed in 2 patients (6.3%).

Operative survivors have been followed for 5 months to 16 years. There were 2 late deaths (6.25%). In both cases, the death was due to rectal cancer, 6 months and 60 months after operation. The overall actuarial survival including early mortality was 87.4 ± 5.9%, 83.2% ± 6.9%, and 79.1% ± 7.7% at 1, 5, and 10 years, respectively (Figure 1). Five patients (15.6%) underwent reoperation at a mean of 55.4 months (range, 4.5-177.5 months) after the initial operation. The indication for reoperation included recurrent infective endocarditis in 2 patients, left ventricular pseudoaneurysm in 1, paravalvular leak in 1, and aortoventricular discontinuity in 1. Although 3 patients developed recurrent infection, 1 could avoid reoperation after successful medical treatment. The absence of reoperation at 1, 5, and 10 years was 88.7% ± 6.2%, 79.8% ± 8.1%, and 75.4% ± 8.8%, respectively (Figure 2).

DISCUSSION

Surgical intervention for active infective endocarditis is mandatory when antimicrobial treatment fails to eradicate infection or hemodynamic status rapidly deteriorates despite proper medical treatment. Early surgical treatment has been advocated by many authors and promising results have been obtained in recent studies [d'Udekem 1996; Jault 1997; Pompilio 1998]. In cases with native valve infection limited to the cusps, operative mortality rates for valve replacement have been reported to be 10 % or less [Jault 1997; Pompilio 1998].

Extension of the infectious process into the annuluss and adjacent structures still remains a challenging problem. In patients with aortic paraannular abscess, the fibrous skeleton of the heart is extensively destroyed, leading to destruction of the conduction system, perforation of the ventricular septum, and aortoventricular discontinuity. In addition, pseudoaneurysm or fistula may develop, as well as fibrinous pericarditis and myocarditis. Nevertheless, complete eradication of all infected tissue should be invariably considered simultaneously with restoring the anatomic integrity and functional stability. It is for these reasons that the reconstructive procedures are inevitably complicated and technically demanding. Aortic paraannular abscess, accordingly, still results in a considerably high operative mortality, with late outcome less than satisfactory [David 1989; d'Udekem 1996; Bauernschmitt 1998; Baumgartner 2000]. In a study of 70 patients

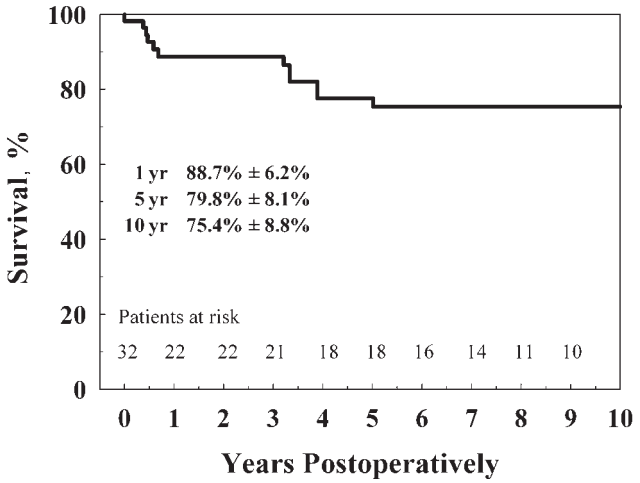

Figure 2. Freedom from reoperation.

who underwent operation for paravalvular abscess, d'Udekem and colleagues [1996] reported an early mortality of 13% and an 8-year actuarial survival of 64%. Watanabe and associates [1994] performed prosthetic valve replacement to treat 73 patients with aortic root infection. The operative mortality rate was 21% and the actuarial survival at 10 years was 62%. In our series, 32 consecutive patients underwent operation for aortic paraannular abscess, resulting in an early mortality of 12.5% and a 10-year actuarial survival of 79.1%. Although the incidence of postoperative morbidity was relatively high, early mortality was similar to those in previous reports. The long-term results seemed to be relatively satisfactory, given that there was no late death closely associated with the operation. In this respect, it appears that our experience compares favorably with those reported by other groups.

In patients with an annular abscess, the formation of an abscess cavity itself implies the possibility of infection by a more virulent microorganism. There is always a risk of recurrent infection of the prostheses. It has been reported that the incidence of reinfection ranges from 15% to 21% after prosthetic valve replacement for active infective endocarditis [D'Agostino 1985; David 1989; Watanabe 1994]. In a study by d'Udekem et al [1996]; 8 of 61 operative survivors (13.1%) developed recurrent endocarditis, whereas Delay and associates [2000] found that 59% of patients required reoperation due to recurrent endocarditis or paravalvular leak within the first year. Hagl and coworkers [2002], however, reported that 1 case of recurrent endocarditis occurred after the Bentall procedure was performed in 28 patients. They attributed the low incidence of recurrent infection to the aggressive removal of all infected tissue at the time of the initial operation. In our practice, 3 patients (9.4%) developed recurrent endocarditis and 2 of them underwent reoperation. The remaining patient did not require operation after successful antibiotic therapy; all of the patients survived reoperation. Many investigators emphasize that radical debridement of infected and necrotic tissue is a major determinant in preventing recurrent endocarditis and improving the short- and long-term results. All infected tissues should be thoroughly removed even if the conduction system is destroyed [David 1989; d'Udekem 1996; Bauernschmitt 1998; Aagaard 2001; Hagl 2002]. As described in previous studies, we noted that 4 patients required permanent pacemakers due to complete atrioventricular block.

Aortic paraannular abscess is a life-threatening complication of infective endocarditis. Patients with paraannular abscess have a more guarded prognosis than those without abscess because of the possibility that the infection can expand and result in a rapidly deteriorating heart failure. It has been reported that the prognosis of aortic root abscess depends mainly on how promptly it is treated [Ralph-Edwards 1994; d'Udekem 1996]. Therefore, the operative mortality has been shown to correlate with the degree of congestive heart failure. Watanabe and associates [1994] suggest that an operation may come too late if the indication for surgery is effected by cardiac failure. While demonstrating that surgery should be performed soon after diagnosis, d'Udekem and coworkers suggested that transesophageal Doppler echocardiography is a valuable diagnostic tool in patients with paravalvular abscess. In a report by Daniel et al [1991] on 44 patients with 46 abscesses proven by operation or autopsy, transthoracic echocardiography identified only 13 of the 46 abscesses, whereas transesophageal echocardiography detected 40. In our series, only 10 of 32 patients had the diagnosis of abscess made preoperatively by transthoracic echocardiography.

There is controversy about the best material for replacement in aortic valve endocarditis, especially when a paraannular abscess is present. Numerous investigators have recommended an aortic homograft for patients with aortic root abscess, suggesting that it is more resistant to both early and late infection when compared to prosthetic valves [Glazier 1991; Haydock 1992]. The operative procedure, furthermore, may be technically easier because the biological tissue is more flexible than a prosthetic device [Lau 1984; McGiffin 1992]. However, it is not feasible to meet the practical requirements of adequate preservation and storage of homografts; this invariably leads to a shortage of suitable homografts, particularly in patients who need urgent or emergent surgery [Hagl 2002]. There is no certainty that appropriate homografts will be readily available when needed. Additionally, patients with acute infective endocarditis are usually younger at the time of operation than those with noninfectious acquired valve diseases, and there is a possibility that they will undergo reoperation for graft failure after homograft implantation. Barratt-Boyes and colleagues reported that a freedom-from-reoperation rate at 14 years was only 42% after aortic root replacement using a homograft [Barratt-Boyes 1987]. For these reasons, many surgeons attempt to treat aortic paraannular abscess using a prosthetic valve to solve the well-known problems associated with homografts. It has also been reported that the outcomes of prosthetic valve replacement are comparable to those of homograft root replacement [Watanabe 1994; d'Udekem 1996; Bauernschmitt 1998; Baumgartner 2000; Aagaard 2001; Hagl 2002]. Radical debridement of all infected tissue is the most important factor for a successful outcome, whereas the type of valve implant is of less significance. In our series, we performed prosthetic valve replacement in all but 1 patient who underwent aortic valve repair. We did not use any homograft, and the short- and long-term results appear to be acceptable. We believe, therefore, that a prosthetic valve can be a good alternative to a homograft in the surgical treatment of aortic paraannular abscess as long as complete removal of infected tissue is achieved.

CONCLUSIONS

In conclusion, we performed prosthetic valve replacement for patients with aortic paraannular abscess and obtained satisfactory outcomes. We conclude from these data that aggressive surgical intervention and meticulous antibiotic therapy for aortic valve endocarditis with paraannular abscess can yield high success rates with relatively low mortality and good long-term results.

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