
**VALVE REPLACEMENT
FOR ACUTE LEFT HEART ENDOCARDITIS**

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ABSTRACT

Between January 1982 and June 1993, 66 patients [48 men and 18 women, mean age 50 years, range 21 to 77] underwent valve replacement for acute infective endocarditis. There were 45 aortic valve and 17 mitral valve infections. Four patients had bivalvular involvement. Fifty-three patients suffered from native valve endocarditis, with underlying valvular lesions documented for 31 patients. Staphylococci and Streptococci were responsible for 68% of the infections and 20% of the blood and valve cultures were negative. Refractory congestive heart failure was the leading surgical indication in 86% of the cases. The mean follow-up period was 44 months. Perioperative mortality was 6%. One and 3 years actuarial survival rates were respectively 88.5 % and 83 %. No early recurrence of infection was noted. Six patients (9.6%) needed reoperation. These data confirm that early surgical management may be considered with satisfactory results in complicated infective endocarditis.

KEYWORDS: Endocarditis; Heart valves; Heart valve prosthesis; Heart valve disease; Heart failure, congestive; Surgery, cardiovascular.

INTRODUCTION

Infective endocarditis refers to bacterial or fungal infection within the heart. It may occur as a complication of any infection, especially in patients with predisposing cardiac lesions or valvular prosthesis. Before the advent of antibiotics, it was considered as a fatal disease but since the introduction of penicillin in the early 1940s, cure and survival have become a reality (1).

Medical management is successful in the majority of patients, but is ineffective in about 25% of cases. Some patients develop acute signs and symptoms of sepsis, congestive heart failure or septic life-threatening septic emboli despite bactericidal antibiotics and intensive medical care. A second group of patients responds to antibiotic therapy but reveals cardiac failure secondary to valvular dysfunction. For these patients, the prognosis was worse before the development of cardiac surgery. Two reports from the mid-1960s described the first valvular replacements for endocarditis and proved that cardiac surgical procedure was feasible and potentially curative in the setting of sepsis and heart failure (2, 3). Implantation of a prosthetic device in an infected area seems paradoxical but has proved its effectiveness in much literature's reports (4, 5). Controversies remain concerning the appropriate time for surgery and early procedure is often advised. The purpose of this study is to retrospectively review our experience and to discuss recent literature trends on surgical management of acute endocarditis.

PATIENTS AND METHODS

Between January 1982 and June 1993, 66 patients underwent valve replacement for acute endocarditis in our Cardiovascular Surgery Department. All of them were in the active phase of the infection and were operated on before the end of the planned 6 weeks of antibiotherapy. The medical records of these patients have been selected according to the following criteria: **1.** clinical history compatible with endocarditis [fever, new or changing heart murmurs, cardiac failure, or embolic events in association with positive blood culture]; **2.** presence of characteristic operative lesions [leaflet destruction or perforation, vegetation, ruptured chordae, ring abscess, or septal rupture]; **3.** histopathological evidence of infective endocarditis [presence of microorganisms and polynuclear on tissue valves].

Follow-up information was obtained by direct or telephone contacts with the patients, families, or the patients' physicians. No patient was lost. The follow-up period extended to 120 months and averaged 44 months. Follow-up was maintained for 36 months or

more in 50% of the patients. The Berkson-Gage method was used to calculate the actuarial survival rates.

RESULTS

1. General characteristics of the patients :There were 48 male and 18 female patients, with a mean age of 50 years [range 21 to 77 years]. Forty-five patients underwent aortic valve replacement [AVR] and 17 mitral valve replacement [MVR]. Four patients needed double [aortic and mitral] valve replacement [DVR]. Fifty-three operations were performed for native valve endocarditis [NVE] and 13 for prosthetic valve endocarditis [PVE]. Twelve PVE occurred more than 6 months after valve replacement but one patient developed early PVE in the first days following AVR for calcified aortic stenosis.

2. Indications for surgery [Table I]: In most patients, surgery was undertaken for refractory heart failure related to valvular dysfunction [57 patients]. All patients were in New York Heart Association Functional Class IV. Emboli occurred in 12 patients [18%]. Nineteen patients were operated on after ineffective antibiotherapy with persistent bacteremia or septic shock. Twenty-six patients had several conditions dictating early operation. The operative procedure included cardiopulmonary bypass with moderate hypothermia in all patients. Cold crystalloid cardioplegia with iced saline in the pericardium was used routinely for myocardial protection during bypass. Infected material was removed as completely as possible. Mechanical valves [Medtronic, Duromedics, St Jude, Carbomedics] were used for 47 procedures. For 23 patients, age, lack of compliance to anticoagulant therapy and neurologic clinical conditions dictate the choice of bioprosthetic valves [Carpentier-Edwards, Mitroflow, St Jude]. All DVR were performed with mechanical valves. Interrupted sutures were used for all valve replacements. Five perforations of the interventricular septum were occluded, all associated with Staphylococcus infection. In 4 cases, debridement of a valve ring abscess was performed and then the valve was secured by stitches tied on both sides of the abscess. One patient needed associated coronary artery bypass grafting [CABG]. One patient underwent septal myomectomy for hypertrophic cardiomyopathy [HCM]. Mitral valve repair with vegetations resection was performed once, associated with AVR. In one case, a fistula between the aorta and the left auricle was closed with pericardial patch.

3. Underlying cardiac lesions [Table II]: Endocarditis occurred on a native valve in 53 patients (80 %) [NVE] and on a previously inserted prosthesis in 13 patients (20%) [PVE] [bioprosthesis in 8 cases and mechanical prosthesis in 5 cases]. In the NVE group, history of a previous heart lesion was documented for 31 patients (58.5%). The major origin of underlying lesions, in descending frequency, were rheumatic heart disease [RHD] (35%),

congenital heart disease [CHD] (22%), myxoid degeneration (20%) or calcified degenerescence (20%) of the aortic and mitral valves. One patient needed valve replacement for recurrent endocarditis on a native valve without any primitive underlying lesion. In the CHD group, 3 bicuspid aortic valves, one hypertrophic cardiomyopathy [HCM], one ventricular septal defect [VSD] associated with trisomy 21 and 2 mitral valve prolapses [MVP] were noted [Table III].

4. *Microbiology* [Table IV]: The causative microorganisms included streptococcus in 22 patients, staphylococcus in 20 patients, both streptococcus and staphylococcus in 5 patients, and gram negative bacteria in 13 patients, mostly in association with gram positive. Two patients had intracellular bacteria endocarditis and only one patient developed candida infection. About 20% of the causative germs are unknown, with negative blood and valve cultures linked to previous blind antibiotic treatment, to fastidious microorganisms or to technical errors.

5. *Contamination sources* [Table V]: The most frequent contamination source was the oropharyngeal tract [15 patients], mostly from dental surgery procedures. The respiratory tract was involved in 8 cases. Miscellaneous contamination sources were found in 14 patients. Iatrogenic infections are more frequent in recent years, and 4 cases of endocarditis were secondary to cardiac catheterizations or percutaneous aortic valvuloplasty procedures. One PVE occurred in the post-operative period after valvular replacement. In 29 cases, no contamination sources could be detected. Ten of these patients had negative blood culture, related to reasons explained above.

6. *Survival* [Table VI] : Perioperative mortality [within 30 days] was 6% [n=4], and no early recurrence of infection was noted. Two women, aged 25 and 29, who were comatose before surgery died from neurological complications on postoperative day 6 and 29, respectively. Another woman, 77 years old, who suffered preoperatively from hemiparesis consecutive to a percutaneous aortic valvuloplasty procedure, died on postoperative day 28 from multiple organ failure [MOF]. The fourth patient, aged 59, suddenly presented mitral insufficiency on day 14 following AVR for PVE. Emergency MVR was performed. During operation, no infectious process was found and mitral dysfunction was related to myocardial infarction. The patient died 3 days later from MOF.

Long term survival rates were 88.5 % at 1 year and 83 % at 3 years. MVR and AVR survival rates were not significantly different. Short and long term survival of patients with mechanical prosthesis was better than with bioprosthesis. All patients from the DVR group are alive. Eleven patients died during follow-up [Table VII]. Two patients died from MOF in weeks following valve replacement with satisfactory postoperative cardiac function. One

patient presented acute aortic bioprosthesis dysfunction from unknown origin during the second postoperative year. One patient died from spontaneous ascendant aortic aneurysm rupture more than 7 years after AVR for NVE.

One patient, who was not reoperated, died from late recurrent endocarditis more than 5 years after AVR. Another patient suffered from recurrent PVE on aortic bioprosthesis 7 years after AVR for NVE. He was successfully treated by antibiotic administration. No patient from the DVR group developed recurrence of endocarditis .

7. Reoperation [Table VIII] : Six patients underwent reoperation during the follow-up. One patient suffered from late endocarditis recurrence on aortic bioprosthesis and needed reoperation on postoperative month 32. Three patients needed prosthesis replacement for bioprosthesis degeneration 5, 7, and 10 years after AVR. Two patients presented valvular insufficiency secondary to periprosthetic leakage. One had MVR with a bioprosthesis, the other one AVR with a mechanical device. They needed reoperation at postoperative months 11 and 26, respectively. All of these patients were alive 1 year after reoperation. No patient from the DVR group needed reoperation.

DISCUSSION

Before antibiotics were introduced in the 1940s, endocarditis was inevitably fatal (1). Penicillin and many specific antimicrobial agents gave a real chance of cure and survival to the majority of treated patients but some of them developed fatal complications in spite of aggressive intravenous antibiotherapy. Even if sepsis is eradicated, irreversible valve lesions may occur and lead to refractory congestive heart failure. The first reports of successful valve replacements for active endocarditis in 1964 and 1965 suggested operation as a treatment modality for infective endocarditis (2, 3). Although valve replacement with prosthetic material in an infected area seems paradoxical, it has proved its safety and effectiveness in many cases (6, 7). Surgical series report satisfactory short and long term survival rates, with acceptable recurrence and reoperation rates (8, 9). Evidence is now accumulating to indicate that early intervention improves prognosis and heart function in patients with fulminant valvular endocarditis.

Medical management requires bactericidal agents, used in high concentrations for a sufficient length of time in order to completely sterilize the vegetations where infecting organisms exist in extremely high densities and are protected from host defenses. Four to 6 weeks of parenteral antibiotic therapy is usually recommended. Surgical intervention before completion of antibiotic treatment is necessary in about 20% of the cases, for patients in whom congestive heart failure, persistent sepsis, recurrent emboli or a combination of these factors occur (10). In our review, refractory congestive heart failure dictated surgical treatment

for 86% of our patients. Heart failure complicating endocarditis may be induced by valvular destruction, by conduction disturbances consecutive to conduction tissue involvement, and by myocardial abscesses with septal perforations. As confirmed by our series with AVR predominance, the morbidity and mortality from cardiac failure are greater with aortic valve infective endocarditis than with mitral valve involvement and can reach 50 to 90% if treated by medical therapy alone (11). With our patients, emboli occurred in 12 cases, and persistent sepsis occurred in 19 patients. In 26 cases, mixed causes dictated the need for early surgery. These results are concordant with literature reports (6, 12).

Earlier surgical management of acute endocarditis should also be mandatory on several conditions. Among causative germs, fungi are particularly resistant to long term parenteral antibiotic treatment. Staphylococcus endocarditis are aggressive and promote early tissular destruction with acute valvular dysfunction, annular destruction, abscesses, or septum perforations (13). In our review, staphylococci were responsible for all the interventricular septum perforations. The features of Staphylococcus and fungal endocarditis should promote early procedure and valvular replacement before the advent of widespread tissular destruction which is always very difficult to repair. New onset of conduction disturbances [auriculo-ventricular block, left bundle branch block], even without heart failure, suggest progression of the infectious process, especially septal spreading. Suppurative pericarditis is very difficult to sterilize (14). These two conditions indicate insufficient response to antibiotherapy and should require early surgery.

Prosthetic Valve Endocarditis is an infrequent but serious complication of valve replacement, associated with higher mortality and morbidity than NVE (15). PVE is more difficult to sterilize than NVE and rapid reintervention (valve rereplacement) is the major cause of improved survival in recent years (16). PVE is associated with higher incidence of valve ring abscesses, with progressive annular destruction resulting in valve dehiscence and perivalvular leak. This complication is more frequent in the aortic position and may lead to the need of complex reconstructions of the functional and anatomic integrity of the cardiac structures (13). Valve stenosis may also complicate PVE, most commonly with bioprosthetic valves in the mitral position. The principles of management of PVE are similar than NVE, and antibiotics seldom eradicate the infection. One of our patients suffered from recurrence of the endocarditis which was controlled by antibiotherapy. Meanwhile, early surgical treatment may be mandatory to avoid widespread tissular destruction or acute valve dysfunction (13, 17, 18).

Isolated echographic demonstration of vegetations is not a sufficient condition for early surgical treatment (19). Reports are not concordant on the real significance of these asymptomatic vegetations on patient prognosis. For some authors, complications and mortality are more frequent if the size of the vegetation reach 1 cm or more, especially in the aortic position (20). Meanwhile, for others, the size, the morphology or the localization of

vegetations do not predict the embolization hazard (21). Our opinion is that large obstructive vegetations or echographic demonstration of vegetations with evidence of systemic emboli clearly indicate surgical operation. In this case cerebral embolism may be fatal.

Fifty-three patients underwent valvular replacement for native valve endocarditis. According to literature (8), the aortic is more usually involved than the mitral valve [77%, n=41]. Fifty-eight percent [n=31] of the patients from the NVE group presented underlying cardiac lesions. Since the introduction of antibiotherapy and the ageing of our European population, incidence of rheumatic heart disease and congenital cardiac disease have markedly decreased (22). Sclerosis and degenerative lesions [39%, n=12] are yet the most frequent underlying valvular diseases (23). Mitral valve prolapse was documented for 2 patients from the mitral NVE group [2/8], and this frequency is also reported in literature (23).

Blood and valve cultures were negative in 20% of our patients. This can be related to fastidious microorganisms, like fungi or intracellular bacteria, but technical errors or previous blind antibiotic treatment, which is indicated before culture results in acute endocarditis, should be considered (24). In 68% of cases, gram-positive microorganisms were isolated. Streptococci are the most frequent of them, but the incidence of Staphylococcus infection is increasing related to iatrogenic inoculation. Some cultures were positive for several microorganisms, like gram negative and gram positive together or Streptococci reported from an early culture and Staphylococci from a later one. This can be explained by infection with mixed flora, but also to culture technical errors or to flora modifications secondary to lengthy antibiotic treatment and long stay in intensive care unit. Infections with gram negative microorganisms are more frequent in our series than in other literature reports where they are usually responsible for 1.7% to 7% of the endocarditis (8, 17, 24). We treated 2 infections due to obligatory intracellular microorganisms [chlamidia and rickettsia], and candida endocarditis occurred on one aortic valve.

The fundamental principles of operative procedures involve meticulous debridement of infected tissue, extensive removal of all nonviable tissue and secure reconstruction of the involved area, with restoration of valve competence and repair of any additional defects, all of this accomplished under cover of the appropriate antibiotic therapy. Abscess cavities must be curetted and left in free drainage by the blood stream to avoid the complications of closed erosive abscesses. Large periannular abscesses, mycotic aneurysms or aortic perforations often require ingenious and complex reconstruction procedures, with sometimes translocation of the aortic valve (25), valve conduit replacement of ascending aorta (26), and pericardial or Dacron patch closure of defects (27). In our series, 5 septal perforations were closed and 4 abscesses needed debridement. If valvular lesions are mild, valve repair is sometimes proposed, especially in mitral valve endocarditis (28). We performed only one mitral repair by vegetations resection, and without prosthetic ring implantation. These valve repairs, which

require peroperative transoesophageal echographic assessment, may be interesting because they avoid prosthetic material insertion in the infected area (28). Partial leaflet resection, leaflet patching or suture, chordal shortening or transposition, and annular remodeling with or without prosthetic ring implantation may be performed. The only limiting factor is the extent of the lesions as all infected tissue must be resected. Early operation could be proposed to avoid extensive lesions and to allow valve repair (28, 29).

Our perioperative death rate was 6%. One patient died from perioperative myocardial infarction. One 77 year old woman died from MOF and 2 young women with preoperative neurologic disturbances died from neurologic complications. These results concord with literature reports where perioperative mortality range from 5 to 20% (6, 8). Low cardiac output, aortic endocarditis, Staphylococcus infection, cardiac tissue destruction, PVE, and preoperative cerebral hemorrhagic infarct are the most predictive variables of perioperative death (7, 30), and valve replacement is very hazardous in the event of evidence of neurologic defects. No early recurrence of endocarditis was noted in our review, and we had only 3 late recurrences (5%). Reported hazard function for recurrent endocarditis signaled a high peaking early phase and a low constant phase for late infection recurrence (31, 32). Recurrence hazards for bioprosthetic and mechanical prosthesis are equal, but early recurrence hazard of allograft valves seems to be lower, especially in the early postoperative period. This fact is related to antibiotic penetration in the entire allograft device (32). Six (9%) patients in our series needed reoperation. One for late recurrence, 2 for paraprosthetic regurgitation and 3 for bioprosthesis degenerescence. Paraprosthetic regurgitation is secondary to partial prosthesis disinsertion due to rupture of stitches binded to oedematous and fragile tissues. This complication is reported to be more frequent with aortic prosthesis, especially if a valve ring abcess is found during the operation (14).

Nowadays, surgical procedure is indicated for serious endocarditis which is not controlled by intensive medical management. Valve replacement with perioperative antibiotherapy gives satisfactory results, although implantation of a prosthetic device in an infected area is paradoxical. The rate of early recurrence is low (8), and no early reinfection is reported in this series. The use of allograft valve could reduce this hazard. In this series, the long term recurrence rate is moderate and similar for bioprosthesis and mechanical prosthesis, and this fact confirms that the resistance to infection of these two types of devices is equal (32). The reoperation rate is higher for bioprosthesis, and this can be related to long-term degenerescence (Table VIII). In this review, the survival rate is higher for mechanical prosthesis than for bioprosthesis (Table VI), but the two populations are not comparable. High risk patients with preoperative neurologic defects received bioprosthesis in the hope of avoiding postoperative cerebral hemorrhage promoted by anticoagulation. In other cases, age, malignant hypertension or several contraindications to anticoagulation dictated the choice of bioprosthesis valves. Bioprosthetic patients are a high risk population for early and late fatal events and this finding is correlated by the worse postoperative survival rate.

CONCLUSIONS

The advent of antibiotics has dramatically improved the natural history and the prognosis of infective endocarditis but some patients still have life-threatening complications. These patients underwent surgical valve management with satisfactory results. Early operation is mandatory in the case of acute heart failure, systemic emboli and persistent sepsis. Early surgical procedure could also avoid widespread tissue destructions, especially in prosthetic valve endocarditis and staphylococcus infection. Valve repair, could be satisfactory in the case of mild mitral valve involvement. The use of allograft valvular prosthesis could reduce the rate of early recurrences, but this remains to be definitively proved.

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