Surgical treatment of late aortic prosthetic valve endocarditis: 19 years' experience

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Abstract

Aim of the study: We retrospectively analyzed the results of operations conducted for aortic prosthetic valve endocarditis in a single center over 19 years.

Material and methods: From February 1992 to January 2011, we performed operations on 27 patients with aortic prosthetic valve endocarditis. Seventeen patients (63.0%) were male, and the mean age was 39.1 ± 14.2 (16-67) years. Blood cultures were positive in 11 patients (40.7%), and the most commonly identified microorganism was *Streptococcus* (7 patients, 25.9%). The mean duration of follow-up was 8.6 ± 4.7 years (0.5-18.2), adding up to a total of 136.9 patient/years.

Results: Forty procedures were performed on these 27 patients. The most commonly performed procedure was aortic valve replacement with a prosthetic valve – 16 patients (59.3%). Fifteen patients were operated on during the active phase of infection. In-hospital mortality was observed in 11 patients (40.7%). Postoperatively, 12 patients (44.4%) had low cardiac output, 3 (11.1%) suffered from a heart block; none of them required permanent pacemaker implantation. The actuarial survival for 1 and 5 years was 55.6 ± 9.6% and 47.6 ± 9.7%, respectively.

Conclusions: Prosthetic valve endocarditis of the aortic valve is a challenging situation for the surgeon. The surgical treatment carries a high mortality rate and long-term survival is low. Among the survivors, however, recurrence and the need for reoperation are unlikely.

Key words: prosthetic valve endocarditis, surgery.

Streszczenie

Cel pracy: Przeanalizowano retrospektywnie wyniki operacji wykonanych ze względu na zapalenia wsierdzia sztucznych zastawek aortalnych w pojedynczym ośrodku w ciągu 19 lat.

Materiał i metody: Pomiędzy lutym 1992 a styczniem 2011 r. operowano 27 pacjentów z zapaleniem wsierdzia związanym ze sztuczną zastawką aortalną. Siedemnastu pacjentów (63.0%) było płci męskiej, a średni wiek wynosił 39,1 ± 14,2 roku (16–67 lat). Wyniki posiewów krwi były pozytywne u 11 pacjentów (40,7%), a najczęściej identyfikowanym drobnoustrojem były streptokoki (7 pacjentów, 25,9%). Średnia długość dalszej obserwacji wyniosła 8,6 ± 4,7 roku (0,5–18,2), co dało w sumie 136,9 osobolat.

Wyniki: Dwudziestu siedmiu pacjentów przeszło w sumie 40 operacji. Najczęściej wykonywanym zabiegiem była wymiana zastawki aortalnej na sztuczną zastawkę – 16 pacjentów (59,3%). Piętnastu pacjentów operowano w czasie aktywnej fazy infekcji. W okresie szpitalnym zmarło 11 pacjentów (40,7%). Pooperacyjnie u 12 pacjentów (44,4%) zaobserwowano niski rzut serca, a u 3 (11,1%) wystąpił blok przedsionkowo-komorowy; żaden z pacjentów nie wymagał wszczepienia stymulatora na stałe. Przeżywalność obliczana metodą „aktuarialną" (*actuarial survival*) dla 1 roku i 5 lat wyniosła odpowiednio 55,6 ± 9,6% oraz 47,6 ± 9,7%.

Wnioski: Zapalenie wsierdzia w obrębie zastawki aortalnej związane z protezą zastawkową stanowi wyzwanie dla chirurga. Leczenie chirurgiczne obarczone jest wysokim współczynnikiem śmiertelności, niewiele lepiej prezentuje się odległa przeżywalność. Jednakże wśród pacjentów, którym udaje się przeżyć, rzadko dochodzi do nawrotu choroby i potrzeby powtórnej operacji.

Słowa kluczowe: zapalenie wsierdzia sztucznej zastawki, chirurgia.

Introduction

Prosthetic valve endocarditis (PVE) is a devastating complication of valve surgery. The treatment is usually prolonged medical therapy and surgery in complicated cases [1]. The incidence is reported to be highest in the early period [2]. We retrospectively analyzed the results of op-

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erations performed for late aortic PVE in a single center in 19 years.

Material and methods

The patient data were collected from the hospital records retrospectively. From February 1992 to January 2011, 27 consecutive patients with aortic prosthetic valve endocarditis underwent surgery at our institution. For the definitions of active, healed, prosthetic and culture negative endocarditis, modified Aranki criteria were used [3]. Endocarditis was labeled 'active' if the patient had fever and/or leukocytosis at the time of surgery or required surgical treatment before completion of a standard course of antibiotic treatment. Endocarditis was labeled 'healed' if surgery was performed after completion of antibiotic treatment and no signs of active infection (fever, leukocytosis) were present. Prosthetic valve endocarditis was defined as infection occurring on any type of tissue or mechanical valve device. Early endocarditis was defined as infective endocarditis that occurred within 60 days of valve replacement. Late prosthetic valve endocarditis was defined as infective endocarditis that occurred after 60 days of valve replacement. These were confirmed at operation by the presence of pannus formation, of vegetations, periprosthetic leakage or perivalvular tissue destruction. The presence of acute or chronic inflammatory changes at microscopy confirmed the diagnosis of endocarditis. The diagnosis of infective endocarditis was made according to the Duke criteria [4]. All patients were examined by transthoracic (TTE) or transesophageal (TEE) echocardiography. Echocardiography revealed valvular vegetation, regurgitation, or periprosthetic leakage.

There were 17 male (63.0%) and 11 female (37.0%) patients with a mean age of 39.1 ± 14.2 (16-67) years. Of these PVE cases, 6 of them had double prosthetic valves. None of the PVE cases were early PVE. The mean duration between the valve replacement and the diagnosis of PVE was 20.0 ± 10.8 (range: 3-32) months. Vegetations on the mitral valve were detected in 3 cases (11.1%) and gross vegetations on aortic valves were detected in 6 patients (22.2%) preoperatively. Four patients (14.8%) had a history of 2 cardiac operations. The preoperative characteristics are summarized in Table I.

The blood cultures were positive in 11 patients (40.7%) and the identified microorganisms were *Streptococcus* in 7 cases (25.9%) and *Staphylococcus* in 4 patients (14.8%). Sixteen cases had negative cultures for both blood samples and the explanted surgical specimens.

Surgery

The patients were scheduled for an operation when the diagnoses were made. Fifteen patients (55.6%) underwent the operation in the active phase of the infection. In 12 cases (44.4%), the operation was performed after the antibiotic treatments were completed and the patient was stabilized. Mechanical prosthetic valves were preferred in most of the patients.

All patients underwent moderate (28°C) hypothermic cardiopulmonary bypass by means of bicaval cannulation

with cannulation of either the ascending aorta (23 patients) or the femoral artery (4 patients). The left ventricle was vented through the right superior pulmonary vein. Isothermic blood cardioplegic solution was administered via the retrograde route during aortic cross-clamping.

For eradication of the PVE, radical debridement of all the necrotic and infected tissues was performed. Aortic root replacement and reconstruction were performed in 8 cases. The list of procedures is presented in Table II. The most commonly performed procedure was re-replacement of the aortic prosthesis with a mechanical valve. Primary repair of the periprosthetic leak was preferred in 2 mitral PVE and 4 aortic PVE cases. Only one of these cases had primary repair of both valves' leak repaired primarily.

Follow-up

All patients received at least four weeks of antibiotic therapy postoperatively. Broad-range antibiotics (vancomycin and aminoglycosides) were preferred for culture negative cases. The other patients were treated according to the antibiograms. The patients were involved in a follow-up program in the outpatient clinic of our hospital. The aver-

Tab. I. Preoperative characteristics

Preoperative characteristics	*n* (%)
Fever	12 (44.4%)
Septic emboli	
Central	2 (7.4%)
Peripheral	3 (11.1%)
NYHA class	
Class I	1 (3.7%)
Class II	5 (18.5%)
Class III	16 (59.3%)
Class IV	5 (18.5%)
Congestive heart failure	22 (81.5%)
Renal dysfunction	4 (14.8%)
Infectious etiology	3 (11.1%)
Chronic dialysis dependent	1 (3.7%)
Periprosthetic leakage	13 (48.1%)
Emergency operation	8 (29.6%)
LVD (EF < 40%)	2 (7.4%)
ECG	
Sinus rhythm	21 (77.8%)
LBBB	1 (3.7%)
AF	5 (18.5%)

NYHA – New York Heart Association, LVD – left ventricular dysfunction, ECG – electrocardiography, LBBB – left bundle branch block, AF – atrial fibrillation

Tab. II. Procedures

Procedures	n (%)*
Aortic valve replacement	16 (59.3%)
With mechanical prosthesis	15 (55.6%)
With bioprosthesis	1 (3.7%)
Primary repair of periprosthetic leak at the aortic prosthesis	4 (14.8%)
Aortic root replacement	7 (25.9%)
Bentall de Bono procedure	3 (11.1%)
Xenograft implantation	3 (11.1%)
Cabrol procedure	1 (3.7%)
Aortic root enlargement	1 (3.7%)
Fistula repair	2 (7.4%)
Subaortic discrete membrane resection	1 (3.7%)
Mitral valve procedures	9 (33.3%)
Mitral valve replacement	6 (22.2%)
Redo mitral valve replacement	4 (14.8%)
Primary repair of periprosthetic mitral valve leak	2 (7.4%)
Vegetectomy of mitral leaflets	1 (3.7%)

*Percentages are the ratio to the number of patients

age duration of follow-up was 8.6 ± 4.7 years (0.5-18.2), adding up to a total of 136.9 patient/years.

Statistical analysis

The statistical analyses were performed with the SPSS 16.0 statistical software package. All continuous variables were expressed as mean ± standard deviation and the ranges were shown. All discrete variables were expressed as frequencies and percentages. Comparisons of the discrete variables were made by χ^2 test. The survival, freedom from recurrence and freedom from reoperation analyses were performed with Kaplan Meier analysis.

Results

Mortality

Eleven patients (40.7%) had in-hospital mortality. Low cardiac output was the primary cause of mortality in all cases except one (patient 3). Six cases with in-hospital mortality underwent an emergency operation. The time and etiology of mortality are summarized in Table III.

Morbidity

The total number of patients who had any morbidity was 18 (66.7%). Postoperative fever was seen in 11 patients (40.7%), five of whom did not have fever preoperatively. Twelve patients (44.4%) had low cardiac output and only two of them survived. Complete heart block was present in 1 (11.1%) patients postoperatively and none of them required

Tab. III. Time and etiology of mortality

	Initial procedure(s)	Operation for PVE	Mortality	Time of mortality	Etiology
1	AVR + MVR	AVR + MVR	In-hospital	po 0 d	LCO
2	AVR	AVR + Aortic root enlargement	In-hospital	po 0 d	LCO
3	AVR (1st procedure) Redo AVR + Aortic root enlargement + Aortic pseudoaneurysm repair (2nd procedure)	Primary repair of periprosthetic leak	In-hospital	po 12 d	Sepsis
4	AVR	Cabrol procedure	In-hospital	po 1 d	LCO
5	AVR	Xenograft replacement of aortic root	In-hospital	po 14 d	LCO, sepsis
6	AVR	Bentall de Bono	In-hospital	po 3 d	LCO
7	AVR + MVR	AVR + MVR	In-hospital	po 27 d	LCO, sepsis
8	AVR	MVR	In-hospital	po 4 d	LCO
9	AVR + MVR + Aortic root enlargement	AVR	In-hospital	po 4 d	LCO
10	AVR (1st procedure) MVR (2nd procedure)	AVR + MVR	In-hospital	po 0 d	LCO
11	AVR + MVR	AVR + MVR	In-hospital	po 8 d	LCO
12	AVR + MVR	Primary repair of periprosthetic leak of the aortic and the mitral prostheses	Ad	po 38 m	Extracardiac
13	AVR	AVR	Ad	po 43 m	Extracardiac
14	AVR (1st procedure) Bentall de Bono (2nd procedure)	Bentall de Bono	Ad	po 6 m	Recurrent PVE

Ad – after discharge, AVR – aortic valve replacement, LCO – low cardiac output, MVR – mitral valve replacement, PVE – prosthetic valve endocarditis, po – postoperative, d – day, m – month
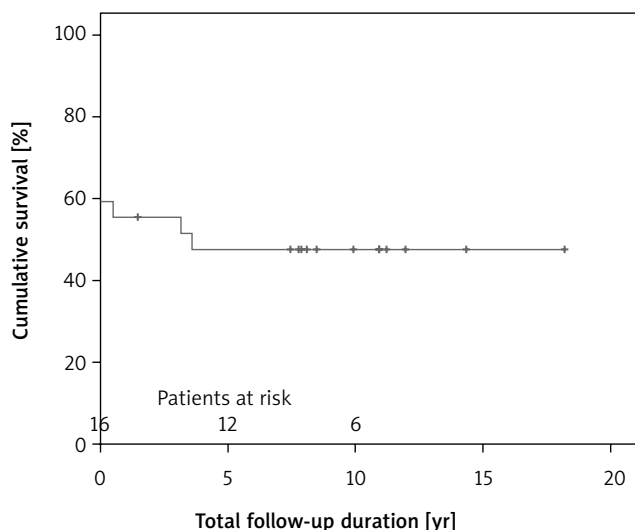
Fig. 1. Cumulative survival

Fig. 2. Survival rate free from recurrence

permanent pacemaker implantation. Two of the patients with postoperative heart block had in-hospital mortality due to low cardiac output (5 cases). Renal dysfunction was present in 12 (44.4%) patients and 4 (14.8%) required dialysis. Pulmonary morbidity was present in 4 (14.8%) patients. Cerebrovascular events occurred in 3 (11.1%) patients. One of them had septic central emboli preoperatively and she died due to low cardiac output during hospitalization and another patient died in his 43rd month due to chronic renal failure.

Follow-up

Of the surviving 16 patients, follow-up was complete in all cases. Three patients (11.1%) had mortality after discharge. The time and etiology of mortality are summarized in Table III. Three patients had recurrences (11.1%) postoperatively and only one of them was operated in the active phase of infection. The actuarial survival for 1, and 5 years was 55.6 ± 9.6% and 47.6 ± 9.7%, respectively (Fig. 1).

Recurrence of infection occurred in 3 (11.1%) cases and 2 patients (5.6%) had reoperations. The blood cultures were negative in one of the patients who had recurrences. The other two patients had positive cultures for *Streptococcus* and *Staphylococcus*, respectively. The survival rate free from recurrence from infection at 1 year was 86.8 ± 7.3% and remained stable throughout the follow-up period (Fig. 2). The survival rate free from reoperation at 1 year was 92.6 ± 5.0% and remained stable throughout the follow-up period (Fig. 3).

Discussion

The incidence of PVE is reported to be 0.32 to 1.2% per patient year with a cumulative incidence of 5% in 10 years [5]. This study is important as it is focused mainly on the surgical treatment of the late aortic PVE. There was a high mortality rate with a high rate of re-replacement with a mechanical prosthesis. The majority of the patient group
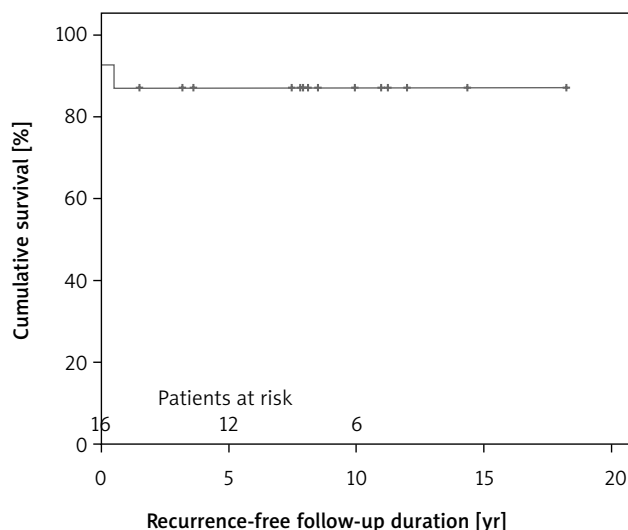
had congestive heart failure. So, the outcomes of this study must be carefully analyzed.

Fariñas *et al.* reported that preoperative NYHA functional class II or IV, alcohol consumption, and previous endocarditis were significantly associated with increased PVE risk. Among the perioperative factors, they found that postoperative fever in the ICU and gastrointestinal bleeding are associated with increased PVE risk [6]. An interesting study by Shapira *et al.* reported unexpected histopathological findings of inflammation in patients operated for noninfectious etiology with an incidence of 0.9% and about a quarter of them required redo surgery for PVE [7].

Common clinical presentations of PVE are persistent fever, profound anorexia, new onset murmur, heart block, congestive heart failure (CHF), and embolic events. In our patient group, 44% of them presented with fever, about 20% with septic emboli and more than 80% presented with congestive heart failure. Lytle *et al.* reported less than ¼ of our incidence in their series [8]. Septic embolus was re-
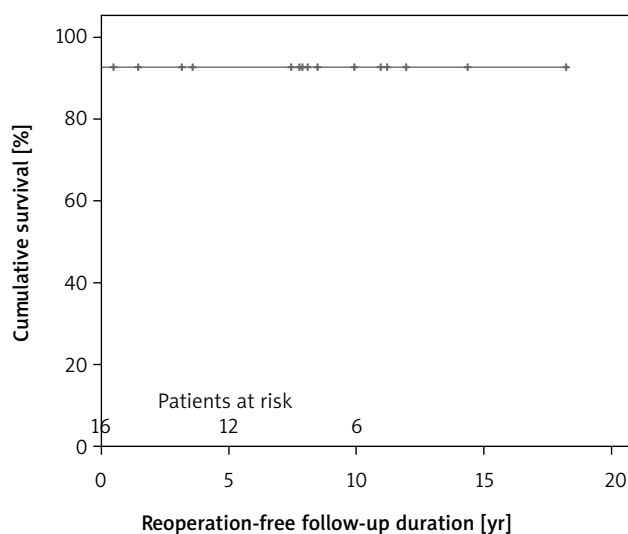

Fig. 3. Survival rate free from reoperation

ported to be a risk factor for mortality for worsening the cerebral edema or conversion of an ischemic stroke into a hemorrhagic case [9]. Of the 5 septic emboli patients, 2 of them had cerebral emboli and they both had in-hospital mortality.

Early PVE frequently involves the junction of the sewing ring and annulus, leading to valve dehiscence and paravalvular abscesses and carries worse prognosis than late PVE [5]. The incidence of annular abscess was reported to be around 15% in a previous study by Lytle and colleagues [8] but up to 63% incidence was also reported [5]. In our patient cohort, almost 50% of the patients had annular involvement.

A significant drawback of our study is the high rate of culture negative results. This fact is mostly related to the blood sampling for cultures during the antibiotic therapy. This has been stated as an important factor in the negative results [5]. We have continued the antibiotic therapy for 6 weeks in these cases especially, as did Hyde and colleagues [10]. Another factor affecting the negative results of the cultures may be the patient group. Lytle and colleagues reported much higher incidence of negative cultures in the late PVE patients [8].

The surgical treatment for PVE carries high mortality risk. Mortality rates ranging from 20% to 80% have been reported [8, 11, 12]. Musci and colleagues report that PVE is a challenging situation with high early and late mortality [13]. In a population of more than 300 PVE patients, their early mortality rates were about 30%. The long-term survivals were also not so satisfactory. The significant predictors for mortality were mechanical support, emergency operation, and preoperative high doses of inotropes, mitral valve replacement and age at the operation [13]. It can be seen that 75% of the emergency operations in this report had in-hospital mortality. Edwards and colleagues reported that age, infection of the explanted prosthesis, and size of the prosthesis had a significant effect on the early mortality [14].

Recurrence and need for reoperation for PVE is another important and life-threatening feature of PVE. In our study, 3 patients (11.1%) had recurrences. Two of them had early recurrences of PVE which presented with an early periprosthetic leak requiring reoperation and the patients died after the reoperations. Primary repair of a periprosthetic leak could be a matter of debate for recurrence. However, among the 6 primary repair procedures (4 aortic and 2 mitral), only one patient had recurrence and reoperation, presented in Table III as patient 3. The size of the patient group is too small to make significant conclusions about this matter. The other case occurred 6 months later and the patient has also died of heart failure. Excluding these cases, the recurrences and reoperation requirements were steady throughout the follow-up duration (Fig. 2 and Fig. 3). Fedoruk *et al.* reported that intravenous drug abuse and human immunodeficiency virus were predictors for recurrence and reoperations for PVE [15]. The high rate of reoperation-free survival in our patients is compatible with other series [14].

There is a high incidence of postoperative complications in our series. Such results have also been reported by

a recent report of PVE from China [1]. Considering the high rate of preoperative congestive heart failure, these two factors may interact to increase the perioperative mortality in this patient group.

Another point of debate may be the use of a mechanical prosthesis commonly in a PVE patient group. Although bioprosthetic materials are preferred in such operations [5], mechanical prostheses are reported to have higher long-term survival in a UK registry [14]. We used silver-coated Silzone mechanical valves in operations for infective endocarditis. The rates of periprosthetic leakage were a question of debate at the time and the effect of those valves on the periprosthetic leakage has been reported before [16]. Apart from such a clinical scenario, we did not have significant problems with mechanical valves. The low rate of recurrence and reoperation-free survival also confirm this result.

Conclusions

Prosthetic valve endocarditis of the aortic valve is a challenging situation for the surgeon. A significant proportion of the patients have important comorbidities and significant valvular destruction and invasion. Emergency operations have high mortality. The surgical treatment carries a high mortality rate and the long-term survival is not so different. Among the survivors, however, recurrence and need for reoperation are unlikely.

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