Clinical profile, prognosis and treatment of patients with infective endocarditis – a 14-year follow-up study

Profil kliniczny, rokowanie i leczenie pacjentów z infekcyjnym zapaleniem wsierdzia – 14-letnia obserwacja

Radoslaw Krecki[1], Jaroslaw Drozdz[1], Georges Ibata[1], Piotr Lipiec[1], Stanislaw Ostrowski[2], Jaroslaw Kasprzak[1], Maria Krzeminska-Pakula[1]

[1] 2nd Chair and Department of Cardiology, Medical University of Lodz, Poland

[2] 1st Department of Cardiology and Cardiac Surgery, Medical University of Lodz, Poland

Abstract: Introduction. Poor prognosis of infective endocarditis (IE) is not only attributable to high morbidity and mortality during an active phase of the disease, but also to late complications and relapses occurring after eradication of the infection. Identification of unfavorable prognostic factors allows to optimize therapeutic modalities in patients with particularly poor prognosis. **Objectives.** To determine clinical features and long-term prognosis among patients with IE. **Patients and methods.** The study group consisted of 69 IE patients hospitalized in our center between 1992 and 2005. The diagnosis of IE was based on the Duke University criteria. The mean age was 52 ±12 years. Surgical treatment was performed in 48 (70%) cases. **Results.** The etiology of IE was *Staphylococcus sp.* in 32% of patients, *Streptococcus sp.* in 16% of patients, in 41% of cases blood cultures were negative. The infection was located on the aortic (43%), mitral (26%), tricuspid (8%) and multiple valves (20%). During 1–14 years of follow-up, 27 patients died (39%). Prognostic factors included NYHA class of heart failure ($p = 0.031$), lower left ventricular ejection fraction ($p = 0.017$), kidney failure ($p = 0.012$), atrial fibrillation ($p = 0.006$), a history of rheumatic valve disease ($p = 0.046$). In multivariate logistic analysis the only significant parameter related to poor prognosis after IE was atrial fibrillation. The analysis of receiver operating characteristic curve showed that patients with atrial fibrillation were significantly associated with higher mortality (HR 5.35, 95% CI 1.47–19.56, $p = 0.011$). **Conclusions.** Regardless of the mode of treatment (medical or combined medical-surgical), the mortality of patients with infective endocarditis remains relatively high. In this study atrial fibrillation seems to be the most important risk factor of death.

Key words: endocarditis, infection, prognosis, treatment

INTRODUCTION

Although infective endocarditis (IE) is a relatively rare disease, mortality and morbidity of patients with this disorder belong to the highest in cardiology [1,2]. Due to dynamic modifications of diagnostic criteria, the introduction of new diagnostic tools (e.g. transesophageal echocardiography, serology, molecular assays for specific gene targets), as well as the progress of therapeutic methods, in-hospital mortality has decreased substantially and is currently reported to be between 16–27%, while it was 40–60% in the 1950s [1,3]. A poor prognosis of IE is not only attributable to high morbidity and mortality during the active phase of the disease, but also to later complications and relapses occurring after eradication of the infection (heart failure, valve lesions or predisposition to recurrence of the disease) [1].

Infective endocarditis is a very heterogenic disease. In most cases, the inflammation encompasses endocardium lining the valves, and rarely atrial or ventricular endocardium (especially when in contact with a foreign body, e.g. an endocavitary electrode) [2,4]. The clinical course of the disease shows various manifestations and without effective treatment leads to acute heart decompensation and to death. Significant progress and more frequent qualification for various invasive procedures (dental, urological, gynecological, cardiac catheterization),

Correspondence to:
Radoslaw Krecki, MD, 2nd Chair and Department of Cardiology, Medical University of Lodz, Str. Kniaziewicza 1/5, 91-347 Lodz, phone: +48-42-251-60-15, e-mail: rkrecki@gazeta.pl
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Table 1. Causative microorganism of infective endocarditis in our study group (n = 69)

Causative microorganism	Total (n, %)	Medically treated patients (n, %)	Surgically treated patients (n, %)	p
Staphylococcus sp.	22 (31.9)	3 (14.3)	19 (39.6)	0.038
Coagulase *Staphylococcus*	15 (21.7)	3 (14.3)	12 (25)	0.62
Staphylococcus aureus	7 (10)	0 (0)	7 (14.6)	0.15
Streptococcus sp.	11 (16)	6 (28.6)	5 (10.4)	0.12
Enterococcus sp.	5 (7.2)	2 (9.5)	3 (6.2)	0.98
Gram negative	2 (2.9)	1 (4.8)	1 (2.1)	0.85
Propionibacterium acnes	1 (1.5)	0 (0)	1 (2.1)	0.67
Negative blood cultures	28 (40.6)	9 (42.8)	19 (39.6)	0.85

an easy access to them, a wide spectrum of applied antibiotics, and a change in the profile of pathologies predisposing to the disease have contributed to inverting the proportion of patients with IE over the past several years [2].

Despite a long history of IE, no randomized controlled trials have been conducted to better clarify the role of the optimal choice and the timing of the therapeutic strategy (medical treatment alone vs. surgery) in improving outcomes. Therefore, the current practice guidelines of the management of IE are largely based on the results of observational studies and expert opinions [2,5,6]. This makes prompt identification of patients with a high risk of complications or death all the more important. The ability to identify such subgroups of patients may modify management strategies, and may help in selecting better therapeutic methods.

The aim of our study was to determine clinical features and long term prognosis among patients with infective endocarditis.

PATIENTS AND METHODS

In a systemic retrospective review of clinical records, we analyzed data on all patients with active infective endocarditis admitted to the 2nd Department of Cardiology of the Medical University of Lodz between 1992 and 2005. Of the 104 patients identified, 69 (66%) fulfilled the Duke University criteria for IE ("definite": 2 major signs, 1 major and 3 minor signs or 5 minor signs present) and were included in the study [1,2]. The follow-up period was until 1 December 2006 (or until patient's death). We collected data from this period on the basis of standardised questionnaires sent to all patients.

Apart from echocardiography and bacteriology, in all patients a set of additional tests was performed to assess the severity of IE as well as the presence of other organ dysfunctions. We analysed many other, mainly biochemical, indices, e.g. blood cell count, erythrocyte sedimentation rate, troponin, urea, creatinine and aminotranspherases. The evaluation also included basic data from the patient's history, ECG recordings, and the presence of factors predisposing to the disease. In all patients with ambiguous results of transthoracic echocardiography or with prosthetic valve endocarditis, transoesophageal echocardiography was performed. Vegetations were defined as localized masses of dense shaggy echoes that were attached to a valve leaflet. Definitions of abscesses and fistulas were circumscribed intramyocardial areas with diminished echoes and penetrating valvular, paravalvular or myocardial lesions visualized by colour Doppler mapping, respectively. All patients with a positive blood culture received antibiotic treatment in accordance with the susceptibility of the causative organism. Treatment was administered for 4–6 weeks according to both the causative agent and the type of the IE involved. In patients with negative blood cultures one of the antibiotics belonged to aminopenicillins or peptide antibiotics, and the second one to aminoglycosides. Decision of surgical treatment was made individually in all cases on the basis of clinical, echocardiographical and biochemical dates (significant valve regurgitation, the presence of large vegetations, abscesses or valve perforations, and persistent sepsis despite theoretically adequate antibiotic treatment). Surgical treatment consisted in the implantation of a mechanical, second generation valve with low thrombogenic potential (St. Jude Medical, Medtronic Hall or Carbomedics AVR). The recommend international normalized ratio (INR) index ranged from 2.5 to 3.5. Renal insufficiency was defined by glomerular filtration rate <60 ml/min/1.73m^2 (calculated with the Cockroft-Gault formula).

Statistical analysis

The distribution of variables was analyzed using the Kolmogorov-Smirnov test to confirm normal distribution. Differences in the incidence of the analysed variables were assessed using variance analysis, the χ^2 test for binary variables, the Student t-test for continuous and unpaired variables or the nonparametric Mann-Whitney pair test. Univariate analysis of factors predicting a fatal outcome was performed with log-rank test for binary variables, and Cox regression analysis for continuous and unpaired variables. The results were con-

sidered statistically significant if the p value was <0.05. Multivariate logistic analysis was performed using the SYSTAT 8.0 statistical software by establishing discrimination analysis with elimination of variables of statistical significance >0.05. The prognostic value of parameters in the whole group of patients, as well as in the surgically treated patients was tested with Cox proportional hazard.

RESULTS

The mean age of patients in our study group (n = 69) was 52 ±12 years; about two-thirds of them (60%) were males. Blood cultures were negative in 28 patients (41%), most of whom had received antibiotic treatment for febrile syndrome before hospitalization. The remaining patients had positive blood cultures. The microbiological profile for our group of patients is shown in Table 1.

In 7 patients (10%) there was an infection of the prosthetic valve. In 30 cases (45%) the infection was localized on the aortic valve, in 18 cases (26%) on the mitral valve, in 6 cases (9%) on the tricuspid valve. In 14 patients (20%) there was multiple valve infection. In most patients (93%), vegetations could be observed on transthoracic echocardiography, and 19 patients had at least one perivalvular complication (13 had abscesses, 6 had fistulas).

Surgical treatment was performed in 48 patients (70%). The initial epidemiological and biochemical characteristics of patients treated medically vs. treated surgically was similar – significant differences involved sex, causative microorganism (in the group treated medically, *Streptococcus sp.* were more frequently responsible for the infection, while in the surgically treated group *Staphylococci sp.* were more frequent), heart failure NYHA functional class (patients treated surgically had more intensive symptoms of heart failure) and preexisting damage to valves (especially in aortic localization; Tab. 2).

During the follow-up period, which ranged from 1 to 14 years (mean 4.3 years), 27 (39%) patients died due to cardiovascular diseases (9 patients died before discharge from hospital, mostly due to early surgery complications, 4 patients due to heart failure, 8 patients due to sudden cardiac death, 6 patients due to embolic complications). The follow-up was completed by 27 alive surgically treated patients (56%) and 16 medically treated patients (71%). All of those patients had symptoms and signs of heart failure; the NYHA functional class was higher in the group treated only medically (p = 0.016). There were 5 IE recurrences (10%) observed in patients treated with surgery, and all of those patients were selected for reoperation. In patients treated only medically there was one recurrence of IE, 3 patients were treated with surgery due to damage to the valve that was initially affected with infection. Medically treated patients were significantly more frequently hospitalized due to cardiovascular diseases (p = 0.017). Informations about medical treatment during follow-up are showed in Table 3.

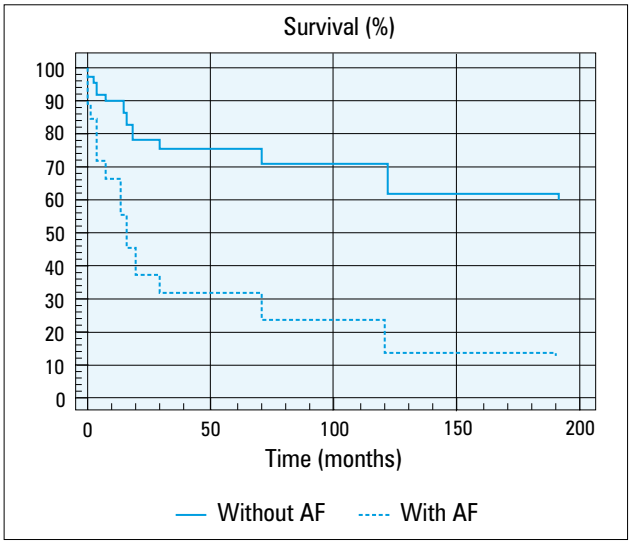

Fig. 1. Kaplan-Meier curves illustrate the survival rate in patients with atrial fibrillation (AF) and without AF

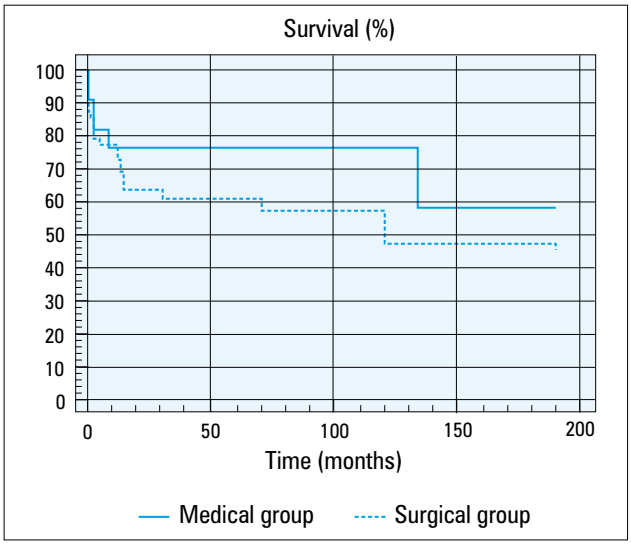

Fig. 2. Kaplan-Meier curves illustrate the survival rate in patients with infective endocarditis treated only medically vs. those treated with surgery (p = 0.201)

In multivariate analysis, only atrial fibrillation (p = 0.011) was associated with poor prognosis. A higher risk of death, although below the level of statistical significance, was demonstrated in patients with *Enterococci* as causative microorganisms of IE (p = 0.069). Although the presence of a higher NYHA functional class of heart failure (p = 0.031), kidney failure (p = 0.012), low left ventricle ejection fraction (p = 0.017), and a history of rheumatic valve disease (p = 0.046) were significant in univariate analysis, they were of lower significance in multivariate analysis as compared to those mentioned above (Tab. 4 and 5).

Table 2. Characterization of patients with infective endocarditis treated only medically vs. those treated with surgery

	Total	Medically treated patients	Surgically treated patients	p
n	69	21 (30)	48 (70)	
Sex				
Women	28 (40.6)	13 (61.9)	15 (31.3)	0.017
Men	41 (59.4)	8 (38.1)	33 (68.8)	
Multiple valve localization	14 (20.3)	2 (9.5)	12 (25)	0.252
Mitral localization	18 (26.1)	7 (33.3)	11 (22.9)	0.365
Aortic localization	30 (43.5)	9 (42.9)	21 (43.8)	0.945
Tricuspid localization	6 (8.7)	1 (4.8)	5 (10.4)	0.762
AH	26 (37.7)	5 (23.8)	21 (43.8)	0.116
DM	8 (11.6)	0 (0)	8 (16.7)	0.114
IHD	14 (20.3)	7 (33.3)	7 (14.6)	0.145
AF	14 (20.3)	2 (9.5)	12 (25)	0.252
NYHA functional class of heart failure				
<III	40 (58)	15 (71.4)	25 (52.1)	
≥III	29 (42)	6 (28.6)	23 (47.9)	
Kidney failure	21 (30.4)	4 (19.0)	17 (35.4)	0.174
Prosthetic valve endocarditis	7 (10.1)	3 (14.3)	4 (8.3)	0.384
History of rheumatic valve disease	9 (13)	5 (23.8)	4 (8.3)	0.171
Pacemaker	6 (8.7)	3 (14.3)	3 (6.3)	0.531
Aortic regurgitation ≥III	25 (36.2)	2 (9.5)	23 (47.9)	0.002
Mitral regurgitation ≥III	10 (14.5)	2 (9.5)	8 (16.7)	0.686
Vegetations on aortic valve	35 (50.7)	9 (42.9)	26 (54.2)	0.387
Vegetations on mitral valve	24 (34.8)	7 (33.3)	17 (35.4)	0.867
Abscesses	13 (18.8)	0 (0)	13 (27.1)	0.021
Fistulas	6 (8.7)	0 (0)	6 (12.5)	0.218
In-hospital complications				
Septic shock	6 (8.7)	2 (9.5)	4 (8.3)	0.762
Renal insufficiency	3 (4.3)	0 (0)	3 (6.3)	0.596
IE during follow-up	6 (8.7)	1 (4.8)	5 (10.4)	0.762
Surgery during follow-up	8 (11.6)	3 (14.3)	5 (10.4)	0.958
In-hospital death	9 (13)	2 (9.5)	7 (14.6)	0.853
Total death	27 (39.1)	6 (28.6)	21 (43.8)	0.235
Hospitalisation during follow-up	28 (40.6)	13 (61.9)	15 (31.3)	0.017
Follow-up period (months)	24 (0–246)	46 (0–246)	22 (0–192)	0.217
Age (years)	52 ±12	50 ±13	53 ±12	0.395
Days from onset of symptoms to treatment initiation	21 (3–180)	21 (7–180)	21 (3–150)	0.853
NYHA functional class of heart failure	2.5 (1–4)	2 (1–3)	2.5 (1–4)	0.066
Heart rate (/min)	76 (40–120)	72 (55–120)	79 (40–111)	0.219
SBP (mmHg)	120 (90–160)	120 (90–145)	120 (90–160)	0.631
DBP (mmHg)	70 (40–90)	75 (40–90)	70 (50–90)	0.683
Hemoglobin (g/dl)	10.8 ±2.14	11.5 ±2	10.5 ±2.15	0.062

Table 2. Characterization of patients with infective endocarditis treated only medically vs. those treated with surgery – cont.

	Total	Medically treated patients	Surgically treated patients	p
Leukocytes (/mm^3)	9707 ±4351	8841 ±3803	10085 ±4555	0.278
Urea (mg/dl)	35 (12–235)	31 (16–96)	35.5 (12–235)	0.378
Creatinine (mg/dl)	0.99 (0.52–5.4)	1 (0.58–4.62)	0.95 (0.52–5.4)	0.597
Erythrocyte sedimentation rate (mm)	50 (9–160)	47.5 (15–160)	56 (9–150)	0.194
Left ventricle ejection fraction (%)	51 ±10	52 ±11	51 ±9	0.811
NYHA functional class of heart failure at the end of follow-up	2 (0–4)	3 (2–4)	2 (0–3)	0.016

Data are shown as number (percent), mean ±standard deviation or median (with minimal and maximal values).

Abbreviations: AF – atrial fibrillation, AH – arterial hypertension, DBP – diastolic blood pressure, DM – diabetes mellitus, IE – infective endocarditis, IHD – ischemic heart disease, SBP – systolic blood pressure

Logistic regression analysis revealed that the risk of death in long-term follow-up was more than 5 times higher in patients with atrial fibrillation (95% CI 1.47–19.56). Logistic regression analysis results are given in Figure 1 and 2.

DISCUSSION

We have presented retrospective analysis of 69 patients in the acute phase of infective endocarditis, whose the mean follow-up amounted to 4.3 years. Despite a quite high mortality in the first 12 months of observation (nearly 30%) as compared with other analyses done so far, the end point of the study was reached by 61% of patients. Among the most frequent reasons of death were heart failure, sudden cardiac death and embolic complications. Recurrent IE was rare (8.7% in the whole observed group), but was relatively more frequent compared to the general population.

In the present study, the most important risk factors associated with poor prognosis were NYHA functional class of heart failure, left ventricle ejection fraction, kidney failure, serum level of urea, and a history of rheumatic disease. An adverse trend towards a higher mortality rate, although without the required statistical significance, included prosthetic valve endocarditis, the presence of abscesses and endocardium infection linked to an endocavitary electrode. Interestingly, the highest statistical significance was reached by atrial fibrillation, which to a certain degree explains a high rate of embolic complications during follow-up.

High rates of embolic complications and deaths due to this complication in the analyzed group of patients (especially in patients treated with surgery) remain in contrast to the findings of other studies [7,8]. A meta-analysis made by Cannegieter et al. [9] demonstrated that the frequency of embolic complications in patients with mechanical valves was 2%/year, and the frequency of substantial bleeding 1.4%/year. In establishing the optimal range of INR during antithrombotic treatment, it is of great importance to identify co-existing embolic risk factors as well as to define thrombogeneity of the prosthetic valve (assessed on the basis of thrombosis of particular types of valves depending on the INR range) [10-12]. Owing to the influence of many other factors dependent on patients as well as on the manner of obtaining data, available data about thrombogeneity of particular types of valves are of limited value. Randomized controlled trials analyzing the efficiency of different values of the INR index in patients with mechanical heart valves treated with antithrombotics unfortunately do not contribute to clinical practice owing to their limitations, which result from different inclusion criteria, a small number of patients, short follow-up studies, and different methodologies, which makes meta-analysis impossible. Nevertheless, a very important aspect in the discussion about antithrombotic prophylaxis is adding acetylsalicylic acid to the standard acenocoumarol management, especially in patients with co-existing embolic risk factors, and first of all in individuals with atrial fibrillation. The metaanalysis conducted by Dentalegi et al. [13] demonstrated that patients with mechanical heart valves and atrial fibrillation had the

Table 3. Medical treatment during follow-up

	Total (%)	Medically treated patients (%)	Surgically treated patients (%)
Aspirin	13.4	45	0
Acenocoumarol	81.6	30	100
β-bloker	64.2	70	61.7
ACE/ARB	59.7	60	59.6
Spironolactone	28.4	35	25.5
Digoxin	13.6	21.1	10.6
Loop diuretics	32.8	40	29.8
Statins	11.9	5	14.9

ACE – angiotensin converting enzyme, ARB – angiotensin receptor blockers

largest benefits from dual antithrombotic prophylaxis (odds ratio 0.27; 95% CI 0.15–0.49).

All patients after surgical implantation of a 2nd generation mechanical heart valve received strict recommendations of antithrombotic prophylaxis with acenocoumarol and the INR index range 2.5–3.5. Based on our results as well as on results from other studies, the antithrombotic treatment was inappropriate. Undoubtedly, there is a need for evaluating, in well-designed prospective investigations, the role of antithrombotic prophylaxis in patients after an IE episode, with a mechanical heart valve and co-existing embolic risk factors.

An important difference between our results and those of earlier series is the significance of the causative microorganism as a prognostic factor. We did not identify any causative agent as directly related to mortality (an adverse trend toward a higher risk of death caused by *Enterococci*, without the required statistical significance, although the number of cases of endocarditis caused by these microorganisms in our study was too small to allow us to draw firm conclusions). Some authors have documented a relationship between the causative microorganism and a worse early or/and late prognosis for IE. Bauerscmitt et al. [14] in an analysis of 123 patients with IE (in the years 1988–1996) demonstrated that *Staphylococcus aureus* as a causative organism is independently associated with poor prognosis in comparison with other causative agents for IE. There are few other studies regarding an association of higher mortality in patients with prosthetic valve endocarditis caused by *Staphylococcus aureus* [15,16], as well as an increased risk of a recurrence of the disease or a higher likelihood of developing a persistent infection in *Staphylococcus aureus* aetiology [17]. Despite statistically significant differences in the frequency of infections caused by *Staphylococci* (especially by *Stahylococcus aureus*) in surgically treated patients in comparison with patients treated only medically, in our analysis this highly destructive microorganism was not associated with worse prognosis.

A quite important difference, that merits special consideration, is a relatively frequent presence of negative blood samples in our group of patients, which mostly resulted from the practice of administering antibiotic treatment for febrile syndrome before hospitalization and making a diagnosis. There are a few studies reporting worse prognosis in patients with infective endocarditis and negative blood samples [18], which could not be confirmed in our investigations. On the other hand, on the basis of identification of new causative pathogens due to enhanced diagnostic sensitivity (serology, molecular polymerase chain reaction approach), those conclusions seem to be accidental [19].

Since the first successful implantation of a prosthetic heart valve in an active phase of infective endocarditis 40 years ago, no randomized controlled trials have been conducted to better clarify the problem of choice of an optimal therapeutic strategy. As a result of advances in diagnosis, improved antimicrobial and surgical treatment, and earlier detection and management of complications, short term prognosis for IE has substantially improved over the past few years. Now early mortality amounts to 2–12% and differences depend on the experience of a surgical center [20,21]. In this respect, qualification for surgical treatment in the active phase of the disease is more common and the proportion of medically treated

Table 4. The most significant factors in univariate analysis in long-term prognosis in patients following infective endocarditis

	HR	95% CI	p
Surgical treatment	1.76	(0.75–3.9)	0.201
Men	0.83	(0.36–1.85)	0.624
Etiology			
Staphylococcus sp.	1.26	(0.55–3.11)	0.55
Streptococcus sp.	0.32	(0.16–1.13)	0.077
Enterococcus sp.	1.84	(0.81–6.82)	0.065
Negative blood cultures	1.08	(0.5–2.39)	0.835
Multiple valve localization	1.84	(0.8– 5.91)	0.13
Mitral localization	0.6	(0.26–1.47)	0.278
Aortic localization	1.29	(0.6–2.87)	0.501
Tricuspid localization	0.84	(0.21–3.33)	0.805
AH	1.65	(0.78–3.94)	0.174
DM	1.84	(0.58–9.5)	0.234
IHD	1.02	(0.37–2.81)	0.965
AF	3.21	(2.05–18.21)	0.001
Kidney failure	2.18	(1.08–6.82)	0.034
Prosthetic valve endocarditis	2.36	(0.93–14.84)	0.063
Bicuspid aortic valve	1.28	(0.34–5.36)	0.671
History of rheumatic valve disease	2.74	(1.33–19.61)	0.018
Pacemaker	3.32	(1.59–59.88)	0.014
Abscesses	1.98	(0.87–6.78)	0.079
IE during follow-up	1.81	(0.56–8.82)	0.252
Age	1.01	(0.98–1.04)	0.6
NYHA functional class of heart failure	1.71	(1.03–2.82)	0.036
Heart rate	0.98	(0.95–1.01)	0.211
Serum level of hemoglobin	0.87	(0.72–1.04)	0.127
Leukocytes	1.04	(0.96–1.13)	0.332
Serum level of urea	1.14	(1.06–1.24)	0.001
Serum level of creatinine	1.02	(0.99–1.06)	0.2
Erythrocyte sedimentation rate	1.01	(1–1.02)	0.191
Aortic regurgitation	1.13	(0.99–1.3)	0.069
Mitral regurgitation	0.97	(0.82–1.14)	0.7
Left ventricle ejection fraction	0.69	(0.49–0.97)	0.033

HR – hazard ratio, other abbreviations – see Table 2

Table 5. The most significant factors in multivariate analysis in long-term prognosis

	HR	95% CI	p
Atrial fibrillation	5.35	(1.47–19.56)	0.011
NYHA functional class of heart failure	0.81	(0.55–1.2)	0.302
Kidney failure	2.57	(0.75–8.83)	0.134
History of rheumatic valve disease	1.77	(0.51–6.13)	0.366
Pacemaker	3.61	(0.69–18.81)	0.128
Left ventricle ejection fraction	0.7	(0.41–1.18)	0.185

n = 69, p = 0.001

Abbreviations – see Table 4

patients in comparison with patients treated with surgery successively diminishes. The question remains open whether the decision of surgical treatment is not sometimes too rash.

Difficulties in selecting a homogenous group of patients with IE make the comparison of therapeutic strategies not an easy task. Qualification for surgical treatment depends to a large degree on the clinical manifestation of the disease and the level of valve destruction, as well as on responsiveness to antimicrobial treatment. The analysis of our patients presents analogous disproportions. Individuals treated with surgery had a higher NYHA functional class of heart failure, a more advanced valve destruction, and more frequently the causative microorganisms were *Staphylococci*. In spite of these disproportions, there were no significant differences in the mortality of patients treated surgically vs. medically, although there was a non-significant trend towards increased mortality in the surgical group. Published studies concerning these 2 therapeutic strategies did not give an unambiguous answer which one is better [6,22-26]. Benefits from early surgery were reported in studies by Vlessis et al. [27] and Olaison et al. [28]. In multivariate analysis of 212 cases conducted by Netzer et al. [3], early surgery, *Streptococcus* etiology, age <55 years and absence of clinical features of heart failure were factors independently associated with better prognosis. Other studies reported that early surgery was associated with a surgical benefit only in selected subgroups of patients, e.g. those with prosthetic valve infection or aortic valve endocarditis [29-31]. In contrast to those findings, data from two cohorts mentioned below demonstrated a higher mortality rate in patients treated surgically. Revilla et al. [32] in the first prospective analysis of 508 cases with IE reported that patients who need urgent surgery, with kidney failure and persistent infection have poor clinical prognosis. The results of the study conducted by Imad et al. [33] suggest that valve surgery in left sided infective endocarditis is associated with an increased 6-month mortality.

The results of our study suggest that, irrespective of the therapeutic strategy (early surgery or only medical treatment), the mortality of patients with infective endocarditis remains relatively high. Atrial fibrillation seems to be the most important risk factor. Although the presence of higher NYHA functional class of heart failure, kidney failure, low left ventricle ejection fraction, serum levels of urea, and a history of rheumatic valve disease were significant in univariate analysis, they were of inferior significance in multivariate analysis. Better antithrombotic prophylaxis, especially in patients treated surgically may improve the prognosis.

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