A Case for Early Surgery in Native Left-Sided Endocarditis Complicated by Heart Failure: Results in 203 Patients

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From January 1982 to December 1988, 203 consecutive patients were selected for early valve replacement (mean 10 days from time of admission) if they had clinical evidence of native valve endocarditis with 1) vegetations on echocardiography, 2) severe valvular lesions, and 3) heart failure. Surgery was performed within 7 days of admission in 56% of patients and was done urgently because of hemodynamic deterioration in 108 (53%). All vegetations were identified by echocardiography and confirmed macroscopically at surgery.

One hundred ten patients had isolated aortic valve infection, 59 had isolated mitral valve infection (p < 0.05 for aortic vs. mitral) and 43 had double-valve infection. Mean aortic cross-clamp time was 57, 38 and 67 min, respectively. Sixty-four patients (32%) had extensive infection involving the anulus or adjacent tissues, or both; such infection more frequently involved the aortic than the mitral valve (p < 0.05). Thirty-eight patients (35%) with aortic valve infection had abscess formation compared with 1 patient (2%) with mitral valve infection (p < 0.05). Only eight patients (4%) died in the hospital. There were seven patients (3%) with a periprosthetic leak and five patients (3%) with early prosthetic valve endocarditis. Long-term follow-up, available in 174 hospital survivors (89%), revealed 10 deaths and two new ring leaks at 38 ± 22 months.

In conclusion, among patients with endocarditis who need surgery for heart failure, aortic valve infection is more prevalent than mitral valve infection and is more often associated with extensive infection, including abscess formation. However, even the presence of heart failure and extensive infection is not necessarily associated with high surgical risk when surgery is performed early.

Medical therapy for endocarditis complicated by heart failure is associated with an unacceptably high in-hospital mortality rate compared with surgical treatment, the difference being as much as 56% versus 11% (1). Most deaths in medically treated patients result from heart failure and recurrent systemic embolism (2–8). For these reasons, it is generally accepted that surgical intervention is the preferred form of treatment for endocarditis complicated by heart failure (9–12). Although surgery has improved survival in this group of patients, the operative mortality rate is still in the range of 10% to 35% (2,9–24). However, there is still a tendency to postpone surgery in this critically ill group of patients in the hope of controlling infection because of the risk of prosthetic valve infection and technical difficulties of operating on friable anular tissues (10,18).

In view of uncertainty regarding the optimal timing of surgical intervention, in 1982 we adopted an approach of referring for early surgery all patients who had congestive cardiac failure due to valvular dysfunction and vegetations on echocardiographic evaluation (25–28). The purpose of this study was to examine the results of this management policy in a large group of patients with active vegetative endocarditis. We also addressed the question of whether extensive infection (for example, abscesses or fistulas) adversely affects surgical outcome and whether outcome and macroscopic findings at surgery differ for aortic, mitral or double valve infection.

Methods

Study patients. We retrospectively analyzed records for 203 consecutive hemodynamically compromised patients with vegetative native valve bacterial endocarditis who underwent valve surgery between January 1, 1982 and December 31, 1988. In all these patients, there was macroscopic evidence of endocarditis at surgery (vegetations and signs of active inflammation with or without abscess formation). There were 119 men and 84 women, aged 6 to 72 years (mean 33 ± 13). On admission, 91 (45%) were in New York Heart Association functional class III and 112 (55%) were in class IV. Just before operation, 2 patients had a cardiac arrest and 19 were in a low output state (systolic blood
Early preoperative event, congestive cardiac failure was made on the basis of an echocardiography system as soon as the clinical diagnosis of echocardiography with the use of the MK5 or UM8 ATL included detailed macroscopic findings of abnormalities on the surgical reports were available for all patients. These in-culture results were sought in all cases. Comprehensive branch block. Blood cultures, valve histologic data and patients had first degree block, 1 had right and 1 had left bundle had complete heart block or myocardial infarction; 17 patients; 23 patients sustained major systemic embolism (16 cerebral, 1 coronary and 8 peripheral). No patient Before surgery, 23 patients sustained major systemic embolism (venous <80 mm Hg and clinical signs of hypoperfusion). Before surgery, 23 patients sustained major systemic embolism (16 cerebral, 1 coronary and 8 peripheral). No patient had complete heart block or myocardial infarction; 17 patients; had first degree block, 1 had right and 1 had left bundle branch block. Blood cultures, valve histologic data and culture results were sought in all cases. Comprehensive surgical reports were available for all patients. These included detailed macroscopic findings of abnormalities on the left side of the heart and aortic cross-clamp times.

### Table 1: Aortic Versus Mitral Versus Double-Valve Endocarditis in 203 Patients

<table>
<thead>
<tr>
<th></th>
<th>AV No. (%)</th>
<th>MV No. (%)</th>
<th>DV No. (%)</th>
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<tbody>
<tr>
<td>Pre operative findings</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Prevalence</td>
<td>170 (54)*</td>
<td>50 (25)</td>
<td>43 (21)</td>
</tr>
<tr>
<td>Urgent surgery</td>
<td>62 (35)</td>
<td>18 (35)</td>
<td>28 (65)</td>
</tr>
<tr>
<td>Mean interval to surgery (days)</td>
<td>12</td>
<td>13</td>
<td>8</td>
</tr>
<tr>
<td>Embolism</td>
<td>11 (10)</td>
<td>7 (14)</td>
<td>7 (12)</td>
</tr>
<tr>
<td>Surgical findings</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extensive infection</td>
<td>45 (21)</td>
<td>7 (14)</td>
<td>12 (28)</td>
</tr>
<tr>
<td>Abscess</td>
<td>38 (18)*</td>
<td>1 (2)</td>
<td>7 (16)</td>
</tr>
<tr>
<td>Fistula</td>
<td>5 (19)</td>
<td>—</td>
<td>—</td>
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<tr>
<td>Pericardial involvement</td>
<td>19 (9)</td>
<td>7 (14)</td>
<td>5 (12)</td>
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<tr>
<td>Aortic cross-clamp time (min)</td>
<td>57</td>
<td>58</td>
<td>67*</td>
</tr>
<tr>
<td>Early postoperative events</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Ring leaks</td>
<td>5 (5)</td>
<td>1 (2)</td>
<td>1 (2)</td>
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<tr>
<td>Early prosthetic infection</td>
<td>4 (2)</td>
<td>—</td>
<td>1 (2)</td>
</tr>
<tr>
<td>Embolism</td>
<td>—</td>
<td>3 (7)</td>
<td>3 (5)</td>
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<tr>
<td>In-hospital death</td>
<td>6 (5)</td>
<td>1 (2)</td>
<td>1 (2)</td>
</tr>
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</table>

*p < 0.05 versus mitral infection. t p < 0.01 versus mitral infection. tp < 0.01 versus mitral infection. AV = aortic valve; DV = double valve; MV = mitral valve.

Surgical findings and procedures. Fifty patients (25%) had vegetations on the mitral valve; 43 of the 50 had mitral valve replacement. 2 had mitral valve repair and 5 had double-valve replacement for associated aortic valve disease. Vegetations were confined to the aortic valve in 110
patients (54%); 95 of the 110 had aortic valve replacement and 15 had a double-valve replacement for associated mitral valve disease. Vegetations were found on both valves in 43 patients (21%); 30 of the 43 patients had double-valve replacement and 13 had aortic valve replacement with debridement of the mitral valve apparatus.

Surgery was performed urgently in 108 patients (53%); on the day of admission in 50 patients, on day 2 in 15, between 3 and 7 days after admission in 29 and after 1 week in 14. Sixty-two (56%) of the 108 patients had aortic valve infection, 18 (36%) had mitral valve infection and 28 (65%) had double-valve infection (Table 1). A mechanical prosthesis was implanted in 247 valves (41% St Jude’s, 57% Medtronic Hall, 2% other) and a tissue valve in 4. Aortic root reconstruction using an autologous or bovine pericardial patch or woven Dacron graft was required in 13 patients (6%). Four pericardial sutures were performed for abnormalities unrelated to endocarditis included closure of a perimembranous ventriculo-septal defect in two cases, ligation of a patent ductus arteriosus and closure of a posttraumatic aortopulmonary fistula.

Infection of the aortic valve was more prevalent than mitral infection (54% vs. 25%, p < 0.05, Table 1). One hundred thirty-nine patients (68%) had limited infection (43 mitral, 65 aortic and 31 double-valve infective endocarditis) and 64 patients (32%) had extensive infection (7 mitral, 45 aortic and 12 double-valve infective endocarditis). Thirty-one patients (15%) had a pericardial effusion; in 13 of the 31 there was associated abscess formation. There were five fistulas (one aorta to right ventricle, one aorta to pulmonary artery, one aorta to pericardium, one ventriculo-septal defect and one aorta to right atrium). All fistulas occurred in association with infection of the aortic valve (Table 1).

There were 153 infected aortic valves (46 were totally destroyed, 26 had perforated cusps and 18 had fibrosis or calcification). Of the 93 infected mitral valves, 6 had a perforated cusp and 46 had a flail leaflet due to ruptured chordae tendineae. Infection resulted in abscess formation in 46 patients (23%). In the group as a whole, there were 19 annular, 9 supraannular, 13 subannular and 5 multiple abscesses. These were found in 38 (35%) of 110 patients with aortic valve infection compared with 1 (2%) of 50 patients with mitral valve infection (p < 0.001). Double-valve infection was complicated by abscess formation in 7 (16%) of 43 patients (Table 1).

Early postoperative mortality. There were eight deaths postoperatively, resulting in an in-hospital mortality rate of 4% (Table 1). Death was attributed to cerebral or coronary embolism in two patients, pump failure in two, sepsis in two and multiple organ failure in two. Seven of these had infection of the aortic valve, which was extensive in five and limited in two. Urgent surgery had been required in all patients who died. Among these patients, surgery was performed within 48 h of admission in six, at 8 days in one and at 62 days in one. The aortic cross-clamp time was 68 min in patients who died and 54 min in those who survived (p < 0.02). Six of the eight patients who died had major systemic embolism before operation (cerebral in four, coronary in one and peripheral in one).

Early postoperative morbidity. Of the 203 patients, 7 (3%) had a periprosthetic leak that did not require reoperation during the hospital stay; 5 had associated prosthetic valve endocarditis, 1 of whom had a fistula extending from the aortic anulus to the right ventricle (Table 1). Two of these patients required repeat operation 4 months after the initial operation. Two additional patients had complete heart block postoperatively, requiring permanent pacemaker implantation.

Late postoperative morbidity and mortality. Of the 195 hospital survivors, long-term follow-up was available in 147 (89%). The others were lost to follow-up because they were from other countries (n = 15) or rural areas of South Africa (n = 14). The mean follow-up interval was 38 ± 22 months (range 4 to 99). There were 10 late deaths (6%), 2 of which were definitely valve-related; one patient died of heart failure due to cardiomyopathy, one from injuries after an assault and six from undetermined causes. Death in 3 of the 10 patients occurred within the 1st year, and these were the only patients followed up for <1 year. A hemodynamically significant ring leak was diagnosed late in two patients; one was reoperated on successfully and the other was managed medically. One patient was reoperated on late for a thrombosed valve.

Discussion

This study of surgery for active endocarditis is unique in terms of 1) the total number of patients, 2) the number of patients with heart failure, 3) the number of patients with double valve infection, 4) the short period of time from diagnosis to surgery, and 5) the surgical outcome. Despite the severe degree of hemodynamic compromise, extensive infection and the large number of patients with double valve involvement, the surgical results were excellent. We attribute this outcome to the early timing of surgery, with the correction of hemodynamic compromise and prevention of preoperative sequelae such as multiple organ failure, embolization and progressive sepsis, all of which we believe increase the risk of deferring surgery.

Timing of surgical intervention. The proper timing of surgery is critical in the management of these patients. Procrastination to achieve a sterile surgical field results in irreversible myocardial damage in patients with hemodynamic dysfunction (12) and in the continued deterioration of renal or neurologic function, which precludes a successful surgical outcome or leaves a major residual defect (14,23). Once heart failure develops in the course of the illness, it tends to be progressive even though it may respond temporarily to medical measures. Surgery should be performed within days of the development of heart failure (28) because
the infected valve can be safely replaced, regardless of the infective state of the patient (2,13,16).30).

Despite these results and the recommendation that surgery be performed early, the interval from diagnosis to surgical intervention in previous studies has not been as short as in our study or has not been specified, with several exceptions. Richardson et al. (2) reported a 14% mortality rate in 81 patients referred for surgery at an average of 21 days after admission and Young et al. (16) reported a 37% operative mortality rate in 30 patients operated on 10 to 27 days after admission. In studies (25-28) from our institution, the time interval ranged from 1 to 12 days after admission and the mortality rate ranged from 7% to 10%. In the present study, the mean interval from admission to surgery was 10 days and there was no significant difference in time intervals among mitral, aortic or double valve involvement. Moreover, 56% of these patients underwent surgery within 7 days.

Congestive heart failure in mitral versus aortic valve endocarditis. Congestive heart failure has been shown to be the most important prognostic indicator of death in patients treated medically (16,31,32). Although medical cure rates of 50% to 90% can be achieved in uncomplicated active endocarditis (29,33), the mortality rate is high (25% to 89%) when infection is complicated by heart failure (1,31,34,35). Richardson et al. (2) reported the mortality rate associated with valve replacement to be 6% with mild failure, 20% with moderate failure and 33% with severe failure. Because of the high mortality rate at operation in patients with uncontrolled severe heart failure, operation is recommended at the first signs that mild heart failure is worsening, regardless of the length of prior antibiotic therapy (31). In view of these findings, our excellent results in patients with heart failure require explanation. One factor may be that more recent myocardial preservation techniques result in a lower mortality rate than that achieved with techniques used in previous decades. Another factor may have been a relatively lower incidence of preoperative embolization and multiorgan failure than in some other studies (14,36). A third factor may be the young age of our patients. Also contributory is the experience of our surgeons, as indicated by the large number of patients in our series with extensive infection.

Although endocarditis occurs most frequently on the mitral valve, surgery is more often performed for aortic valve infection because of heart failure (9,12). Once infection occurs on the aortic valve, the degree of destruction is much more extensive and results more frequently in heart failure. Acute severe aortic regurgitation is notoriously deadly, more so than acute severe mitral regurgitation, probably as a result of the left ventricle being less compliant than the left atrium, with resultant left ventricular end-diastolic pressure that is higher in aortic regurgitation. In our series, isolated aortic valve infection complicated by heart failure was also more prevalent than mitral valve infection (54% vs. 25%, p < 0.05). Also of note is the high prevalence (21%) of double-valve infection in our consecutive group of patients (Table 1). Rheumatic fever with its propensity to affect multiple valves is the most common cause for valvular dysfunction in these patients. This, together with possible diminished host resistance or more virulent organisms, or both, might account for the higher incidence of double valve infection (25).

Extensive infection in mitral versus aortic valve endocarditis. Our study is remarkable for the following findings. There was a high incidence (32%) of extensive infection in the study group. Abscess formation was found in 46 (23%) of the 203 patients. In the 64 patients with extensive infection, 46 (72%) had associated abscess formation. The latter, usually related to the infected valve annulus, is the typical manifestation of extensive infection in isolated aortic valve endocarditis (80%). In contrast, extensive infection in isolated mitral valve endocarditis is rarely associated with abscess formation (38 of 45 vs. 1 of 7, p < 0.05). Also, infection was more often extensive on the aortic than on the mitral valve (41% vs. 14%, p < 0.05). Similarly, Becker et al. (36) reported no case with mitral valve infection associated with an abscess containing actively infected material. This finding should justify an aggressive management strategy in aortic endocarditis, with early surgical intervention to prevent myocardial rupture. It has been suggested (37) that a pericardial effusion is highly suggestive of an annular abscess associated with aortic valve infection. There were 31 pericardial effusions, of which 13 (42%) had abscess formation. In the majority of patients, the presence of an effusion is probably reactive to infection, in cases where there is no obvious extension of infection to the pericardium or possibly to heart failure. It is noteworthy that, despite evidence of vegetations and abscess formation at surgery, many of our patients had negative blood and valve cultures, probably as a result of the administration of antibiotics before referral.

A mechanical prosthesis was implanted in the majority of patients. In a similar group of patients, other investigators (38) have reported an overall 6% incidence of reoperations for endocarditis in patients with a mechanical prosthesis versus 20% for those with a bioprosthetic valve. Despite the presence of extensive infection in 41% of patients with aortic valve involvement, mechanical valve implantation as opposed to homograft utilization did not preclude a good short-term (39) and long-term result.

Conclusion. The presence of heart failure and extensive infection in left-sided valve endocarditis is not necessarily associated with high surgical risk when surgery is performed early. Early surgical intervention in these critically ill patients has acceptably low mortality and morbidity and is the optimal form of treatment.

References


