Mitral valve repair for active culture-positive infective endocarditis

G. Doukas, M. Oc, C. Alexiou, A.W. Sosnowski, N.J. Samani*, T.J. Spyt

Department of Cardiac Surgery and Cardiology*, Glenfield Hospital, University of Leicester, Leicester, UK

Corresponding author:
Professor T.J. Spyt
Department of Cardiac Surgery
Glenfield Hospital, Leicester LE3 9QP, UK
Tel: 44 116 2563991, Fax: 44 116 2322511
E-mail: tom.spyt@uhl-tr.nhs.uk

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Abstract

Objective: To describe the clinical and echocardiographic outcome following mitral valve repair for active culture-positive infective mitral valve endocarditis.

Patients and Methods: Between 1996 and 2004, 36 patients (mean age of 53 ± 18 years) with positive blood culture up to three weeks before surgery (or positive culture of material removed at operation) and intraoperative evidence of endocarditis underwent mitral valve repair in the authors’ institution. Staphylococci and streptococci were the commonest pathogens. All patients had moderate or severe mitral regurgitation (MR). Mean NYHA class was 2.33 ± 1.0. Follow up was complete (mean 38 ± 19 months).

Results: Operative mortality was 2.4% (1 patient). At follow up, there has been no episode of recurrent endocarditis. One patient developed severe recurrent MR and underwent valve replacement and one patient had moderate MR. There were two late deaths, both non-cardiac. Kaplan-Meier 5-year freedom from recurrent moderate/severe MR, re-operation and survival were 94 ± 4%, 97 ± 3% and 93 ± 5% respectively. At most recent review the mean NYHA class was 1.17 ± 0.3 (p < 0.0001). At latest echocardiographic evaluation, left atrial diameters, left ventricular end-diastolic diameter and MV diameter were significantly reduced (p < 0.05) compared to preoperative values.

Conclusions: Mitral valve repair for active-culture positive endocarditis is associated with low operative mortality and provides satisfactory freedom from recurrent infection, re-operation and survival. Hence, every effort should be made to repair infected mitral valves and valve replacement should be undertaken only when repair is not possible.
Introduction

Mitral valve (MV) infection accounts for 35% to 50% of native infective endocarditis (IE).[1][2] Although the diagnosis and medical treatment of IE have improved overtime, patients with persistent sepsis and those developing complications such as severe valve dysfunction, organ failure, abscess formation, large mobile vegetations and central or peripheral embolization may need surgical intervention.

Prosthetic valve replacement, the traditional surgical therapy for IE, has several problems. Bioprostheses have limited durability, whereas mechanical valves are prone to thromboembolism and require anticoagulation. Moreover, when valve replacement is undertaken during the active phase of IE the risks of early death and infection of the implanted device are substantial.[3][4][5]

Mitral valve (MV) repair for non-infective MR carries lower morbidity, including endocarditis, than valve replacement. [6] Therefore, attempting repair of an abnormal MV due to IE would seem logical. The few available studies in the literature addressing issues related to MV repair for IE describe encouraging outcomes.[7][8][9][10][11][12][13][14][15]

However, there remain questions with regard to the feasibility and durability of MV repair performed whilst the infection is active. This paper describes the early and mid-term clinical and echocardiographic results of MV repair for active culture-positive IE.
Patients and methods

Between 1996 and 2004, 762 patients underwent MV repair at Glenfield Hospital, Leicester. Thirty-six (5%) of these patients (24 males and 12 females, mean age of 53±18 years, range 17–81 years) had active culture-positive mitral valve IE and are the subject of this report. Active culture-positive IE was defined as the presence of a positive blood culture up to three weeks before surgery (or positive culture of other material removed intra-operatively) accompanied by macroscopic evidence of lesions typical for endocarditis. [16][17] Over the same period (1996–2004), 589 patients underwent MV replacement. Of these patients, 43 (7.3%) had IE.

Data were collected from the departmental database and the medical records. The follow up was complete (mean 38±19 months, range 8–72 months).

Statistical analysis

Continuous variables are expressed as means values ± standard deviation and proportions as percentages. Categorical variables are compared with $\chi^2$ or Fisher’s test and continuous variables with an a t-test or a non-parametric test. Freedom from events was calculated with the Kaplan-Meier method.
Results

Preoperative clinical profile

Six patients (17%) were receiving anti-anginal medications, ten (28%) were in atrial fibrillation with the remaining being in sinus rhythm. One patient (3%) had a previous stroke and two (5%) were hypertensive. Four patients (11%) had severe aortic regurgitation due to co-existing aortic IE, four (11%) had severe tricuspid regurgitation, and two (5.6%) had an atrial septal defect (ASD). The mean NYHA functional class was 2.3±1.0.

The offending micro-organism was identified in all patients (Table 1). Twenty-eight (78%) of them had positive blood cultures preoperatively and eighteen (22%) had positive microbiological examination of material removed at operation. Surgery was performed at a mean time of 24±6 days after commencement of antibiotic treatment (range 2–64 days).

The main indications for surgery included mobile vegetations (>1cm) in 29 patients (80%), severe mitral regurgitation in 23 (69%), uncontrolled sepsis in 23 (69%), congestive heart failure in 13 (36%), acute renal failure in 4 (11%), peripheral systemic emboli in 2 (5%), and cardiogenic shock in 1 (3%).

Operative data and postoperative antibiotics

The operations were carried out with the aid of cardiopulmonary bypass and cardioplegic arrest. The MV was accessed through the left atrium or the inter-atrial septum.

The distribution of anatomic lesions according to surgical findings were vegetations in 29 cases (80%), leaflet prolapse in 22 (61%), leaflet perforation in 20 (56%), chordal rupture in 17 (47%) and annular abscess in 2 (5.5%). The vegetations and infected tissues were debrided. Carpentier’s techniques [18] were used for repair including quadrangular resection in 18 cases (50%), pericardial patch closure of leaflet perforation in 14 (39%), direct leaflet closure in 6 (17%) and anterior leaflet repair in 4 (11%). Concomitant procedures were
coronary artery bypass grafting in 2 patients, tricuspid valve annuloplasty in 4, aortic valve replacement in 4 and closure of ASD in 2. A Cosgrove-Edwards annuloplasty band was inserted in 33 cases (92%). Preoperative TOE showed moderate to severe MR in all cases. After repair, TOE showed no MR in 26 patients (72%), trivial MR in 4 (11%) and mild MR in 6 (17%).

Postoperatively, patients having positive culture of material excised at operation would normally receive a six weeks course of intravenous antibiotics. Otherwise, a four weeks course was given (mean duration of postoperative antibiotic treatment: 39±15 days).

**Clinical and echocardiographic outcome**

One patient (2.7%) died from septic emboli, cerebral infarct and bronchopneumonia. Seven patients (19%) sustained complications including complete heart block requiring permanent pacemaker (3), acute renal failure (1), stroke (1) and transient ischaemic attack (TIA) (2). There were two late deaths. A 59-year old died from malignancy three years postoperatively and a 79-year old who was on Warfarin for atrial fibrillation died from gastro-intestinal bleeding six years after MV repair. Kaplan-Meier 5-year survival was 93±5 %.

One patient exhibited severe MR and underwent MV replacement. One patient developed moderate MR and was managed medically whereas four patients had mild MR. Kaplan-Meier freedom from recurrent moderate/severe MR and re-operation at five years were 94±4% and 97±3% respectively. One patient experienced TIA and another patient had a stroke 1 and 4 years after their operations. There has been no case of recurrent endocarditis. At latest follow up, the mean NYHA class was 1.17±0.3 (compared to preoperative values: p<0.0001).

The mean time of the latest echocardiogram was 28±11 months (range 5-62 months).

Preoperative and late postoperative echocardiographic data are shown on Table 2.
**Discussion**

Although operating in a sterile field during the “inactive” (healed) phase of IE is highly desirable, expeditious surgery in the face of an ongoing infection may be necessary. The differing definitions of “active” endocarditis in previously published papers may prevent a meaningful evaluation of various therapies applied in such circumstances. We used the definition first proposed by the Mayo Clinic [16] and subsequently adopted by the Southampton group [17] and studied only patients having active culture-positive IE.

MV repair is the preferred surgical option for degenerative MR.[6][19][20][21] Its role, however, in the management of active IE is less well established. This study shows that MV repair for active culture-positive IE carries low operative mortality and provides satisfactory freedom from recurrent infection, recurrent MR, re-operation and survival.

The operative mortality of 2.4% in this group is similar to 1.5% mortality rate recorded following repair of MV for degenerative MR in our institution (*unpublished data*) and identical to 2.5% reported by Dreyfus.[7] These results compare favourably with early mortality of 10–36% quoted following MV replacement for IE.[3][22] Nevertheless, the results of MV replacement are satisfactory too considering that early death rates for patients with complicated forms of the disease treated by non-surgical means can be as high as 60% to 90%.[23][24]

The insertion of a mitral annuloplasty ring in the setting of active infection could theoretically raise the risk of recurrent infection. The lack of recurrent endocarditis amongst our patients, 92% of whom received an annulopasty ring, is gratifying and in agreement with previous studies [7][8][9] who did not record episodes of recurrent infection following MV repair for IE at a mean follow up of up to 30 months.

In the present series, MV repair appeared to be efficient in restoring normal valve function. Whilst before surgery all patients exhibited moderate to severe MR, at follow up two patients...
developed moderate or severe MR. The freedom from recurrent moderate/severe MR and re-
operation of 94±4% and 97±3% are indeed encouraging and compare favourably with
previous reports.[7][8][9][10][11][12][13][14][15] Detailed information on the late
haemodynamic status of patients after MV repair for IE is limited. This study documents the
haemodynamic benefit of restoration of normal MV function as evidenced by a significant
decrease in the left atrial diameters, left ventricular end-diastolic diameter and MV diameter.
The MV gradient rose following correction of MR without causing mitral stenosis whereas
left ventricular contractility was preserved. These lasting haemodynamic gains are certainly
responsible for the significant improvement in the NYHA class recorded at the latest follow
up and the 5-year survival rate of 93±5%.

We consider that these satisfactory outcomes reflect the routine use of echocardiography,
adancements in the quality of care offered by the cardiologists, microbiologists, anaesthetists
and intensive care specialists, and the familiarity of surgeons with MV repair techniques. It is
likely that accumulated experience with various MV repair procedures encourages an earlier
surgical intervention in the disease process before irreversible haemodynamic compromise
and extensive pathological damage of the MV set in.

In conclusion, this study shows that MV repair for active-culture positive IE is associated
with low mortality and provides good freedom from recurrent infection, re-operation and
survival. Hence, every effort should be made to repair infected mitral valves and valve
replacement should be undertaken only when repair is not possible.
Acknowledgements

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References


Table 1. Causative microorganism

<table>
<thead>
<tr>
<th>Microorganism</th>
<th>Number of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Streptococcus viridans</em></td>
<td>10 (28%)</td>
</tr>
<tr>
<td><em>A-hemolytic streptococcus</em></td>
<td>4 (1%)</td>
</tr>
<tr>
<td><em>B-hemolytic streptococcus</em></td>
<td>4 (11%)</td>
</tr>
<tr>
<td><em>Streptococcus suis</em></td>
<td>2 (5.5%)</td>
</tr>
<tr>
<td><em>Staphylococcus aureus</em></td>
<td>11 (30.5%)</td>
</tr>
<tr>
<td><em>Staphylococcus epidermitis</em></td>
<td>3 (8.5%)</td>
</tr>
<tr>
<td><em>Enterococcus</em></td>
<td>2 (5.5%)</td>
</tr>
</tbody>
</table>
### Table 2. Echocardiographic data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Preoperative (36 patients)</th>
<th>Late postoperative (35 patients)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severe MR</td>
<td>31 (86.1%)</td>
<td>1 (2.8%)</td>
<td>&lt; 0.0001*</td>
</tr>
<tr>
<td>Moderate MR</td>
<td>5 (13.8%)</td>
<td>1 (2.8%)</td>
<td>0.19</td>
</tr>
<tr>
<td>Mild MR</td>
<td>0</td>
<td>4 (11.4%)</td>
<td>0.053</td>
</tr>
<tr>
<td>Ejection fraction</td>
<td>58 ± 5 %</td>
<td>55 ± 4%</td>
<td>0.75</td>
</tr>
<tr>
<td>Fractional shortening</td>
<td>29 ± 2 %</td>
<td>29 ± 3%</td>
<td>0.96</td>
</tr>
<tr>
<td>Good LV function</td>
<td>30 (84%)</td>
<td>32 (92%)</td>
<td>0.64</td>
</tr>
<tr>
<td>LA diameter</td>
<td>5.6 ± 0.8 cm</td>
<td>4.6 ± 0.6 cm</td>
<td>&lt; 0.001*</td>
</tr>
<tr>
<td>LA area (min)</td>
<td>16 ± 4.5 cm²</td>
<td>13 ± 3.4 cm²</td>
<td>0.02*</td>
</tr>
<tr>
<td>LA area (max)</td>
<td>28 ± 7.4 cm²</td>
<td>18 ± 3.1 cm²</td>
<td>&lt; 0.0001*</td>
</tr>
<tr>
<td>LVESD</td>
<td>3.5 ± 0.5 cm</td>
<td>3.1 ± 0.3 cm</td>
<td>0.08</td>
</tr>
<tr>
<td>LVEDD</td>
<td>5.38 ± 0.8 cm</td>
<td>4.7 ± 0.3 cm</td>
<td>0.04*</td>
</tr>
<tr>
<td>ESV</td>
<td>48 ± 21.1 ml</td>
<td>45 ± 6.2 ml</td>
<td>0.75</td>
</tr>
<tr>
<td>EDV</td>
<td>144 ± 49 ml</td>
<td>137 ± 28 ml</td>
<td>0.65</td>
</tr>
<tr>
<td>MV mean gradient</td>
<td>1.9 ± 0.9 mmHg</td>
<td>3.3 ± 1.5 mmHg</td>
<td>0.0009*</td>
</tr>
<tr>
<td>MV diameter</td>
<td>3.7 ± 0.2 cm</td>
<td>3.2 ± 0.4 cm</td>
<td>0.003*</td>
</tr>
</tbody>
</table>

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