CARDIOVASCULAR MEDICINE

Mitral valve repair for active culture positive infective endocarditis

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Objective: To describe the clinical and echocardiographic outcome after mitral valve (MV) repair for active culture positive infective MV endocarditis.

Patients and methods: Between 1996 and 2004, 36 patients (mean (SD) age 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 MV repair. Staphylococci and streptococci were the most common pathogens. All patients had moderate or severe mitral regurgitation (MR). Mean New York Heart Association (NYHA) class was 2.3 (1.0). Follow up was complete (mean 38 (19) months).

Results: Operative mortality was 2.8% (one patient). At follow up, endocarditis has not recurred. 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 five year freedom from recurrent moderate to severe MR, freedom from repeat operation, and survival were 94 (4)%, 97 (3)%, and 93 (5)%, respectively. At the most recent review the mean NYHA class was 1.17 (0.3) ($p < 0.0001$). At the latest echocardiographic evaluation, left atrial diameters, left ventricular end diastolic diameter, and MV diameter were significantly reduced ($p < 0.05$) compared with preoperative values.

Conclusions: MV repair for active culture positive endocarditis is associated with low operative mortality and provides satisfactory freedom from recurrent infection, freedom from repeat operation, and survival. Hence, every effort should be made to repair infected MVs and valves should be replaced only when repair is not possible.

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

Prosthetic valve replacement, the traditional surgical treatment for IE, has several problems. Bioprostheses have limited durability, whereas mechanical valves are prone to thromboembolism and require anticoagulation. Moreover, when the valve is replaced during the active phase of IE the risks of early death and infection of the implanted device are substantial.^{3–5}

MV repair for non-infective mitral regurgitation (MR) carries lower morbidity, including endocarditis, than valve replacement.⁶ Therefore, attempting repair of an abnormal MV caused by IE seems logical. The few available studies in the literature addressing issues related to MV repair for IE describe encouraging outcomes.^{7–15} However, questions remain with regard to the feasibility and durability of MV repair performed while the infection is active. We describe 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 (4.7%) of these patients (24 men and 12 women, mean (SD) age 53 (18) years, range 17–81 years) had active culture positive MV 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 intraoperatively)

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 mean (SD) and proportions as percentages. Categorical variables were by χ^2 or Fisher's test and continuous variables by 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 antianginal medications and 10 (28%) were in atrial fibrillation with the remainder being in sinus rhythm. One patient (2.8%) had a previous stroke and two (5.6%) were hypertensive. Four patients (11%) had severe aortic regurgitation caused by coexisting aortic IE, four (11%) had severe tricuspid regurgitation, and two (5.6%) had an atrial septal defect. The mean New York Heart Association (NYHA) functional class was 2.3 (1.0).

The offending microorganism was identified in all patients (table 1). Twenty eight (78%) of them had positive blood cultures preoperatively and 18 (50%) had positive microbiological examination of material removed at operation. Surgery was performed at a mean of 24 (6) days after beginning antibiotic treatment (range 2–64 days).

Abbreviations: IE, infective endocarditis; MR, mitral regurgitation; MV, mitral valve; NYHA, New York Heart Association

Table 1 Causative microorganism

Microorganism	Number of patients
<i>Streptococcus viridans</i>	10 (28%)
α Haemolytic streptococci	4 (11%)
β Haemolytic streptococci	4 (11%)
<i>Streptococcus suis</i>	2 (5.6%)
<i>Staphylococcus aureus</i>	11 (31%)
<i>Staphylococcus epidermidis</i>	3 (8.3%)
Enterococcus	2 (5.6%)

The main indications for surgery were mobile vegetations (> 1 cm) in 29 patients (80%), severe MR in 23 (69%), uncontrolled sepsis in 23 (69%), congestive heart failure in 13 (36%), acute renal failure in four (11%), peripheral systemic emboli in two (5%), and cardiogenic shock in one (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 interatrial septum.

The distribution of anatomical lesions according to surgical findings were vegetations in 29 patients (81%), leaflet prolapse in 22 (61%), leaflet perforation in 20 (56%), chordal rupture in 17 (47%), and annular abscess in two (5.6%). The vegetations and infected tissues were debrided. Carpentier's techniques¹⁸ were used for repair: quadrangular resection in 18 (50%), pericardial patch closure of leaflet perforation in 14 (39%), direct leaflet closure in six (17%), and anterior leaflet repair in four (11%). Concomitant procedures were coronary artery bypass grafting in two patients, tricuspid valve annuloplasty in four, aortic valve replacement in four, and closure of atrial septal defect in two. A Cosgrove-Edwards annuloplasty band was inserted in 33 patients (92%). Preoperative transoesophageal echocardiography showed moderate to severe MR in all patients. After repair, transoesophageal echocardiography showed no MR in 26 patients (72%), trivial MR in four (11%), and mild MR in six (17%).

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

Table 2 Echocardiographic data

Parameter	Preoperative (n = 36)	Late postoperative (n = 35)	p Value
Severe MR	31 (86%)	1 (2.8%)	<0.0001*
Moderate MR	5 (14%)	1 (2.8%)	0.19
Mild MR	0	4 (11.4%)	0.053
Ejection fraction (%)	58 (5)	55 (4)	0.75
Fractional shortening (%)	29 (2)	29 (3)	0.96
Good LV function	30 (84%)	32 (92%)	0.64
LA diameter (cm)	5.6 (0.8)	4.6 (0.6)	<0.001*
Minimum LA area (cm ²)	16 (4.5)	13 (3.4)	0.02*
Maximum LA area (cm ²)	28 (7.4)	18 (3.1)	<0.0001*
LVEDD (cm)	3.5 (0.5)	3.1 (0.3)	0.08
LVEDD (cm)	5.38 (0.8)	4.7 (0.3)	0.04*
ESV (ml)	48 (21.1)	45 (6.2)	0.75
EDV (ml)	144 (49)	137 (28)	0.65
MV mean gradient (mm Hg)	1.9 (0.9)	3.3 (1.5)	0.0009*
MV diameter (cm)	3.7 (0.2)	3.2 (0.4)	0.003*

Data are mean (SD) or number (%).

EDV, end diastolic volume; ESV, end systolic volume; LA, left atrium; LV, left ventricle; LVEDD, left ventricular end diastolic; LVEDS, left ventricular end systolic; MR, mitral regurgitation; MV, mitral valve.

Clinical and echocardiographic outcomes

One patient (2.8%) died of septic emboli, cerebral infarct, and bronchopneumonia. Seven patients (19%) sustained complications of complete heart block requiring permanent pacemaker (three), acute renal failure (one), stroke (one), and transient ischaemic attack (two). There were two late deaths. A 59 year old died of malignancy three years postoperatively and a 79 year old who was taking warfarin for atrial fibrillation died of gastrointestinal bleeding six years after MV repair. Kaplan-Meier five 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 to severe MR and repeat operation at five years were 94 (4)% and 97 (3)%, respectively. One patient experienced a transient ischaemic attack and another patient had a stroke one and four years after their operations. No patient has had recurrent endocarditis. At latest follow up, the mean NYHA class was 1.17 (0.3) (compared with preoperative values, $p < 0.0001$).

The mean time of the latest echocardiogram was 28 (11) months (range 5–62 months). Table 2 shows preoperative and late postoperative echocardiographic data.

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 treatments applied in such circumstances. We used the definition first proposed by the Mayo Clinic¹⁶ and subsequently adopted by the Southampton group¹⁷ and studied only patients having active culture positive IE.

MV repair is the preferred surgical option for degenerative MR.^{6 19–21} 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, and repeat operation and satisfactory survival.

The operative mortality of 2.8% in this group is similar to the 1.5% mortality recorded after repair of MV for degenerative MR in our institution (unpublished data) and identical to the 2.5% reported by Dreyfus *et al.*⁷ These results compare favourably with early mortality of 10–36% quoted after 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 60–90%.^{23 24}

The insertion of a mitral annuloplasty ring in the setting of active infection may theoretically raise the risk of recurrent infection. The lack of recurrent endocarditis among our patients, 92% of whom received an annuloplasty ring, is gratifying and in agreement with previous studies,^{7–9} which did not record episodes of recurrent infection after 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. Whereas before surgery all patients exhibited moderate to severe MR, at follow up two patients developed moderate or severe MR. The freedom from recurrent moderate to severe MR of 94 (4)% and from repeat operation of 97 (3)% are indeed encouraging and compare favourably with previous reports.^{7–15} 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 shown by a significant decrease in left atrial diameter, left ventricular end diastolic diameter, and MV diameter. The MV gradient rose after 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 five year survival rate of 93 (5)%.

We consider that these satisfactory outcomes reflect the routine use of echocardiography, advancements in the quality of care offered by the cardiologists, microbiologists, anaesthetists, and intensive care specialists, and the familiarity of surgeons with MV repair techniques. Accumulated experience with various MV repair procedures probably 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, freedom from repeat operation, and survival. Hence, every effort should be made to repair infected MVs and valves should be replaced only when repair is not possible.

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