ORIGINAL ARTICLE

Double Valve Replacement (Mitral & Aortic) with Bileaflet Mechanical Prostheses in 94 patients: Long-Term results

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ABSTRACT

Background: in this retrospective study with long-term follow-up, we extracted a cohort of 94 patients underwent double-valve replacement [mitral valve replacement (MVR) & aortic valve replacement (AVR)] between 1995 and 1999. All of these 94 patients were operated on by mechanical bileaflet low profile prostheses, either St Judes or carbomedics depending upon the availability of valve at the time of surgery.

Methods: The largely predominant etiology was rheumatic heart disease (97.87%). Patients were classified as New York Heart Association class III/IV in 60% of cases. Patients were investigated mainly by echocardiography, with a mean left ventricular ejection fraction of 54.7 ±12.2, and the pulmonary artery pressure was elevated with a mean value of 40.0±11.6 mm Hg. The diameter of the implanted valve was 21.7 ± 2.3 mm in the aortic position and 29 ± 2.3in the mitral position. The updated follow-up in 2005 till 2008 was performed by a patient questionnaire, and the patient's attending physician or cardiologist was also contacted. Five patients were lost to follow-up in this updated survey, with a mean follow-up of 10 years.

Results: The mean length of stay in intensive care was 29.74 ± 13.27 hours, whereas mean hospital stay was 12.2 ± 3 days. The operative mortality (<30 days) was 9.08%. The leading cause of operative mortality was a low cardiac output syndrome (20%) responsible for a high operative mortality. On follow-up the majority of patients were classified as New York Heart Association class I or II, 80% of patients considered that they had a normal quality of life, and 20% reported a less or very limited quality of life. Twenty-four patients died and 5 were lost to follow-up, the early mortality rate (<1 month) was 9%, and 5- and 10-year survival rates were 81% and 64%, respectively. The mortality rate remained stable during the entire follow-up period (5%/patient-year). Most patients (n=9) died of cardiac causes; heart failure and sudden, unexpected death were the most frequent causes of cardiac death.

Conclusions: The long-term results of double mechanical valve replacements are satisfactory in terms of both survival and quality of life with modern surgical perioperative treatment and durable bileaflet mechanical prostheses that have excellent hemodynamic performance.

Key words: Double valve replacement, echocardiography, long term follow up

INTRODUCTION

The first double valve replacement using first generation mechanical prostheses for combined aortic and mitral valve disease was done in 1960s; until the mid-1970s, it was associated with a high operative mortality[1,2,3].

The high profile first generations of mechanical valves, cardiopulmonary bypass techniques and imperfect myocardial protection did not allow this surgery to be performed under optimal conditions for achieving satisfactory results. With the development of second-generation mechanical bileaflet low profile valves, advent of modern myocardial protection techniques improved the short-term, medium-term, and long-term prognosis of these patients in the early 1980s[4,5,6].

This retrospective study with long-term follow-up, we extracted a cohort of 94 patients underwent double-valve replacement [mitral valve replacement (MVR) & aortic valve replacement (AVR)] between 1995 and 1999. All of these 94 patients were operated on by mechanical bivalvular low profile prostheses, either St Judes or carbomedics depending upon the availability of valve at the time of surgery.

PATIENTS AND METHODS

We studied a cohort of 94 patients operated on for double valve replacement (aortic & mitral) using bivalvar, low profile mechanical prostheses at the Cardiac Center of Nawaz Sharif Social Security Hospital, between 1995 and 1999. Clinical data

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obtained from the registries and hospital records included age, sex, body surface area, and the presence of concomitant medical problems such as smoking, diabetes mellitus, and hypertension; New York Heart Association functional class, etc. the preoperative characteristics are shown in Table 1. The largely predominant etiology was rheumatic heart disease (97.87%). Predominant mitral valve disease was mitral insufficiency in 37(39.36%) of cases Table 2, whereas the predominant aortic disease was aortic insufficiency in 51% of cases. Patients were classified as New York Heart Association class III/IV in 60% of cases. Patients were only investigated mainly by echocardiography, with a mean left ventricular ejection fraction of 54.7±12.2, and the pulmonary artery pressure was elevated with a mean value of 40.0±11.6 mm Hg. The cardiothoracic index calculated on the standard chest roentgenogram was increased, with a mean of 0.59 ± 0.73.

The standard procedure was performed by median sternotomy under cardiopulmonary bypass with moderate hypothermia at 28°C & St. Thomas crystalloid cardioplegic technique was used.

The mitral valve was accessed directly through the left atrium in interatrial groove. The aortic valve was implanted after implantation of the mitral valve to facilitate exposure of the mitral ring. The diameter of the implanted valve was 21.7 ± 2.3 mm in the aortic position and 29 ± 2.3in the mitral position Table 3.

Postoperative complications recorded included low cardiac output (defined as a cardiac index less than 2 L • min^{-1} • m^{-2} or the need for intravenous inotropic drugs or intraaortic balloon support for more than 24 hours postoperatively), reoperation for bleeding, renal failure requiring dialysis, respiratory insufficiency (defined as the need for reintubation or mechanical ventilatory support for more than 48 hours), and the presence of new postoperative ventricular or atrial arrhythmias. Operative mortality was defined as any death during hospitalization or within 30 days of the surgical procedure.

Follow-up: we updated an initial complete follow-up performed in 2004 through the use of standardized questionnaires that were given to patients and their cardiologists. The updated follow-up in 2005 till 2008 was performed by a patient questionnaire, and the patient's attending physician or cardiologist was also contacted. Five patients were lost to follow-up in this updated survey, with a mean follow-up of 10 years. The data were collected following the recommendations of the main international guidelines. [7, 8]

Causes of death and cardiac complications were classified according to guidelines[9] and were obtained from medical reports, death certificates, and contact with physicians.

Statistical methods: Continuous variables were expressed as mean±standard deviation and compared using Student's *t* test. Qualitative variables were expressed as a percentage and compared by χ^2 test or Fisher's exact test, as appropriate. A *p* value less than 0.05 was considered to be significant.

RESULTS

Early results: The mean length of stay in intensive care was 29.74±13.27 hours, whereas mean hospital stay was 12.2 ± 3 days. On discharge from the hospital, the numbers of patients in sinus rhythm and AF were similar to those observed preoperatively. 3 percent of patients developed complete atrioventricular block and required implantation of a permanent pacemaker. The operative mortality (<30 days) was 9.08%. The leading cause of operative mortality was a low cardiac output syndrome (20%) responsible for a high operative mortality.

Clinical status of surviving patients: The majority of patients were classified as New York Heart Association class I or II 86%. Therefore, 80% of patients considered that they had a normal quality of life, and 20% reported a less or very limited quality of life. Twenty-five percent of patients were receiving too little or too much anticoagulant therapy (international normalized ratio <2 or >4, respectively) and often needed to adjust their treatment.

Table 1: Patient characteristics

Mean age (y)	39.8 ± 8.5
Sex	25.5%F & 74.5%M
Etiology	
Rheumatic fever	92(97.87%)
Endocarditis	2
NYHA class III/IV	60%
Rhythm	
Sinus	27(28.7%)
Atrial fibrillation	70(71.3%)
LVEF, %	54.7 ±12.2
Pulmonary artery pressure, mm Hg	40.0±11.6

Table 2: Disease pattern

Disease (%)	**Mitral**	**Aortic**
Insufficiency	37(39.36%)	48(51%)
Stenosis	35(37.2%)	22(23.3%)
Mixed	22(23.3%)	24(25.5%)

Table 3: Operative data

Aortic valve size mm	21.7 ± 2.3
Mitral valve size mm	29 ± 2.3
Cross-clamp time (min)	148.2 ± 31.0
CPB time (min)	221.1 ± 53.7

Table 4: Causes of late deaths

Sudden death	3
Thromboembolism	7
Cerebral bleeding	4
Endocarditis	1
Arrhythmic death	2
Prosthesis dysfunction	3
Cardiac failure	4

During the follow-up, many major complications were encountered; the most common were stroke (n=17), endocarditis (n=4), and bleeding during anticoagulation related haemorrhage (n=7). Due to diagnostic difficulties, we have not differentiated between embolic and hemorrhagic stroke as causes. Twenty-four patients died and 5 were lost to follow-up Table 3; the early mortality rate (<1 month) was 9%, and 5- and 10-year survival rates were 81% and 64%, respectively. The mortality rate remained stable during the entire follow-up period (5%/patient-year). Most patients (n=9) died of cardiac causes; heart failure and sudden, unexpected death were the most frequent causes of cardiac death Table 3. Noncardiac death occurred in 12 patients. In 3 patients, the cause of death remained unknown; these cases were regarded as probably cardiac related. In calculations, they were grouped together with cardiac death.

DISCUSSION

The optimal timing of double valve replacement for combined aortic and mitral disease is not well defined.[10] The decreased operative mortality rates and improved late survival rates during the past decade require reassessment of indication for surgery in patients with combined valvular disease[11]. Our observations demonstrate that combined valvular surgery can be performed with a low operative mortality rate of <9% and good late results (10-year survival rate, 61%), whereas three fourths of long-term survivors had a fair quality of life (NYHA classes I and II)[12]. Nevertheless, the early operative mortality rate is higher and the late survival rate is lower than those after isolated aortic or mitral valve replacement[13]. Heart failure and sudden, unexpected death are the major late causes of death. Heart failure can occur slowly and insidiously, many years after valve replacement, The introduction of new treatments, such as angiotensin-converting enzyme inhibitors or angiotensin II inhibitors, has allowed long-term improvement of these forms of secondary left ventricular failure.

Preoperative LVEF is an important determinant of post operative long term survival after double valve replacement for combined aorto-mitral valve disease. The potential for recovery after successful double valve replacement is equally limited when preoperative systolic function is severely depressed[14,15]. The long-term results of double mechanical valve replacements are satisfactory in terms of both survival and quality of life, comparable to single valve replacement. The double-valve replacement provides a higher mortality rate but does not show any deterioration in long-term prognosis compared with isolated valve replacement surgery. While replacing mitral valve during double valve replacement, preservation of the subvalvular apparatus is important, as it preserves post operative left ventricular function resulting in better short-term, medium-term, and long-term prognoses. Optimization of anticoagulant therapy also remains an important as to further reduce morbidity and mortality of these patients. Wherever coexisting tricuspid valve disease is present, patients must be operated on before left ventricular failure appears, as they carry poor long-term prognosis.

With modern surgical perioperative treatment and durable prostheses that have excellent hemodynamic performance, late postoperative results in combined aortic and mitral valve disease depends crucially on preoperative LV function. Low operative mortality rates and good late results make double valve replacement mandatory even in moderately symptomatic patients before LV function dysfunction ensues. Durable, modern mechanical bileaflet prostheses should be chosen for valve replacement. Close surveillance of patients after successful double valve replacement surgery should be maintained, especially in patients with preoperatively decreased myocardial function & modern medical treatment of postoperative myocardial dysfunction should be provided.

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