Mitral Valve Replacement For Functional Severe Mitral Incompetence In Patients With Idiopathic Dilated Cardiomyopathy

Ihab Abdelfattah,

Alaa Omar,

Ahmed Elsharkawy,

Kareem Mahmoud*

Objectives: to evaluate outcome of mitral valve replacement (MVR) for patients with functional severe mitral regurgitation and congestive heart failure (CHF) due to idiopathic dilated cardiomyopathy (IDCM).

Methods: Between January 2012 and September 2013, eight patients underwent mitral valve replacement with mechanical valves and preservation of whole mitral valve apparatus for severe functional MR due to IDCM. Most Patients had ejection fraction (EF) < 40%. CHF patients of ischemic or valvular etiologies were excluded.

Results: Thirty day survival and 1-year survival rates were 100%. After a mean follow up of 14±3 months New York Heart Association class improved from 3.5±0.5 to 1.8±0.6 (p =0.01), LVEF improved from 37.4±5.6% to 43.2±6.7 (p =0.04), LVEDD improved from 6.7±4.4 cm to 6.3±5.0 cm (p =0.1).

Conclusion: mitral valve replacement with preservation of whole mitral valve apparatus can provide good early results for patients with non-ischemic DCM and severe FMR.

KEY WORDS: IDCM - FMR – WHOLE VALVE PRESERVATION- MVR

IDCM: Idiopathic dilated cardiomyopathy. FMR: Functional mitral regurgitation. MVR: Mitral valve replacement.

Dilated cardiomyopathy (DCM) is often complicated by the appearance of functional mitral regurgitation (FMR). The incidence of FMR complicating dilated cardiomyopathy has been reported in as high as 60% of patients. It is related both to changes in the geometry of the left ventricle and the sub-valvular mitral apparatus, and to dilatation of the mitral annulus leading finally to congestive heart failure. Despite improvements in medical management, approximately 50% of patients with severe CHF die within 3 years of presentation (1). The appearance of FMR has a negative impact on survival of patients with DCM, with a mortality rate of 40% to 70% after 12 months from the diagnosis of FMR (2).

Surgical correction of FMR has been demonstrated to improve symptoms and quality of life and promote reverse LV remodeling in a significant proportion of patients with is- chemic and dilated cardiomyopathy (3-6). It has been demonstrated that mitral repair can be safely performed in DCM patients with severe FMR. However little data is available about the outcome of mitral valve replacement for those subset of patients (4). Mitral annuloplasty using undersized rigid or flexible ring technique, with or without edge-to-edge leaflet suturing is considered the standard to correct mitral regurgitation in those patients (5). However, FMR can reappear in the follow-up of patients treated with ring annuloplasty even with annular over-reduction (6). The objective of this study was to assess the early outcome of mitral valve replacement for severe FMR in patients with DCM.

Lecturer of Cardiothoracic Surgery- Cairo University

* Lecturer of Cardiology, Cairo University

Corresponding by
Ihab Abdelfattah

ihab.m.fattah@gmail.com

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METHODS

Study Population

Between January 2012 and September 2013, eight patients underwent mitral valve replacement with mechanical valves and preservation of whole mitral valve apparatus for severe functional mitral regurgitation secondary to idiopathic DCM. FMR was graded preoperatively by echocardiography into 4 grades by measurement of absolute regurgitant jet area, and/or regurgitant jet area relative to left atrial size. The severity of mitral regurgitation (MR) was graded as: mild, 1+ (jet area/left atrial area <10%); moderate, 2+ (jet area/left atrial area 10–20%); moderately severe, 3+ (jet area/left atrial area 20–45%); and severe, 4+ (jet area/left atrial area >45%). Based on regurgitant jet area, severe FMR was defined as grade 4 with regurgitant jet area equal or more than 8 cm.

Inclusion criteria

- *Idiopathic DCM Patients with severe FMR grade 4*

Exclusion criteria

- FMR patients of ischemic or valvular etiologies
- Pulmonary artery pressure (PAP) >70 mmHg
- EF < 25 %
- Left ventricular end diastolic dimension (EDD) > 7.5 mm
- Patients with severe right ventricular failure
- Patients with severe renal or hepatic impairment

End points

Primary end points: 30 day post operative survival.

Secondary end points: 1-year survival, NYHA class improvement, need for re-hospitalization, left ventricle dimensions and EF changes.

Surgical technique

Conventional median sternotomy, standard cardiopulmonary bypass using bi-caval cannulation. Myocardial protection was achieved using antegrade intermittent cold cardioplegia. Mitral valve replacement was performed with preservation of the whole valve with out excision of any valve leaflets or chordae; this was easily performed due to huge annular dilatation. Sutures were passed from the annulus toward middle of leaflet tissue to pass finally to tip of the leaflet plicating the whole leaflet tissue. Mechanical bi-leaflet valves size 29 and 31 were used in all cases.

Follow-up

Patients were seen and followed up in a heart failure out patient clinic with physical examination, electrocardiography and echocardiography. All patients had an echocardiographic exam at hospital discharge and again at 1-year follow-up.

RESULTS

The mean age of the patients was 56 ± 12.5 yrs. The mean ejection fraction (EF) was less than 40 % (table 1). Most of the patients were in sinus rhythm (67.5 %). Table 1 summarizes the preoperative patient characteristics.

All patients (n=8) underwent mitral valve replacement by a mechanical bi-leaflet valve. Two sizes were used, size 29 in 3 patients (37.5%) and size 31 in 5 patients (67.5%). Concomitant segmental tricuspid valve annuloplasty was performed in 3 patients (37.5%). The baseline clinical and echocardiographic characteristics, together with the relevant operative data are summarized in table 1. Most of the patients were in NYHA grade III-IV (62.5%).

Age (mean ± SD)	56 ± 12.5
EF %	37.4 ± 5.6
LVEDD (mm)	67 ± 4.4
LVESD (mm)	51 ± 8.0
PAP (mmHg)	45 ± 11
NYHA	
II-II	3 (37.5%)
III-IV	5 (62.5%)
AF (%)	3 (37.5%)
Mitral valve size 31	5 (62.5%)
Mitral valve size 29	3 (37.5%)
Concomitant tricuspid repair	3 (37.5%)

AF: atrial fibrillation; EDD: left ventricle end diastolic dimension; EF: ejection fraction; ESD: left ventricle end systolic dimension; NYHA: New York heart association; PAP: pulmonary artery pressure;

Table 1. Preoperative and operative patient characteristics

Hospital survival was 100 %. At hospital discharge there was a significant improvement in NYHA functional class compared to preoperative values (p=0.01). Most of the patients were NYHA class II-III (75%).

The Echocardiography study done at discharge showed decreased left ventricular dimensions as compared to the preoperative values, however with no statistical significance (p=0.1). Nevertheless, there was a significant improvement in EF at discharge. It went up from a mean of 37.4%± 5.6 to a mean of 42% ± 7.6 (p=0.04).

Only one patient (12.5%) stayed in NYHA class IV postoperatively and continued as such at the 1-year follow up. This same patient was the only patient who later needed re-hospitalization for symptoms of congestive heart failure. He had chronic AF, a preoperative EF of 30%, a postoperative EF of 28% and preoperative moderate tricuspid regurgitation with PAP of 65 mmHg. The patient was admitted to the hospital at 8 months for decompensated heart failure, received intravenous diuretics and was later discharged at 9 days after losing the excess edema fluid and improvement of his clinical condition.

The NYHA class of the patients at 1-year did not differ much as compared to hospital discharge data. That is true also for the EF. Other than the single patient who needed re-hospitalization for CHF, no other patient needed re-hospitalization or re-operation during the 1-year follow up period. Table 2 reports postoperative data at hospital discharge and at 1-year follow up.

	Hospital Outcome	One year follow-up
Death	0 (0)	0 (0)
NYHA class		
I-II	1 (12.5%)	2 (25.0%)
II-III	6 (75.0%)	5 (62.5%)
III-IV	1 (12.5%)	1 (12.5%)
Re-hospitalization for HF	--	1 (12.5 %)
EF %	42 ± 7.6	43.2 ± 6.7
LVEDD (mm)	62 ± 4.5	63 ± 4.0
LVESD (mm)	48 ± 4.0	50 ± 4.4

EF: ejection fraction; HF: heart failure; LVEDD: left ventricle end diastolic dimension; LVESD: left ventricle end systolic dimension; NYHA: New York heart association

Table 2. Hospital outcome and 1-year follow-up

DISCUSSION

In patients with idiopathic dilated cardiomyopathy left ventricular dysfunction and/or remodeling lead to functional mitral regurgitation (FMR), which is associated with cardiac mortality and congestive heart failure episodes independently of all other baseline patient characteristics [7]. Surgical correction of FMR has been demonstrated to improve symptoms and quality of life and promote reverse LV remodeling in a significant proportion of patients with ischemic and non-ischemic cardiomyopathy. However, recent data confirm that moderate to severe residual MR, whether ischemic or non-ischemic, remains an independent predictor of cardiac death and heart failure [8]

In the current study we chose to surgically correct only grade 4 severe FMR however others state that even moderate FMR should be surgically corrected (6). We excluded patients with severe right ventricular failure and renal or hepatic failure as this spectrum of patient population has the highest risk of mortality. However the new evolving advent of percutaneous interventions like MitraClip has a new hope for those patients (7). Although there is a well-established data retrieved from literature confirming efficiency of mitral repair with rigid rings in patients with severe FMR secondary to DCM, however recurrent regurgitation after repair in that cohort of patients is a critical issue (8). In our study we decided to replace the mitral valve with bi-leaflet mechanical valves of 29 and 31 sizes, to overcome the recurrence of mitral regurgitation. Those valve sizes were selected with tendency for under sizing to relatively plicate hugely dilated mitral annulus.

All 8 patients in the study survived the immediate postoperative period as well as through the 1-year follow up. This is slightly better than the results reported by Bonis et al in 2011[9]. They reported 3 out of 54 (5 %) hospital mortality. Their patients were subjected to surgical mitral repair with ring. In addition, 70% of their study population was subjected to AF ablation and/ or ventricular resynchronization therapy.

Most of our patients were in sinus rhythm (62.5%), which translated to a good postoperative outcome. In fact the one patient who seemed not to benefit clinically from surgery had chronic AF and severe pulmonary hypertension. He also had a severely dilated left ventricle with LVEDD of 7.4 mm. The patient survived the surgery but remained in NYHA class III-IV postoperatively. He was re-hospitalized for congestive heart failure 8 months postoperative. Many authors reported AF and severely dilated left ventricle to be predictors of morbidity and mortality in patients with non-ischemic heart failure [9,10]

Almost all of our patients had clinical improvement and at least one step-down in their NYHA class (7/8 patients). Postoperatively most of the patients were in NYHA class II-III (6/8) while one patient was in class I-II. This clinical improvement coincided with significant improvement in EF, which stepped up from a mean 37 % preoperative to a mean of 42 % postoperative. Through the 1-year follow up the clinical picture and echocardiographic data have not changed significantly.

These results were well close to the work of Theron et al [10]. The group reported in 2013 the early and mid-term outcome of mitral valve replacement versus mitral repair with under-sizing annuloplasty for chronic FMR in 59 patients. The mitral replacement arm had an early mortality of 2%, had an 8-year survival free from cardiovascular death of 72%, as compared to 3.3% and 60 % respectively for the repair group, although the difference in favor of replacement group was not statistically significant [10]. The most important finding in that study was the incidence of recurrence of mitral regurgitation. Fifty percent of the mitral repair group had recurrence of

significant mitral regurgitation, while none of the mitral replacement group patients experienced recurrence of mitral regurgitation. The team concluded that surgical treatment of FMR could be performed with an acceptable operative risk and mid-term survival. Mitral valve replacement is a reasonable approach, which does not expose patients to mitral regurgitation recurrence, particularly frequent after mitral repair with undersizing annuloplasty [10].

In conclusion, it seems that mitral valve replacement with preservation of whole mitral valve apparatus can provide good early results for patients with non-ischemic DCM and severe FMR.

Limitations of The Study

1- This is a pilot study. It is considered exploring uncharted territory. Very little data is available in the literature regarding mitral valve replacement for severe FMR secondary to idiopathic DCM. Accordingly our patient selection was strict, the sample size was small (8 patients) and their preoperative clinical and echocardiographic characteristics were generally better than what is recorded in the literature.

2- The effective regurgitant orifice (ERO) and the regurgitant volume (RVol) were not routinely adopted to quantify the severity of FMR. Therefore, they were not used for analysis and comparison.

3- This is a single arm study, looking at short-term results of a specific procedure. A comparative pivotal study is needed to compare the outcome of mitral valve replacement to repair, with emphasis on mid-term and long-term outcomes

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