DOES MITRAL VALVE REPAIR IMPROVE THE MID-LONG TERM RESULTS OF MILD TO MODERATE CHRONIC ISCHEMIC MITRAL REGURGITATION

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The optimal management of patients with mild or moderate ischemic mitral regurgitation (MR) who have underwent CABG is not well defined. The aim of this study is to investigate the effects Kay annuloplasty at the time of CABG in patients with mild or moderate MR.

In our prospective study, we identified the patients requiring CABG with ischemic MR during the period of 1996 and 2000. Echocardiography revealed akinesia or aneurysm and mild- moderate mitral regurgitation. Patients with severe MR and with ruptured papillary muscle or chordae were excluded from the study. We separated the patients into two groups; CABG alone (group I, n=45) or CABG + Kay annuloplasty technique (group II, n=23). The patients were followed up a mean of 3.1±0.8 years after operation.

Preoperative mean PAP, left ventricular end-diastolic volume (LVEDV) and left ventricular end-sistolic volume (LVESV) and left ventricular ejection fraction (LVEF) values were analyzed. Mean PAP was 34.2± 8.0 mmHg in group I and 33.4± 10.0 mmHg in group II. Mean LVEDV was 179±23 ml in group I and 173±21 ml in group II. Mean LVESV values were 80±12 ml and 78±11 ml. Preoperative mean EF values were 39.6 %± 2.6 and 40.9 %±2.6. At the postoperative third year mean PAP was 35.5± 7.3 mmHg in group I and 29.9± 7.4 mmHg in group II (p=0.001). Mean LVEDV value was decreased to 151±17ml in group I and 139 ±24 ml in group II. Mean LVESV was decreased to 71± 8 ml in group I to 61±7 ml in group II. Postoperative mean EF value was incerased slightly to 46.3%± 2.3 in group I and increased significantly to 52.6%±1.4 in group II (p=0.001).

In 6 patients MR progressed to severe MR in group I whereas no progression was observed in group II. In comparison to the CABG-alone group, the CABG–annuloplasty group had a significantly improved morbidity.

Mitral valve repair by using Kay annuloplasty technique at the time of CABG for mild or moderate mitral regurgation was associated with improved long term survival without increased operative mortality. Mitral valve repair is the main predictor of survival in ischemic heart disease with mitral insufficiency.

Key words: Mitral regurgitation, coronary artery bypass grafting, mitral valve repair

Ischemic mitral regurgitation remains one of the most challenging management problems in cardiac surgery. Over the past decade, the operative approach to severe ischemic mitral regurgitation has evolved to include surgical revascularization combined with mitral valvuloplasty or replacement. This approach has improved operative mortality and long-term survival in patients suffering severe ischemic mitral regurgitation (MR) (1). However, the optimal management of mild or moderate ischemic mitral regurgitation remains controversial. The presence of mild MR reduces long-term survival. Revascularization alone for moderate ischemic MR improves contractile function and reduces the severity of MR in some patients but fails to do so in many others (2). Some authors advocate CABG alone, whereas others suggest concomitant mitral annuloplasty (3,4). In this study, we prospectively observed all patients in our department who underwent CABG alone or CABG combined with Kay annuloplasty for mild or moderate chronic ischemic mitral regurgitation (5-7).

MATERIAL AND METHODS

In our prospective study we analyzed 68 patients who were admitted to our department because of coronary artery disease and mild-moderate mitral insufficiency during the period of 1996 and 2000. The patients were separated into two groups non-randomly; control group (group I) consisted 45 patients who underwent coronary artery bypass grafting (CABG) alone and study group (group II) consisted 23 patients who underwent CABG and mitral valve valvuloplasty with Kay annuloplasty repair (bilateral commisural plication). In group I, 32 of which were males with a mean age of 68.3±8 years were included. In group II, 16 of which were males with a mean age of 69.7±8 years were included. All patients had undergone echocardiography, coronary angiography and ventriculography. Severity of mitral regurgitation was evaluated echocardiographically and angiographically (8). In mild mitral regurgitation, regurgitant fraction (RF) <30%, regurgitant orifice area (ROA) ≤ 0.1 cm2 by doppler echocardiography, <20% opacification of left atrium by color doppler and left atrium (LA) opacification cleared with each beat in angiography. In moderate mitral regurgitation, regurgitant fraction (RF) 30-50%, regurgitant orifice area (ROA) > 0.1- 0.3 cm2 by doppler echocardiography, 20-40 % opacification of left atrium by color doppler and left atrium from and (LA) opacification did not clear with each beat but opacification was less than left ventricle in angiography. In severe mitral regurgitation, regurgitant fraction (RF) >50%, regurgitant orifice area (ROA) > 0.3 cm2 by doppler echocardiography, >40 % opacification of left atrium by color doppler and left atrium and (LA) opacified with one beat or ejection to pulmonary veins in angiography. Patients with severe mitral regurgitation (MR) (LVESV> 90 ml, regurgitant fraction >75%) and with ruptured papilary muscle or chordae and rheumatic or other origin mitral valve regurgitation were excluded from our study. Echocardiography revealed central regurgitation in all patients. Preoperative mean PAP, left ventricular end-diastolic volume and left ventricular end-sistolic volume and left ventricular ejection fraction values were also analyzed. PAP was higher than 40 mmHg in 11 patients in group I (24.4 %) and 7 patients in group II (30.4 %). In 31 patients in group I (68.8 %) and in 13 patients in group II (57.5 %), mean PAP was >25 mmHg and < 40 mmHg. Mean PAP value in group I was 34.2± 8.0 mmHg and 33.4± 10.0 in group II. Mean left ventricular end-diastolic volume was 179±23 ml in group I and 173±21 ml in group II. Mean left ventricular end-systolic volume value was 80±12 ml in group I and 78±11 ml in group II. Preoperative mean EF value was 39.6%± 2.6 in group I and 40.9±2.6 in group II. In group I, mild mitral regurgitation (MR) was seen in 12 patients, moderate MR was seen in 33 patients whereas in group II, mild mitral regurgitation (MR) was observed in 8 patients, moderate MR was observed in 15 patients. ECG revealed old inferior or posterior MI in 37 patients in group I and 18 patients in group II. In 42 patients in group I and 19 patients in group II echocardiography

revealed posterobasal or inferior severe hypokinesis or akinesis or dyskinesis. Our criteria for determining the mitral regurgitation was that secondary to coronary artery disease are given as following: 1. no historical sign of rheumatic heart disease and connective tissue disorders, 2. no evidence of degenerative changes or congenital defects of the mitral valve on macroscopic appearance or pathological examination, 3. signs or symptoms of myocardial ischemia diagnosed before mitral regurgitation, 4. intraoperative evidence of papillary muscle rupture, 5. lack of intraoperative findings of mitral valve prolapse, commissural fusion, or other stigmata of inflammatory valve disease, 6. central regurgitation due to dilatation of left ventricular cavity. The patients were chosen non-randomly and no significant preoperative risk factors were seen between two groups (11 patients in group I and 6 patients in group II with diabetes mellitus). In group I, 8 patients had NHYA functional class I, 33 patients had functional class II and 4 patients had functional class III. In group II, 6 patients had NHYA functional class I, 15 patients had functional class II and two patients had functional class III (Table 1). 40 patients in group I and 21 patients in group II were in sinus rhythm.

Anesthesia was induced with midazolam and fentanyl. Single venous cannulation was used in control group and bicaval venous cannulation was used in study group. Cardiopulmonary bypass was initiated with a temperature of 28°C. Antegrade St. Thomas II cardioplegia was infused with topical iced saline flush simultaneously. In group II, after the Kay annuloplasty was performed for mitral regurgitation (MR), distal anastomosis were done.

The patients were followed up for 3.1 ± 0.8 years after operation. Data were analyzed with the use of SPSS 9.05 for Windows. All data are expressed as mean±SD. All data for the 2 groups were compared by Mann Whitney U test. Regarding categorical data, the comparison between the groups was performed with Fisher's exact test.

RESULTS

Total cardiopulmonary bypass and aortic cross clamp times were significantly different according to left atriotomy and mitral valve repair (Table 2). The number of distal anastomosis was similar in two groups. After atriotomy was done in group II, we observed

Table 1. Preoperative characteristics of patients.

	Group I (n=45) (control group)	Group II (n=23) (study group)	*P*
Male / Female	32/ 13	16/7	1.000
Mean age (years)	68.3±8	69.7±8	0.672
Diabetes mellitus	11	6	1.000
Hypertension	8	5	0.656
Prior MI	37	18	1.000
NHYA FC I	8	6	0.656
NHYA FC II	33	15	0.692
NHYA FC III	4	2	1.000
Sinus rhythm	41	22	1.000
Mild MR	12	8	0.692
Moderate MR	33	15	0.692
EF(%)	39.6%± 2.6	40.9±2.6	0.782
PAP(> 40 mmHg)	11	7	1.000
PAP(>25mmHg, <40 mmHg)	31	13	0.459
Akinesis or global hypokinesis in LVgram	42	21	0.274
Lack of perfusion on thallium scan	38	19	0.252

Table 2. Operative characteristics of patients.

	Group I	Group II	*P*
Cross clamp time (min)	46.2 ± 7.3	61.3.± 6.9	0.001
Perfusion time (min)	65.7±5.2	83.9±5.7	0.001
Number of grafts	3.2 ± 0.4	3.1 ± 0.5	0.612
Inotropic agents (No of patients)	11	6	1.000
IABP	6	3	1.000
Revision	2	1	1.000
Date of ICU	3.7 ±1.3	2.5± 0.9	0.012
Date of discharge	13.4±1.2	10.1±1.1	0.001
Exitus(hospital mortality)	1	-	1.000

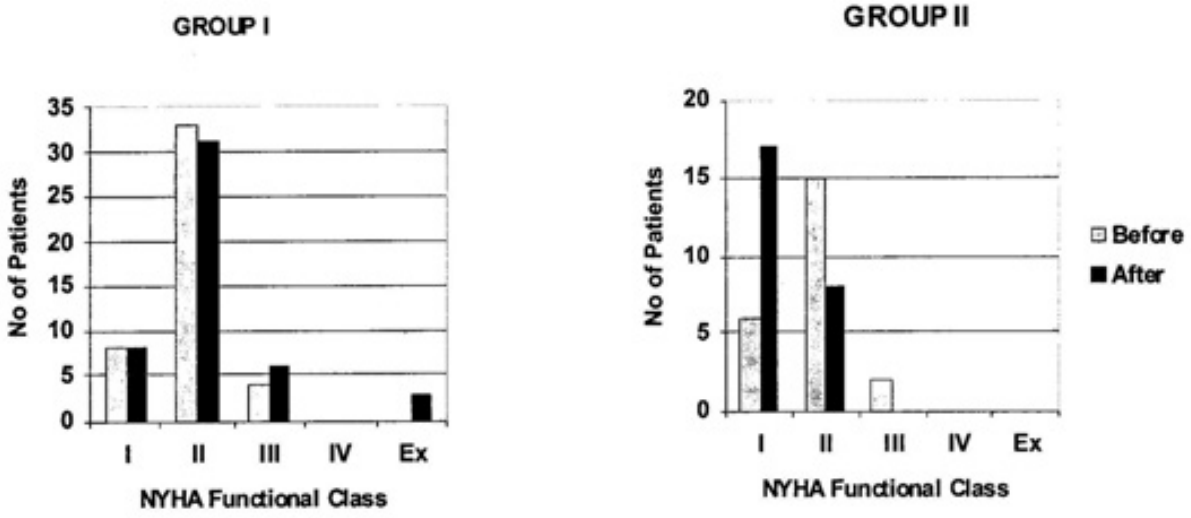

Figure 1. Preoperative and postoperative changes of functional status in group I and group II.

the condition of the mitral valves. LITA graft was used in all patients for LAD artery.

During the early postoperative period in group I, 11 patients and in group II, 6 patients in group II required therapeutic inotropic support more than 5 μg. kg-1. min-1 of dopamine. 2 patients in group I and one patient in group II were revised because of bleeding. Three patients in group I and two patients in group II had respiratory problems. One patient in group I had acute renal failure for 2 days period and treated without any dialysis. One patient in group I died of left ventricular dysfunction during the early postoperative period.

Discharging period of the patients between the two groups were significantly different. In group I, the patients were discharged on the postoperative 13.4±1.2 days whereas in group II the patients were discharged on the postoperative 10.1±1.1 days.

A mean of 3.1 ± 0.8 years follow-up in group I, 8 patients (17.7 %) had NHYA functional class I, 31 patients (68.8 %) had functional class II and 6 patients (13.3 %) had functional class III (one patient was died during early postoperative period, 2 patients were died during follow-up period and excluded from our study). In group II, 17 patients (73.9 %) had NHYA functional class I, 6 patients had functional class II (26.1 %)(Fig 1).

Echocardiography was done per 6 months periodically and after 3.1 ± 0.8 years follow-up period in group I, MR was unchanged in 4 of 12 patients who had mild MR preoperatively. In 7 patients of the same group MR progressed to moderate MR (one patient died in this group and excluded from our study). 11 of 33 patients who had moderate MR preoperatively, MR was unchanged. In 12 patients MR progressed to severe MR (2 patients died during the follow-up period and excluded from our sturdy). In 6 patients MR regressed to mild MR. In 2 patients MR was not observed. In group II, no MR was observed in 6 of 8 patients who had mild MR whereas in 2 patients MR was unchanged. In 3 of 15 patients who had moderate MR, was unchanged. In 8 of patients MR was regressed to mild MR. In 4 patients MR was not observed.

Pulmonary artery pressures (PAP) were compared preoperatively and postoperatively in two groups by echocardiographically. Also preoperative and postoperative left ventricular

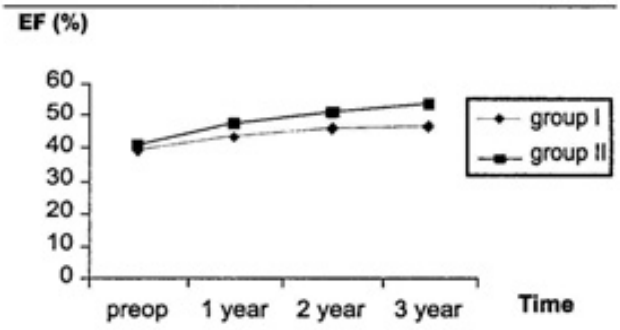

Figure 2. Peroperative LVEF changes in both groups.

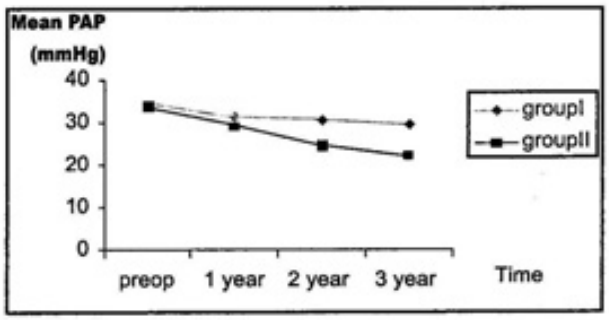

Figure 3. Peroperative mean PAP values in group I and group II.

ejection fractions, end-diastolic and end-systolic volumes were compared. Left ventricular ejection fractions were increased in group II whereas slightly increased in group I (Fig 3,4) . During follow-up period mean PAP values were decreased significantly in group II, which were slightly decreased in group I (Fig5,6). Preoperative mean PAP value in group I was 34.2± 8.0 mmHg and 33.4± 10.0 in group II. At the postoperative first year mean PAP was 31.2± 7.4 mmHg in group I and 28.9± 7.6 mmHg in group II (p=0.0001). At the postoperative third year mean PAP was 29.5± 7.3 mmHg in group I and 21.9± 7.4 mmHg in group II (p=0.001).

After 3.1± 0.8 years follow-up, mean left ventricular end-diastolic volume value decreased from 179±23 ml to 151±17 ml in group I and from 173±21 ml to 139 ±24 ml in group II. Also mean left ventricular end-systolic volume value was decreased from 80±12 ml to 71± 8 ml in group I from 78±11 ml to 61±7 ml in group II. Preoperative mean EF value was 39.6%± 2.6 in group I and 40.9±2.6 in group II. Postoperative mean EF value was increased slightly to 46.3%± 2.3 in group I and increased significantly to 52.6%±1.4 in group II (p=0.001).

Control angiography was performed to all patients and no stenoses or obstruction were observed at the grafts. However in group I, four of the patients who had moderate mitral regurgitation preoperatively were reoperated because of severe MR (three of the patients who had inferior MI and posterobasal akinesis preoperatively) and mitral valve was replaced in all patients. One patient underwent mitral valve replacement with a reoperation of aorto-coronary bypass grafting two years after the first operation. PTCA to right coronary artery was done in two patients and in one patient to circumflex artery.

In group II, no reoperation was needed but in two patients PTCA to right coronary artery was necessary.

COMMENTS

The surgical procedure in mitral insufficiency is still controversial. Ischemic mitral regurgitation can be regressed or recovered by coronary artery bypass grafting alone is one of the opinions (9) whereas increasing the effect of operative mortality by mitral valve replacement (MVR) is another. In most of the studies, operative mortality is above 10% for classical MVR without chordal preservation combined with CABG (10-12). In addition there are lots of studies that prefer to avoid mitral valve replacement in patients who have not severe mitral regurgitation because of many reasons such as; difficulty of mitral valve exposure in patients with small left atrium, complications related to valve replacement and no significant differences in early postoperative periods between two groups of patients who have undergone CABG alone and CABG combined with MVR (13,14) However there are no evident results about late postoperative periods of mitral regurgitation in almost all studies. It is still uncertain that the variation of mitral valve insufficiency in patients who have undergone CABG alone and the necessity of mitral valve reoperation. In our prospective study reoperation of mitral valve was necessary in 5 of the patients in group I during the postoperative 3 years period. Early postoperative period has many complications in patients who have undergone CABG and MVR when compared with CABG alone. Cross clamp times, cardiopulmonary bypass times are increased in patients who underwent CABG combined with MVR. Moreover afterload mismatch can occur when mitral regurgitation is corrected. LVEF is decreased acutely and afterload is increased. Consequently the necessity of inotropic agents

is increased as in our study also. Although the patients who underwent combined CABG and mitral valve repair have more troublesome events during the early postoperative period, their morbidity and long term survival are more favorable. The necessity of reoperation is significantly decreased. Simultaneous myocardial revascularization and mitral valve repair in patients with mild mitral regurgitation has a higher five-year survival rate than in patients with revascularization alone (15). It is not too easy to determine the prognosis of mitral valve in patients who have undergone CABG alone. Mitral regurgitation is regressed or improved in patients who have hibernating myocardium where the papillary muscles attach. The demonstration of viability of the papillary muscle or myocardial area by localized myocardial ischemia is still controversial.

As observed in our study, mitral regurgitation was regressed in a small amount of patients, mitral valve replacement was necessary in a small amount of patients also, but mitral regurgitation was unchanged in most of patients. The functional status of the patients wasn't improved significantly.

The probability of reoperation, effects the patients psychologically. Nowadays postoperative left ventricular functions are preserved favorably in patients whom mitral valve replacement or repair with chordal preservation is done. Postoperative wall stress isn't increased in patients who have undergone mitral valve replacement with chordal preservation when compared to those without preservation. Almost all patients who have mild or moderate MR, have a chance to be repaired during the early postoperative period. In our study group, mitral valve was repaired without the necessity of mitral valve replacement. Long therm survival is similar between repair and replacement group(16) whereas complications of prosthesis valves (anticoagulation, endocarditis) were excluded in repair group.

As a conclusion we suggest that it is beneficial to repair mild or moderate mitral regurgitation combined with coronary revascularisation to improve the patients' functional status, in order to avoid from reoperation by only increasing the cross clamp time.

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