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Effect of Coronary Artery Bypass Grafting on Chronic Ischemic Mitral Regurgitation in Patients with Coronary Artery Disease

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Abstract

Objective: To evaluate outcome following On pump Coronary artery bypass grafting for Coronary artery disease without addressing associated Chronic ischemic mitral regurgitation. To find out the efficacy and adequacy of On pump Coronary artery bypass grafting and factors affecting the outcome in these patients.

Methods: This study was conducted in 30 patients of CAD with trace, mild or moderate MR and treated with coronary artery bypass grafting from January 2012 to December 2012. Group I (n=19) included patients of CAD associated with trivial (1+) or mild (2+) ischemic MR and Group II (n=11) included patients of CAD associated with moderate (3+) ischemic MR. Pre and postoperative data related to clinical profile, ECG, 2D Echocardiography along with preoperative CAG and LV angiogram data, collected. All patients underwent conventional on pump CABG. Patients were followed up at 2 and 6 months after surgery.

Results: There was similar downgrade of congestive heart failure NYHA class, in both the groups. In Group I, there was significant improvement in echocardiographic parameters like LVEDD, LVEF, LVESD, EPSS and ESV. In Group II, there was significant improvement in echocardiographic parameters like LVEDD, LVEF, EPSS and ESV. Postoperative echo revealed downgrading of MR. Mean MR of Group I downgraded from 1.8 to 1.4, postoperatively. Mean MR of Group II downgraded from 3.0 to 2.6, postoperatively. There was no incidence of re-admission due to congestive heart failure or mortality in either of the groups.

Conclusion: Revascularization alone for trivial to moderate ischemic MR achieves low operative mortality, leads to EF improvement, decreases MR and improves NYHA class but longer follow up could shed more light on long term outcomes and survival benefit.

Keywords: CIMR; CABG; CAD.

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Introduction

Patients of CAD undergoing coronary artery bypass grafting not very infrequently have associated mild or moderate mitral regurgitation which is left unaddressed leading to an uncertain postoperative course and follow up. The purpose of this study was to evaluate 6 months outcome in patients with mild or moderate mitral regurgitation after isolated coronary artery bypass grafting.

Ischemic mitral regurgitation is one of the most intriguing and ambiguousfacets in the treatment of coronary artery disease. It has significant impact on outcome. It occurs in almost 20–25% of followed up patients after an ischemic event[1–5] and in nearly half

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of the patients with congestive heart failure (CHF).[6] In patients with CHF, survival chances are inversely proportional to grade of mitral regurgitation (MR). MR grade worsening is linked with increasingly poorer 5-year survival rate.[2]

A substantial number of patients suffering from CAD undergoing coronary artery bypass grafting have accompanying mitral regurgitation.[7] Almost up to 5–8% of patients undergoing coronary angiography have some amount of MR.[8] Concomitant MR negatively influences the survival after an ischemic event even if it is only mild.[9] Mostly, the grade of associated MR is mild.[10] 83% and 94% is the 1-year survival of patients with MR and without MR.[11]

There are well defined management protocols regardingpatients of CAD along with associated MR who are being treated with coronary artery bypass grafting (CABG). Most of the surgeons prefer not address the MR as it would significantly increase the complexity and accompanying risk of the procedure and possibly little benefit in outcome.[12]

Isolated CABG is the treatment of choice for most of the surgeons in presence of ischemic MR. Emory University has supported this school of thought, and reported 5-year survival of 77% amidst patients treated with isolated CABG even in presence of moderate ischemic MR.[13] No significant survival benefit could be appreciated even after 10 years of follow up on comparing with matched cohort of patients of CABG without MR.[14]

Whereas many studies in literature have contradictory inferences that overlooking moderate MR in patients undergoing CABG leads toinferior long-term outcome[15] and significant residual MR as reported by Aklog and colleagues.[16]

Because of these discrepancies, this study was done to assess results of opting for isolated CABG in patients with ischemic MR of grade 1+ to 2+on preoperative echocardiography.

Aim was to evaluate the changes in mild and moderate chronic ischemic mitral regurgitation in patients of coronary artery disease treated with coronary artery bypass grafting alone.

Methods

This prospective and retrospective study was conducted in 30 patients of CAD with trace, mild and moderate MR who under went coronary artery bypass grafting in the Department of Cardiothoracic and Vascular Surgery, PGIMER, Chandigarh from January 2012 to December 2012. Patients with papillary muscle infarction causing its rupture or elongation, recent MI (less than 2 weeks), rheumatic or degenerative mitral valve regurgitation, dilated cardiomyopathy due to etiology other than ischemic, pacemaker implanted, other simultaneous cardiac surgical procedure (LV aneurysmorrhaphy, ischemic VSR closure, valve replacement), severe chronic ischemic mitral regurgitation, renal failure and patients with previous mitral valve surgery were excluded from the study.

Mitral regurgitation was defined as ischemic when caused by CAD in patients who had a previous myocardial infarction before hospital admission for CABG and exhibited normal anatomy of valve and its apparatus. All patients with IMR had restrictive systolic leaflets motion (Carpentier's type III b) or annular dilation (Carpentier's type I), or both. The patients were divided in two groups depending upon the degree of mitral regurgitation assessed by transesophageal echocardiography (TEE). Group I (n=19) included patients of coronary artery disease associated with Trivial (1+) or mild (2+) mitral regurgitation and Group II (n=11) included patients of coronary artery disease associated with moderate (3+) mitral regurgitation.

Preoperative clinical profile, ECG, chest X-ray (PA view), 2D Echocardiography and Coronary angiogram werenoted. A preoperative transthoracic echocardiogram (TTE) was performed by cardiologist at our hospital. Severity of MR was graded, based on the size and characteristics of the regurgitant jet (No MR – 0, Trace/trivial – 1+, Mild – 2+, Moderate – 3+ and Severe – 4+). We included only trivial, mild and moderate MR patients.

Patients underwent conventional multivessel CABG through midline sternotomy on topical and systemic hypothermic cardiopulmonary bypass with antegrade and retrograde cold blood cardioplegia at regular intervals. Left internal mammary artery and the great saphenous vein or only the great saphenous vein was used as conduit. Distal anastomoses were performed on pump with a cross clamped aorta. Proximal anastomoses were performed after applying side biting clamp. Out of 30 patients, 2 patients underwent CABG with 2 grafts, 5 patients had 3 grafts, 15 patients received 4 grafts and 7 patients with 5 grafts. 6 grafts received by one patient. Postoperative follow up, consisting of clinical examination, ECG and 2D Echocardiography at 2 months and 6 months, were recorded.

A postoperative transthoracic echocardiogram (TTE) was performed by cardiologist at our hospital

after 2 and 6 months of surgery in these patients. Degree of MR was recorded on the same scale as above.

Preoperative, operative, and postoperative data was collected prospectively and retrospectively. Data was collected using Microsoft Excel software (Microsoft, Redmond, Washington). The analysis of data (SPSS software) was done by using Descriptive statistical parameters like mean, standard deviation and confidence interval (CI). Continuous variables were analyzed with Student's paired t test. Independent variables were analyzed using Student's unpaired t test. Categorical variables were analyzed with the help of Chi-square test. Dichotomous variables were analyzed with Fisher's exact test. A p value of less than 0.05 was considered to be statistically significant.

Results

The mean age of patients in Group I was 60.9 years and in Group II was 61.9 years. In group I, 13 patients were male and 6 were female whereas in group II, 10 patients were male and 1 was female. In group I, 7 patients were from NYHA class 2, 10 patients from class 3 and 2 patients from class 4. In group II, 3 patients were from NYHA class 2, 5 from class 3 and 3 patients from class 4. There was similar downgrade of NYHA class of angina, in both the groups. The baseline characteristics of patients with CAD and mitral regurgitation with trivial, mild (Group I) and moderate MR (Group II) is shown in Table 1.

Table 1: Base line characteristics of patients with CAD and Mitral Regurgitation with trivial , Mild (Group I) and Moderate MR (Group II).

Characteristic	Group I (N=19)	Group II (N=11)
Mean age, years	60.9	61.9
Male	13 (68.4%)	10 (90.9%)
Diabetes Mellitus	11 (57.8%)	4 (36.3%)
COPD	1 (5%)	0
Hypertension	15 (78.9%)	9 (81.8%)
Renal Dysfunction	2 (10.5%)	3 (27.7%)
CHF	0	2 (18.2%)
NYHA Class III or higher	12 (63.1%)	8 (72.7%)
Angiography Findings		
Anterior descending	19 (100%)	11 (100%)
Circumflex Artery	17 (89.4%)	11 (100%)
Right coronary	17 (89.4%)	11 (100%)
Left Main coronary	8 (42.1%)	3 (27.7%)
Mean MR on Preop ECHO	1.8	3
Mean LVEF, %	37	36
LVEF 40%, OR Less	14	10
Bypass Time, minutes	152	163
Cardiac Arrest Time	93	103

All the patients in the study group underwent on pump Coronary Artery Bypass Grafting. The number of grafts varied from 2 grafts to 6 grafts.

Postoperative echocardiography of these patients was done after twoand six months of surgery and changes were noted and compared with preoperative echocardiographic findings. Post operatively, ejection fraction improved in both the groups. Mean Ejection fraction became 39% from 37% in group I where as group II showed improvement from 36% to 39% mean ejection fraction ($P < 0.05$). When we compared the postoperative echocardiographic findings with preoperative echo in individual group we found certain significant changes in both the groups and are shown in Table 2. In Group I, there were statistically significant differences in NYHA class, LVEF, LVES, EPSS and in ES ($p < 0.05$). In Group II, also we found significant changes in NYHA class, LVEF, EPSS and in ES ($p < 0.05$).

Table 2: Comparison of Preoperative and post operative Echo cardiographic parameters in the two groups.

Parameter	Group I			Group II		
	Preop	Postop	p value	Preop	Postop	p value
Mean MR Status	1.8	1.4	<0.05	3	2.6	>0.05
LVEF,%	37	39	0.001	36	39	0.025
LVEDV	57.2	57.1	0.331	60.9	61	0.34
LVESV	43.8	43.1	0.018	45.7	44.3	0.06
ED	125	125	*	129	127	0.22
ES	79	77	0.003	83	79	0.003
NYHA	2.7	1.1	**<0.05**	3	1.36	**<0.05**

* The correlation and t cannot be computed because the standard error of the difference is 0.

Postoperative echo revealed downgrading of MR. Out of 30 patients, 1 patient had MR 0, nine patients had MR 1+, thirteen patients had MR 2+ and seven patients had MR 3+. Preoperatively, Mean MR of group I was 1.8 which downgraded to 1.4, postoperatively. Group II had preoperative mean MR 3, which downgraded to 2.6 postoperatively. Preoperatively, in group I,out of 19 patients 3 patients had 1+ MR, 16 patients had 2+ MR.In group II, all 11 patients had 3+ MR. Postoperatively, in group I, 1 patient had MR status 0,9 patients had 1+ MR, 9 patients had 2+ MR whereas in group II, 7 patients had 3+ MR and 4 patients had 2+ MR. There was no incidence of re-admission due to congestive heart failure or mortality in either of the groups.

Discussion

Ischemic mitral regurgitation is not so infrequently associated with CAD with previous history of

myocardial infarction. Significance and prevalence of ischemic MR is, quite often, toned-down. The risk of mortality is higher in its presence and directly proportional to the grade of MR. Management of moderate IMR is controversial. Hence, we decided to evaluate patients with is chemiccardiomyopathy who underwent isolated CABG to gauge the impact of trivial to moderate MR on the outcome.

Duarte and associates[14] determined that there was no significant benefit in late survival of CAD patients with or without IMR although we have not included CAD patients without IMR for comparison. Tolis and associates[28] proclaimed sufficiency of CABG alone in case of associated mild to moderate IMR along with ischemic cardiomyopathy supporting our findings of reduction in IMR and improvement in EF. Kim and associates[17] concluded that CABG alone provide similar 5-year survival compared to CABG along with MVR hence we need longer follow up to compare late outcomes like functional status and event free survival. Conversely, Mallidi and colleagues[18] found an increased incidence of symptoms of failureas well asreduced cardiac event free survival in patients with IMR compared with patients without IMR which is contrary to our findings. Schroder and associates[19] showed that, after isolated CABG, in patients with mild or moderate IMR, 5-year survival and event-free survival, was significantly diminished. Grossi and colleagues[20], determined similar conclusions after 10 year follow-up. Calafiore and associates[21] revealed poorer long-term results in patients of mild to moderate MR complicated with left ventricular dysfunction (EF less than 40%).

On the other hand, none of the existing randomized studies are able to conclude that long-term mortality is better if IMR is addressed in conjunction with revascularization. We need further follow up of our patients to compare late outcomes.

In our study, postoperatively, MR improved significantly after revascularization alone even though residual MR was present in all but one. The improvement in MR was reflected in significant improvement in LV function and NYHA class.

Christenson and colleagues[27] assessed CAD patients with LV dysfunction treated with isolated CABG concluded that there was downgrade of MR recorded on postoperative echocardiography, comparable mortality, reduction in NYHACHF status, and absence of requirement for late mitral valve-directed intervention. These results provide close support for our findings.

Duarte et. al.[14] concluded that moderate MR at the time of CABG does not always requires urgical intervention although post operative assessment of residual MR was not done. This also supports our findings. Although, surgeons advocating concurrent mitral valve repair in a case of CABG believe that the advantages of addressing the ischemic MR compensate over and above for the enhanced cross-clamp and pump time along with amplified difficulty. On the other hand, /opponents dissuade unnecessarily increased cross clamp time and addition of complexity leading to increased mortality with no long-term benefit. In our study, cross clamp time and CPB time showed variations which can't be considered significant given that different surgeons operated upon these patients.

Chen and colleagues[16] compared survival rates of patients treated with CABG alone or combined mitral valve repair in patients with ischemic MR, and severe LV dysfunction. They appreciated similar survival rates over a period of 5 years. We believe that this comparison suggests that no long term survival benefit was achieved by addressing the MR at the time of operation. In our study, remarkably, there was no mortality. Performance of a more complex procedure, however, might have contributed to additional operative mortality.

This study finds that an approach of CABG alone is highly beneficial in patients with ischemic cardiac disease and mild to moderate MR. This approach achieves low operative mortality (none so far in our study), produces EF improvement, decreases MR, improves NYHACHF class and expected to achieve long-term survival not surpassed by other approaches.

We believe that the low operative mortality, improved functional and symptomatic state demonstrated in this study indicate that revascularization alone is a safe and effective approach.

The goal of surgical therapy is not only to improve the late survival but also to improve late functional status and late quality of life. However, these goals should be achieved without increasing perioperative morbidity and mortality.

In addition, these patients avoided the morbidity associated with anticoagulation for mechanical prostheses.

Conclusion

Surgical correction of MR provides temporary

reduction in MR without significantly affecting the long-term prognosis. It is difficult to comprehend that by tackling MR, we can over whelm and eradicate the risk associated with added complexity of mitral valve repair to the extent that it not only enhances the long-term survival but also diminishes operative mortality, by addition of a surgical procedure.

Our data revealed that revascularization alone for trivial to moderate ischemic MR achieves low operative mortality, leads to EF improvement, decreases MR and improves NYHA CHF class but longer follow up could shed more light on long term outcomes and survival benefit. In our study, post operatively, MR improved significantly after revascularization alone even though residual MR was observed in all but one.

A large multicentric randomized prospective trial is necessary to consolidate the role of CABG in regression of ischemic MR along with benefits related to long term outcome and survival.

Therefore, until such a trial is performed, we propose a high threshold for mitral valve repair in such patients.

Conflict of Interest: Nil

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