

ORIGINAL ARTICLE

Medicine Science 2018;7(1):114-7

Isolated coronary artery bypass surgery in patients with mild to moderate ischemic mitral regurgitation: Early results

Baris Akca¹, Mehmet Cengiz Colak¹, Olcay Murat Disli¹, Necip Ermis², Cemil Colak³, Bektas Battaloglu¹, Nevzat Erdil¹

¹Inonu University, Medical Faculty, Department of Cardiovascular Surgery, Malatya, Turkey

²Inonu University, Medical Faculty, Department of Cardiology, Malatya, Turkey

³Inonu University, Medical Faculty, Department of Biostatistics and Medical Informatics, Malatya, Turkey

Received 04 September 2017; Accepted 11 October 2017

Available online 28.12.2017 with doi: 10.5455/medscience.2017.06.8716

Abstract

The optimal management of moderate ischemic mitral regurgitation (MR) remains controversial. Some surgeons advocate coronary artery bypass alone, while others suggest concomitant mitral valve annuloplasty. We aimed to evaluate the early results of isolated coronary artery bypass operation on the cases with mild-to-moderate ischemic MR. Between May 2010 and May 2011, 59 patients (64% male, mean age: 50.5 years) with a preoperative diagnosis of mild-to-moderate ischemic MR underwent a coronary bypass operation. Patients evaluated with preoperative and postoperative (in twelve-month period with an average of five months) transthoracic echocardiogram (TTE). Postoperative mortality was not observed in study group. The preoperative functional capacity of the patients as well as the variables of mild MR and moderate MR showed a statistically significant difference in a positive way when compared with the postoperative functional capacity and MR variables. Postoperative TTE evaluation revealed that only 2 cases have severe MR (3,4%) also 62,7 % of patients have mild and 33.9% of patients have moderate MR. While there was a significant difference in a positive way between the preoperative and postoperative period in terms of left atrial diameter, no significant difference was found for the variables of ejection fraction and pulmonary artery pressure. Among the patients whom undergoing coronary bypass surgery, if there is mild or moderate MR revealed with the TTE prior to the operation, performing only coronary bypass operation will be adequate, and our early results in this matter are satisfactory. But, if severe MR revealed with TTE, performance of mitral valve repair or replacement should be evaluated additional to coronary bypass operation.

Keywords: Mitral valve insufficiency, coronary artery disease, coronary artery bypass

Introduction

Although the majority of surgeons accept the fact that mild-to-moderate ischemic MR can possibly be fixed only through coronary artery by-pass grafting (CABG), the discussions over this subject still continue [1]. The first argument on this subject showed that bloodstaining the ischemic area could fix the regional wall activity and MR; while the second argument showed that performing only CABG would not affect the long-term survival or the functional condition; and the third argument showed that including mitral valve surgery in CABG had increased the operative mortality by more than 10% in most studies [1,2].

Nevertheless, most surgeons advocated the fact that mitral valve repair in moderate ischemic MR be performed along with CABG. One of the reasons for these is that chronic ischemic MR is closely associated with the afterload and preload of the heart. A preoperative echocardiography performed demonstrates

only a momentary condition of MR. The patients with mild-to-moderate ischemic mitral regurgitation may come with the findings of congestive heart failure. CABG cannot repair MR due to myocardial damage, and annular and ventricular dilatation, particularly in those who have undergone myocardial infarction [1,3]. The progression of MR may reduce late symptoms as well as long-term survival. Mild or moderate mitral insufficiency can be repaired almost any time without even requiring a mitral valve replacement. The progression of MR may create the need for a mitral valve surgery later on, which also may pose a prominent operative risk [2-4].

The objective of this study was to investigate the effect of isolated CABG surgery in coronary artery disease patients accompanying mild-to-moderate MR on early results, and also investigate the course of mitral regurgitation in the early stage.

Material and Methods

59 patients with mild and moderate MR on whom isolated CABG surgery was performed between May 2010 and May 2011 were incorporated into the study. TTE (ATL HDI-5000; Bothell, WA, USA) performed on the patients prior to the operation, those

*Corresponding Author: Baris Akca, Inonu University, Medical Faculty, Department of Cardiovascular Surgery, Malatya, Turkey
E-mail: dr.baris.akca@yandex.com.tr

revealed severe MR, and mitral stenosis, those who underwent a valve or peripheral phlebotomy concomitantly, those with rupture in the papillary muscle and core, also those with aneurysm in the left ventricle were excluded from the study. MR was graded as mild, moderate and severe. In grading MR, the characteristic of the back flow towards the left atrium was targeted, which is already shown in Table 1.

Table 1. Grading of Mitral Regurgitation

Grade	RJ Size	RJA/LAA	VC Width
Mild	< 1/3 length LA	20–40%	1–3 mm
Moderate	<2/3 length LA	20–40%	3–6 mm
Severe	>2/3 length LA	> 40%	>6 mm

RJ: fault current; LA: left atrium; RJA: fault current area; LAA: left atrial area; VC: vena contracta

Anaesthesia

A standard anaesthesia protocol was performed on all the patients. The patients were monitored after having been taken into the operating room. A pulse-oximetre probe was attached to keep track of the peripheral arterial oxygen saturation. A 20 G-branule was placed into the right radial artery to track the systemic arterial pressure as well as the arterial blood gas. The anaesthetic induction was provided along with 1 mg/kg- 2% lidocaine (Aritmal, Biosel), 0,2-0,3 mg/kg midazolam (Dormicum, Roche), 5 µg/kg fentanyl (Fentanyl Citrate, Abbott) and 0.1 mg/kg vecuronium (Norcuron, Organon). All the cases were made to respire manually (100% O₂) and were intubated while the complete muscle relaxation was being followed up, and they were connected to a mechanical ventilator in the way that the end-tidal carbon dioxide pressure would be 35-40 mmHg (Oxygen flow rate: 45%, tidal volume: 6-10 mL/kg, frequency: 10-12/min) (Drager, Cato edition, Lübeck, Germany). The anaesthetic maintenance was ensured with 10-30 µg/kg fentanyl and 0.1-0.3 mg/kg/hour midazolam according to the hemodynamic condition. For antibiotic prophylaxis, 1 gr of cefazolin sodium was administered through i.v. path prior to the surgical incision. As the standard throughout the operative period; 3 µg/kg fentanyl was administered before incision, before sternotomy and at the beginning of cardiopulmonary bypass (CPB).

Cardiopulmonary Bypass and Myocardial Protection

For cardiopulmonary bypass, a roller pump (Stöckert S5, Munich, Germany), a non-heparin coated oxygenator (Trillium Affinity NT Oxygenator, Minneapolis, USA), a polyvinyl chloride tubing set, and a two-phased venous cannula were used. The prime volume was provided through 1600 mL Ringer's lactate solution, 150 ml mannitol, 1 g cefazolin sodium and 2500 IU heparin.

Mild systemic hypothermia (33-34 °C) and 2,4 L/dk/m² non-pulsatile pump current were used. Throughout the cardiopulmonary bypass, hematocrit was kept between 22-25%, and the mean arterial pressure was tried to be fixed between 50-70 mmHg. The anticoagulation was ensured along with heparin right before the start of CPB in the way that the activated clotting time would indicate to > 480 sec. Myocardium was protected through the antegrade and retrograde cold blood cardioplegia combined with 4:1 blood-crystalloid ratio in the wake of the aortic cross-clamp. Hot blood cardioplegia was provided a few minutes before the removal of the aortic clamp. All the distal and proximal anastomoses were

performed throughout the cross-clamp. CPB was ended when the rectal temperature reached 36 °C and when the cardiac data proved to be on the optimal level. In the termination of cardiopulmonary bypass, 1,3 mg- protamin was used for each 100 IU heparin dose, and then it was neutralized. In the event that the hematocrit level proved to be 20% throughout KPB and

less than 25% during the postoperative period, blood transfusion was performed in that respect. The anaesthetic requirement was met along with 0,1 mg/kg midazolam + 200 µg fentanyl (at the start of 100 µg KPB and during 100 µg- warming up period) + 6 mg vecuronium throughout the cardiopulmonary bypass.

Surgical Technique

The operations were performed through median sternotomy on all the cases. The distal and proximal anastomoses were performed under cross-clamp in all the operations. Before the removal of cross-clamp, retrograde hot blood cardioplegia was provided. As for the graft to be performed in all the cases; the left internal mammary artery was preferred in the revascularization of the left anterior descending artery, whereas saphena vein was preferred in the revascularization of other coronary vessels. On the other hand the postoperative TTE was performed at regular intervals in our hospital, and the degree of mitral regurgitation was recorded, as well (TTE was performed regularly between 3 – 8 months).

Statistical Analysis

The quantitative data were summarized in mean and standard deviation, whereas the qualitative data were summarized in numbers and percentages. The compliance of the data with the normal distribution was evaluated through the Shapiro Wilk test. In the preoperative and postoperative comparisons of the variables, the T-test and Chi Square test were used for the independent variables. P<0.05 was accepted to be statistically significant.

Results

64% of a total of 59 patients were male, and the mean age was between 30 and 78. 60% of the patients had unstable angina, while 20% of them had stenosis in the left main coronary artery. The mean number of vessels bypass performed was 3±1. 30% of the patients had undergone a myocardial infarction before. The mean ejection fraction (EF) was 47,1%. In 35% of the patients was diabetes mellitus, whereas 12% of them had peripheral artery disease for which no surgery was thought to be performed, and 11% of them had chronic obstructive lung disease. No perioperative mortality was observed in the study.

The mean cross-clamp period was 57 minutes, while the mean cardiopulmonary by-pass period was 78 minutes. The mean ventilation time was 7 hours, whereas the mean intensive care stay was 2 days, and the mean period of discharge from the hospital was 7 days. Major complication was not observed in the study.

TTE was performed in the postoperative fifth month on the average. The preoperative functional capacity of the patients as well as the variables of mild MR and moderate MR showed a statistically significant difference in a positive way when compared with the postoperative functional capacity and MR variables (Table 2, P<0.05). Postoperative TTE evaluation revealed that only 2 cases have severe MR (3,4%) also 62,7% of patients have mild and 33.9% of patients have moderate MR. There was no significant difference between the preoperative and postoperative periods in

terms of the left atrial width, EF and Pulmonary Artery Pressure (PAP) variables. The qualitative atrial fibrillation did not show any significant difference between the preoperative and postoperative periods ($P>0.05$) (Table 2).

Table 2. Descriptive Statistics of the Variables

Variable	Before Operation (n=59)	After Operation (n=59)	P value
FC, [n (%)]			
1	4 (6.8)	44 (74.6)	<0.001
2	43 (72.9)	12 (20.3)	
3	12 (20.3)	3 (5.1)	
EF, [mean±SD]	47.8±4.6	48.7±8.8	0.052
PAP, mm Hg [mean±SD]	32.6±6.1	33.8±2.8	0.83
Left Atrium width mm [mean±SD]	40.2±4.1	41.1±4.4	0.086
Mitral Regurgitation			<0.05
Mild MR, [n (%)]	14	37	0.055
Moderate MR, [n (%)]	45	20	
Severe MR, [n (%)]	-	2	
Atrial Fibrillation, [n (%)]	8 (16.7)	10 (16.9)	

FC: Functional Capacity ; EF: Ejection Fraction; PAP: Pulmonary Artery Pressure; MR: Mitral Regurgitation

Discussion

In this study isolated coronary bypass surgery performed to patients concomitant mild or moderate ischemic MR. The evaluation of preoperative and postoperative TTE revealed improvement or continuing same level in most of these patients with mild or moderate MR but only two of them progressed severe MR which follow up with medical treatment.

Our greatest trouble during the early stage of ischemic mitral regurgitation is the concern about not being able to provide sufficient amount of cardiac contraction to leave the cardiopulmonary bypass system after the removal of cross-clamp, if no surgical procedure performed on the valve after the bypass process. In the event, patient can't wean off from the cardiopulmonary bypass system, inotropic agents and supplementary devices are used for cardiac-supporting, and a surgical intervention became necessary to the valve. Each additional intervention performed on the patient extends the period of the pump, which causes extra complications along with it. Additional surgical intervention in case of need to the mitral valve such as valve repair or replacement advised to be performed by experienced surgeons. Moreover, the great problem during the late follow up of these patients is the risk of second open heart surgery.

TTE was shown to have sufficient evaluation in similar studies, therefore we make cardiac evaluations through the use of TTE before and after the operation [5,6]. The thinning (dilution) and stretching (distension) in myocardium after the ischemic mitral regurgitation myocardial infarction causes insufficiency in the mitral valve due to dyskinesia in the ventricle and the elongation in the papillary muscles [7,8].

Some authors conventionally do not recommend mitral valve repair along with CABG practice as far as mild-to-moderate MR is concerned [9,10].

Aklog et al. [1] showed that MR had prominently progressed after performing CABG on the patients with moderate MR. Again, in another study conducted, no prominent difference in terms of survival was found between those with moderate MR who underwent only CABG and those who received treatment for MR [11].

Tolis et al.[12] determined an improvement in the ventricular functions along with the regression in MR after the isolated CABG they had performed on the patients with severe ventricular dysfunction who had mild-to-moderate MR. While the degree of MR regressed from 1.73 to 0.54 almost 3 years after the operation, New York Heart Association (NYHA) regressed from class 3.3 to 1.8. The mean Left Ventricular Ejection Fraction (LVEF) in these patients was 20%.

Also in our study; TTE, which was performed in the postoperative fifth month on the average, the patients' preoperative variables of mild MR and moderate MR showed a statistically significant difference in a positive way when compared with the postoperative MR variables. The recovery in the functional capacity of the patients, though not showing any statistically significant difference in the left ventricle EF, was still found to be statistically significant.

In a study conducted by Kim et al. [13] only in those who underwent a coronary by-pass was 2 degree or more decrease was seen in the mitral regurgitation of 11% of the patients (19 patients). Ogun et al. [14] performed only coronary by-pass on 31 patients with left ventricle dysfunction who had moderate MR, and it was shown that there was recovery in the functional capacity and in the left ventricle ejection fraction during the postoperative early-middle period, while there was a decrease from 1.35 to 0.96 in the degree of MR.

Prifti et al. [15], in their study conducted on 99 patients, with mild-to-moderate ischemic MR, showed that 3-year-mortality in the patients on whom MR-oriented repair was performed along with CABG had proved to be prominently higher than those on whom only CABG was performed. Again, in most series, the operative mortality in those for whom mitral valve repair was included in the coronary bypass operation varied between 9.5% and 15%, whereas this rate proved to be between 3-4% in those on whom only bypass operation was performed [5].

In our series, no operative mortality or morbidity was seen in the patients with mild-to-moderate ischemic MR who underwent coronary bypass surgery.

In the long-term studies conducted on more than 2000 patients, the mortality risk in those with unrepaired mitral regurgitation on whom only bypass was performed had increased twice as much when compared with those on whom concomitant valve repair was performed [5]. Also, Gopal et al. [8] showed that the repair of moderate mitral regurgitation in the selected patients had increased the long-term quality of life.

Conclusions

In conclusion, if mild or moderate MR revealed with TTE prior to the CABG operation, according to our experience there is no need of intervention to mitral valve. But, if severe MR revealed with TTE prior to the CABG, intervention to mitral valve; repair or replacement with CABG surgery should be considered. While

obtaining current early results with our data, novel investigations with prospective, randomized controlled trials in large patient series needed for the late results of these patient group.

References

1. Aklog L, Filsoufi F, Flores KQ, Chen RH, Cohn LH, Nathan NS, Byrne JG, Adamas DH. Does coronary artery bypass grafting alone correct moderate ischemic mitral regurgitation? *Circulation*. 2001;104:I-68-I-75.
2. Izhar U, Daly RC, Dearani JA, Orszulak TA, Schaff HV, Mullany CJ. Mitral Valve Replacement or Repair After Previous Coronary Artery Bypass Grafting. *Circulation*. 1999;100:II-84-II-89.
3. Sade LE. Fonksiyonel mitral yetersizliği. *Anadolu Kardiyol Derg*. 2009;9:3-9.
4. Perez de Isla L, Zamorano J, Quezada M, Almeria C, Rodrigo JL, Serra V, Garcia Rubira JC, Ortiz AF, Macaya C. Prognostic significance of functional mitral regurgitation after a first non-ST-segment elevation acute coronary syndrome. *Eur Heart J*. 2006;27(22):2655-60.
5. Lehmann KG, Francis CK, Dodge HT. Mitral regurgitation in early myocardial infarction: incidence, clinical detection, and prognostic implications. TIMI Study Group *Ann Intern Med*. 1992;117(1):10-7.
6. Yetim M, Karaagac K, Sasmaz A, Yilmaz M. The Relationship Between Left Atrial Mechanical Function and Functional Capacity in Mitral Stenosis. *J Clin Anal Med*. 2013;4(6):458-61.
7. Otsuji Y, Handschumacher MD, Schwammenthal E, Jiang L, Song J-K, Guerrero JL, Vlahakes GJ, Levine RA. Insights from three-dimensional echocardiography into the mechanism of functional mitral regurgitation direct in vivo demonstration of altered leaflet tethering geometry. *Circulation*. 1997;96(6):1999-2008.
8. Gopal AS, King DL, Katz J, Boxt LM, King DL Jr, Shao MY. Three-dimensional echocardiographic volume computation by polyhedral surface reconstruction: in vitro validation and comparison to magnetic resonance imaging. *J Am Soc Echocardiogr*. 1992;5(2):115-24.
9. Di Mauro M, Di Giammarco G, Vitolla G, Contini M, Iacò AL, Bivona A, Weltert L, Calafiore AM. Impact of no-to-moderate mitral regurgitation on late results after isolated coronary artery bypass grafting in patients with ischemic cardiomyopathy. *Ann Thorac Surg*. 2006;81(6):2128-34.
10. DeRose Jr JJ, Toumpoulis IK, Balaram SK, Ioannidis JP, Belsley S, Ashton Jr RC, Swistel DG, Anagnostopoulos CE. Preoperative prediction of long-term survival after coronary artery bypass grafting in patients with low left ventricular ejection fraction. *J Thorac Cardiovasc Surg*. 2005;129(2):314-21.
11. Czer L, Maurer G, Bolger AF, DeRobertis M, Chaux A, Matloff JM. Revascularization alone or combined with suture annuloplasty for ischemic mitral regurgitation. Evaluation by color Doppler echocardiography. *Tex Heart Inst J*. 1996;23(4):270-8.
12. Tolis GA, Korkolis DP, Kopf GS, Elefteriades JA. Revascularization alone (without mitral valve repair) suffices in patients with advanced ischemic cardiomyopathy and mild-to-moderate mitral regurgitation. *Ann Thorac Surg*. 2002;74(5):1476-81.
13. Kim Y-H, Czer LS, Soukiasian HJ, De Robertis M, Magliato KE, Blanche C, Raissi SS, Mirocha J, Siegel RJ, Kass RM, Trento A. Ischemic mitral regurgitation: revascularization alone versus revascularization and mitral valve repair. *Ann Thorac Surg*. 2005;79(6):1895-901.
14. Ogus NT, Us MH, Ogus H, Isik O. Coronary artery bypass grafting alone for advanced ischemic left ventricular dysfunction with significant mitral regurgitation: early and midterm outcomes in a small series. *Tex Heart Inst J*. 2004;31(2):143-8.
15. Prifti E, Bonacchi M, Frati G, Giunti G, Leacche M, Proietti P, Babatasi G, Sani G. Should Mild to Moderate and Moderate Ischemic Mitral Regurgitation Be Corrected in Patients with Impaired Left Ventricular Function Undergoing Simultaneous Coronary Revascularization? *J Card Surg*. 2001;16(6):473-83.