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CORONARY ARTERY BYPASS GRAFTING IN PATIENTS WITH SEVERE LV DYSFUNCTION: EARLY RESULTS

Murtaza A. Chishti¹, Ajay Meena², Gaurav Goyal³, Premraj Nagarwal⁴, Varun Chhabra⁵, Ashish Jain⁶, Deepesh Aggarwal⁷, Ramanand D. Sinha⁸

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ABSTRACT: BACKGROUND: Coronary artery disease with severe left ventricular dysfunction is always a challenge for surgeon and cardiologist. Previous reports showed high mortality (>50%) for operations. Current studies favours surgical revascularization. **MATERIALS AND METHODS AND RESULTS:** Between Jan 2014 to June 2015 n=102 patients underwent coronary artery bypass grafting for coronary artery disease with severe left ventricular dysfunction at our centre. Severe left ventricular dysfunction was defined by ejection fraction less than 30% on two dimensional echocardiogram. Operative criteria for these patients were included preserved wall thickness, angina class III or IV, myocardium viability >20% and good target vessels. Preoperative characteristics and outcomes were analysed. **RESULTS:** No early or late morbidity and mortality occurred. Significant improvement in ejection fraction and relief of angina ($p<0.0055$) was present. 83% operations were done off pump. **CONCLUSION:** Coronary revascularization is good option in patient with severe left ventricular dysfunction particularly patients with angina, good target vessels, preserved wall thickness and viable myocardium >20%. (Words-161).

KEYWORDS: Coronary Artery Disease, Left Ventricular Dysfunction.

INTRODUCTION: Coronary artery bypass grafting (CABG) in patients with poor left ventricular (LV) function remains a surgical challenge and cardiac transplantation may be the only alternative in some cases. Because of poor long-term survival and unsatisfactory results surgeons are still unsure as to the choice between medical and surgical options.¹⁻³ in early reports mortality was as high as 50% so surgical revascularization was not preferred.⁴ more recent studies reported lower mortality rates in surgical management of such patients. Myocardial revascularization in patients with severe LV dysfunction prevents further myocardial damage and induces the recovery. Few studies have shown that these patients benefit most from revascularization, if angina is present.⁵⁻⁶

MATERIALS AND METHODS: The study was conducted in the department of cardiothoracic and vascular surgery, department of cardiac anesthesia and department of cardiology. From January 2014 to June 2015 total 633 patient of coronary artery disease were operated out of which 102 patients had severe LV dysfunction. Severe left ventricular dysfunction was defined by ejection fraction on two dimensional echocardiogram of 30% or less. These patients were studied retrospectively. At our center selection criteria for surgery include angina, preserved LV wall thickness on two dimensional echocardiography, suitable target vessels and presence of >20% viable myocardium on myocardial viability test. Patients with recent cardiac events were medically optimized prior to surgery. We studied the variables that might affect the outcome including age >70 year, sex, angina class, left main disease, diabetes, smoking, hypertension and Renal Dysfunction.

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We looked at use of intra-aortic balloon counter pulsation, inotropic support, ICU stay, hospital stay, post op NYHA class after surgery and in follow-up. In the preoperative assessment diabetes was defined as receiving anti-diabetic medication or insulin for control of blood glucose level. Hypertension was defined as systemic arterial pressure >140/90mmHg or usage of at least one antihypertensive medication. Renal failure was defined as serum Creatinine level >1.5mg/dL. Early hospital mortality and late mortality terms were used to refer the deaths occurring within 30 days postoperatively and thereafter, respectively.

Operative Techniques: After standard anaesthesia induction procedure, a radial artery line, a femoral artery line and a Swan-Ganz catheter were inserted to monitor the systemic pressure, and the cardiac filling pressures. Intra-aortic balloon counterpulsation (IABP) was on standby. All operations were performed through median Sternotomy and Left internal mammary artery (LIMA) was used in all except one patient. Off pump CABG using a tissue stabilizer was our default technique. Criteria to go on pump was concomitant surgeries for other cardiac lesion, rhythm changes, rise in pulmonary artery pressure (systolic >50). Complete revascularization was aimed at in all cases.

Statistical Analysis: Statistical analyses were performed by SPSS/PC+ (ver. 11.5) computer program. The probability (p) less than 0.05 were considered significant. Frequency and %values of categorical variables, and mean, average and standard deviation values of continuous variables were determined. Patient characteristics and hospital outcomes were compared by using t tests for continuous variables and chi-square or Fisher exact test for categorical variables.

RESULTS:

Demography and Clinical Characteristics: Of all 102 patients 84.3% (n=86) were male and 15.7% (n=16) were female. Mean age was 60±5.7years. All patients were in New York heart Association (NYHA) class III or IV. Out of these 48% patients were diabetic, 84% patients were chronic active smoker, 54% patients were hypertensive and 36% patients had all these three risk factors. Two patients had previous history of stroke with complete recovery. One patient had heart block and underwent temporary pacemaker outside with IABP preoperatively and underwent surgery after stabilization. Preoperative left main disease was present in 19% of patients. Echocardiographic ejection fraction (EF) assessed and mean EF was 27±2.66%. Mean Preoperative hemoglobin level was 12±5gm%, preoperative renal function was normal in all patients except one. Preoperative mitral valve regurgitation was present in 41 patients (40%), out of which 16 patients (15%) had moderate mitral valve regurgitation and two patients had severe mitral valve regurgitation and both underwent mitral valve replacement. Cardiopulmonary bypass was used in 17 patients (beating heart surgery was done in 15 patient and two patients underwent surgery with arrested heart where mitral valve replacement was done. (Table 1).

Early Results: No hospital mortality occurred. No perioperative myocardial infarction (MI) {defined by CK MB >90 IU/L and the presence of a new Q wave in two derivations of electrocardiogram (ECG)} observed. Two patients needed re-exploration for bleeding in postoperative period. None of our patient developed renal dysfunction postoperatively. One patient who had renal dysfunction had lower creatinine level in post-operative period and good urine output. Cardiac supportive drug used in immediate postoperative period includes noradrenaline, adrenaline and dobutamine.

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Out of 102 patients 69% of patient required inotropic support for less than 24 hour and only 27% patients required support for more than 48 hours. None of our patient required inotropic support after 96 hour of surgery. 71% of patient managed with only single inotropic support and only three cases required three inotropic support. Postoperative mean ICU stay was 3 ± 1 days. Mean post-operative hospital stay was 9.2 ± 8 days. Immediate post-operative hemoglobin was 9.6 ± 2 and 16% patients. Left internal mammary was used in all patients except one and bilateral mammary were used in one patient. Total 18.6% (n=20) of patient developed atrial fibrillation in post-operative period. Post-operative echocardiography was done on day 6 which showed no deterioration in left ventricular function and mean EF was $35.3\pm 3\%$ after surgery and 67 patients (66%) showed improvement in ejection fraction in post-operative period (Table 2 and 3).

Survival and Relief of Symptoms: In this study no early and late death occurred. Two patients were re-explored for bleeding. None of our patient developed renal failure or respiratory failure. Only complication which occurred in 18.6% patients was atrial fibrillation which was managed with drugs, we preferred amiodarone infusion and used cautiously in these patient. 16.8% (n=17) patient needed cardiopulmonary bypass for safe conduct of revascularization. All patients were angina free till last follow up. There was no cardiac event noticed in post-operative period. Echocardiographic evaluation showed significant improvement in ejection function in post-operative period ($p=0.0003$).

Pre-operative all of our patients were in class III or IV while in post-operative period 92% of patients were in class II or I and this improvement was significant ($p=0.0002$). Echocardiographic assessment in post-operative period showed reduction of mitral regurgitation in 10 patients out of 16 patients who had moderate mitral regurgitation but it was not statistically significant. By multivariate analysis none of the preoperative factor showed any significant association with improvement in ejection fraction and angina.

DISCUSSION: Medical treatment of patients with CAD with severe LV dysfunction helps in certain extent but carries a poor long term prognosis. Luciani.⁷ et al reported that patients with mean LVEF of 22%, the 5-year survival was just 28% with medical treatment. Louie and colleagues.⁸ reported a survival rate of less than 25% in 3 years. The alternative treatment like heart transplantation carries its own morbidity and mortality as well as donor availability and post-operative complications related to immunosuppressants. The Coronary Artery Surgery Study (CASS) reported that there was survival benefit for patients with LVEF $<26\%$ who had a 43.5% 5-year survival with medical therapy versus 63% with surgery.⁹

Islamoglu et al.¹⁰ reported 5.16% of hospital mortality rate, and 78.57% of survival rate in 42.14 ± 19.96 months of follow-up time. In their study they assess the effect of many factors on outcome and they found age >70 year, myocardial preservation techniques, NYHA class III or IV were some factors which affected the outcome.

At our center protocol is to assess first operability of such patients and we decide on the basis of presence of angina, target vessels, preserved myocardial wall thickness in echocardiography, left main disease and viable myocardium more than 20% on myocardial viability test. In such cases we preferred complete revascularization and we preferred off pump surgery to avoid CPB related complications. We aimed at complete revascularization. The indication for CPB mainly was hemodynamic instability, significantly rise in pulmonary artery pressure during cardiac manipulation and positioning and where an additional procedure like mitral valve replacement was needed.

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Atrial fibrillation which occurred in patients was managed with amiodarone. Gatti et al.¹¹ identified early predictors of mortality as prolonged invasive ventilation, acute renal injury and multiple blood transfusions. In our study major advantage was that most of our patient underwent surgery off pump and post-operative renal dysfunction was not a problem. Although we found that there was a drop in hemoglobin level but it was not associated with any morbidity or mortality and we prefer not to transfuse blood in postoperative period unless hemoglobin dropped below 8gms/dl.

Hospital stay was 9.2 ± 2 days. Many of our patients come from far flung areas and a few extra days in hospital are allowed for non-medical reasons.

Gatti et al and islamoglu et al showed significant improvement in ejection fraction and angina in postoperative period. We also found significant improvement in ejection fraction and relief of angina episodes in post-operative period and it was statically significant $p < 0.0003$ and < 0.0002 respectively.

Trachiotis and colleagues found that clinical predictors of mortality were older age, female sex, and diabetes, severity of angina class, hypertension, and CHF.¹² Some of these factors correlated with poor survival, such as diabetes, hypertension, CHF and previous MI were also predictors of postoperative angina.¹² Mickleborough and colleagues showed that predictors of decreased survival were advanced age, functional symptom class IV, and poorly visualized coronary vessels unsuitable for CABG.¹³ Argenziano and colleagues studied 900 randomized patients with LVEF 35%, and identified that the presence of CHF symptoms as well as previous CABG were determinants of mortality, and advanced age, implantable cardioverter-defibrillator (ICD) implantation, and the presence and severity of CHF symptoms were determinants of increased length of stay in hospital.¹⁴

In our study none of preoperative characteristics were associated significantly with outcome. In conclusion, CABG should be considered in suitable patients with LV dysfunction because it considerably improves the LVEF and the functional capacity. In our study mitral valve regurgitation was also improved post-operatively. Off pump CABG is associated with low risk and low morbidity and mortality in such patients.

Limitations of the Study: This study was retrospective, the duration of follow-up of this study was somewhat more limited than those of some current multi-centre based trials. This is single centre, single surgeon study. It needs corroboration in a larger population with longer follow-up.

Follow up- follow up data is complete for all 102 patients. Until last follow up visit 92% of them were in NYHA functional class II or I.

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	n=102
Male	84.3% n=86
Female	15.7% n=16
Diabetes mellitus	48%
Smoker	84%
Hypertension	54%
Diabetes +hypertension + smoker 36%	
Stroke (recovered)	1.8%
Renal dysfunction	0.9%
Heart block	0.9%
IABP (Intra-aortic ballon counter pulsation)	0.9%
Mitral valve regurgitation	
Mild	22.5%(23)
Moderate	15.7%(16)
Severe	1.9%(2)

Table 1: Demography and preoperative characteristics of patients

Peri-operative MI	Nil
Bleeding	2(1.9%)
Post-operative renal dysfunction	Nil
Inotropic support <24 hour	69%
>24 hour	31%
Mean ICU stay	3±1 days
Mean postoperative hospital stay	9.2±8 days
Atrial fibrillation	18.6%
Death	Nil
Table 2: Post-Operative Outcome	

	Pre-operative	Post-operative
Angina		
Mean Ejection fraction	27±2.66	35.3±3 (p<0.005)
NYHA class I/II	nil	92%
III/IV	100%	8%(p<0.005)
Table 3: Pre and Post-operative comparison of ejection fraction and angina		

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AUTHORS:

1. Murtaza A. Chishti
2. Ajay Meena
3. Gaurav Goyal
4. Premraj Nagarwal
5. Varun Chhabra
6. Ashish Jain
7. Deepesh Aggarwal
8. Ramanand D. Sinha

PARTICULARS OF CONTRIBUTORS:

1. Assistant Professor, Department of Cardiothoracic and Vascular Surgery, Mahatma Gandhi University of Medical Sciences and Technology, Jaipur.
2. Assistant Professor, Department of Cardiothoracic and Vascular Surgery, Mahatma Gandhi University of Medical Sciences and Technology, Jaipur.
3. Assistant Professor, Department of Cardiology, Mahatma Gandhi University of Medical Sciences and Technology, Jaipur.
4. Assistant Professor, Department of Cardiology, Mahatma Gandhi University of Medical Sciences and Technology, Jaipur.

FINANCIAL OR OTHER

COMPETING INTERESTS: None

5. Assistant Professor, Department of Cardiology, Mahatma Gandhi University of Medical Sciences and Technology, Jaipur.
6. Senior Resident, Department of Cardiac Anesthesia, Mahatma Gandhi University of Medical Sciences and Technology, Jaipur.
7. Assistant Professor, Department of Cardiology, Mahatma Gandhi University of Medical Sciences and Technology, Jaipur.
8. Assistant Professor, Department of Cardiology, Mahatma Gandhi University of Medical Sciences and Technology, Jaipur.

NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Murtaza A. Chisti,
Assistant Professor,
Department of Cardiothoracic and
Vascular Surgery,
Mahatma Gandhi University of Medical
Sciences and Technology, Jaipur.
E-mail: cmurtazaa@gmail.com

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