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SURGICAL REVASCULARIZATION IN ISCHEMIC CARDIOMYOPATHY WITH FIXED PERFUSION DEFECT

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All the authors contributed significantly to the research that resulted in the submitted manuscript.

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ABSTRACT

Objective: The object of study was to evaluate our six years data of surgical revascularization in ischemic cardiomyopathy

Methodology: This descriptive cross sectional study was conducted at National Institute of cardiovascular diseases Karachi from January 2007 to January 2014. Patients were followed for 6 months. All the patients with Ischemic Cardiomyopathy who underwent coronary artery bypass grafting and had a preoperative left ventricular ejection fraction less than or equal to 35% were included. Left ventricular ejection fraction was determined by transthoracic echocardiography. Indication for surgery was predominance of anatomical nature of coronary artery disease. Functional improvement was evaluated through NYHA class improvement.

Results: A total of 34 patients were included in this study. There were 22 (64.7%) males and 12 (35.3%) females with mean age of 69.3 years. An average of 2.9 ± 0.67 coronary bypass grafts per patient were performed. In-hospital mortality was 14.7% (5 patients). The 6 month survival rate was 92.8%. While NYHA calss improvement was observed in 52.9% of survivors at six month.

Conclusion: In selected patients with severe ischemic left ventricular dysfunction and no tissue viability, coronary artery bypass grafting is high risk procedure. Improvement in functional class was documented in survivors. CABG may be considered in ischemic cardiomyopathy in selected cases.

Key Words: Revascularization, Ischemic Cardiomyopathy, Coronary Artery Bypass Graft

INTRODUCTION

Coronary artery disease is leading cause of heart failure.[1] Different options for management of ischemic heart failure include guideline directed medical therapy, revascularization, surgical ventricular reconstruction and cardiac transplantation and stem cell therapy.[2] Device therapy like ventricular assist devices and total artificial heart and cardiac restraint as well as many other modalities are still under trial phases.[3]

Role of surgical revascularization is always debated in ischemic heart failure secondry to high early mortality and undefined long term benefit .In fact, Surgical Treatment of Ischemic Heart failure (STICH) trial, was the first of the randomized trial addressing the impact of revascularization on ischemic heart failure.[4] Surgical Treatment for Ischemic Heart Failure (STICH) trial indicate that with CABG, the reduction of mortality benefit is not statistically significant (hazard ratio [HR], 0.86; p = 0.12). However, CABG is superior in reducing cardiovascular deaths (HR, 0.81; p = 0.05), and the combination of cardiovascular deaths and cardiovascular hospitalizations (HR, 0.74; p < 0.001) compare to guidline directed medical therapy. The results of STICH trial instead of answering this question left the long list of unresolved questions. The evidence base for the benefits of revascularization is even weaker when angina is not present in patients with ischemic cardiomyopathy. In this specific subset of patient population the potential benefits of revascularization must be weighed against the high periprocedural risks. We reviewed the early and midterm (6 month) results of surgical revascularization in ischemic cardiomypapthy with graftable coronary aretery disease and attempted to identify patients likely to benefit from this therapy. We presented a multicentre data of surgical revascularization by single surgeon in patients with severe LV systolic dysfunction.

METHODOLOGY

This descriptive cross sectional study was conducted in National Institute of Cardiovascular Diseases (NICVD), Karachi from January 2007 to January 2014. Patients with Ischemic cardiomyopathy who underwent CABG by a single surgeon were included. These surgeries were conducted in three different hospital.

All the patients irrespective of age and sex with left ventricular Ejection Fraction <35% and functional class NYHA III-IV, angina class I-II or no angina and fixed perfusion defect were included in this study. Patients were followed for six month by surgical team.

Patients who had concomitant valve surgery and/or aneurysmectomy were excluded from the study. Similary patients requiring non elective surgery ,on ionotropic support or on mechanical cardiac support were also excluded from study.

All the patients underwent CABG by a single surgeon (m.m) using Onpump with two stage venous cannula and aortic root vent. Myocardial protection was achieved by means of moderate systemic, topical hypothermia and cold blood cardioplegia administered into the ascending aorta before each graft or repeated after 15 minutes what ever came first. Left internal mammary artery (LIMA) to Left anterior descending artery (LAD) was planned in every patient unless IMA was damaged or it had low flow. Operative course is mentioned in table 2.

Follow-up was obtained from hospital records and from surgeon's personel data base . Post operative course along with early and six month outcome is shown in table 3.

All the data were analyzed by SPSS (Statistical Package for Social Sciences) Version 19.0 for Windows. Categorical variables were expressed as numbers and percentages while continuous variables were expressed as mean ± SD (Standard deviations)

Student t-test was used for comparison of quantitative/continuous variables with outcome (NYHA improvement). Chi-square test was used for comparison of

Table 1: Patient Characterstics and Disease Pattern with Comorbidities

Variables	Number
Gender	
Male Number (Percent)	22 (64.7%)
Female Number (Percent)	12 (35.3%)
Age in years (Mean ± S.D)	69.3 ± 9.23
Diabetes Number (Percent)	22 (64.7%)
Hypertension Number (Percent)	24 (70.6%)
Smoker Number (Percent)	19 (55.9%)
PVD Number (Percent)	5 (14.7%)
COPD Number (Percent)	11 (32.4%)
CKD Number (Percent)	5 (14.7%)
Mitral regulative (MR)	
0 Number (Percent)	26 (76.5%)
1 + Number (Percent)	4 (11.8%)
2 + Number (Percent)	4 (11.8%)
Systolic diameter Number (Percent)	40.4 ± 4.28
Diastolic diameter Number (Percent)	55.8 ± 5.04

PVD = Peripheral Vascular Disease, COPD = Chronic Obstructive Pulmonary Disease
CKD = Chronic Kidney Disease

Table 2: Operative Courses

Variables	Number	
Bypass graft (Mean ± S.D)	2.9 ± 0.67	
Bypass time In minutes (Mean ± S.D)	77.0 ± 8.78	
X - time In minutes (Mean ± S.D)	48.0 ± 8.22	
IMA Number (Percent)	27(79.4%)	
Ionotrope		
1 - Number (Percent)	20	58.8%
2 - Number (Percent)	14	41.2%
IABP support Number (Percent)	7	20.6%
Weaning failure Number (Percent)	3	8.8%

qualitative/categorical variables with outcome NYHA improvement). A p-value of <0.05 was considered as statistically significant.

Table 3: Post Operative Morbidity and NYHA Improvment

Complication		
None	16	47.1%
Yes	18	52.9%
Type of complication		
Atrial fibrillation	9	26.5%
Low cardiac output	8	23.5%
Cardiac arrest	3	8.8%
Prolong ventilation	3	8.8%
CVA	2	5.9%
Wound infection	2	5.9%
Perioperative Infarction	1	2.9%
Mediastinal bleed reqire exploration	3	8.8%
Acute kidney injury	3	8.8%
Leg Ischemia	1	2.9%
Psychosis	3	8.8%
Tamponad	1	2.9%
NYHA improvement	18	52.9%
Mortality	7	20.6%
30 days	5	14.7%
1 Month - 6 months	2	5.9%

Table 4: Comparison of Patients Characteristics with Outcome (NYHA)

Variables	No. of subjects (n=34)	NYHA Improvement		P-value
		Yes (n=18)	No (n=16)	
Gender				
Male	22 (64.7%)	10 (55.6%)	12 (75.0%)	0.236
Female	12 (35.3%)	8 (44.4%)	4 (25.0%)	
Age in years (Mean ± S.D)	65.6 ± 9.21	65.6 ± 9.21	73.6 ± 7.38	0.009
Diabetes	22 (64.7%)	9 (50.0%)	3 (18.8%)	0.059
Hypertension	24 (70.6%)	11 (61.1%)	13 (81.3%)	0.198
Smoker	19 (55.9%)	11 (61.1%)	8 (50.0%)	0.515
PVD	5 (14.7)	2 (11.1%)	3 (18.8%)	0.530
COPD	11 (32.4%)	7 (38.9%)	4 (25.0%)	0.380
CKD	5 (14.7%)	2 (11.1%)	3 (18.8%)	0.530
Mitral regulative (MR)				
0	26 (76.5%)	17 (94.4%)	9 (56.3%)	
1+	4 (11.8%)	1 (5.6%)	3 (18.8%)	0.025
2+	4 (11.8%)	-	4 (25.0%)	
Lt. Internal Mammary Arteries (LIMA)	27	15 (83.3%)	12 (75.0%)	0.549
Systolic diameter	40.4 ± 4.28	38.6 ± 2.73	42.5 ± 4.80	0.005
Diastolic diameter	55.8 ± 5.04	42.5 ± 4.80	58.4 ± 4.31	0.003

RESULTS

A total of 34 patients were included in this study. There were 22 (64.7%) males and 12 (35.3%) females with mean age of 69.3 years. Patient characteristics and comorbidities are shown in table 1.

NYHA improvement patients was observed in younger population, mean age (65.6 ± 9.21), with preserved left ventricular dimension , Systolic diameter (38.6 ± 2.73), Diastolic diameter (42.5 ± 4.80) as compared to no NYHA improvement in patients witn mean age (73.6 ± 7.38, p<0.01), systolic and diastolic dimensions (SD 42.5 ± 4.80 & DD 58.4 ± 4.31 p<0.01). NYHA improvement was also oberved in patient witn ≤ + 1 MR (94.4%) as compared to NYHA not improved in patients with ≥ +2 Mitral regurgitation (56.3%, p < 0.05) as shown in table 4. NYHA improvement was significant in patients with postoperative morbidity 27.8% as compared to patients with unfavorable postoperative course 81.3%, 37.5% (p<0.05) shown in Table 5.

Table 5: Comparison of Operative and Postoperative Course with Outcome (NYHA)

Variables	No. of subjects	NYHA Improvement		P-value
		Yes (n=18)	No (n=16)	
Bypass graft (Mean ± S.D)	2.9 ± 0.67	2.8 ± 0.43	3.2 ± 0.83	0.076
Bypass time (minutes) (Mean ± S.D)	77.0 ± 8.78	75.2 ± 8.48	79.0 ± 8.96	0.216
X – time (minutes) (Mean ± S.D)	48.0 ± 8.22	45.7 ± 7.39	50.8 ± 8.47	0.068
Lt. Internal Mammary Arteries (LIMA)	27 (79.4%)	15 (83.3%)	12 (75.0%)	0.549
Ionotrope				
1	20 (58.8%)	11 (61.1%)	9 (56.3%)	0.774
2	14 (41.2%)	7 (38.9%)	7 (43.8%)	
IABP support				
Yes	7 (20.6%)	2 (11.1%)	5 (31.3%)	0.147
No	27 (79.4%)	16 (88.9%)	11 (68.8%)	
Weaning failure				
Yes	3 (8.8%)	1 (5.6%)	2 (12.5%)	0.476
No	31 (91.2%)	17 (94.4%)	14 (87.5%)	
Morbidity (Complications)	18 (52.9%)	5 (27.8%)	13 (81.3)	0.002
Atrial fibrillation	9 (26.5%)	4 (22.2%)	5 (31.2%)	
Low cardiac output	8 (23.5%)	1 (5.6%)	4 (25.0%)	
Cardiac arrest	3 (8.8%)	-	3 (18.7%)	
Prolong ventilation	3 (8.8%)	-	3 (18.7%)	
CVA	2 (5.9%)	-	2 (12.5%)	
Wound infection	2 (5.9%)	-	2 (12.5%)	
Mortality	7 (20.6%)	1 (5.6%)	6 (37.5%)	0.021
Early (Day 30)	5 (14.7%)	1 (5.6%)	4 (25.0%)	
Late (6 months)	2 (5.9%)	-	2 (12.5%)	

DISCUSSION

Heart failure is a growing and well-recognized public health problem. Heart failure is a leading cause of frequent hospitalization. It is responsible for decrease survival due to sudden cardiac death, myocardial infarction and renal failure. Coronary artery disease (CAD) specially after myocardial infarction (MI), is a major risk factor for heart failure . The etiology of patients presenting with symptoms of either denovo (44%) or worsening (56%) heart failure was commonly reported to be ischemic (46%) while a third of patients with acute heart failure of non ischemic origin had increased blood levels of troponin, suggesting myocardial injury.[5] Outcome of medical therapy remains unsatisfactory in this subset of patient population with mortality as high as 72 %by 10 years, other therapeutic modalities such as revascularization or resynchronization have to be considered.[6-9] Coronary artery bypass grafting is one of the standard method of myocardial revascularization for multivessel coronary artery disease. Many well controlled randomized prospective trial achieved the primary endpoint that CABG relieves symptoms and prolongs life in patients with multivessel advanced coronary artery disease and results has been repeated in every decade since the 1960's following the beginning of coronary artery bypass grafting.[6,8,10] Nevertheless its role in patients with ischemic heart failure is still not defined due to absesnce of any randomized trial prior to STICH trial.[11,4] The benefits of coronary revascularization for patients with heart failure and CAD for symptomatic improvement, slow or reverse disease progression, or improve prognosis are less certain. Patients in whom LV dysfunction is predominantly due to hibernating or stunned myocardium have been shown to improve function and survival following surgical revascularization.[12-16] However, many of previous studies suggestive of a positive association between myocardial viability and outcome have been retrospective. It is also uncertain in most of these studies whether the decision to perform CABG may have been driven by the results of the tests or there was adjustment for other important variables were adequate and patients who did not undergo CABG weather received aggressive medical therapy for heart failure or not.[17] Furthermore data on the role of viability testing from observational studies are conflicting.[18] Samady et al, failed to show difference in outcome in both groups of patients whether improvement of LVEF after CABG surgery observed or not.[19] Outcomes for patients with coronary artery disease have improved in recent years with advances in both medical therapy, devices as well as advances in CABG therapy.[20-23] Follow up of STICH trial regarding the quality of life over the period of 36 month favours CABG plus medical therapy for important clinical improvements in quality of life in ischemic left ventricular dysfunction and multivessel coronary artery disease compared with medical therapy alone.[4,24] Rouleau JL et al, suggest for high risk of mortality for these patients undergoing CABG that is eliminated by 2 years and thereafter do better for long term while role of viability assessment in decision of therapeutic approach is questionable in these patient.[25] However Inspite of suggested benefit of CABG in this subset of population it has been observed that patient with decrease exercise capacity; unable to walk 300 m or with a PAS $\leqslant$ 55 had higher mortality during the first 60 days with CABG and similar 5-year mortality with CABG compared with medical therapy, whereas those with better exercise capacity have improved survival with CABG.[26]

CONCLUSION

In selected patients with severe ischemic left ventricular dysfunction and no tissue viability, coronary artery bypass grafting is high risk procedure. Improvement in functional

class was documented in survivors. CABG may be considered in ischemic cardiomyopathy in selected cases.

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