# Efficacy Of Off Pump Coronary Artery Bypass Grafting For Low Ejection Fraction In Patients

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**Abstract**

**Introduction:** Coronary artery disease is the most common cardiovascular disease and it is the major cause of death in the middle aged and older people in the most developing countries. In south Asian region increased prevalence and excess mortality in coronary artery disease is reported by several studies. Revascularization surgery in such patients with amenable coronary anatomy is a valid option. **Objective:** The purpose of this study is to evaluate the safety and efficacy of off pump coronary artery bypass grafting for EF e"35% and EF <35% and also to compare between pre and postoperative echocardiographic findings in this two groups. **Materials & Methods**: This study was conducted in the Department of Cardiac surgery, Bangabandu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh. Study period was from June 2017 to July 2019. It was a Prospective Cohort Study. The study was carried out in patients with Ischemic Heart Disease (IHD) who underwent isolated off pump coronary artery bypass graft surgery. The preoperative, at discharge, 1 month and 3 month postoperative follow up data of total 60 patients in two groups ( EF e"35% and <35%) who underwent isolated off pump coronary artery bypass grafting. **Results:** Total number of 60 patients were selected for off pump coronary artery bypass surgery. Age distribution Group1 patients, highest number of percentage 60% were in 41-50 years age group and both 51-60 and 61-70 years age group percentage were equal that is 20%. Among them 30 patients ejection fraction was ≥35 % (Group1) and 30 patients ejection fraction was <35% (Group 2). The findings of the study obtained from data analysis are presented below. Whereas among Group 2 patients highest percentage were in 61-70 years age group and both 41-50 and 51-60 age group patients were 9 %. In group 1 preoperative LVIDd and LVIDs was 54.86±3.45 mm and 45.23 ±4.13mm and LVEF was 42.7±4.66. Postoperatively at 3 month follow up the LVIDd 45.43±5.03 mm, LVIDs 34.7±5.33 mm and LVEF 53.46±5.06. The improvement of mean LVIDd and LVIDs is statistically significant ($p<0.001$) and ($p<0.05$) respectively. But improvement of LVEF is not statistically significant ($p>0.05$). Similarly in group 2 patients preoperative LVIDd, LVIDs and LVEF is 67.06±3.67mm, 59.1±4.35mm and 29.26±4.25. Postoperatively at 3 months follow up of this group the LVIDd, LVIDs and LVEF is changed to 57.56±4.96 mm, 48.3±5.53 mm and 38.93±6.03. The improvement of mean LVIDd and LVIDs is statistically significant ($p<0.001$) and ($p<0.05$) respectively. And the improvement of LVEF is also statistically significant ($p<0.001$). Significant improvement in terms of CCS grade and NYHA class was also observed specially in <35% ejection fraction group at 3moths follow up. **Conclusion:** We concluded that off pump coronary artery bypass grafting can be safely performed to the patients with normal and poor left ventricular ejection. Hence we recommended that off-pump CABG can be safely carry out in case of <35% ejection fraction patients.

**Key Words:** Beating Heart Surgery, Coronary artery bypass, Low Ejection Fraction.

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## I Introduction

Coronary artery bypass grafting can be done with or without using cardiopulmonary bypass (CPB). In off-pump coronary artery bypass (OPCAB) heart continues to beat except the portion to be anastomosed immobilized by commercially available stabilizing devices. Coronary blood flow is maintained by intracoronary shunt. In recent years OPCAB is done to avoid CPB related complications like pulmonary dysfunction, increased bleeding tendency & renal failure. From the beginning of cardiac surgery the contribution of postoperative pulmonary complications to morbidity & mortality was recognized. Coronary artery disease is the most common cardiovascular disease and it is the major cause of death in the middle aged and older people in the most developing countries. In south Asian region increased prevalence and excess mortality in coronary artery disease is reported by several studies. Moreover this disease starts at young age and more aggressive presentation. Socioeconomic improvement and changes in life style in respect to increased saturated fat intake decrease in physical activity, increasing body weight and consequently increasing rate of Diabetes Mellitus, Dyslipidemia and Hypertension in the population contribute to increase in coronary artery disease. According to the latest WHO data published in April 2011 Coronary Heart Disease Deaths in Bangladesh reached 163,769 or 17.11% of total deaths. Bangladesh ranks 25th position in the world in respect to cause of death due to coronary artery disease [1]. Significant morbidity and mortality due to ischemic heart failure is well documented.

Revascularization in such patients with amenable coronary anatomy has yielded significant functional improvement [2]. However; left ventricular (LV) dysfunction has been clearly shown to be a predictor of perioperative morbidity and mortality during conventional coronary artery bypass grafting (CABG) on cardiopulmonary bypass (CPB). An analysis from the New York State cardiac surgery data-base including patients who underwent CABG from 1997 to 1999 showed that in-hospital mortality and morbidities were significantly higher in patients with depressed LV function compared with patients with normal LV function [3]. The use of substantial inotropic and vasopressor support is difficult to quantify but is clearly a frequent and integral component of cardiac surgery in patients with significant LV dysfunction. The use of an intraaortic balloon pump (IABP) is a somewhat more definitive outcome, and in many settings, reflects the next step beyond inotropic support. Cross clamp-induced myocardial ischemia and adverse systemic effects of CPB may produce greater overall physiologic derangement in patients with ventricular dysfunction. Off-pump coronary artery bypass (OPCAB) obviates these factors and may provide a benefit [4]. Historically, coronary artery bypass grafting (CABG) in patients with LV dysfunction was associated with high perioperative mortality [5]. However; advances in surgical techniques have led to improved outcomes, making CABG a relatively safe procedure in selected high-risk patients [6]. The development of specialized techniques, tissue stabilizers and apical suction devices allows the application of off-pump CABG to almost all patients, as surgeon experience matures. Furthermore, there are several reports that off-pump CABG is a safe alternative to on-pump grafting in high-risk patients such as redo CABG cases or those with advanced age, female sex, or impaired LV function.[7-9] Several prospective nonrandomized studies have supported the assumption that patients with the worst preoperative prognoses would benefit most from a less invasive procedure, avoiding cardiopulmonary bypass and cardioplegic arrest [10]. The safety of OPCAB techniques in multivessel revascularization has been confirmed in this group of patients [11]. The purpose of this study is to assess the short term outcome of OPCAB in patients with LV dysfunction. CABG provides a survival benefit over medical therapy alone in patients with LV dysfunction and coronary artery disease [5, 12]. Alternatives to CABG, such as implantation of LV assist devices and transmyocardial laser revascularization, are restricted; therefore, CABG offers the only feasible chance of improved survival for most patients with severe LV dysfunction [13, 14]. Nevertheless, the out- comes have often been controversial and depend on patient selection, baseline workup, and critical decision- making.[15] In a systematic review of CABG trials, Nalysnyk and colleagues identified low EF, history of stroke, myocardial infarction, or heart surgery, and the presence of diabetes or hypertension with increased 30-day mortality [16].

## II Materials & Methods

This study was conducted in the Department of Cardiac surgery, Bangabandu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh. Study period was from June 2017 to July 2019. It was a Prospective Cohort Study. The study was carried out in patients with Ischemic Heart Disease (IHD) who underwent isolated off pump coronary artery bypass graft surgery. Total number of patients was 60 (Sixty). Sampling was Purposive.

**Patients were divided in Two Groups.**

Group 1: 30 (Thirty) patients with Ejection Fraction (EF) ≥35 %.
Group 2: 30(Thirty) patients with Ejection Fraction (EF) <35%.

**Inclusion criteria:**

a) Only IHD patients with EF below 35% and above 35% who undergo elective Off Pump CABG.

**Exclusion criteria:**

a) Patients undergo combined CABG and valvular or congenital cardiac procedures.
b) Systemic disease such as end stage renal disease, hepatic failure, respiratory failure.
c) Previous history of cardiac surgery.
d) Emergency CABG.
e) Redo CABG.

**Study Procedure:** Patients admitted for off pump coronary artery bypass grafting that fulfills the selection criteria was enrolled in the study. Cases were selected purposively. Detailed history, clinical examination and relevant investigation reports of all patients were recorded in the data collection sheet preoperatively. All patients were premedicated with tablet midazolam 7.5 mg per oral the night before surgery. Morphine sulphate (0.1 mg/kg) intramuscularly (I.M.) and tablet Metoprolol 50 mg orally will be given 60 minutes before the operation. Patients were taken to the operating room, oxygenation will be done by face mask with 50% oxygen. Peripheral venous catheterization and central venous catheterization in the internal jugular vein was performed with all aseptic precautions. Standard anesthetic technique including induction, maintenance and weaning /recovery were followed for the both procedure. Both the group was operated by same surgical team. A median sternotomy was done and at the same time Great saphenous vein was harvested and prepared for graft. Internal mammary artery was prepared for the pedicle graft. The distal anastomosis of reverse saphenous venous graft was done with cross clamp. Echocardiography was done to determine Ejection Fraction (EF %) by modified Simpson's method using two dimensional (2D), M mode and color Doppler echocardiography pre operatively, at the time of discharge from hospital, 1 month and 3 months after surgery. All data was collected and recorded in data collection sheet. Data editing and analysis was done. Data and results will be presented in the form of tables and diagram where applicable. Statistical analysis was conducted on SPSS (Statistical package for the social sciences) latest version as per availability for windows software. Sensitivity, specificity and data accuracy was

calculated. Parametric data was expressed in mean ± SD. Test of significance was done and level of significance will be defined as p value <0.05. The difference of LVEF between <35% and ≥35 % ejection fraction patients was compared by unpaired t-test. The pre and postoperative difference of LVIDd and LVIDs between <35% and ≥35% ejection fraction patients was compared by paired t-test. The mean ± SD LVEF between pre and post-operative was compared by paired t-test. Pre-operative, discharge and 1st month and 3rd month follow up LVIDd, LVIDs and EF were data were compared by ANOVA test.

## III Results

Total number of 60 patients were selected for off pump coronary artery bypass surgery. Among them 30 patients ejection fraction was ≥35 % (Group1) and 30 patients ejection fraction was <35% (Group 2). The findings of the study obtained from data analysis are presented below. Age distribution: Table 1. Shows that among Group1 patients, highest number of percentage 60% were in 41-50 years age group and both 51-60 and 61-70 years age group percentage were equal that is 20%. Whereas among Group 2 patients highest percentage were in 61-70 years age group and both 41-50 and 51-60 age group patients were 9 %. In Group 1 patients and in Group2 patient's male patient was 24 and 25 respectively and female patient was 6 and 5 respectively. The mean height was 157.96±3.65 cm in group 1 patients and 158.96±4.21 cm in group 2 patients. The mean weight was 69.8±4.67 kg in group1 patients and 71.63±4.08 kg in group2 patients. The mean body surface area was 1.74±0.12 $m^2$ in group1 patients and 1.75±0.05 $m^2$ in group 2 patients. The mean difference of height (cm), weight (kg) and body surface area ($m^2$) were statistically insignificant (p>0.05) in unpaired t test. All the patients had some risk factors for coronary artery disease (CAD). Group1 patients out of 30 patients 19 (63.3%) were smoker, 12(40%) had Diabetes Mellitus, 11(36.66%) had hypertension and 7(23.33%) had hyperlipidaemia. On the other hand in group 2 patients 25(83.3%) were smoker, 17 (56.67%) had Diabetes Mellitus, 14 (46.66%) had hypertension and 8(26.66%) had hyperlipidaemia.

Table-1: Age distribution of the patients (N=60)

| Age of the Patients (years) | Group-1<br>N (%) | Group-2<br>N (%) |
|---|---|---|
| 41-50 | 18 (60) | 9 (30) |
| 51-60 | 6 (20) | 9 (30) |
| 61-70 | 6 (20) | 12(40) |
| Total | 30 (100) | 12(40) |
| Mean age (years) | 51.9± 8.69 | 57.2± 7.48 |
| Figures in Parenthesis denote corresponding %, Data were presented as mean ± SD | | |

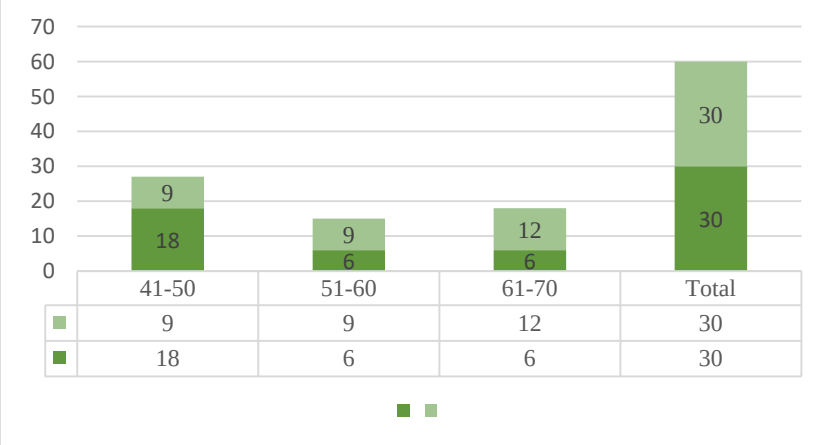


Figure-1: Age distribution of the patients (N=60)

Table-2: Preoperative and postoperative NYHA and CCS functional class (N=60)

| CCS grade | Preoperative N=60 | | Post-Operative | | | |
|---|---|---|---|---|---|---|
| | Group-1 N (%) | Group-2 N (%) | 1 month/ N=60 | | 3 month/ N=60 | |
| | | | Group-1 N (%) | Group-2 N (%) | Group-1 N (%) | Group-2 N (%) |
| Grade I | 1(3.33) | 0(0) | 17(56.6) | 11(36.6) | 22(73.3) | 20(66.6) |
| Grade II | 12(40) | 8(26.6) | 12(40) | 16(53.3) | 6(20) | 9(30) |
| Grade III | 15(50) | 18(60) | 1(3.33) | 3(10) | 0(0) | 1(3.33) |
| Grade IV | 2(6.66) | 4(13.3) | 0(0) | 0(0) | 0(0) | 0(0) |
| Total | 30 | 30 | 30 | 30 | 28 | 30 |
| NYHA | | | | | | |
| Grade I | 1(3.33) | 0(0) | 12(40) | 14(46.6) | 25(83.3) | 25(83.3) |
| Grade II | 17(56.6) | 18(60) | 13(43.3) | 12(40) | 3(10) | 5(16.6) |
| Grade III | 10(33.3) | 8(26.6) | 5(16.6) | 3(10) | 0(0) | 0(0) |
| Grade IV | 2(6.66) | 4(13.3) | 0(0) | 1(3.33) | 0(0) | 0(0) |
| Total | 30 | 30 | 30 | 30 | 28 | 30 |
| n denote number of sample, figures in the parentheses denote corresponding % | | | | | | |

Table-3: Changes in Echocardigraphic findings in the groups (N=60)

| Findings | Preoperative | At Discharge | 1-Month After Operation | 3-Month After Operation | P Value |
|---|---|---|---|---|---|
| Group 1 | | | | | |
| LVIDd (mm) | 54.86±3.45 | 57.56±4.07 | 50.2 ±4.18 | 45.43±5.03 | <0.05$^S$ |
| LIVDs (mm) | 45.23 ±4.13 | 47.03±4.46 | 40.53± 4.83 | 35.7±5.33 | <0.05$^S$ |
| LVEF (%) | 42.7±4.66 | 41.66±4.71 | 45.6± 4.66 | 50.46±5.06 | <0.001$^S$ |
| Group 2 | | | | | |
| LVIDd(mm) | 67.06±3.67 | 68.1±3.39 | 61.13±5.45 | 57.56±4.96 | <0.05$^S$ |
| LIVDs (mm) | 59.1±4.35 | 60.53±4.44 | 53.83±6.34 | 48.3±5.53 | <0.05$^S$ |
| LVEF (%) | 59.1±4.35 | 28.63±4.01 | 32.8±5.56 | 35.93±6.03 | <0.05$^S$ |
| S-Significant, data were presented as mean ± SD, Data were analyzed using ANOVA test, p-value <0.05 considered significant | | | | | |

Table 2 depicts the comparison between preoperative and postoperative during 1 month and 3 months in CCS grade and NYHA class in the study groups. The table shows that the preoperative CCS grade I, II, III and IV occupied 1, 12, 15 and 2 patients respectively in group 1 patients. Whereas CCS grade II, III and IV occupied 8, 18and 4 patients respectively in group 2 patients. None in CCS grade I. During postoperative follow up in 1 month CCS grade I, II and III occupied 17, 12 and 1 patient respectively in group1patients. On the other hand in 1 month postoperative follow up of CCS grade I, II and III occupied 11, 16 and 3 patients. No patient was in CCS grade IV in both groups. In 3 months postoperative follow up of CCS grade I and II occupied 22 and 6 respectively in group 1 patient. While CCS grade I, II and III occupied 20, 9 and 1 patients in 3 months follow up in group 2 patients. None was in grade III and IV in group 1 patients and none in grade IV in group 2 patients. The table 2 also shows the changes in NYHA class in group 1 patients group and in group 2 patients. Preoperatively NYHA class I, II, III and IV occupied 1, 17, 10 and 2 patients in group 1 respectively. On the other hand in group 2 NYHA class II, III and IV occupied 18, 8 and 4 patients respectively with no patient in class I. In 1 month post-operative follow up in group 1 NYHA class I, II and III occupied 12, 13 and 5 patients respectively. No patient in class I. where as in group 2;1 month postoperative follow up shows NYHA class I, II, III and IV occupied 14, 12, 3 and 1 patients respectively. During 3 months post-operative follow up of group 1 patients, NYHA class I and II occupied 25 and 3 patients respectively with no patient in III and IV class. While in group 2 NYHA class I and II occupied only 25 and 5 patients respectively. None was in class III and IV. Among the investigation, Xray chest in group 1 highest number, that is 18 (60%) patients was in no abnormality followed by 4 (13.33%) in enlarge cardiac silhouette and 4 (13.33%) in hilar vessels prominence and upper lobe diversion findings. Both no specific findings and hilar vessels prominence findings had equal that is 2 (66%) number of patients. Where as in group 2 no abnormality findings also had highest that is 19 (63.33%) patients followed by 2 (6.66%) each in hilar vessels prominence and in hilar vessels prominence and upper lobe diversion findings. Only 1 (3.33%) patient was in no specific findings. The ECG in group1, 12 (40%) patients were in no abnormality followed by 8 (26.66%) in evidence of old inferior MI, 6 (20%) in evidence of old antero-inferior MI and 4 (13.33%) in no specific findings. On the other hand in group 2, 13 (43.33%) patients were in no abnormality followed by 7 (23.33%) in old inferior MI, 7 (23.33%) in old antero-inferior MI and only 3 (10%) in no specific findings. The distribution of the involvement of coronary arteries among the patients of Group 1 and 2 was: In Group 1 patients 2 patients had single vessel coronary disease, 7 patients had double vessels coronary disease and 21 patients had triple vessels disease. On the other hand in Group 2 patients 6 patients had double vessels disease and 24 patients had triple vessels coronary disease. No one had single vessel disease. Echocardiography findings in preoperative and postoperative (during discharge, 1

month follow up, 3 month follow up) are shown in table 3. It was found that in group 1 the mean ±SD LVIDd was 54.86±3.45 mm during preoperative period and it was 57.56±4.07 mm during discharge. During 1 month postoperative follow up LVIDd was 50.2±4.18 mm and during 3 month follow up it was 45.43±5.03 mm. In ANOVA test preoperative, discharge, 1 month and 3 month follow up LVIDd was statistically significant (<0.05). Similarly it was observed that in group 2 the mean ±SD LVIDs was 45.23±4.13 mm during preoperative period and it was 48.03±4.46 mm during discharge. During 1 month postoperative follow up LVIDs was 40.53±4.83 mm and during 3 month follow up it was 34.7±5.33 mm. In ANOVA test preoperative, discharge, 1 month and 3 month follow up LVIDs was statistically significant (<0.05). We found that in group 1 the mean ±SD LVEF was 42.7±4.66 (%) during preoperative period and it was 39.66±4.71 (%) during discharge. During 1 month postoperative follow up LVEF was 48.6±4.66 (%) and during 3 month follow up it was 53.46±5.06 (%). In ANOVA test preoperative, discharge, 1 month and 3 month follow up LVEF was statistically significant (<0.001). On the other hand in group 2 it was evident that the mean±SD LVIDd in preoperative period was 67.06±3.67 mm and during discharge it was 68.1±3.39 mm. and during 1month follow up the LVIDd was 61.13±5.45 mm and during 3 month follow up it was 57.56±4.96 mm. in ANOVA test the preoperative, discharge, 1 month and 3 month follow up of LVIDd was statistically significant (<0.05). It was found that in group1 the mean±SD LVIDs in preoperative period was 59.1±4.35 mm and during discharge it was 60.53±4.44 mm. and during 1month follow up the LVIDs was 52.83±6.34 mm and during 3 month follow up it was 48.3±5.53 mm. in ANOVA test the preoperative, discharge, 1 month and 3 month follow up of LVIDs was statistically significant (<0.05). Similarly it was found that in group 2 the mean±SD LVEF in preoperative period was 29.26±4.25 (%) and during discharge it was 27.63±4.01 (%) and during 1month follow up the LVEF was 34.8±5.56 (%) and during 3 month follow up it was 38.93±6.03 (%) in ANOVA test the preoperative, discharge, 1 month and 3 month follow up of LVEF was statistically significant (<0.001). The change in preoperative and post-operative 3 month follow up of LVIdd in group 1 was statistically significant (<0.001) in paired t-test. While, the change in preoperative and postoperative 3 month follow up of LVIds in group 2 was statistically significant (<0.05) in paired t-test. It was also found that the change in preoperative and postoperative 3 month follow up of LVEF in group 1 was not statistically significant (0.123) in paired t-test. On the other hand The change in preoperative and postoperative 3 month follow up of LVIdd in group 2 was statistically significant (<0.001) in paired t-test. While the change in preoperative and postoperative 3 month follow up of LVIds in group 1 was statistically significant (<0.05) in paired t-test. It was also found that the change in preoperative and postoperative 3 month follow up of LVEF in group 1 was statistically significant (<0.001) in paired t-test. LVEF between the group 1 and 2 in paired t-test it was statistically significant (<0.001) at 3months; which was 35.93±6.03 in Group 1 vs 50.46±5.06 in Group 2. The postoperative outcome parameters like the mean duration of mechanical ventilation in group 1 and group 2 was 7.55±2.03 hours and 12.76±5.36 hours respectively. And the difference was statistically in significant (p>0.05) in unpaired t-test. Whereas, the mean duration of ICU stay between group 1 and 2 was 30.85±7.44 hours and 32.36±7.31 hours respectively. Among the major postoperative complications 2 cases of prolonged ventilation >24 hours was found in group 2. Whereas deep sternal wound infection was found 1 case each in both the groups. None was found in other complications like stroke, renal dysfunction and reoperation in both the groups.

## IV Discussion

All the surgery was performed by the same surgical team. Total number of patients was 60, which was divided into two groups, 30 patients in each group. Male predominance in this study has been seen in both the groups which is <84% and this findings are similar to the study conducted by Meharwal and colleagues which was which is 90.4% [7]. According to the age distribution highest number of patients was in 61-70 years group in both in group 1 and group 2. Study conducted by Daniel J. Goldstein and colleagues also found highest number of patients belonging to 61-70 years age group[8]. The study risk factors showed majority of the patients were smoker. They also had other risk factors like Diabetes Mellitus, hypertension and hyperlipidemia. The mean height in group 1 was 158.96±4.21 (cm) and in group 2 was 157.7±3.65 (cm). The mean weight in group 1 was 71.63±4.08 (kg) and in group 2 was 69.8±4.67 (kg). The mean body surface area was in group 1, 1.75±0.05 (m2) and in group 2 was 1.74±0.12 (m2). Though these observations were statistically insignificant (p>0.05). All the patients were symptomatic with pain. This is similar to most of the studies [3, 13]. Most of the patients were in Canadian Cardiology Society grade III. In both groups 15 (50%) in group 1 and 18 (60%) in group 2 were found. Apart from pain all were symptomatic with exertional dyspnea with most were of New York Heart Association class II. In group 1 it was 17 (56.6%) and in group 2 it was 18 (60%). Class III and IV had 10 (33.3%) and 2 (6.66%) in group 1 and 8 (26%) and 4 (13%) in group 2 respectively. Preoperatively most of the patients were in class II and III in both group which is not consistent with study conducted by Islamoglu F. and his colleagues [20]. OPCAB has gained popularity in recent years, and may improve the outcome in cases of severe LV dysfunction [14]. Al Ruzzeh and colleagues noted that OPCAB in high-risk patients with multivessel disease had a similar 30-day mortality but fewer major complications than CABG[10]. CABG in low EF CAD patients has been reported to be superior to medical therapy by several authors. Alderman showed that patients with an EF<35% who were treated with medical management had a 43% 5-years survival rate compared with 63% 5 year survival rate in the surgically treated patients [5]. Passamani followed a group of CABG patients with an EF<50% for 7 years and showed that 84% of the surgically treated patients were alive at 7 years, whereas only 70% of medically treated patients were alive [17, 5]. Postoperatively at 3 months follow up most of the patients became class I which is 25 (83%) in each group. These findings are similar to the findings of the study conducted by Islamoglu F. and his colleagues [20]. Chest X-ray was done preoperatively in every patient. Most of them had no abnormality with 60% and 63.33% in group 1 and group 2 respectively. Enlarged cardiac silhouette in transverse diameter was found in 13.3% and 20% in group 1 and 2 respectively. As the patients were controlled

medically well, hilar vessel prominences only in 6.66% in each group. Electrocardiography was done preoperatively in every patient. Most of them had no abnormality, which was 40% and 43.33% in group 1 and group 2 respectively. 26.66% and 23.33% had evidence of old inferior myocardial infarction in group 1and group 2 respectively. While 20% and 23.33% patients had evidence of old antero-inferior myocardial infarction in group1 and group 2 respectively. Echocardiography was done preoperatively, during discharge and postoperative 1 month and 3 month follow up using modified Simpson's biplane method. Those parameters findings are given in table. The mean ±SD left ventricular internal diameter in diastole (LVIDd) and left ventricular internal diameter in systole (LVIDs) and left ventricular ejection fraction (LVEF) in pre and postoperatively 3 months shown for both groups. For in group 1 patients preoperative LVIDd and LVIDs was 54.86±3.45 mm and 45.23 ±4.13mm respectively. LVEF for this group is 42.7±4.66 (%). Postoperatively at 3 month follow up in this group of patients is LVIDd 45.43±5.03 mm, LVIDs 34.7±5.33 mm and LVEF 53.46±5.06 (%). The improvement of mean LVIDd and LVIDs is statistically significant ($p<0.001$) and ($p<0.05$) respectively. But improvement of LVEF is not statistically significant ($p>0.05$). Similarly in group 2 patients preoperative LVIDd, LVIDs and LVEF is 67.06±3.67mm, 59.1±4.35mm and 29.26±4.25 (%) respectively. Postoperatively at 3 months follow up of this group the LVIDd, LVIDs and LVEF is changed to 57.56±4.96 mm, 48.3±5.53 mm and 38.93±6.03 (%) respectively. The improvement of mean LVIDd and LVIDs is statistically significant ($p<0.001$) and ($p<0.05$) respectively. And the improvement of LVEF is also statistically significant ($p<0.001$). These findings are mostly consistent with the findings of other studies conducted by Trachiotis G D and his colleagues and Islamgolu F and his colleagues [13, 20]. Postoperative ICU stay was measured in hours. The mean ±SD ICU stay for group 1 patients was 30.85±7.44hours and for group 2 patients it was 32.36±7.31 hours, comparison of this findings was statistically significant ($p<0.001$). But comparison of duration of mechanical ventilation and total hospital stay between these two groups were not statistically significant. The mortality was found in only in each group was 1 in number. Morbidity was observed in prolonged ventilation in group 2. And equal number of case found in wound infection in each group. This above findings were consistent with studies conducted by Ascione R. and his colleagues and Lslamoglu F and his colleagues [15, 20]. In spite of a significant increase in the preoperative risk in the patients, this indicates a very significant improvement in the quality of cardiac surgical care rendered by The Society of Thoracic Surgeons (STS) members [22]. It is clearly recognized that complication in cardiac surgery may not be fatal but can significantly impact on patient's functional status and quality of life. The ability of CABG surgery to improve overall health related quality of life has been demonstrated and is considered as a major indication for a CABG operation [23, 24].

## V Conclusion

In this series of patients with left ventricular dysfunction, off pump CABG was administered with good early outcome with low mortality and morbidity and significant improvement in postoperative left ventricular function. Post-operative morbidity like arrhythmia, neurological manifestation, kidney failure, and reoperation didn't happen, but only one case of wound infection was found in each group. Mortality was encountered in normal ejection fraction group. No mortality was found in <35% ejection fraction group. CCS grade and NYHA functional class improved from preoperative period to postoperative 3 months follow up. It can be concluded that off pump coronary artery bypass grafting can be safely performed to the patients with normal and poor left ventricular ejection. However poor ejection fraction patients show somewhat better result regarding mortality and morbidity. From this study it can be concluded that off pump coronary artery bypass grafting can be performed safely and effectively for <35% ejection fraction patients which helps to improve patients quality of life in terms of CCS grade, NYHA class and echocardiographic findings of left ventricular status.

**References:**

1. World health rankings, live longer live better [internet].2012 [cited 2012 Nov 10]. Available from: http://www.worldlifeexpectency.com/ country-health-profile/Bangladesh.
2. Elefteriades JA, Morales DL, Gradel C, Tollis G Jr, Levi E, Zaret BL. Results of coronary artery bypass grafting by a single surgeon in patients with left ventricular ejection fractions < or = 30%. Am J Cardiol 1997; 79:1573–78.
3. Topkara VK, Cheema FH, Kesavaramanujam S, Coronary artery bypass grafting in patients with low ejection fraction. Circulation 2005; 112(9 Suppl):I-344 – 50.
4. Woo YJ, Grand TJ, Liao GP, Panlilio CM. Off-pump revascularizatrion for significant left ventricular dysfunction. Asian Cardiaovasc Thorac Ann 2006; 14:306-9.
5. Alderman EL, Fisher LD, Litwin P, Kaiser GC, Myers WO, Maynard C, et al. Results of coronary artery surgery in patients with poor left ventricular function (CASS). Circulation 1983; 68:785-95.
6. Christakis GT, Weisel RD, Fremes SE, Ivanov J, David TE, Goldman BS, et al. Coronary artery bypass grafting in patients with poor ventricular function. Cardiovascular surgeons of the University of Toronto. J Thorac Cardiovasc Surg 1992; 103: 1083-92.
7. Meharwal ZS, Trehan N. Off pump coronary artery bypass grafting in patients with left ventricular dysfunction. Heart Surg Forum 2002; 5:41-45.
8. Goldstein DJ, Beauford RB, Luk B, Karanam R, Prendergest T, Sardari F, et al. Multivessel off pump revascularization in patients with severe left ventricular dysfunction. Eur J Cardiothorac Surg 2003; 24:72-80.
9. Eryilmaz S, Corapcioglu T, Eren NT, Yazicioglu L, Kaya K, Akalin H. off pump coronary artery bypass in the left ventricular dysfunction. Eur J Cardiothorac Surg 2002; 21:36-40.

10. Al – Ruzzeh S, Nakamura K, Athanasiou T, Modine T, George S, Yacoub M, et al. Does off pump coronary artery bypass surgery (OPCAB) improve the outcome in high risk patients? A comparative study of 1398 high risk patients. Eur J Cardiothorac Surg 2003; 23:50-55.
11. Arom KV, Flavin TF, Emery RW, Kshettry VR, Petersen RJ, Janey PA. Is low ejection fraction safe for off pump coronary bypass operation? Ann Thorac Surg 2000; 70: 1021-25.
12. Pigott JD, Kouchoukos NT, Oberman A, Cutter GR. Late results of surgical and medical therapy for the patients with coronary artery disease and depressed left ventricular function . L Am Coll Cardiol. 1985; 5:1036-45.
13. Trachiotis GD, Weintraub WS, Johnston TS, Jones EL, Guyton RA, Carver JM. Coronary artery bypass grafting in patients with advanced left ventricular dysfunction. Ann Thorac Surg 1998; 66:1632-39.
14. Nishi H, Miyamoto S, Takanashi S, Minamimura H, Ishikawa T, Shimizu Y. Complete revascularization in patients with severe left ventricular dysfunction. Ann Thorac Cardiovasc Surg 2003;9: 111-16.
15. Ascione R. Severe left ventricular dysfunction: a continuous surgical challenge. J Card Surg 2006;21:233-34
16. Nalysnyk L, Fahrbach K, Reynolds MW, Zhao SZ, Ross S. Adverse events in coronary artery bypass graft (CABG) trials: a systemic review and analysis. Heart 2003; 89:767-72.
17. Passamani F, Davis KR, Gillespie ML, Killin T. A randomized trial of coronary artery bypass surgery of patients with low ejection fraction. N Engl J Med. 1985; 312:1665-71.
18. Roach GW, Kanchuger M, Mangano CM, Newman M, Nussmeier N, Wolman R et al. Adverse cerebral outcomes after coronary bypass surgery. Multicenter study of perioperative ischemia research group and the ischemia research and education foundation investigators. N Engl J Med 1996; 335:1857-63.
19. Hart JC, Puskas JD, Sabik JF, 3rd. off pump coronary revascularization: current state of the art. Semin Thorac Cardiovasc Surg 2002; 14:70-81.
20. Lslamoglu F, Apaydin AZ, Posacioglu H, Ozbaran M, Hamalu A, Buket S, et al. Coronary artery bypass grafting in patients with poor left ventricular function. Jpn Heart J 2002; 43:343-56.
21. Carr JA, Haithcock BE, Paone G, Barnabei AF, Silverman NA. longterm outcome after coronary artery bypass grafting in patients with severe left ventricular dysfunction. Ann Thorac Surg 2002; 74:1531-36.
22. Ferguson TB, Jr, Hammil BG, DeLong ER, et al., A decade of change : risk profiles and outcomes for isolated CABG procedures, 19901999, ANN Thorac Surg 2002;73:480-90.
23. Rumsfeld JS, Magid D, O'Brian MM,et al., Changes in health related quality of life following coronary artery bypass graft surgery, Ann Thorac Surg 2001;72:2026-32.
24. Totaro, P., Fucci, C., Minzioni, G., Bonacchi, M., Prifti, E., Giunti, G. and Sani, G., 2001. Preserved pleura space integrity and respiratory dysfunction after coronary surgery. *European Journal of Cardio-thoracic Surgery*, 20(5), pp.1067–1070.