

Improvement of Ejection Fraction in Patients undergoing Coronary Artery Bypass Grafting with Impaired Left Ventricular Function

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ABSTRACT

Background

Myocardial revascularization surgery has shown better long term survival expectancy compared to medical therapy in patient with impaired left ventricular function.

Objective

To evaluate the change in ejection fraction after 90 days in patients who underwent coronary artery bypass surgery and had preoperative left ventricular ejection fraction of less than and equal to 45% in a single cardiac center of Nepal over the period of 2 years.

Method

Out of 82 eligible patients during 2 years, 3 patients expired in immediate post-operatively and 24 patients had loss of 90 days' follow up. So, they were excluded from the study. Total 55 patients were taken for the study for whom statistical analysis was done to compare preoperative ejection fraction with post-operative 90 days' ejection fraction.

Result

Single vessel disease was present in 2(3.6%) patients, double vessel disease in 7(12.7%) patients and triple vessel disease in 46(83.6%) of the patients. In 2(3.6%) patients 2 grafts, in 18(32.7%) patients 3 grafts, in 33(60%) patients 4 grafts and in 2(3.6%) patients 5 grafts were placed for revascularization. The mean left ventricular EF in preoperative patients was 37.12±5.69% which improved to 45.80±10.00% in postoperative follow up at 90 days which was statistically significant (p=0.000).

Conclusion

Surgical revascularization of myocardium in preoperatively impaired left ventricular function patients helps improve left ventricular ejection fraction postoperatively. So we suggest surgical revascularization in patient with low ejection fraction for improvement of myocardial function. Hence improve survival rate in these patients.

KEY WORDS

Coronary artery bypass graft, Ejection fraction, Ventricular function

INTRODUCTION

Impaired left ventricular function has been considered to be associated with increased risk of hospital stay and mortality after coronary artery bypass grafting (CABG) since long.¹ However improvement in surgical technique, myocardial protection and postoperative care has shown that patients have improved ejection fraction (EF) and have better long term survival expectancy after coronary surgery than with continuous medical therapy.²⁻⁴

Medical management in patient with coronary artery disease with impaired left ventricular ejection fraction have poor outcome with a two year survival rate of only 20 to 30%.⁵ Most of this group of patient has shown to benefit from myocardial revascularization surgery.⁶

The aim of this study is to evaluate the change in ejection fraction after 90 days in patients who underwent CABG and had preoperative EF of less than and equal to 45% in a single cardiac center of Nepal over the period of 2 years. The outcome of this study can be useful as future reference in choosing the surgical treatment option in this impaired left ventricular function patients.

METHODS

After obtaining institutional review board approval the patient with ejection fraction of less than or equal to 45% who underwent isolated CABG surgery from January 2018 to December 2019 were taken from hospital record book for this study.

This was a retrospective observational study performed at Shahid Gangalal National Heart Center of Nepal. All adult cardiac surgical patients more than 18 years of age who underwent elective isolated onpump CABG surgery with EF of less than and equal to 45% from January 2018 to December 2019 were included in this study. Out of 82 eligible patients during the time frame 3 patients expired in post-operative period and 24 patients had loss of 90 days' follow up. So, they were excluded from the study (fig. 1).

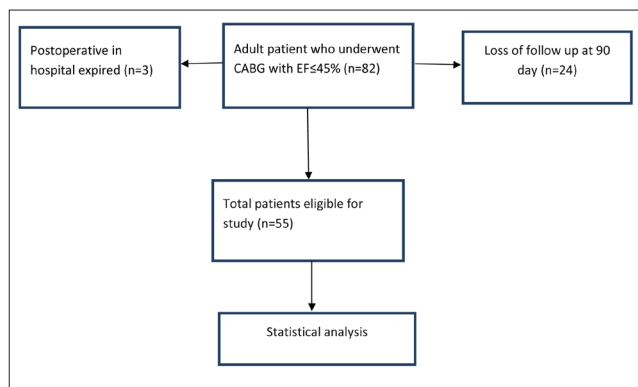


Figure 1. Conceptual framework

Total 55 patients were taken for the study and demographic details of the patients like age, sex, height and weight were recorded. Total number of diseased vessel preoperatively and number of grafts used in the patients were also recorded. Preoperative left ventricular EF and post-operative left ventricular EF after 90 days was recorded by transthoracic echocardiography in all of these patients and these data were recorded from hospital record book. The objective of the study was to evaluate the effect of CABG surgery in patient with preoperative impaired left ventricular function on improvement of EF after 90 days follow up postoperatively.

Collected data were analysed by means of statistical software SPSS22. Statistical analysis for demographic variables was done by chi-square test and student's paired t test was applied to compare the ejection fraction pre and post operatively. P-value of < 0.05 was considered to be significant.

Table 1. Demographic variables

Gender male : female	43:12
Age in years median (Range)	60(38-80)
Weight in kg median (Range)	62(40-82)
Height in cm median (Range)	160(141-170)
BMI (kg/m ²) median (Range)	24.2(18.35-32.43)

RESULTS

Out of the 55 patients eligible for the study, 43(78.3%) were male and 12(21.8%) were female. The demographic data of patients is shown in Table 1. Single vessel disease was present in 2(3.6%) patients, double vessel disease was present in 7(12.7%) patients and triple vessel disease was present in 46(83.6%) of the patients (fig. 2). In 2(3.6%) patients 2 grafts were placed, in 18(32.7%) patients 3 grafts were placed, in 33(60%) patients 4 grafts were placed and in 2(3.6%) patients 5 grafts were placed for revascularization (fig. 3). The mean left ventricular EF in preoperative patients was 37.12±5.69% which improved to 45.80±10.00% in postoperative follow up at 90 days which was statistically significant (p=0.000).

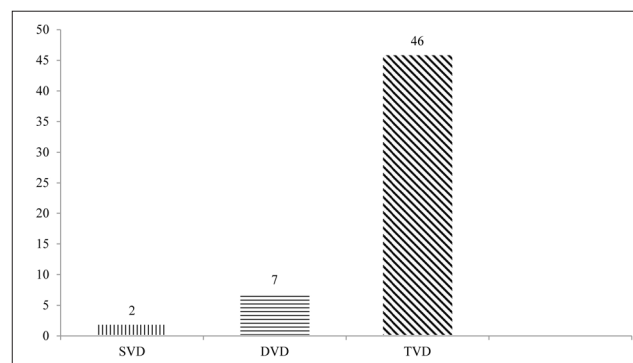


Figure 2. Number of disease vessel present in patient preoperatively

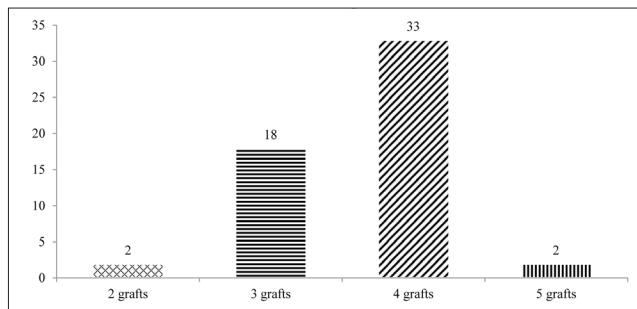


Figure 3. Total number of grafts used for revascularization

Table 2. Comparison of pre and post-operative EF

Preoperative EF (Mean \pm SD)	Postoperative EF at 90 day (Mean \pm SD)	p value
37.12 \pm 5.69	45.80 \pm 10.00	0.000

DISCUSSION

The management of patients with impaired left ventricular function is challenging and is often thought to be associated with significant morbidity and mortality after coronary artery bypass grafting since long.¹ However due to improvement of surgical techniques, cardiac anesthesia, myocardial protection during bypass and perioperative intensive care the patients with impaired left ventricular function have shown better results after surgical revascularization which helps to recruit the contractile reserve after CABG.^{7,8} In our study, mean EF improved from 37.12 \pm 5.69% preoperatively to 45.80 \pm 10.00% postoperatively after 90 days of follow up which was statistically significant. In patients with impaired LV function due to stunned myocardium or hibernating myocardium, revascularization helps to recruit the myocardial reserve and improve the LV function.⁷ In a similar study done by Vakil et al. in the overall study population of 74 patients mean EF improved from 28 \pm 6% preoperatively to 36 \pm 12% postoperatively ($p < 0.0001$).⁹ Their result was consistent with our findings. The study done by Koene et al. also had the findings similar to our study which showed improvement of EF from (36 \pm 9)% to (41 \pm 12)%, $p < 0.001$

within 6 months of CABG surgery.¹⁰ So, was the finding in the study done by Haxhibeqiri-Karabdic et al. where after the aortocoronary bypass grafting ejection fraction increased from 25.6 \pm 5.2 to 31.08 \pm 5.5 postoperatively on 30 days after operation.¹¹ However the study done by Diller et al. didn't show any improvement in left ventricular EF after CABG.¹² The decrease in EF post-operatively after CABG surgery could be due to various factors like presence and extent of viable tissue preoperatively, significant intraoperative global ischemia, myocardial stunning or early postoperative graft failure.¹³⁻¹⁵ Our study also showed in-hospital mortality of 3.65% in the patients with EF of less than or equal to 45% after CABG surgery which is acceptable with other currently published data.^{16,17} Various factors are shown to contribute to mortality like presence of diabetes or use of intra or post-operative intra-aortic balloon pump.^{18,19} On-pump surgery on arrested heart has shown to cause more myocardial edema and ischemia compared to on-pump beating heart surgery.²⁰ Moreover off-pump CABG surgery has shown to have more improved outcomes and less mortality compared to conventional technique.²¹

The limitations of this study is that it is a retrospective study with a small sample size and we couldn't get the information of all the cases in that time frame due to loss of follow up. These could be the major confounding factors for the result of our study. Besides, all the cases were on pump CABG surgeries. So we recommend to do a comparative study between on pump and off pump CABG with a larger sample size and longer follow up in future.

CONCLUSION

Surgical revascularization of myocardium in preoperatively impaired left ventricular function patients help to improve their left ventricular ejection fraction postoperatively. So, we suggest surgical revascularization in patients with low ejection fraction for improvement of myocardial function and hence improve the overall survival rate in these patients.

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