Al-Azhar Med. J. *Vol. 47(3), July, 2018, 467-473*
DOI : 10.12816/0052810

EARLY REVASCULARIZATION BENEFITS IN LOW CARDIAC FUNCTION PATIENTS

By

Medhat Refaie and Mohamed Al Shehri*

Department of Cardiothoracic Surgery, Al-Azhar University, and Cardiac Services at Military Prince Khalid Ben Sultan Centre*

ABSTRACT

Background: Management ofpatients with impaired left ventricular functionremains challenging in spite of the progress achieved in medical therapies and surgical techniques.

Objectives: Detecting the impact of revascularization on the left ventricular function in low ejection fraction patient's ≤ 35% after coronary artery bypass.

Patients and Methods: Twenty three patients with impaired left ventricular function were subjected to coronary artery bypass grafting (CABG) during the period from January 2017 to January 2018 at military prince Khalid Ben Sultan Centre, Saudi Arabia. The only inclusion criterion was preoperative ejection fraction (EF) ≤ 35%. Echocardiography assessments were done preoperatively and early postoperatively (three months after CABG).

Results: Baseline preoperative transthoracic echocardiography assessment (TTE) was done for the twenty three patients and revealed that the mean end diastolic diameter (EDD) was 5.2 ± 0.08 mm, the mean end systolic diameter (ESD) was 4 ± 0.1 mm and the mean ejection fraction was 30 ± 1.1%. The first 3 months after CABG, the mean ejection fraction increased significantly from 30 ±1.1% at baseline TTE to 36 ±1.6 %. Moreover, the mean EDD decreased significantly from 5.2±0.08 mm at baseline TTE to 4.8±0.2 mm at early follow up. However, the reduction in the ESD from 4±0.1 mm at baseline to 3.8±0.2 mm postoperatively was insignificant.

Conclusion: The low EF patients undergoing CABG showed significant improvement in LV function by 20% increase in EF in the early postoperative follow up.

Key words: Revascularization, Low cardiac function.

INTRODUCTION

Management of patients with coronary artery disease (CAD) and low ejection fraction (EF) is still controversial in spite of the progress achieved in medical therapies and surgical techniques. Options of treatment for such cases are intensive medical therapy, coronary artery bypass grafting, and heart transplantation *(Gupta et al., 2017,* and *Koene et al., 2017).* The Surgical Treatment of Ischemic Cardiomyopathy (STICH) trial with 10 years survival showed that the mortality of coronary artery disease (CAD) patients with impaired left ventricular ejection fraction (LVEF)was high with 72% mortality in the medically treated population *(Velazquez et al.,2012).* Moreover, in a study done by *(Nagendran et al., 2018),* the CABG surgery in LV dysfunction patients showed a better long-term survival and outcome over percutaneous intervention (PCI). Even

though, heart transplantation showed outstanding results with a 65.6% 5-year survival rate, the rarity of donor organs makes this option unfeasible for many patients *(Lomivorotov et al., 2017)*. Although Coronary artery bypass grafting (CABG) in patients with low ejection fraction (EF) carries a higher perioperative risk with 5-15% hospital mortality, CABG resulted in significant improvement in left ventricular function of such patients. Theadvances in anesthesia, myocardial protection, surgical procedures and perioperative support decrease the risks and made CABG more superior thanmedical therapy in terms of long term survival and quality of life *(Pieri et al.,2016)*.

(The present study aimed to detect the impact of revascularization on the left ventricular function in low ejection fraction patient's ≤ 35% after coronary artery bypass.

PATIENTS AND METHODS

Twenty three patients were included in the current study. All the patients were subjected to CABG in the period from January 2017 to January 2018 at military prince Khalid Ben Sultan Centre, Saudi Arabia. The only inclusion criterion was preoperative ejection fraction (EF) ≤ 35%.

Preoperative evaluation of EF and early postoperative after three months was performed by calculation via 2-D mode echocardiography (Modified Simpson's rule) using the biplane apical method and the ventriculography was evaluated.

CABG: Induction of general anesthesia was carried out using etomidate(2 mg/kg), fentanyl(1 ?g/kg) , vecuronium(1 mg/kg) and maintaince was achieved by using isoflourane(1MAC).Cardiopulmonary bypass (CPB) was conducted with ascending aortic cannulation and two-stage venous cannula. Activated clotting time (ACT) was kept over 400 seconds. Mild hypothermia (33?C) was maintained. An initial dose of 1000 ml antegrade, cold (4-8?C) and retrograde blood cardioplegia were given with topical ice application. Intermittent 500 ml of blood cardioplegia was administered every 15-20 minutes antegrade/retrograde. Terminal warm (36-37?C) blood cardioplegia was given prior to aortic cross clamp release.

Follow-up after surgery:

Patients follow up were done regularly in our clinic, the first week after surgery, then two weeks later and every month for three months, for vital signs and EKG. ECHO was done after the first three months to assess EF and LV dimensions after CABG.

Statistical analysis:

Data were presented as mean ± S.E. PairedStudent'st test has been used for statistical analysis of data using SPSS statistical software where appropriate. Values were considered significantly different when $p < 0.05$.

RESULTS

Twenty three patients were included in the present study. Their mean age was 61±2.2 years and their sex ratio was 2 males : 1 female. In addition, risk factors included hypertension (19 patients -63%), smoking 8 patients (35%), diabetes mellitus (DM) 12 patients (52%), serum creatinine 141±24.3 mg/dl, and previous

myocardial infarction 12 patients (52%). Moreover, 2 patients (9%) were subjected to percutaneous intervention (PCI) and 5 patients (22%) needed insertion of intraaortic balloon pump. The mean preoperative ejection fraction (EF %) was 30±1.1; The mean end systolic diameter (ESD) was 4±0.1 mm. The mean end diastolic diameter (EDD) was 5± 0.08mm and the mean number of grafts was (4±0.2) (Table 1).

On average, cardiopulmonary bypass time was 137±9 minutes and mean cross clamp time was 96±6 minutes. The mean stay in the intensive care unit was 3±2 days with a mean total hospital stay of 18±3 days. No early operative mortality (<30days) was recorded. The preoperative and postoperative complications included one case (4%) having stroke and one case (4%) required re-wiring for sternal infection. No deaths were reported during the first 3 months follow up following CABG, resulting in 100% survival (Table 1).

Table (1): Demographic data included in the present study

AGE	61 ± 2.2 years
Sex	2 M 1 F
Diabetes millitus	12 (52%)
Hypertension	19 (83%)
Smoking	8 (35%)
Serum creatinine	141 ± 24.3
Previous myocardial infarction	12 (52%)
Previous percutaneous coronary intervention	2 (9%)
Preoperative ejection fraction	30 ± 1.1%
End systolic diameter	4 ± 0.1 mm
End diastolic diameter	5 ± 0.08 mm
Number of grafts	4 ± 0.2
Preoperative intra-aortic balloon pump	5 (22%)

The mean ejection fraction increased significantly from 30 ±1.1 %at baseline TTE to 36 ±1.6 %at early follow up, i.e. 3 months after CABG (Figure 1). The mean EDD decreased significantly from 5.2±0.08mm at baseline TTE to 4.8±0.2 mm at early follow up (Figure 2). However, the reduction in ESD from 4±0.1 mm at baseline to 3.8±0.2 mm postoperatively was insignificant (Figure 3).

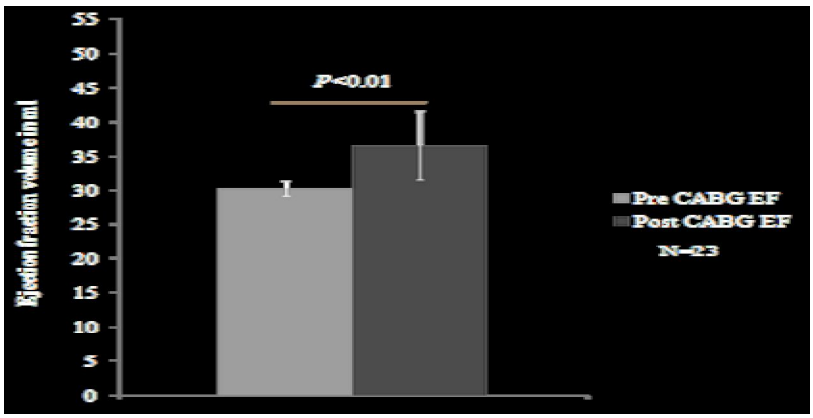

Figure (1): Bar graph comparing pre CABG (baseline EF) and post CABG ejection fracton at early follow up (after the first three months after surgery) in 23 patients who showed significant low ejection fraction (≤35%) before coronary revascularization.

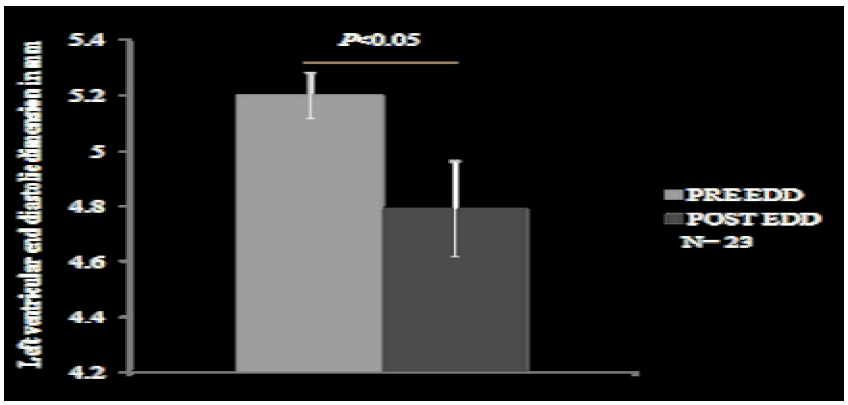

Figure (2): Bar graph comparing pre CABG (baseline) EDD and post CABG EDD at early follow up (after the first three months after surgery) in 23 patients who showed significanr low ejection fraction before (≤35%) coronary revascularization.

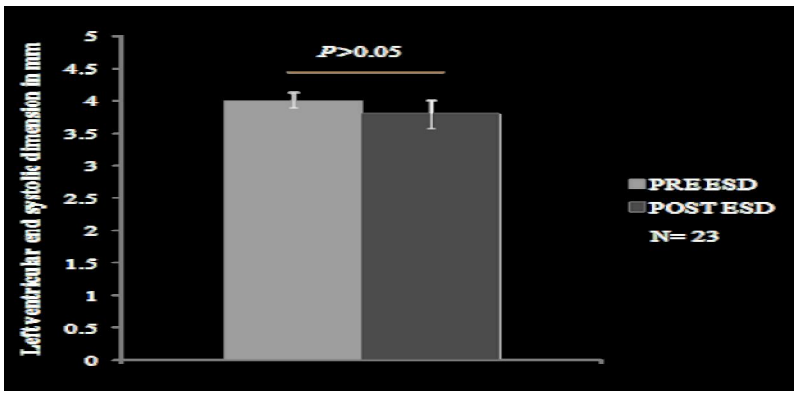

Figure (3): Bar graph comparing pre CABG (baseline) ESD and post CABG ESD at early follow up (after the first three months after surgery) in 23 patients who showed significan low ejection fraction (≤35%) before coronary revascularization.

DISCUSSION

Although management of patients with impaired left ventricular function remains challenging, it has been evident that there is an increased need for CABG in such patients because of the growing number of patients presented with ischemic cardiomyopathy, increased age and scarcity of cardiac transplant donors *(Pieri et al., 2016* and *Lomivorotov et al., 2017).*

The literature showed that the coronary artery disease patients, who were on a maximum medical therapy, have a result of only20-30%with a two year survival rate.It has been cited by many authors that CABG is superior to medical therapy in low-EF CAD patients *(Inamdar et al., 2017).* Many controlled trials of coronary artery bypass grafting in patients with low ejection fraction; have shown that these patients benefit from revascularizationand especial significant reduction in anginal symptoms *(Haxhibeqiri-Karabdic et al., 2014).*

The current study was directed to find out the early result of LV functional improvement after CABG in low EF CAD patients (≤35%). The parameters we identified to determine such improvements were; the LVEF and LV dimensions (end diastolic and systolic diameters). Our results showed 20% increase in EF following CABG. In addition, significant reduction was shown in end diastolic diameter whereas no significant change was detected in ESD. Regarding the improvement in the EF, our findings were supported by many results that showed significant improvement in EF following CABG in low EF patients.

Many authors believe that CABG can improve LVEF by approximately10% and this is most likely due to recruitment of the ischemic viable myocardial tissue by revascularization.The magnitude of improvement in left ventricle EF is directly related to the extent of the viable tissue. Second, the presence and extent of viability is predictive of the improvement of symptoms after revascularization *(Lozonschi et al., 2017).*

Many authors suggested the hypothesis of a positive correlation between the amount of viable myocardium before CABG and the chance of improvement in LV function after CABG Moreover, the degree and timing of recovery in regional LV function depends on the extent of trans-mural myocardial fibrosis *(Haxhibeqiri-Karabdic et al., 2014).* Moreover, in a study done by *(Nagendran et al., 2018)* exhibited a significantly better long-term survival over PCI, without a higher risk of stroke after a long-term follow-up of patients with coronary artery disease (CAD), DM, and left ventricular dysfunction(LVD) treated with CABG.

CONCLUSION

Low EF patients experienced a significant improvement in LV function.The significant increase was 20% in EF following CABG in the early postoperative period.These results coincidewith many similar results.So, CABG isrecommended to patients with depressed LV function.

REFERENCES

1. **Gupta M., Mishra P K., Shoeb M., Agarwal A. and Prasad J. (2017):** A comparison of clinical outcomes of LVEF ≤35% versus LVEF>35% in off-pump coronary artery

bypass graft surgery. Int Surg J, 4(6):1908-1912.

2. **Haxhibeqiri-Karabdic I, Hasanovic A, Kabil E and Straus S. (2014):** Improvement of ejection fraction after coronary artery bypass grafting surgery in patients with impaired left ventricular function. Med Arch., 68(5):332-4.

3. **Inamdar AK, Shende SPald Inamdar SA. (2017):** Outcome of coronary artery bypass graft surgery in patients with low ejection fraction. Med J DY Patil Univ; 10:162-6.

4. **Koene, R. J., Kealhofer, J. V., Adabag, S., Vakil, K., and Florea, V. G. (2017):** Effect of coronary artery bypass graft surgery on left ventricular systolic function. Journal of Thoracic disease, 9(2). 262-270.

5. **Lomivorotov VV, Efremov SM, Kirov MY, Fominskiy EV and Karaskov AM. (2017):** Low-Cardiac-Output Syndrome After Cardiac Surgery. J Cardiothorac Vasc Anesth. 31(1):291-308.

6. **Lozonschi L., Kohmoto T., Osaki S., De Oliveira N C., Dhingra R., Akhter S A. and Tang P C. (2017):** Coronary bypass in left ventricular dysfunction and differential cardiac recovery. Asian Cardiovascular & Thoracic Annals, 25(9) :586–593.

7. **Nagendran J, Bozso SJ, Norris CM, McAlister FA, Appoo JJ, Moon MC, Freed DH and Nagendran J. (2018):**Coronary Artery Bypass Surgery Improves Outcomes in Patients With Diabetes and Left Ventricular Dysfunction. J Am Coll Cardiol. 27; 71(8):819-827.

8. **Pieri M., Belletti A., Monaco F., Pisano A., Musu M., Dalessandro V., Monti G., Finco G., Zangrillo A. and Landoni G. (2016):** Outcome of cardiac surgery in patients with low preoperative ejection fraction. BMC Anesthesiology, 16:1-10

9. **Velazquez E J., Williams J B., Yow E., Shaw L K., Lee K L., Phillips H R., O'Connor C M., Smith P K. and Jones R H. (2012):**Long-term Survival of Patients with Ischemic Cardiomyopathy Treated by CABG versus Medical Therapy. Ann Thorac Surg, 93: 523–530.

الفوائد المبكرة لترقيع شرايين القلب التاجية للمرضى الذين يعانون من ضعف فى وظيفة القلب

مدحت أحمد رفاعي - محمد علي الشهري*

قسم جراحة القلب والصدر*- كلية طب الازهر، ومركز الأمير خالد بن سلطان العسكري لخدمات القلب*

خلفية البحث : لا يزال علاج المرضى الذين يعانون من ضعف في وظيفة البطين الأيسريمثل تحديا على الرغم من التقدم المحرز في العلاجات الطبية والتقنيات الجراحية.

الهدف من البحث: تقييم مدي تأثير إعادة التروية على وظيفة البطين الأيسر فى المرضى ذوى كسرإفراغى يساوى٣٥٪ أو أقل وذلك بعد عملية ترقيع شرايين القلب التاجية.

المرضي وطرق البحث: ضمت الدراسة الحالية ثلاثة وعشرين مريضا ذوى ضعف فى عضلة القلب وقد تم إخضاعهم لعملية ترقيع الشرايين التاجية فى الفترة من يناير ٢٠١٧ إلى يناير٢٠١٨. كان المعيار الوحيد لإدراج المرضى هو وظيفة عضلة القلب االتى تساوى ٣٥٪ أو أقل. وقد تم إجراء تقييمات بالموجات الفوق صوتية قبل إجراء الجراحة وبعد (ثلاثة أشهر عقب الجراحة).

النتائج: أظهرت النتائج الأساسية للموجات الفوق الصوتية لعضلة القلب للمرضي و البالغ عددهم ثلاثه وعشرون مريض أن متوسط قطر البطين الأيسر الانبساطي هو٠،٠٨ ± ٥،٢ مم،ومتوسط قطر البطين الايسرالإنقباضي، ٠١ ±٤ مم،ومتوسط الكسر الإفراغي ١،١ ± ٣٠٪.

وفي المتابعه الأولية المبكرة بعد ثلاثة أشهر عقب الجراحة كان متوسط الكسر الإفراغي قد ارتفع ارتفاعا ملحوظا من١،١ ± ٣٠ ٪ الى ١ ± ٦،٣٦٪،علاوة علي ذلك إنخفض متوسط قطر البطين الأيسر الإنبساطي إنخفاضا ملحوظا من٠،٠٨ ± ٢،٥ مم الي ٠،٠٢ ± ٨،٤ مم وبالرغم من حدوث إنخفاض في متوسط قطر البطين الأيسرالإنقباضي من ٠،١ ± ٤ مم الى ٠،٠٢ ± ٣،٨ مم إلا أنه كان غيرذي دلاله إحصائية إيجابية.

الاستنتاج: أظهرت النتائج الأولية للبحث إرتفاعا في وظيفة عضلة القلب وذلك بمعدل٢٠٪ زيادة في الكسر الإفراغي وذلك بعد عمل جراحة ترقيع شرايين تاجيه لمرضي القلب الذين يعانون من ضعف في عضلة القلب.