Advanced Medical Journal, Vol.9, No.1, P.28-36, 2024 https://doi.org/10.56056/amj.2024.234

Impact of Coronary Artery Bypass Graft on left Ventricular Systolic Function

Dilshad Abdulqadir Rasul* **Mohammed Hasan Alwan** **

Abstract

Background& objective: Coronary artery disease is the common cause of disease-specific mortality and morbidity in Iraq. The objective was to evaluate the effect of coronary artery bypass graft surgery on left ventricular systolic function.

Methods: Present study was an observational prospective study implemented in Surgical Specialty Hospital in Erbil city-Kurdistan region/Iraq through the period of one year from 1st of June 2021, to 31st of May 2022 on sample of one hundred and forty patients with ischemic heart diseases underwent coronary artery bypass graft. The ejection fraction of patients was assessed before and after coronary artery bypasses graft surgery.

Results: Mean left ventricular ejection fraction of all patients underwent coronary artery bypass graft was significantly reduced post bypass graft (p=0.01). However, the mean left ventricular ejection fraction for patients with ejection fraction≥50% was significantly declined post bypass graft (p<0.001) and for those with ejection fraction <50% was significantly increased post bypass graft (p=0.001), The changes in left ventricular ejection fraction of 139 patients after grafting was distributed into; 34.3% of patients with improved, 21.4% of patients with unchanged and 44.3% of patients with declined, and one patient died.

Conclusions: The left ventricular systolic function following coronary artery bypass graft is dependable on preoperative left ventricular systolic function and it is improved in patients with low ejection fraction, while reduced in patients with normal ejection fraction.

Keywords: Coronary artery disease, Coronary artery bypass graft, Left ventricular ejection fraction.

Introduction Coronary artery diseases (CADs) are diseases resulted from insufficient blood supply to myocardium. Occluded coronary arteries lead to deficient oxygen supply by formed plaques in lumen of coronary arteries which obstructed blood flow.[1, 2]

*M.B.Ch.B, KBMS (internal medicine); High diploma Interventional Cardiology Candidate/Howler Medical University; Erbil Cardiac center-Kurdistan region/Iraq. E-mail: drdilshad81@yahoo.com

**M.B.Ch.B, FICMS (Med), FICM.S (Cardio); Assistant professor at Hawler Medical University-Erbil city-Kurdistan region/Iraq. Email: mohdcrt@yahoo.com

*Corresponding author: Dilshad Abdulqadir Rasul

Coronary artery diseases are the leading cause of mortality all over the world and the World Health Organization (WHO) recorded about nine million deaths in 2016 attributed to CADs.[3] The mortality rates of CAD are different from developed to developing countries. The CAD mortality rates in developed countries are decreasing, although higher incidence reaching to 16.5 million new cases in 2018 in adults with predominance in male gender[4]. In developing countries, the mortality trend of CAD is increasing. [3, 4]

Management of CAD included optimal medical therapy (OMT)[5] and controlling comorbidity like hypertension HTN, diabetes mellitus DM, dyslipidemia, smoking session or revascularization either with percutaneous coronary intervention (PCI) or coronary artery bypass graft (CABG).[6] The selection between OMT alone or combined with revascularization is dependable on patient condition, clinical co-morbidity, coronary lesion extent and clinical symptoms duration.[7] Additionally, long term adverse outcome of CAD is minimized after revascularization.[8] The CABG showed lower rates of mortality, incidence of myocardial infarctions and rate of recurrent revascularizations, [9] although the relationship between CABG outcome and left ventricular systolic function (LVSF) is controversial. It was shown that the CABG is improving the survival in comparison to medical therapy for patients with reduced or normal left ventricular function.[10] The Surgical treatment for Ischemic Heart Failure (STICH)[11] trial revealed a better survival for patients with severe left ventricular systolic dysfunction (EF ≤35%). Other trial reported a better quality of life and ejection fraction following CABG than outcomes following medical therapy alone.[12] Despite these findings, the preoperative LVSF for patients undergoing CABG is important indicator for changes in LV function following CABG. One study showed inverse correlation between LVSF and CABG with obvious decrease in LVSF in patients with normal pre-operative systolic function.[13] However, they showed improvement in LVSF for patients with decreased pre-operative LVSF.[13] The aim of this study was to evaluate the effect of coronary artery bypass graft surgery on left ventricular systolic function.

Methodology

The present project was an observational prospective study implemented in Surgical Specialty Hospital (SSH)-Erbil Cardiac Center in Erbil city-Kurdistan region/Iraq (The SSH- Cardiac Center is a contemporary specialized tertiary referral center providing ambulatory as well as inpatient care) through the period of one year from 1st of June 2021, to 31st of May 2022.The studied population was all patients with CAD admitted to SSH and underwent coronary artery bypass Graft. Inclusion criteria were adult age patients regardless of gender with ischemic heart diseases underwent coronary artery bypass Graft. Exclusion criteria were patients undergo CABG plus surgical intervention for other valve lesion, patients with artificial valve, those missed to attend their postoperative echocardiography follow-up and patients refused enrollment in the study. The study ethics were implemented in regard to Helsinki Declaration by informed written and verbal consent of patients, approved by ethical committee in Ethics Committee of Kurdistan Higher Council of Medical Specialties and agreement of SSH authority in addition to confidentiality of data. A sample of one hundred and forty patients with ischemic heart diseases underwent coronary

artery bypass Graft was selected by consecutive sampling method after eligibility to inclusion and exclusion criteria.

Information of patients was collected directly through a prepared questionnaire design, included age, gender and risk factors, and coronary angiography report, while electrocardiography and echocardiography before and 6 month after CABG. Patients undergone CABG according to CAD conditions as indicated according to the American College of Cardiology (ACC) and American Heart Association (ACC),[6] baseline Echocardiography were done to all the participants involved in the study before surgery then 6 months after CABG, in specific regard to their LVSF. Transthoracic 2D Echocardiography (TTE) was performed by cardiologist; echocardiography machine to be used was (GE) vivid 9 ultrasound system. The modified Simpson's rule was used to measure ejection fraction (EF).
The patients' information were entered and interpreted statistically by SPSSprogram-26. Suitable statistical tests for data were implemented accordingly like Chi-square, Fishers exact and paired t-tests and the p value of ≤0.05 was significant.

Results

In this study, 140patients underwent coronary artery bypass Graft were enrolled with mean age (60.8 years); 30% of them were in age of 60-69 years. Male patients underwent coronary artery bypass Graft were more than females (76.4% vs. 23.6%). As shown in (Table 1), the common risk factors for patients underwent coronary artery bypass Graft were HT & DM (25.7%), DM (22.9%), HT, DM & smoking (20%), smoking (17.1%) and HT (14.3%). A shown in (Table 2), the mean LVEF of all patients underwent coronary artery bypass graft was not significantly reduced post bypass graft (p=0.09). However, the mean LVEF of patients underwent coronary artery bypass graft with EF≥50% was significantly declined post bypass graft (p<0.001) and mean LVEF of patients underwent coronary artery bypass graft with EF<50% was significantly increased post bypass graft (p=0.001).

The changes in LVEF of139 patients underwent coronary artery bypass graft after grafting was distributed into; 34.3% of patients with improved EF, 21.4% of patients with unchanged EF and 44.3% of patients with declined EF, in addition to one patient died. (Figure 1) As shown in (Table 3), no significant differences were observed between patients with different changes in LVEF regarding age (p=0.35) and gender (p=0.12). There was a significant association between patients with higher risk factors and declined LVEF after bypass graft (p=0.005). There was a significant association between patients with chronic coronary syndrome and declined LVEF after bypass graft (p=0.03); 65.6% of patients with declined EF outcome had chronic coronary syndrome. (Table 4)

Table (1): General characteristics of patients underwent coronary artery bypass Graft.

Variable	No.	%
Age mean±SD (60.8±10.3 years)		
<50 years	24	17.1
50-59 years	34	24.3
60-69 years	42	30.0
≥70 years	40	28.6
Gender		
Male	107	76.4
Female	33	23.6
Risk factors		
HT	20	14.3
DM	32	22.9
HT & DM	36	25.7
Smoking	24	17.1
HT, DM & smoking	28	20.0
Total	140	100.0

Table (2): Distribution of left ventricular ejection fraction pre and post CAD bypass graft.

Variable	CoronaryArtery Bypass Graft		p value
	Pre	Post	
	Mean±SD	Mean±SD	
All patients			
LVEF %	52.08±7.7	50.4±8.5	0.09 NS
Patients with LVEF≥50%			
LVEF %	55.6±3.7	52.09±7.7	<0.001*S
Patients with LVEF<50%			
LVEF %	40.5±5.5	44.9±8.9	0.001*S

*Paired t-test, S=Significant, NS=Not significant.

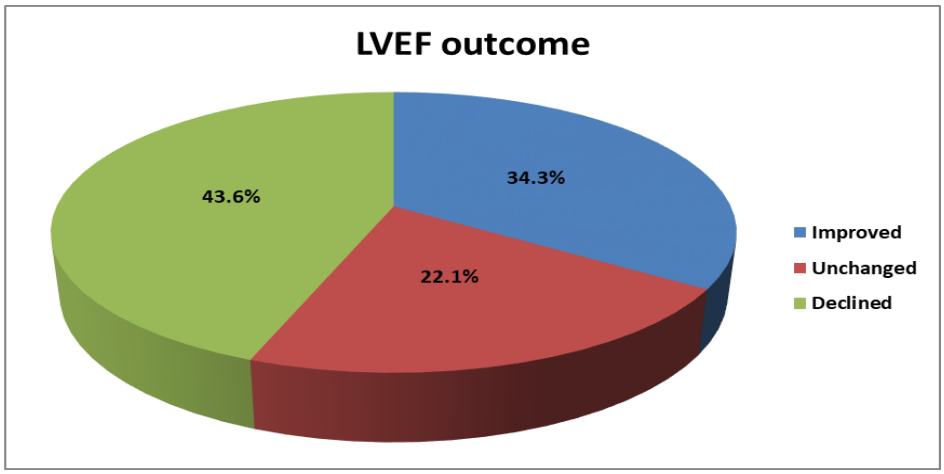

Figure (1): LVEF changes after coronary artery bypass graft.

Table (3): Distribution of general characteristics according to LVEF changes post-bypass graft.

Variable	LVEF changes						p value
	Improved		Unchanged		Declined		
	No.	%	No.	%	No.	%	
Age							
<50 years	10	20.8	8	25.8	6	9.8	
50-59 years	12	25.0	4	12.9	18	29.5	0.35* NS
60-69 years	12	25.0	10	32.3	20	32.8	
≥70 years	14	29.2	9	29.0	17	27.9	
Gender							
Male	36	75.0	20	64.5	51	83.6	0.12** NS
Female	12	25.0	11	35.5	10	16.4	
Risk factors							
HT	6	12.5	10	32.3	4	6.6	
DM	10	20.8	8	25.8	14	23.0	0.005**S
HT & DM	16	33.3	9	29.0	11	18.0	
Smoking	6	12.5	2	6.5	16	26.2	
HT, DM & smoking	10	20.8	2	6.5	16	26.2	

*Fishers exact test, **Chi-square test, NS=Not significant, S=Significant.

Table (4): Distribution of cardiac characteristics according to LVEF changes post-bypass graft.

Variable	LFEF changes						p value
	Improved		Unchanged		Declined		
	No.	%	No.	%	No.	%	
CAD types							
Acute coronary syndrome	14	29.2	3	9.7	21	34.4	0.03 *S
Chronic coronary syndrome	34	70.8	28	90.3	40	65.6	

*Chi-square test, S=Significant.

Discussion

Present study showed that mean LVEF of all patients underwent coronary artery bypass graft was not significantly reduced post bypass graft (p=0.01). This finding is consistent with results of Papestiev et al[14] prospective study in Republic of Macedonia which reported no changes in LVEF of whole studied patients with CAD after CABG, while they showed a significant improvement of LVEF in patients with low preoperative LVEF and a significant decline of LVEF in patients with normal preoperative LVEF. This study showed that mean LVEF of patients underwent coronary artery bypass graft with EF≥50% was significantly declined post bypass graft (p<0.001) and

mean LVEF of patients underwent coronary artery bypass graft with EF<50% was significantly increased post bypass graft (p=0.001). These findings are in agreement with results of many literatures such as Koene et al[13] study in USA and Khaled et al[15] cross sectional study in Egypt which revealed a significant improvement in LVEF after CABG among patients with preoperative low LVEF and a significant decline in LVEF among patients with preoperative normal LVEF. It was shown that improvement of the LVSF and survival after CABG in patients with ischemic cardiomyopathy with LV dysfunction following surgical revascularization is predominantly to be due to hibernating or stunned myocardium.[16]

Current study found that 34.3% of patients undergone CABG had improved EF, 21.4% of patients undergone CABG had unchanged EF and 44.3% of patients undergone CABG had declined EF, in addition to one patient died. These findings are close to results of Haxhibeqiri-Karabdic et al[17] who reported that 31.08% of CAD patients had improved LVEF following CABG. Koene et al[13] found

that23.7% of patients undergone CABG had improved EF, 55.2% of patients undergone CABG had unchanged EF and 21.1% of patients undergone CABG had declined EF. This inconsistency might be attributed to differences in preoperative LVEF of patients in two studies. Current study showed a significant association between patients with higher risk factors and declined LVEF after bypass graft (p=0.005). This finding is parallel to results of Trașcă et al[18] who found that diabetes mellitus and smoking had a great impact on outcome of CABG and affecting the LVEF. Present study also revealed a significant association between patients with chronic coronary syndrome and declined LVEF after bypass graft (p=0.03). Similarly, Deo et al [19] revealed that patients with chronic coronary syndrome with mid-range preoperative LVEF had a negative impact on survival and declined LVEF following CABG.

This study concluded that left ventricular systolic function following coronary artery bypass graft is dependable on preoperative left ventricular systolic function. The left ventricular ejection fraction following coronary artery bypass graft is improved in patients with low ejection fraction, while reduced in patients with normal ejection fraction. The coronary artery bypass graft is essential in patients with coronary artery diseases. Further large sized multi-centers longitudinal studies are required in evaluation survival for patients with coronary artery diseases with different ejection fractions after coronary artery bypass graft.

Conclusions

The left ventricular systolic function following coronary artery bypass graft is dependable on preoperative left ventricular systolic function and it is improved in patients with low ejection fraction, while reduced in patients with normal ejection fraction.

Conflicts of interest

None

Acknowledgment

Gratitude and thanks for the staff of Surgical Specialty Hospital (SSH)-Erbil Cardiac Center.

References

1. Dalen JE, Alpert JS, Goldberg RJ, Weinstein RS. The epidemic of the 20(th) century: coronary heart disease. Am J Med 2014; 127(9):807-12.
2. Maleki A, Ghanavati R, Montazeri M, Forughi S, Nabatchi B. Prevalence of Coronary Artery Disease and the Associated Risk Factors in the Adult Population of Borujerd City, Iran. J Tehran Heart Cent 2019; 14(1):1-5.
3. Nowbar AN, Gitto M, Howard JP, Francis DP, Al-Lamee R. Mortality from Ischemic Heart Disease. Circ Cardiovasc Qual Outcomes 2019; 12(6):e005375.
4. Benjamin EJ, Virani SS, Callaway CW, et al. American Heart Association Council on Epidemiology and Prevention Statistics Committee and Stroke Statistics Subcommittee. Heart Disease and Stroke Statistics-2018 Update: A Report from the American Heart Association. Circulation2018; 137(12):e67-e492.
5. Cortes-Beringola A, Fitzsimons D, Pelliccia A, Moreno G, Martin Asenjo R, Bueno H. Planning

secondary prevention: Room for improvement. Eur J Prev Cardiol 2017; 24 (Suppl 3):22–8.
6. Amsterdam EA, Wenger NK, BrindisRG, et al. 2014 AHA/ACC guideline for the management of patients with non-ST-elevation acute coronary syndromes: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. Circulation. 2014; 130 (25): 344-26.
7. Windecker S, Kolh P, Alfonso F, et al; Authors/Task Force members. 2014 ESC/EACTS guidelines on myocardial revascularization. Eur Heart J 2014; 35 (37):2541–619.
8. Velazquez EJ, Lee KL, Jones RH, et al; STICHES Investigators. Coronary-Artery Bypass Surgery in Patients with Ischemic Cardiomyopathy. N Engl J Med. 2016; 374(16):1511-20.
9. Sipahi I, Akay MH, Dagdelen S, Blitz A, Alhan C. Coronary artery bypass grafting vs percutaneous coronary intervention and long-term mortality and morbidity in multivessel disease: meta-analysis of randomized clinical trials of the arterial grafting and stenting era. JAMA Intern Med 2014; 174(2):223-30.
10. Yusuf S, Zucker D, Peduzzi P, et al. Effect of coronary artery bypass graft surgery on survival: overview of 10-year results from randomised trials by the Coronary Artery Bypass Graft Surgery Trialists Collaboration. Lancet 1994; 344(8922):563-70.
11. Loop FD, Lytle BW, Cosgrove DM, et al. Influence of the internal-mammary-artery graft on 10-year survival and other cardiac events. N Engl J Med1986; 314(1):1-6.
12. Hovnanian AL, Matos Soeiro Ad, Serrano CV et al. Surgical myocardial revascularization of patients with ischemic cardiomyopathy and severe left ventricular disfunction. Clinics (Sao Paulo) 2010; 65(1):3-8.
13. Koene RJ, Kealhofer JV, Adabag S, Vakil K, Viorel G. Florea VG. Effect of coronary artery bypass graft surgery on left ventricular systolic function. J Thorac Dis 2017; 9 (2):262-70.
14. Papestiev V, Jovev S, Sokarovski M, et al. Changes of Left Ventricular Systolic Function in Patients Undergoing Coronary Artery Bypass Grafting. Open Access Maced J Med Sci 2019; 7(21): Available from: https://doi.org/10.3889/oamjms.2019.849
15. Khaled S, Kasem E, Fadel A, et al. Left ventricular function outcome after coronary artery bypass grafting, King Abdullah Medical City (KAMC)- single center experience. Egypt Heart J 2019; 71 (1): 2.
16. Lee KS, Marwick TH, Cook SA, et al. Prognosis of patients with left ventricular dysfunction, with and without viable myocardium after myocardial infarction: relative efficacy of medical therapy and revascularization. Circulation 1994; 90 (6):2687–94.
17. Haxhibeqiri-Karabdic I, Hasanovic A, Kabil E, Straus S. Improvement of ejection fraction after coronary artery bypass grafting surgery in patients with impaired left ventricular function. Med Arch 2014; 68(5):332-4.
18. Trașcă SP, Goanță EV, Târtea GC, Ciurea PL. The Impact of the Risk Factors in the Evolution of the Patients with Left Main Coronary Artery Stenosis Treated with PCI or

CABG. Curr Health Sci J 2019; 45(1):19-27.
19. Deo SV, Sundaram V, Sahadevan J, et al. Outcomes of coronary artery bypass grafting in patients with heart failure with a midrange ejection fraction. J Thorac Cardiovasc Surg. 2021:S0022-5223(21)00132-X.