Original Article

Studying the Frequency of Graft Failure in Symptomatic Post-CABG Patients

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Abstract

Background: CABG and PCI are two important methods of revascularization in patients with ischemic heart disease. they are often considered competitive procedures, but it is more appropriate to view them as complementary. An increase number of patients who have treated with CABG and later have recurrent ischemia undergo revascularization with PCI. Aim of this study, was evaluated LIMA and SVG graft in symptomatic post CABG patients. **Methods:** 129 symptomatic post CABG patients (chest pain, dyspnea, MI, etc) that referred to Ghaem and Imam Reza hospitals admitted for coronary angiography between 2018 and 2019. Indication of coronary angiography in these patients were similar to others patients. Graft failure was defined as ≥ 70% stenosis. **Result:** There were a total of 379 grafts. comprised of 252 venous grafts and 127 arterial grafts (LIMA). Angiography were detected grafts failure in 56.6% of patients. Arterial graft failure was 11.8% and venous graft failure Was 38.5%. there was no relationship between the presence of graft failure and any of the cardiovascular major risk factors. **Conclusion:** Given the high volume of venous graft CABG should only be used in urgent failure, cases and it is advisable to use LIMA if possible.

Keywords: Coronary artery bypass grafting, Left Internal mammary artery graft, Saphenous vein graft

Introduction

CABG (Coronary Artery Bypass Graft) and PCI (Percutaneous Coronary Intervention) are two important methods of revascularization of ischemic heart disease. Although they are seen as competing procedures, they are complementary to each other. Currently, the number of patients with a history of CABG going under PCI due to recurrent ischemia is increasing [1]. Coronary angiography is the standard procedure for evaluating stenosis of the coronary artery, and the indications for coronary angiography in subjects who have undergone CABG are similar to those of others [2]. Normally in the myocardial tissue at rest and during physical activity or emotional excitement, the amount of heart oxygen supply and demand is in balance. When the supply of oxygen to the myocardium fails to meet the myocardial oxygen demand, the myocardial ischemia occurs. [3] Its cause is coronary atherosclerosis in more than 95% of cases [4].

The risk factors for ischemic heart disease are divided into two groups: corrigible and non-corrigible. The corrigible group included stress, alcohol use, smoking, high blood sugar, hypertension, obesity and hyperlipidemia, and the non-corrigible group included male sex, high age, positive family history, kidney disease, hypercholesterolemia and type 1 and type 2 diabetes [4].

Cardiovascular diseases are also increasing major health and social problem in the eastern Mediterranean and the Middle East. In sporadic studies in Iran, 25 to 45 percent of deaths were due to cardiovascular diseases [5].

This disease causes more deaths, disabilities, and costs than other diseases, so that, considering all age groups, ischemic heart disease is the most common cause of death in both men and women [6].

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Coronary artery bypass graft surgery is an important way of treating these patients that, if performed in a timely and proper manner, can play a key role in reducing the mortality and complications of these diseases. This procedure, which is performed as open-heart surgery, provides a bypass route from the aorta to the occluded arteries for blood supply to the heart muscle. Approximately 598,000 cases of coronary artery bypass graft were performed in the United States alone in 2012 [7]. Nowadays, coronary artery bypass graft surgery is one of the most performed in Europe. (18-91 / 100,000) [8].

Although there have been many advances in drug therapy and catheterization techniques, surgical interventions are still one of the most important treatments for these diseases [7].

Coronary artery bypass graft surgery depends on the severity of symptoms, coronary anatomy, and left ventricular function. Patients who are candidates for this procedure have problematic or debilitating symptoms that are not fully controlled by medical treatment or cannot tolerate medical treatment and want to live a more active life or they have severe coronary artery stenosis. CABG is commonly used when a patient has left ventricular dysfunction or critical obstruction in more than one of the main arteries [9].

Many bypass surgeries are currently performed through a middle sternotomy and cardiopulmonary bypass with cardioplegia. In terms of technical issues, the bypass aims to vascularize completely all of the appropriate diameter vessels with significant proximal stenosis. CABG in a specific group of people with CAD (Coronary artery disease) increases survival removes angina and improves the quality of life; it has excellent effects in the treatment of patients in the short- to medium-term, but its long-term results are affected by venous graft failure [1].

A study conducted on 1828 patients 12 to 18 months after surgery or patients who were referred earlier because of symptoms, showed that 782 (42.8%) of 1828 patients had venous graft failure. Demographic data and clinical symptoms were similar between the two groups with and without graft failure. In the group with venous graft failure, the duration of operation was longer and the venous graft length was longer, and the vein more frequently underwent harvesting [10].

Also in 2017, 216 patients with a history of CABG who had symptoms such as chest pain and shortness of breath, etc., underwent angiography. The mean age of the subjects was 65±8.06 and the mean number of years was 9.4±4.5 years. The graft patency rate for LIMA was 84%, RIMA was 78%, SVG to PDA was 67% and SVG to OM was 65%. Significantly, SVG patency was more (81%) when it was used for LAD or D (81%) [11].

Also in 2009, 107 patients underwent coronary angiography one week after CABG to assess the early postoperative patency rate. The total number of grafts was 366, including 250 venous grafts and 116 arterial grafts. Acute graft failure was reported in 32 (8.7%) cases, including 26 (10%) venous grafts and 6 (5%) arterial grafts. The rate of graft failure of LIMA was 2.7%. Among the various factors before, during, and after surgery, pump time was significantly longer in people with graft failure [12].

148 patients with a history of CABG underwent coronary angiography between one month and 1.5 years postoperatively; the rat of graft failure was 26% (39 patients). Overall, there were 129 venous grafts and 116 arterial grafts, with a rate of 20% (26 grafts) of venous graft failure and 11% (13 grafts) of arterial graft failure [13].

A 2018 study of 127 patients with a history of CABG undergoing coronary angiography at 139.78±36.64 months after surgery showed that the graft patency rate for LIMA was 90.16%, 75.55% for RIMA, 79.25% for radial artery and 74.3% for SVGs [8].

Cardiac surgeries are undoubtedly complex, and possibly cardiac arrest and extracorporeal circulation can have potential complications [7].

The success of the bypass grafts is also closely related to the technique and skill of the surgeon and the topographic knowledge of the cardiovascular system and the site of the lesion during surgery; we can evaluate it concerning the outcome of postoperative angiography.

Coronary angiography is the standard procedure for the evaluation of coronary artery bypass graft patency and stenosis. the indication for coronary angiography in patients with CABG is similar to patients without bypass surgery [2]. Patients without symptoms may benefit from angiography if they have left ventricular dysfunction or new heart failure [14].

According to the World Health Organization (WHO), the number of deaths from IHD will increase from 7200,000 in 2002 to 11 million in 2020. Despite widespread prevention, IHD mortality is rising at the age of fewer than 65 years [11]. In our country, the average age of patients with IHD is at least 10 years younger than in Western countries.

The purpose of this investigation was to determine the incidence of post-CABG graft failure in symptomatic patients, in addition to being aware of the graft failure rate, to evaluate the efficacy and use of CABG.

Method

This project has been approved by the Ethical Committee of Mashhad University of Medical Sciences under the code IR MUMSMEDICALREC-1397-191. The present investigation is a cross-sectional study. 129 symptomatic post CABG patients (chest pain, dyspnea, MI, etc) that referred to Ghaem and Imam Reza hospitals in mashhad admitted for coronary during 2018 and 2019.

the patients' medical histories were recorded and examined them clinically. We recorded their angiographic results in the checklist. If a patient did not have a previous surgical report or CD angiography or did not wish to enter the study, it was excluded from participation in the study.

Based on the available data that about 15-30% of patients develop graft failure within the first year after CABG [1], taking into account alpha 0.05, p: 0.25 and d: 0.3p, the minimum sample size was 129 people.

After data collection, we recorded them on the computer using SPSS version 23 software and then used the frequency distribution table or diagram for descriptive statistics. A Chi-square test was used to examine the relationship between qualitative data and T-test was used to compare quantitative variables between the two groups. A statistical significance level of tests was considered less than 5%.

RESULTS:

In this study, 129 CABG patients who referred to Ghaem (AS) and Imam Reza (AS) hospitals between 2018 and 2019 with symptoms such as chest pain, dyspnea , MI , arrhythmia and syncope underwent angiography.

Patients were divided into two groups according to the number of years after surgery. The first group was those who underwent angiography during the first 5 years after CABG (78 people) and the second group was those who underwent angiography 5 to 10 years after CABG (51 people). The mean age in the first group was 61.34±9.88 and in the second group 67.50±7.02.

Generally, graft failure occurred in 73 patients (56.6%). The graft failure rate was 41 (52.6%) in the first group and 32 (62.7%) in the second group (P-value: 0.91).

In total, there were 379 grafts , comprised of 252 venous grafts and 127 arterial grafts (LIMA to LAD). There were no other arterial grafts in this study.

Four patients (3.1%) underwent angiography during the first 3 months after CABG, with only one having venous graft failure due to technical difficulties.

Patients who had more grafts in comparison with those who had less , became symptomatic sooner after surgery and needed angiography.(Table 7). The rate of graft failure was higher in those who had four grafts (71.4%) than in others. This may be due to the diffuse of CAD.

Diabetes, hypertension, hyperlipidemia, and smoking are important risk factors for cardiovascular disease. 54 patients (41.9%) had a history of diabetes, 74 patients (57.4%) had a history of hypertension, 30 patients (23.3%) had a history of hyperlipidemia and 20 patients (15.5%) had a history of smoking. We studied these risk factors between the two groups with and without graft failure. It was found that the statistical significance of these risk factors was not significantly different between the two groups (P-value: 0.39) (Table 1).

Table 1: Demographic information of patients at the time of referral

Variable	Number of patients (%)
Age	
Mean-year	9.33 ±63.78
Minimum	36
Maximum	85
Gender	
Man	92 (71.3%)
Woman	37 (28.7%)
Risk factor	
History of hypertension	74 (57.45)
History of diabetes	54(4.9%)
History of hyperlipidemia	30 (23.3%)
History of smoking	20 (15.5%)
Symptoms at the time of referral	
Chest pain	107 (82.9%)
Shortness of breath	41 (31.8%)
MI	16 (12.4%)
Syncope	3 (2.3%)
arrhythmia	4 (3.1%)

A comparison of mean age between those with and without graft failure showed no significant difference between the two groups (P-value: 0.92). In the graft failure group, the mean age of those who had graft failure in the first 5 years postoperatively was significantly lower than the others (p-value <0.001) (Table 2). The mean age of those who had graft failure was 63.71 ± 9.4 and that of those who had not the mean age was 63.87 ± 9.31.

Table 2: Comparison of mean age between the two groups 5 years after CABG and 5-10 years after CABG

Group	Number	Mean	Standard deviation	p-value
5 years after CABG	78	61.34	9.88	*< 0.001
5-10 years after CABG	51	67.5	7.02	

*independent sample t-test

Table 3: Frequency distribution of graft failure during the first 5 years after CABG and 5 to 10 years after CABG

	graft failure during the first 5 years after CABG	graft failure 5 to 10 years after CABG	*p-value
Yes	(52.6%) 41	(62.7%) 32	0.92
No	(47.4%) 37	(37.3%) 19	
Total	(100%) 78	(100%) 51	

*Fisher's Exact test

The graft failure rate of patients under study was 56.6%.

As Table 3 shows, the graft failure event occurring during the first 5 years after CABG or the second 5 years after CABG has no significant difference (P-value: 0.91).

Diagram 1 shows that the highest Patency rate is related to the graft of LIMA and the highest graft failure rate is related to SVG to D.

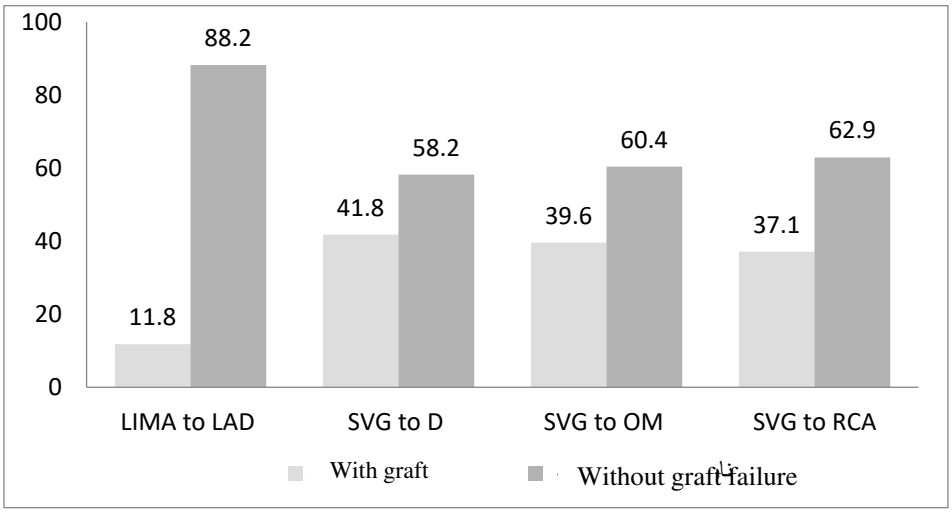

Diagram 1: Frequency distribution of graft failure by type of grafting

Table 4: Relationship between graft failure and the number of years after CABG

Type of graft	With graft failure		*P-value
	< 5 years	5 years ≤	
LIMA to LAD (N =127)	10(12.8%)	5(10.2%)	0.65
SVG to D (N =55)	10(3.33%)	13(52%)	0.16
SVG to OM (N =96)	19(32.8%)	19(50%)	0.91
SVG to RCA(N= 89)	21(36.8%)	12(37.5%)	0.95
SVG to RAMUS (N =12)	2(20%)	(50%)	0.45

*Fisher 's Exact test

Table 4 shows that there is no significant relationship between graft failure and the type of grafting in the first and second 5 years after CABG.

Table 6: Relationship between graft failure and major cardiovascular risk factors

Variable	Patent	occluded	Total	*P-value
Sex: female	15(40.5%)	22(59.5)	37	0.67
Male	41(44.6%)	51(55.4%)	92	
With DM	26(48.1%)	28(51.9%)	54	0.35
Without DM	30(40%)	45(60%)	75	
With HTN	30(40.5%)	44(59.5%)	74	0.44
Without HTN	26(47.3%)	29(52.7)	55	
With HLP	10(33.3%)	20(66.7%)	30	0.20
Without HLP	46(46.5%)	53(53.5%)	93	
Smoking	10(50%)	10(50%)	20	0.51
No smoking	46(42.2%)	63(57.8%)	109	

*Fisher 's Exact test

As shown in Table 6, there was no relationship between the presence of graft failure and any of the cardiovascular major risk factors.

Table 7: Comparison of the rate of venous graft failure (its number) and the meantime of referral based on the number of patient's grafts

Number of graft	venous graft failure 1		venous graft failure 2		venous graft failure 3		venous graft failure 4		meantime of referral (month)	Rate of venous graft failure
	Individual	Percentage	Individual	Percentage	Individual	Percentage	Individual	Percentage		
Graft 1 (N: 6)	-	-	-	-	-	-	-	-	29.78±74.4	No
Graft 2 (N: 30)	11	%100	-	-	-	-	-	-	80.45±44.1	36.6%
Graft 3 (N: 53)	17	%89.5	2	%10.5	-	-	-	-	35.72±61.78	35.8%
Graft 4 (N: 35)	11	%44	8	%32	5	%20	1	%4	74.79±34.63	71.4%
Graft 5 (N: 5)	1	%50	-	-	1	%50	-		54±8.48	40%

Table 7 shows that Patients who had more grafts in comparison with those who had less , underwent angiography sooner after surgery.The rate of graft failure was higher in those who had four grafts (71.4%) than in others.

Discussion

This study was performed in Ghaem and Imam Reza hospitals between 2018 and 2019. Symptomatic Post CABG patients who referred to these hospitals for angiography were included in the study.

Similar to previous studies, the LIMA patency rate was higher than that of SVG grafts. According to the results of Mario's article, patients underwent angiography one month to one and a half years after surgery; they had 11% graft failure. If we compare the results of 11% of this study with the results of our study of about 13% and Grigore Tinica's study, based on which patients underwent coronary angiography at 139.78 ± 36.64 months postoperatively, about 10% for LIMA, we conclude that the problem of LIMA failure is primarily technical, which can be at the site of anastomosis or harvesting [7].

In our study, SVG to D graft failure had more than other grafts but in previous studies, SVG to D graft failure had less than other grafts.

We examined the risk factors for cardiovascular disease that may be associated with graft failure. It was similar between the two groups with and without graft failure; it had no significant association with diabetes even as it was a risk factor for atherosclerosis. Some previous studies have suggested that low age or hyperlipidemia may have adverse effects on graft patency. According to these studies, the rate of LIMA patency was approximately uniform between one and a half years to 14 years after surgery.

Our study showed that LIMA had the highest patency rate and SVG to D had the highest graft failure. The use of LIMA graft has had better results, although its use has been entirely dedicated to LAD and D. The study showed that the long-term outcome of our surgery, which was mainly performed in Mashhad, was not significantly different from the other centers.

According to our study, Patients who had more grafts in comparison with those who had less , became symptomatic sooner after surgery and needed angiography .The rate of graft failure was higher in those who had four grafts (71.4%) than in others. This may be due to the diffuse of CAD, the longer duration of surgery, the longer graft, and the frequent harvesting; it requires careful examination.

Conclusion

Given the high volume of venous graft failure, CABG should only be used in urgent cases and it is advisable to use LIMA if possible.

Appreciation

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