

## **Research Article**

# **Comparison of the postoperative complications of CABG surgery between patients with a left ventricular ejection fraction of less than 30 percent and those with a left ventricular ejections fraction of more than 30 percent in Imam Khomeini Hospital of Tehran from June 2006 to March 2010**

**Ghasemali Mish Mast Nahi<sup>1</sup> and Mahmood Al Mohammad<sup>2</sup>**

1-Physiology Assistant Professor Zahedan University of Medical Sciences

2-Anesthesiologist, Assistant Professor of Tehran University

## **SUMMARY**

The Increase of coronary artery diseases has caused the use of coronary bypass surgery to be one of the most effective methods of treatment. Obviously any remedial action may entail complications and determination of these complications can be effective in dealing with diseases; thus, the objective of this study is to compare the postoperative complications of CABG surgery between patients with a left ventricular ejection fraction of less than 30 percent and those with a left ventricular ejections fraction of more than 30 percent in Imam Khomeini Hospital of Tehran from June 2006 to March 2010

Methods: In this retrospective cross-sectional study, all patients' cases who underwent CABG surgery were examined during June 2006 to March 2010. Also the prevalence and relation of postoperative complications with EF were determined. The data collected according to research objectives were analyzed using statistical tests.

Results: Myocardial infarction with a percentage of 20.4 and the need for mechanical ventilation with a percentage of 1.2 were the highest and lowest complication of the disease, respectively. The frequency of myocardial infarction, acute renal failure, infection, pulmonary edema and death in patients with EF <30% ( $p= .001$ ) have had significant correlation, Such that the occurrence of five high complications in patients with EF <30%, was significantly higher than the group with EF  $\geq$ 30%.

Conclusion: On the basis of this study, presence or absence of postoperative complications of CABG surgery have a significant relationship with the individual's EF; however, due to lack of studies in this area, more researches is recommended for the future.

**Keywords:** Arteries bypass surgery, left ventricular ejection fraction, postoperative complications of CABG

## **INTRODUCTION**

Coronary artery disease is the most common cause of death in developed countries, and about one-third of all deaths in Western societies is caused by coronary heart disease and about 35% of people in America who are over 65 years die of ischemic heart disease IHD (1,2, 3). Treatment and control of disease and disability arising from it imposes high costs on individuals and societies

(5, 4). Based on studies carried out in Iran, deaths from this disease are so high in Iran, in a way that it constitutes the first cause of death in the country; in other words, before accidents and cancers, the heart diseases -by more than 35%- are the most common cause of death(6). Coronary artery disease refers to the narrowing or blockage of all or part of the lumen of the coronary arteries

following atherosclerosis; spasm or thrombosis. In this disease, the artery cannot provide the oxygen nutritional requirements of myocardial muscle, resulting in angina and myocardial infarction (7).

The blood supply to the heart: cardiac output of coronary blood flow in normal and resting condition is about 70 ml i.e. 4.5%. The two coronary artery of myocardia exit from the sinuses behind the aortic valve leaflets in the aortic root; eddy currents, keep the valves away from the artery pores and cause the coronary arteries to remain open throughout the cardiac cycle (8). At rest, the heart receives 80-70% of oxygen of each blood unit and the reception and utilization of oxygen is possible only with more blood flow. The primary factor being responsible for myocardial perfusion is aortic pressure, which of course is caused by the heart but the main factor in the regulation of coronary blood flow is the myocardial metabolic activity; Such that when the metabolic activity of the heart is increased the resistance of coronary arteries is reduced and the blood flow is increased and conversely when the activity is reduced the resistance is increased and the blood flow is reduced (9).

#### Myocardial infarction (MI)

Myocardial infarction is the destruction or permanent and irreversible death of cells in a part of the heart muscle (myocardium) which happens due to the loss of blood flow and the occurrence of a severe ischemia of the heart (11,10). The stop of the blood flow may occur suddenly and without any prior symptoms, or after some angina attacks (chest pain). The main reason of the MI is the closure of feeder vessels of the heart. Apart from medications, the balloon and open heart surgery (replacing the blocked vessel) are used to relieve blockage. Myocardial infarction is a widespread complication that annually causes the death of thousands. (10). Myocardial infarction is caused due to the high prevalence of atherosclerosis in developed societies also there are a relationship between atherosclerosis and the level of lipoprotein's blood circulation as well a strong positive correlation between atherosclerosis and

the blood circulation of homocysteine's concentrations that this material damages the endothelial cells and in the presence of folate and vitamin B12 is converted into non-toxic methionine so the supplementations of folate and B12 reduce the occurrence of coronary heart disease (8). Some of the predisposing factors for myocardial infarction are: diabetes, high blood pressure, high blood cholesterol, excessive smoking and alcohol, physical inactivity, stress, family history and age. Only in America, in 2004, more than 150,000 people died because of this disease. (10)

Ejection fraction: ejection fraction is a valuable indicator of ventricular function and it can be measured by the labeled red blood cells injecting radio- nucleotides (8). And the ratio of end-diastolic volume that is extrapolated from the heart is called ejection fraction (EF) and is usually "equal to 65-60% of end-diastolic volume; the increase in the end-diastolic volume and the decrease in the end-systolic volume the output of stroke volume, and finally the "ejection fraction: is increased to twice the normal amount (8). Increase cardiac contractility of catecholamine may reduce the volume of residual ventricular and thus increase the stroke volume and ejection fraction (9). Heart failure may be systolic or diastolic; in systolic type we are faced with the poor ventricular contraction and the stroke volume and ejection fraction are reduced in a way that the ejection fraction reaches from 65% to 20% and in diastolic dysfunction, myocardial elasticity is reduced such that the filling during diastole is reduced, resulting in insufficient stroke volume, although its ratio remains constant to ejection fraction (8).

#### Pathology

Often coronary artery atherosclerosis and thereby the blockage of feeder arteries of heart muscle lead to myocardial infarction and its treatment will not be easy. If the Closed artery is the main coronary artery the likelihood of death is much more. Predisposing factors such as diabetes, hypertension, smoking and hyperlipidemia are

introduced for MI. (10) Atherosclerosis is one of the most important factors in reducing coronary blood flow; it can be said that some factors including genetic predisposition, sedentary life and overweight or obese, high blood pressure with the damage of endothelial cells of coronary artery gradually cause a high amount of cholesterol precipitate in many parts of the body and below the arterial endothelium and finally make atherosclerotic plaques. In this part the artery conduit is completely or partially blocked and the blood stops circulating due to the enlargement or rupture of plaques. One of the most common points for this blockage is the first few centimeters of the coronary artery (1). Today it is identified that the most common cause of myocardial infarction is the atherosclerosis plaque's rupture or bleeding into it which causes clot formation in the coronary artery in the position of plaque. Many doctors believe that local spasm of the coronary artery, can also cause blockage of the coronary artery due to the direct harassment of smooth muscle of the arterial wall by the edges of the atherosclerosis plaques (1). Vasoconstrictor effects of alpha receptors in the pericardium are too severe in some people and the severe sympathetic irritation myocardial ischemia and angina pectoris are often felt (1).

What is important in dilating blood vessels by endothelial is the formation and liberalization of NO called the relaxation factor of vessels derived from the endothelium. When endothelial cells are stimulated by different materials NO is produced and liberated. These materials do not cause vasodilatation in the arteries which are mechanically damaged and lack endothelium. It is noteworthy that damage of the vascular endothelium of coronary artery results in atherosclerosis, and in fact, endothelium has an anti-atherogenic property (9).

#### Clinical signs

In most cases the myocardial infarction is associated with typical representations that makes the diagnosis easy. A localized chest pain in the center of the chest (thoracic) with the ability to

release towards the jaw, arms, back and neck, especially in MI symptom is more than 20 minutes. If left untreated, the pain is annoying and will last a long time. (10, 11) Sometimes it takes several hours and resists to trinitrate, the de poitrine's medication calms the pain from angina. Also there are other signs like the immediate emergency ECG that can facilitate detection. There are a large number of cases of myocardial infarction that are represented as anxiety, for example, forms a false sense of indigestion and burping, nervousness, difficult breathing (due to a problem in the left ventricle and thus the pulmonary edema), edema and swelling in the hands and feet that may be accidentally detected in routine tests and regular medical tests.

We need to remember that when an elderly patient with high blood pressure whose age is over 40, is anxious and has a stressful live and is experiencing severe and continuous pain in the chest visits a doctor, the possibility of infarction should be regarded and electrocardiogram should be asked (10,11).

#### Diagnosis

Angina is caused by ischemia of heart. As long as the person is not doing an activity he/ she does not have any pain. But as soon as the pressure is imposed to the heart such as muscle activity or intense emotion, or being exposed to cold air or full stomach, angina appears and by stopping the pain conditions it disappears. Identification of a patient with acute myocardial infarction, can be simple, difficult or in the middle of the two modes. Usually a simple diagnosis of Acute Myocardial Infarction is possible in the people with a number of symptoms of atherosclerosis risk factors and signs and symptoms concerning the lack of blood flow to the heart. Usually patients with suspected myocardial infarction are transmitted to emergency. When the clinical image of the patient indicates the myocardial infarction, several diagnostic test will immediately be implemented. These tests include: electrocardiogram EKG, blood tests, and echocardiography. Electrocardiogram:

electrocardiogram is the first diagnostic test that may indicate early heart attack has already happened or is happening. Laboratory tests: living cells contain enzymes and proteins (e.g, creatine, kinase, troponin and myoglobin) which are in connection with the professional performance. When a heart cell dies, it causes the cell membrane to lose its integration and in these conditions, proteins and enzymes slowly find their ways into the bloodstream. These enzymes and proteins can be detected by laboratory tests. Identification and measurement of them have an important role in the diagnosis and the lesion of the myocardial infarction. Other isomer enzyme measures include MB, creatine kinase, troponin T and troponin I (ALT, AST) (8).

Echocardiogram (ECHO): In an echocardiogram the normal or abnormal contraction of left ventricular is discussed. One of the first measures of myocardial cells during the reduction of blood flow, is to turn off the mechanism which requires more energy for contraction. This mechanism starts immediately after reducing the blood flow. An echocardiogram can help identify affected areas of the heart muscle by myocardial infarction and diagnose vessels which are likely to be blocked (10, 11).

#### Treatment

Following myocardial infarction, the first step is the complete rest, oxygen and controlling blood pressure and heart rhythm. Usually anticoagulant drugs such as aspirin or heparin and sympathetic beta-blockers, like propranolol are prescribed. Following ischemia, if ischemia is severe and prolonged, irreversible changes lead to myocardial infarction. If the coronary arteries are relatively narrowed, will be narrowed more because of the vasospasm caused by myocardial infarction. Following coronary artery disease that lead to hypoxia, ischemia, angina pectoris, and finally myocardial infarction, several drugs can be used that dilate coronary artery. Such as; 1. Nitrates which are metabolized with NO, dilate large veins, reduce venous return and reduce the heart's workload. In addition, dilate coronary arteries and

increase the blood flow of the peripheral circulation. 2. Calcium channel's antagonists also dilate blood vessels. 3. Beta-adrenergic antagonists that reduce the heart rate indirectly reduce the required blood flow to the heart (9).

CABG: The narrowed areas of coronary arteries are restricted to some certain points which are blocked by Atherosclerosis plaque and the arteries which are placed after the blocked parts are healthy. To overcome the problem of myocardial infarction in 1960, a surgery was achieved called the coronary artery bypass surgery known as CABG or coronary aortic bypass in which an under-skin vein of the arm or leg (saphenous vein) is taken and transplanted between the aortic root and a more peripheral arterial coronary after the obstruction point. Usually 5-1 transplant of coronary artery is conducted, which provides blood for the main artery. Or through internal mammary artery's graft and the main coronary artery, the reperfusion is placed in the coronary artery (12). This surgical method is an effective method to reduce or eliminate symptoms of angina. In other words surgical treatment, is one of the ways of improving the quality of treatment to reduce morbidity and mortality (13). All over the world ,annually, 1 million heart surgery is conducted, the most common among which is CABG with on-pump method, which is done with the help of conventional cardiopulmonary bypass (CPB) .(14) Based on the studies, CABG, through medical treatment, has upgraded the 5-year prognosis in patients with left ventricular dysfunction due to ischemic causes from 40% to 80% (15).

However, like most surgeries, CABG, is associated with complications such as wound infection, bleeding, repeated MI, prolonged time of hospitalization and so on. (16, 15) So in this field, Hasanzadeh M, et al.2013 (16), who had conducted a 10-year old study on patients who had undergone CABG, reported the incidence of postoperative complications in order of prevalence as follows: Dysrhythmia 31.6%, renal complications 15.8%, pulmonary

complications 8.2%, bleeding 5.8%, cerebral complications 2.8%, cardiac arrest 1.9%, CHF 1.5% and MI 1.2%.

In addition to the items listed in the above studies, one of the factors that appears to predict postoperative complications of CABG surgery is left ventricular ejection fraction (EF) of the patient before surgery; Christakis GT, et al (17), in a study of 12471 patients undergoing CABG found that mortality in 9445 patients with  $EF \geq 40\%$  was 2.3 percent and mortality in 2539 patients with  $EF \leq 20-40\%$  was 8.4 percent and mortality in 487 patients with  $EF \leq 20\%$  was 9.8%. According to the above studies and the lack of studies on the relationship between left ventricular function and complications of CABG, every region and every treatment center should report separately. The objective of this study is to compare the postoperative complications of CABG surgery between patients with a left ventricular ejection fraction of less than 30 percent and those with a left ventricular ejection fraction of more than 30 percent in Imam Khomeini Hospital of Tehran from June 2006 to March 2010. It is noteworthy that besides CABG, angioplasty was introduced in 1980 to open the narrowed coronary arteries. And in recent years, newer methods of treatment are being tested, including using a laser beam to destroy the lesion of atherosclerosis.

#### Prevention

Lifestyle changes to a healthy style can prevent the risk of heart disease. The basic elements of a healthy lifestyle, include not smoking or smoking cessation, proper diet (more fruits and vegetables and less fat, sugar and meat), at least 30 minutes of exercise a day, control of diseases such as diabetes, high blood pressure and cholesterol, and avoiding stressful condition (10,11)

#### **METHODOLOGY:**

In this retrospective cross-sectional study, all patients' cases who underwent CABG surgery were examined during June 2006 to March 2010. All available records, regarding the inclusion criteria were investigated and those cases that

didn't meet the criteria's of the study were excluded. Inclusion criteria of the study included: 1) patients who underwent CABG, 2. Patients who underwent CABG and at the same time, were not undergoing heart valve surgery, 3. the patients had no history of heart surgery.

The information mentioned in patient's records, in compliance with ethical principles and maintenance of the anonymity of the records were entered in a check list being composed of two parts. The first part included demographic and clinical information (cardiovascular risk factors) including: age, sex, history of MI, bleeding disorder, a heart rhythm disorder, high blood pressure, kidney failure, diabetes mellitus, smoking, hyperlipidemia, and left ventricular ejection fraction (EF) And the second part contains the possibilities of postoperative complications of CABG including: myocardial infarction (MI), stroke, ARF or acute renal failure, bleeding, wound infection, pleural effusion, pulmonary edema, need for mechanical ventilation, second surgery and mortality. Pleural effusion occurs as the existence of fluid in pleural area based on CXR, stroke occurs as any signs of brain infarction confirmed by Angiography, Pulmonary edema happens as the existence of fluid in lung tissue, myocardial infarction arises as any signs of myocardial infarction by ECG or confirmed serum level of CK-MB, further surgery happens because of complications due to haemorrhage or cardiac tamponade, acute renal failure or ARF, occur as  $mg/dl cr > 1.5$  in blood tests after surgery, wound infection happens as purulent discharge in the area of surgery and bleeding as drainage, and bleeding happens of a total of 1000 ml or 400 ml per hour - or three hours after each 200 ml per hour of operation (15,16,17,18). It should be noted that to carry out this study, patients were classified in both  $EF < 30\%$  and  $EF \geq 30\%$ .

Finally, after the completion of the checklist, the data were analyzed using SPSS version 19 (version 19, SPSS Inc, Chicago, IL) and statistical methods to determine the frequency of variables.

**Statistical methods of data analysis**

Statistical analysis was conducted by SPSS / PC + (ver 17.0) and P value was considered to be less than 100% significance. Mean and standard deviation of data were calculated and variables relating to disease and clinical results were obtained using student t-test for quantitative variables and chi-square test for qualitative variables. The mortality, morbidity and survival of patients using Kaplan-Meier analysis and comparison of pre- and postoperative symptoms were evaluated by linear regression.

**Ethical Considerations**

The information contained in patient records were extracted in compliance with ethical principles and maintenance of the anonymity of the files.

**RESULTS**

A total of 1454 cases were investigated and in the end 1025 cases could obtain the inclusion criteria. The average age of patients was 10.2± 56.6, with the minimum age of 34 and maximum age of 81 years. 748 men (9/72) and 277 women (02% / 27) were among the 1025 patients. Information on cardiovascular risk factors are presented in Table 1. According to this table, the most common underlying factor in patients with a percentage of 85.6%, 82.5% and 80.9% relates to the history of hyperlipidemia, hypertension, and diabetes, respectively and the lowest prevalence of underlying diseases with a percentage of 22.6% and 27.2% relates to a history of renal failure and coagulopathy respectively.

The frequency of surgical complications of CABG, is presented in Table 2, below. The results showed that the myocardial infarction with a percentage of 20.4 % and the need for mechanical ventilation with 1.2% are the highest and the lowest complication among the patients.

From a total of 1025 patients, 374 people (36.4%) had an EF <30% and 651 patients (63.5%) were in the group EF ≥30%.

From a total of 747 men, 232 of them (31.05%) belonged to the Group EF <30% and 515 cases (9/68) were in the group EF ≥30%. From a total of 277 women, 102 patients (36.8%) were in the group with EF <30% and 175 patients (63.1%) were in the group with EF ≥30%.

The frequency of postoperative complications of CABG surgery in patients with an EF above and below 30% are indicated in Table 3. Based on the results, the frequency of myocardial infarction, acute renal failure, infection, pulmonary edema and death, had a significant relationship with EF percent of patients with P ≤0.001, in a way that the occurrence of five above complications in patients with EF <30%, was significantly higher than the group with EF ≥30%. However, the frequency of other complications such as stroke (=023 / 0p) hemorrhage (=012 / 0p), pleural effusion (=011 / 0p), mechanical ventilation (=011 / 0p) and reoperation (=013 / 0p) and the percentage of EF, was not significantly different in the level of P ≤0.001.

**Table 1:** Prevalence of cardiovascular risk factors among 1025 patients

History of the disease Risk factor	Positive	Negative
Hyperlipidemia	(85.6 %)878	(14.3 %)147
blood pressure	(82.5 %) 846	(17.4%)179
Diabetes	(80.9%) 830	(19%)195
Myocardial infarction	(76.6%)786	(23.3%)239
Cigarette	(68.4%)702	(31.5%)323
Heart rhythm disorder	(29.1%)299	(70.8%) 726
Coagulopathy	(27.2%) 279	(72.7%) 746
Kidney failure	(22.6%) 232	(77.3%) 793

**Table2:** The frequency of postoperative complications of CABG among 1025 patients

Complications	Number
Myocardial infarction	(20.4%) 210
Kidney failure	(11.8%) 121
Pleural effusions	(9.4%) 97
stroke	(8.48%) 87
death	(3.5%) 36
Bleeding	(3.3%) 34
Reoperation	(3.3%) 34
Wound infection	(3.3%) 34
Pulmonary edema	(2.9%) 30
Mechanical ventilation	(1.2%) 13

**Table 3:** The frequency of postoperative complications of CABG in 1025 Patients based on the percentage of EF

Left ventricular ejection fraction Complications	EF> 30% (Number: 651)		EF< 30% (number: 374)		p-value
	Positive	Negative	Positive	Negative	
Myocardial infarction	112 (17.2%)	539 (82.7%)	98(26.2%)	276 (73.7%)	0.001
stroke	62 (9.5%)	589 (90.4%)	25 (6.6%)	349 (93.3%)	0.023
Acute renal failure	21 (3.3%)	630 (96.7%)	46 (12.2%)	328 (87.7%)	0.001
bleeding	23(3.5%)	628 (96.4%)	11 (2.9%)	363 (97%)	0.012
Wound infection	10 (1/5%)	(98/4%)641	(6/4%) 24	(93/5%)350	0.001
Pleural effusions	52 (7.9%)	599 (92%)	45 (12%)	329 (87.9%)	0.011
Pulmonary edema	9 (1.3%)	642 (98.6%)	21 (5.6%)	353 (94.3%)	0.001
Mechanical ventilation	6 (0.9%)	645 (99%)	7 (1.8%)	367 (98.1%)	0.001
Reoperation	15 (2.3%)	636 (97.6%)	19 (5.08%)	355 (94.9%)	0.013
Death	12 (1.8%)	639 (98.1%)	24 (6.4%)	350 (93.5%)	0.001

**Discussion**

Babatabar Darzi H, et al. investigated the relationship of postoperative complications of CABG surgery with duration of intubation. In this cross-sectional study, 600 cases of 986 patients

were evaluated; the patients who underwent CABG surgery were treated in two hospitals in Tehran. According to the results the minimum and maximum duration of intubation of patients were 81/8 and 75/24 hours respectively. The results

showed that there were significant correlations between the duration of intubation and postoperative bleeding, returning to the operating room, CHF, heart failure and hypotension after the stability of it, (18).

Hassanzadeh M, et al. conducted a Study to evaluate the morbidity and mortality of CABG. In this cross-sectional study which was conducted during 1999 to 2009, the complications of CABG like, mortality, postoperative bleeding, cerebral complications, heart failure, MI, arrhythmias, etc. were examined. The results showed that the highest complications with a percentage of 31.6 related to cardiac arrhythmias and the lowest side effect with a percentage of 0.3% related to deep vein thrombosis. The mortality rate in the samples was 1.6% (16).

Alder DS and colleagues studied 2000 patients undergoing CABG to investigate the long-term survival investigation. According to the results of the 10 year study, 5 and 8 years Survivals of patients were reported to be 8.9% and 80% after diagnosis. Also according to this study, the dependency ratio (RR), and long-term survival of patients with study variables were obtained as follows: Cardiogenic shock (14), intra-aortic balloon pump (2/2), EF less than 50% (2.4), history of CHF (2/2), cardiopulmonary bypass time (1.4) and diabetes (1.6). The age and sex were not correlated with Survival of patients. (15) Christakis GT and colleagues conducted a study on 12471 patients who underwent CABG, entitled CABG in patients with poor left ventricular function. Mortality in 9445 patients with  $EF \geq 40\%$ , was 2.3 percent and mortality in 2539 patients with  $EF \leq 20-40$  percent, was 4.8 percent and mortality in 487 patients with  $Ef \leq 20\%$  was 9.8%.

Based on our findings, the most and the least frequency of underlying factors belonged to the patients with the history of hyperlipidemia with a percentage of 85.5% and a history of kidney failure 22.6%, respectively. Babatabar Darzi H et al (18) in their cross-sectional study conducted on 600 patients introduced the myocardial infarction

and coagulation as the most common and the least common underlying factors in Patients undergoing CABG, with a percentage of 29.2% and 2.1 % respectively. Hassanzadeh M, et al (16) in their 10-year old study, the same as this study, and unlike that of Babatabardarzi H, reported that hyperlipidemia with 45.3 % is the most frequent underlying disease in patients undergoing CABG. The results show that, myocardial infarction with a percentage of 20.4 and the need for mechanical ventilation with a percentage of 1.2, are the highest and the lowest complication of CABG respectively. Bandolier L (19) in their study of the incidence of MI obtained similar results, while the study of Hassanzadeh M, et al (16), which uses the records of 1,000 patients undergoing CABG, concluded that the highest and the lowest side effects are related to the Dysrhythmia and deep venous thrombosis with a percentage of 31.6% and 0.3% respectively. The prevalence of postoperative bleeding in this study was 3.3%. Hassanzadeh M (10) and Babatabar Darzi H (18), found that the incidence of bleeding 4.5% and 6% respectively. Bandolier L (19) and Priesman S (20), in two separate studies have found the prevalence of this kind of bleeding to be 3%.

In this study, the incidence of wound infection was 3.3%. However, Hosseinzadeh M (16), Babatabar Darzi H (18), Omran AS (21) and Softah A (22) found that the wound infection, is respectively, 0.04%, 0.05%, 0.047%, and 0.2% and the incidence of wound infection in our study compared to other studies is remarkable.

The results of this study showed that, in patients undergoing CABG whose  $EF < 30\%$ , the frequency of myocardial infarction, acute renal failure, wound infection, pulmonary edema and death is more than the patients with  $EF \geq 30\%$ . The role of EF in the incidence of complications of CABG is investigated in a few studies; however, Alder DS et al (15), conducted a study on 2000 patients undergoing CABG, and showed that myocardial infarction and  $EF < 50\%$  is significantly correlated with Survival of patients.

Also Christakis GT, et al (17), found that mortality in patients undergoing CABG with EF <20% is noticeable -9.8%. And the results of the present study show that mortality rates in patients with EF <30% have been 6.4%.

The mortality rate in the present study was 3.5%. However, Hasanzadeh M (16) found this amount to be less than that of our study and equal to 0.07% and Darwazah AK et al (23) found the mortality rate (8.7%) to be higher than our study and Hasanzadeh's study.

Conclusion Based on this study, EF of patients can have a relationship with CABG surgery's complications. However, due to lack of studies in this field and different clinical factors and facilities of treatment centers, recommended in future studies and in other health centers.

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