Res Cardiovasc Med. 2016 February; 5(1): e30590. doi: 10.5812/cardiovascmed.30590

Published online 2016 January 9. **Research Article**

Comparison of the Effects of Coronary Artery Bypass Grafting Versus Medical Therapy on Short and Long Term Outcomes in Octogenarian Patients With Multi-Vessel Coronary Artery Disease

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Received 2015 June 7; **Revised** 2015 July 17; **Accepted** 2015 July 23.

Abstract

Background: Appropriate treatment methods lead to a reduced rate of mortality and morbidity, and an improved quality of life, in patients with multi-vessel coronary artery disease.

Objectives: In this study, we compared short and long-term outcomes of coronary artery bypass grafting (CABG) versus medical therapy in patients 80 years of age and older with multi-vessel coronary artery disease (MVCAD).

Patients and Methods: In this retrospective study, 50 octogenarian patients with MVCAD who underwent CABG were compared with 50 patients in the same condition who were treated with medical therapy during the same time. The primary objective was to compare mortality and morbidity rates, as well as other factors such as the occurrence of chest pain, deterioration of the NYHA functional class, and re-hospitalization, between the two groups. The comparison was made using medical records from the five years post-treatment.

Results: After five years, the overall mortality rate included 11 patients (22%) in the CABG group versus 18 patients (36%) in the medical therapy group; this difference was not significant between the two groups (P = 0.186). Regarding short-term outcomes, in the CABG group, cardiogenic shock occurred in 9 patients (18%), renal failure in 13 patients (26%), pulmonary complications in 9 patients (18%) and neurologic complications in 3 patients (6%); in the medical therapy group, these same complications occurred, respectively, in 6 patients (12%), 7 patients (14%), 10 patients (20%) and 1 patient (2%). In addition to these factors, freedom from chest pain and improvement in the functional class among the CABG group was significantly higher than among the medical therapy group (P = <0.001).

Conclusions: CABG may be the superior form of treatment for long-term outcomes in terms of the relief of chest pain, improvement of the functional class, reduced need for re-admission, and later death for octogenarians. However, short-term morbidity may be higher among the CABG group, but the mortality rate after 30 days is quite similar.

Keywords: Drug Therapy, Coronary Artery Bypass Surgery, Coronary Artery Disease, Outcome Study

1. Background

The general increase in the elderly population has been associated with an increase in the occurrence of diseases, especially cardiovascular diseases (1). Given these increases, there is a need to determine the best treatment for increasing the elderly patients' quality of life when they are suffering from such diseases (2).

Many trials have been conducted throughout the world in order to compare the results of using coronary artery bypass grafting (CABG) as opposed to medical therapy for the treatment of this condition. These studies have generally resulted in the recommendation of bypass surgery for patients with triple-vessel disease, particularly for those with reduced left ventricular function (3-5). However, the results of these trials do not reflect recent advances in medical and surgical therapy for coronary artery disease (CAD), and other factors, such as the age of the patient, have not been taken into consideration (6).

2. Objectives

This study aims to compare mid-term (five year follow-up) CABG outcomes with medical therapy outcomes in patients with MVCAD aged 80 years and older.

3. Patients and Methods

The study was done in a university hospital, Tabriz University of Medical Sciences, Tabriz, Iran. In this retrospective study, the population was comprised of a subset of 100 octogenarian patients (80 - 90 years old) who had three-vessel coronary artery stenosis (3VD)

in cardiac catheterization. 50 patients were allocated to the CABG group, and 50 patients were treated with medical therapy. In all patients, the physician had determined the type of treatment based on Patients' drug taking history.

Of these patients, those with complicated valvular anomalies, a history of ventricular arrhythmia, a history of angioplasty, or a history of pacemaker or ICD placement were excluded.

Echocardiographic data was assessed for both groups. Mortality and morbidity rates in the two groups were compared after the first 30 days of angiography, and later during the five-year follow-up period, with the use of medical records. Morbidity resulting from cardiogenic shock, renal failure, pulmonary complications, neurological complications, and arrhythmia were studied in both groups. Cardiogenic shock here included hemodynamic parameters: persistent hypotension (systolic blood pressure < 80 to 90 mmHg or mean arterial pressure 30 mmHg lower than baseline) with severe reduction in cardiac index (< 1.8 Liter/minute/m^2 without support or < 2.0 to 2.2 Liter/minute/m^2 with support) and inadequate or elevated filling pressure (e.g., left ventricular end-diastolic pressure > 18 mmHg or right ventricular end-diastolic pressure >10 to 15 mmHg) (6). Renal failure was defined in terms of a creatinine level > 1.5 or increasing more than 50% in the blood. Neurological complications that were considered included coma and cerebrovascular accident (CVA). The arrhythmias in this study were atrial fibrillation (AF), ventricular fibrillation (VF) and ventricular tachycardia (VT).

3.1. Statistical analysis

The collected data were analyzed using IBM SPSS for Windows, Version 21.0 statistical package (IBM SPSS Inc, Chicago, IL, USA). Qualitative data were analyzed using Chi-square or Fisher's exact test and quantitative parameters using independent samples t-test. P value ≤ 0.05 was considered statistically significant.

4. Results

In this study, 100 patients were divided into two groups: 50 patients were in CABG group and 50 patients were in medical therapy group.

4.1. Baseline and Angiographic Data

The baseline characteristics in the two groups are depicted in Table 1. There were no significant differences between the groups in terms of the measured baseline data of the patients.

The primary angiographic findings in the two groups are shown in Table 2. The severity of stenosis in the main coronary arteries was not statistically significant different between the two groups.

4.2. Echocardiographic Data

The echocardiographic data of patients at admission time and at follow-up are shown in Table 3. As seen in Table 3, there were no significant differences between the echocardiographic data of the groups at admission time.

During the follow-up period, there were statistically significant differences between the two groups involving the mean of all left ventricle ejection fraction (LVEF) during the follow-up period (P = 0.001). In the CABG group, the mean of LVEF by echocardiography was statistically higher than the mean of LVEF in the medical therapy group. Furthermore, the mean of the left atrial diameter during the follow-up period was 3.37 ± 0.75 cm in the CABG group, compared to 3.71 ± 0.65 cm in the medical therapy group. This difference is also statistically significant (P = 0.02).

4.3. Short-Term Mortality and Morbidity Data

Short-term mortality and morbidity in up to 30 days of hospital stay are shown in Table 4. There were no significant differences between the two groups regarding the death rate (P = 0.70) and the time of death (P = 0.30). The morbidities included cardiogenic shock, renal failure, pulmonary complications, neurological complications, and arrhythmia, and were not statistically significant different between the two groups, as shown in Table 4.

Eight early deaths occurred among patients in the CABG group and the causes of death were cardiopulmonary arrest in two, multi-organ failure in four, and cardiogenic shock in two. Seven patients died in the medical therapy group in the same 30-day time frame. The causes of death in the medical therapy group was cardiopulmonary arrest in one, cardiogenic shock in four, myocardial reinfarction (MI) in one, and multi-organ failure in one.

In the CABG group, nine patients needed early re-operation: six patients (67%) due to bleeding, two (22%) for closing of the sternum left open previously and one (11%) due to the loosening of the sternal wire.

4.4. Long-Term Mortality and Morbidity Data

Table 5 shows the long-term mortality and morbidity rates in the two study groups. Late mortality and morbidity are defined as any complication or death that occurred after 30 days and up to 5 years. There were significant differences between the two groups regarding late death (P = 0.041). The death rate among the medical therapy group is statistically higher than that of the CABG group. In the CABG group, three patients died: one patient because of repeated myocardial infarction (Re-MI), and two patients because of CVA. In medical therapy group, all 11 patients died due to Re-MI.

In the study of long-term morbidity, chest pain and deterioration of the New York Heart Association (NYHA) functional class were statistically lower in the CABG group as compared to the corresponding numbers in the medical therapy group (P < 0.001). Deterioration of the functional class was diagnosed if the functional class decreased at

each assessment in comparison to each previous examination in the follow-up period. Re-hospitalization in the medical therapy group was higher than it was in the CABG group (P = 0.001). The causes of re-hospitalization in the CABG group were cardiac complications in three; adrenal cancer in one, and CVA in two, but in the medical therapy group, all re-hospitalization was the result of cardiac complications (chest pain or Re-MI).

Total short-term and long-term mortality in the CABG group was 11 (22%) compared with 18 (36%) in the medical therapy group. Total mortality was not statistically significant different in the two groups (P = 0.186).

Table 1. Baseline Characteristics of Patients[a]

Demographic and Clinical Variables	CABG (n=50)	Medical Therapy (n=50)	P Value
Gender			
Male	39 (78)	30 (60)	0.051
Female	11 (22)	20 (40)	
Age, y	82.78 ± 5.04	83.72 ± 2.61	0.193
Risk factors			
HTN	37 (74)	40 (80)	0.397
DLP	25 (50)	22 (44)	0.502
DM	17 (34)	22 (44)	0.311
C/S	18 (36)	12 (24)	0.114
FH	12 (24)	14 (28)	0.596
History of MI	16 (32)	10 (20)	0.109

Abbreviations: C/S, cigarette smoking; DLP, dyslipidemia; DM, diabetes mellitus; FH, family history; HTN, hypertension, MI, myocardial infarction; NA, not available.
[a]Values are presented as No. (%).

Table 2. Angiographic Results in the Two Groups[a]

Angiographic Variables	The Degree of Main Coronary Artery's Stenosis						P Value
	Normal	< 50%	50 - 70%	70 - 90%	90 - 99%	100%	
LMCA							0.21
CABG	40 (80)	5 (10)	2 (4)	2 (4)	1 (2)	0	
MT	45 (90)	2 (4)	1 (2)	1 (2)	1 (2)	0	
LAD							0.22
CABG	1 (2)	1 (2)	1 (2)	33 (66)	7 (14)	7 (14)	
MT	0 (0)	0 (0)	20 (10)	27 (54)	3 (6)	10 (20)	
LCX							0.12
CABG	9 (18)	0 (0)	9 (18)	26 (52)	4 (8)	2 (4)	
MT	3 (6)	4 (8)	11 (22)	21 (42)	4 (8)	7 (14)	
RCA							0.30
CABG	5 (10)	2 (4)	8 (16)	16 (32)	3 (6)	16 (32)	
MT	3 (6)	1 (2)	9 (18)	20 (10)	3 (6)	14 (28)	

Abbreviations: CABG, coronary artery bypass grafting; LAD, Left anterior descending artery; RCA, right coronary artery; LCX, left circumflex artery; LMCA, left main coronary artery; MT, medical therapy.
[a]Values are presented as No. (%).

Table 3. Echocardiographic Data of Patients at Admission and at Follow-Up

Echocardiographic variables	CABG (n=50)	Medical Therapy (n=50)	P Value
At Admission			
LVEF, %	45.90 ± 7.99	42.10 ± 11.83	0.059
LVEDD, cm	4.61 ± 0.68	4.68 ± 0.85	0.604
Left atrial diameter, cm	3.38 ± 0.71	3.62 ± 0.62	0.071
At Follow-Up[a]			
LVEF, %	45.5 ± 10.5	36.9 ± 12.65	< 0.001
LVEDD, cm	4.7 ± 0.7	4.94 ± 0.88	0.112
Left atrial diameter, cm	3.37 ± 0.75	3.71 ± 0.65	0.024

Abbreviations: LVEDD, Left ventricle end diastolic; LVEF, Left ventricle ejection fraction diameter.
[a]The mean of all echocardiographic variables during follow-up period.

Table 4. Short-Term Mortality and Morbidity (up to 30 Days in Hospital)[a]

Outcome Variables	CABG (n=50)	Medical Therapy (n=50)	P Value
30 days mortality	8 (16)	7 (14)	0.779
Time of death after operation or therapy, d	23.75 ± 12.85	16.14 ± 14.75	0.310
Cardiogenic shock	9 (18)	6 (12)	0.604
Renal failure	13 (26)	7 (14)	0.211
Pulmonary complications	9 (18)	10 (20)	0.799
Neurological complications	3 (6)	1 (2)	0.617
Arrhythmia	16 (32)	18 (36)	0.833

[a]Values are presented as No. (%).

Table 5. Long-Term Mortality and Morbidity (up to 5 Years Later)[a]

Long-Term Outcomes	CABG (n=50)	Medical Treatment (n=50)	P Value
Late death (from 30 days up to 5 years)	3 (6)	11 (22)	0.041
Mean of death time (year)	1.56 ± 0.96	1.11 ± 0.51	0.210
Chest pain	12 (24)	44 (88)	< 0.001
Deterioration of functional class	2 (4)	38 (76)	< 0.001
Re-hospitalization	6 (12)	21 (42)	0.001

[a]Values are presented as No. (%).

5. Discussion

In this study, we conducted a 5-year follow-up analysis of octogenarian patients with MVCAD who underwent CABG surgery or medical therapy. Our study demonstrated that the long-term mortality rate in the medical therapy group was higher than the short-term mortality rate. The causes of mortality in the CABG group, whether short-term or long-term were non-cardiac, in most cases, while causes of mortality in medical therapy group, particularly in the long-term, were cardiovascular (Re-MI). The total number of all short-term and long-term deaths in five years was higher in the medical therapy group as compared to the CABG group. However, although the increased death rate in medical therapy patients was clinically important, this higher rate was not statistically significant (P = 0.186). In our study, the difference between short-term morbidity ratesies waswere not statistically significant different between CABG and medical therapy group whiles, whereas the long-term cardiac event-free survival was significantly improved by CABG.

Pfisterer et al. (7) have studied the major cardiac events in patients treated for CAD, and there were no significant differences between the CABG and medical therapy groups according to an analysis of mortality within one year and nonfatal MI. Although the 30-day mortality rate in the CABG group was higher than the rate of the medical treatment group, the mortality rate had a declining trend over the course of the following 1 - 2 years in the CABG group, while the medical treatment group's death rate remained consistent (7).

The studies that examined the impact of CABG in patients 80 years and older reported different ranges of morbidity and mortality rates, including a mortality range from 8% to 24%, a stroke range from 2% to 9% and a renal failure range from 2 to 13% (8, 9). Alexander et al. studied 67,764 geriatric patients (> 64 years old), 4743 of who were aged 80 years and older, and concluded that neurological complications (CVA) and renal failure increase with age and lead to increased hospital mortality (9). They suggested that age, Hypertension (HTN), emergency procedures, recent MI, and low LVEF are the most important predictors of in-hospital mortality after CABG in octogenarian patients. Unlike other studies, this report shows that increases in the number of involved vessels and underlying diseases such as DM and vascular disease has little effect on mortality in patients 80 years and older (9).

LVEF is known as a strong predictor of survival in patients with cardiovascular diseases (10-17). In a study conducted by Caracciolo et al. (13), 912 patients with left main equivalent coronary artery disease (total stenosis > 70% in the proximal LAD and proximal LCX) were followed for 15 years. The results revealed that the average survival rate of patients in the CABG group was significantly higher than that of the medical therapy group. Thus, the authors of this study concluded that CABG is not superior to medical therapy in patients with LVEF ≥ 50% in terms of survival. However, in patients with LVEF < 50%, the survival rate in the CABG group was significantly higher than the corresponding rate of the medical therapy group. In confirmation of these results, Velazquez et al. (11) analyzed the data of 763 patients with ischemic cardiomyopathy and LVEF < 35% in a 10-year

follow-up period and reached a similar conclusion.

In our patients, the baseline LVEF and other echocardiographic variables such as LVEDD and left atrial diameter were not different in the two groups; all patients in both groups were chosen with the same condition. Based on echocardiography reports during the follow-up period, LVEF in the CABG group had improved more significantly than it had in the medical therapy group. In addition, significant differences were observed between the two groups in terms of deterioration of the functional class. This difference shows that CABG may be more effective in improving the quality of life of patients.

CABG can have different results depending on the qualities of the patient (13-17). Hueb et al. (18) analyzed three treatment methods: CABG, Percutaneous coronary intervention (PCI), and medical therapy, in 611 patients with CAD. Their study revealed that the reported absence of chest pain in the CABG group was significantly higher than it was with the use of the other two treatment methods. However, some studies have shown that the positive effects of CABG are reduced after 10 years, including Rogers's study (19) which assessed quality of life in 780 patients with ≥ 70% stenosis of coronary arteries. The average age of the patients was 51 years, and it was reported that the relief of chest pain at the end of 5-year follow-up was 63% in the CABG group in comparison with 38% in the medical therapy group. At the end of the 10-year follow-up, reported cases of chest pain in members of the CABG group had a trend of reduction (47%), but the frequency of chest pain reduced to 42% in medical therapy group. In our results, the rate of chest pain in the CABG group was significantly lower than that of the medical therapy group in the follow-up period.

In our study, the number of patients re-admitted in the CABG group was less than the number in the medical therapy group. Hamilton et al. (20) reported that surgical procedures will be decreased re-hospitalization compared to medical treatment.

5.1. Conclusions

After our comprehensive analysis of the 5-year follow-up, we concluded that, in octogenarian patients with MVCAD, CABG may be superior in terms of providing positive long-term results such as chest pain relief, improved functional class, reduced need for re-admission, and later death. Short term morbidities may be higher in the CABG group, but the 30 day mortality rate is comparable between CABG and medical therapy groups.

5.2. Limitations

The main limitations of our study are the small sample size (n = 50 in each groups), and our reliance on a retrospective study design. However, prospective assessment of large numbers of patients > 80 years old undergoing CABG or receiving medical therapy is a difficult and time-consuming task. If any researcher could manage to conduct this type of study, our central study question could be answered with a higher level of certainty.

Acknowledgments

With special thanks to the Medical Record Staff in Madani Hospital, Tabriz University of Medical Sciences, Tabriz, Iran for gathering the patients' data.

Footnote

Authors' Contribution: Azin Alizadehasl, Bahram Sohrabi and Laleh Panjavi conducted the study plan, collected data, contributed to writing the paper, and submitting it to the journal; Anita Sadeghpour, Rasoul Azarfarin and Behshid Ghadrdoost managed the patients and collected data; Rasoul Azarfarin, Reza Zolfaghari and Afshin Habibzadeh performed statistical analyses and contributed to the writing of the manuscript.

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