

The effect of gender on the early results of coronary artery bypass surgery in the younger patients' group

O efeito do gênero sobre os resultados iniciais da cirurgia de revascularização do miocárdio em grupo de pacientes mais jovens

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Abstract

Introduction: In this retrospective study, we aimed to determine the risk factors for coronary artery bypass surgery in patients under 45 years of age, and evaluate the early postoperative results and the effect of gender.

Methods: A total of 324 patients under 45 years of age who undergone on-pump coronary artery bypass surgery between April 12, 2004 and January 10, 2012 were included to the study. Patients divided into groups as follows: Group 1 consisted of 269 males (mean age 41.3), Group 2 consisted of 55 females (mean age 41.6). Preoperative risk factors, intraoperative and postoperative data and early mortality rates of the groups were compared.

Results: Smoking rate was significantly higher in Group 1. Diabetes mellitus incidence and body mass index were significantly higher in Group 2 (P values $P=0.01$; $P=0.0001$; $P=0.04$ respectively). The aortic cross-clamping and cardiopulmonary bypass time and number of grafts per patient were significantly higher in Group 1 (P values $P=0.04$; $P=0.04$; $P=0.002$ respectively). There were no deaths in either group.

Conclusion: We found that gender has no effect on early mortality rates of the coronary bypass surgery patients under 45 years.

Descriptors: Cardiopulmonary Bypass. Coronary Artery Bypass. Education, Medical.

Resumo

Introdução: Este estudo retrospectivo teve como objetivo determinar os fatores de risco para cirurgia de revascularização do miocárdio em pacientes com menos de 45 anos de idade e avaliar os resultados pós-operatórios precoces e o efeito do gênero.

Métodos: Um total de 324 pacientes com menos de 45 anos de idade, que submeteram à cirurgia de revascularização miocárdica entre 12 de abril de 2004 e 10 de janeiro de 2012 foram incluídos no estudo. Os pacientes divididos em dois grupos: Grupo 1, composto por 269 homens (idade média 41,3 anos), Grupo 2, composto por 55 mulheres (idade média 41,6 anos). Fatores de risco pré-operatórios, dados intraoperatórios e pós-operatórios e mortalidade precoce dos grupos foram comparados.

Resultados: A taxa de tabagismo foi significativamente maior no grupo 1. Incidência de diabetes mellitus e massa corporal foram significativamente maiores no grupo 2 (valor de P : $P=0,01$, $P=0,0001$, $P=0,04$, respectivamente). O pinçamento aórtico e tempo de circulação extracorpórea e número de enxertos por paciente foi significativamente maior no grupo 1 (valor de P : $P=0,04$, $P=0,04$, $P=0,002$, respectivamente). Não ocorreram mortes em ambos os grupos.

Conclusão: O gênero não tem efeito sobre as taxas de mortalidade precoce dos pacientes de cirurgia de revascularização do miocárdio com menos de 45 anos.

Descritores: Ponte Cardiopulmonar. Ponte de Artéria Coronária. Educação Médica.

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Abbreviations, acronyms & symbols	
ACC	Aortic cross-clamping
BMI	Levels, body mass index
CABG	Coronary artery bypass graft
CAD	Atherosclerotic coronary artery disease
COPD	Chronic obstructive pulmonary disease
CPB	Cardiopulmonary bypass
DM	Diabetes mellitus
HT	Hypertension
Htc	Pre- and postoperative hematocrit
ICU	Intensive care unit
LDL	Low-density lipoprotein
LIMA	Left internal mammarian artery
LMCA	Left main coronary artery
MI	Myocardial infarction

INTRODUCTION

Atherosclerotic coronary artery disease (CAD) is the leading cause of morbidity and mortality in the developed countries, and the World Health Organization estimate that it will be leading cause of death all over the world by the year 2020^[1]. It primarily affects the 40 year and older population but younger males and females can also be affected^[2]. In the autopsies of 760 accident, homicide or suicide victims aged between 15 and 34; it was founded that in 2% of the 15-19 year old males group there were advanced atheromas in the coronary arteries as well as there were no coronary lesions in the same aged females group^[3]. In the same study, 20% of the 30-34 year old males group and 8% of the same aged females group had advanced coronary artery lesions^[3]. In the 20-24 year old male group there were advanced coronary lesions in about 2% of the patients, but not in the female group. In the 25-29 year old male and female groups, the percentage of advanced coronary artery lesions were nearly the same (between 2 - 3%)^[3].

Young patients who had suffered myocardial infarction (MI), usually have more than one risk factors related with CAD. In results of some studies, it is reported that 90 – 97% of the patients had one or more risk factors for atherosclerosis^[2,4,5]. Smoking^[2-7], family member with CAD^[2,5,7], hypercholesterolemia^[2,3,5-7], diabetes mellitus (DM)^[2,4,5,7], hypertension (HT)^[2,3,5-7], obesity^[2,3,6,7] and other risk factors such as oral contraceptives in young females, cocaine addiction, etc^[8] may act as etiological factors in younger patients for coronary atherosclerosis.

As the incidence of CAD in younger patients increases, the coronary artery bypass graft (CABG) surgery practice increases in this population. It is known that CABG surgery can prolong the life time especially in patients with left main coronary artery (LMCA) or 3-vessel disease when compared to medical therapy^[9]. There are many studies concerning the results of CABG surgery in younger patients and many different results are reported in these studies about the risk factors for CAD. In this retrospective study, we evaluated the

pre and postoperative data of the CABG surgery in 45 year old patients and younger aged male and female patients and aimed to determine the effect of gender on these parameters.

METHOD

Patient Selection

In most of the studies, patients between 40 - 45 years of age are considered as “young”^[2] so we decided to include the patients who were younger than 45 years in our study. A total of 324 patients were selected to be included to the study from the data pool of 5527 patients who underwent CABG surgery between April 12, 2004 and January 10, 2012 in Adana Numune Training and Research Hospital Fatma Kemal Timuçin Heart Center, Adana, Turkey. Off-pump CABG surgery, concomitant heart valve or aortic surgery, age over 45 years were criteria for exclusion.

Patient groups

Patients were divided into groups according to their gender. Group 1 consisted of 269 males (mean age 41.3) and Group 2 consisted of 55 females (mean age 41.6). All the patients were operated under standard cardiopulmonary bypass (CPB) circumstances. All the data of the following parameters of groups were compared: Smoking, diabetes mellitus, hypertension, chronic obstructive pulmonary disease (COPD), low-density lipoprotein (LDL) levels, body mass index (BMI), pre- and post-operative hematocrit (Htc), left internal mammarian artery (LIMA) graft utilization, the amount of blood product used, the length of intensive care unit (ICU) stay, aortic cross-clamping (ACC) and cardiopulmonary bypass time, inotropic agent administration, intra-aortic balloon pump (IABP) counter pulsation, preoperative ejection fraction (EF), postoperative drainage through chest tubes and mortality rates.

Surgical procedure

In the operating room, after electrocardiographically (ECG) and invasive blood pressure monitoring was set, general anesthesia protocol was followed. After median sternotomy and LIMA and saphenous vein graft harvesting, CPB was established with an ascending aortic and a single two stage right atrial cannula. After heparinization with bolus injection of 3 mg/kg of body weight heparin, cardiopulmonary bypass circuit was initiated with a roller pump and non-pulsatile flow technique. Moderate hemodilution (hematocrit value: 22 to 24%) and mild hypothermia (nasopharyngeal temperature: 32°C) were sustained during CPB. Pump flow rate during CPB was maintained at 2.4 l/m²/min and mean arterial blood pressure was sustained above 60 mmHg. A membrane oxygenator (Compactflo Evo, Dideco, Mirandola, Italy) was used for CPB. Pump prime was a volume of 1 liter of 0.9 % sodium chloride solution. Ante grade 10 ml/kg blood cardioplegia solution was administered through the aortic root cannula. After completion

of each distal coronary anastomosis, 250 ml of cardioplegic solution was administered through the grafts. Ringer's lactate solution at 4°C was used for topical cooling of the heart. Left internal mammary artery grafts were reconstructed to the left anterior descending arteries (LAD) as the final anastomosis in all patients. Proximal anastomoses were implemented under partial aortic clamping.

Preoperative data

The mortality in the first post-operative 30-day period was used to compare the mortality rates of the groups. The total amount of hemorrhage through the mediastinal and thoracic drainage tubes until they were drawn was defined as mediastinal drainage. Re-operation for any reason (bleeding, cardiac tamponade, graft failure, etc) in the first postoperative 24 hour period was defined as postoperative revision. Other parameters were recorded as they were.

Statistical Analysis

All tests were performed using SPSS for Windows 13.0. Categorical values were expressed by numbers and percentages and the numerical values were expressed as mean±standart deviation. After normality tests were employed, Mann Whitney U test and chi-square (x²) test were used to compare groups. A P value less than 0.05 were accepted as significant.

RESULTS

The demographical data, risk factor distribution and co morbidities of the groups are shown in Table 1. Smoking rate was higher in Group 1, DM incidence and BMI were higher in Group 2 (P values P=0.01; P=0.0001; P=0.04 respectively). Age, HT and COPD incidence were not significantly different. There were no significant differences for the following data either: LDL levels, preoperative EF, Hct values, ventilator support duration, drainage through chest tubes, blood transfusion volumes, the length of ICU stay and length of hospital stay (Table 2).

Table 1. Demographic data of the groups and distribution of the risk factors.

	Group 1 (n=269)	Group 2 (n=55)	P value
Age (mean)	41.3±3.3	41.6±3.8	0.2
BMI	26.2±4.7	27.7±5.1	0.04
Smoking	161 (59.9%)	22 (40%)	0.01
LDL	117.5±44.2	115.8±41.7	0.912
EF (%)	53.3±7.2	52.7±8.1	0.701
DM	59 (22%)	29 (53%)	0.0001
HT	50 (19%)	16 (29%)	0.098
COPD	11 (4%)	1 (2%)	0.698

DM=Diabetes Mellitus; EF=Ejection fraction; HT=Hypertension; COPD=Chronic Obstructive Pulmonary Disease; LDL=Low Density Lipoprotein; BMI=Body mass index

Graft counts in the groups were as follows (Group 1/ Group 2 respectively): One vessel 26/10 patients, two vessels 84/25 patients, three vessels 126/17 patients, four vessels 30/3 patients and five vessels 3/0 patients (Table 3). The ACC happened to be 37.7±15 mins and CPB time was 67.5±23.6 mins in Group 1 and they were 33.3±13 mins and 60.5±22.5 mins respectively in Group 2. The ACC and CPB time and graft counts per patient were significantly higher in Group 1 (P=0.04; P=0.04; P=0.002) (Table 3). The LIMA graft utilization rate was 86.4% in the study population. It was higher in Group 1 and it was statistically significant (88.5% in Group 1; 76.4% in Group 2; P=0.03) (Table 3).

Inotropic agent support was needed for weaning from CPB in 46% of the patients. The EuroSCORE values of the patients were between 0 and 3. There was one patient that IABP support was needed for weaning from CPB in Group 1. No mortalities happened in either of the groups.

Table 2. Clinic data of the groups.

	Group 1 (n=269)	Group 2 (n=55)	P value
Graft Count (mean)	2.6±0.8	2.2±0.8	0.002
Preoperative Hct	42.7±4.5	41.9±4.2	0.255
Postoperative Hct	28.3±2.1	28.3±2.2	0.852
Blood transfusion (Unit)	0.9±1.1	1.1±1.1	0.319
Inotropic support	129 (48%)	20 (36%)	0.155
Ventilatory support (hr)	3.8±1.4	3.8±1.7	0.978
Chest tube drainage (ml)	443±174	420±178	0.378
ICU stay (days)	1.14±0.3	1.18±0.3	0.489
In-hospital stay (days)	4.3±0.4	4.2±0.4	0.600

Hct=Hematocrit; ICU=Intensive care unit

Table 3. Operative data of the groups.

Graft Count	Group 1 (n=269)	Group 2 (n=55)
One vessel	26 (10%)	10 (18%)
Two vessels	84 (31%)	25 (45%)
Three vessels	126 (47%)	17 (31%)
Four vessels	30 (11%)	3 (5%)
Five vessels	3 (1%)	0
ACC time (mins)	37.7±15	33.3±13.4
CPB time (mins)	67.5±23.6	60.5±22.5
IABP	0	1 (1.8%)
LIMA	238 (88%)	42 (76%)

ACC=Aortic cross-clamping; CPB=Cardio-pulmonary bypass; IABP=Intra-aortic balloon pump; LIMA=Left internal mammarian artery

DISCUSSION

It is reported that sedentary life style, excessive consumption of fatty foods, smoking, HT, etc are more commonly seen in people with CAD^[6]. These findings were confirmed in Framingham study and by observing the people with atherosclerotic

diseases in younger ages. But it is also shown that advanced coronary artery disease may occur without the previous habits and risk factors^[6].

The coronary atherosclerosis is shown to be present in autopsy studies of the patients in their 20's and some studies report that about 19% of males in their early 30's have advanced coronary artery atherosclerosis (>40% stenosis). Smoking, HT and dislipidemia are very important factors for premature CAD in young patients^[6]. Besides that smoking is shown to be the main risk factor^[2,6,8]. Kannel et al.^[8] reported in Framingham study that smokers aged between 35 - 40 years have 3 times more relative risk of CAD according to non-smokers in the same age. Also the studies evaluating the results of younger age patient undergoing CABG surgeries showed high rates of smoking in their patient populations^[7,9,10]. The smoking rate in our patient population was 56.5% and it was more common in males than females ($P=0.007$).

In a study conducted in 1998, the smoking prevalence was in 62.8% of the Turkish male population and 24.3% in Turkish female population^[11]. In our study, the smoking rate of males was similar to that data (59.9% vs. 62.8%) but it was remarkably higher in our female patient group (40% vs. 24.3%).

Gu et al.^[12] reported in their study that the most common etiology of mortality in diabetic patients younger than 40 years of age was CAD. Diabetics have 2 – 4 times higher risk of CAD according to non-diabetics^[6]. It is not clear how the CAD progresses in young diabetic female patients despite the protective effect of estrogen^[8]. Smoking and oral contraceptive administration together can increase mortality of CAD about 13.6 times^[13]. Truncal obesity and high BMI are independent risk factors of mortality of CAD in females^[8]. The DM incidence and BMI were found to be significantly higher in female patients in relation to males in our study (53% vs. 22%, $P=0.0001$; 27.7% vs. 26.2%; $P=0.04$ respectively).

The results of CABG surgery are better in patients younger than 40 years. Five years survival rate is 92% and the 10 year survival rate is 86% but the same rates for the 65 years and older age population are 73% and 58%, respectively^[14]. Rocha et al.^[15] also reported that the in-hospital mortality of elderly patients was 8.9% in their study. In a meta-analysis Sá et al found no effect of gender, number of grafts and age on the outcomes^[16]. The long term patency of internal mammary artery (IMA) graft is better than saphenous vein graft so it is accepted to use IMA grafts for the LAD lesions in younger patients^[17,18]. The utilization rate of LIMA graft is 86.4% in our study. It is significantly higher in Group 1 in relation to Group 2 (88.5%; 76.4% respectively; $P=0.03$).

Wagner et al.^[19] reported that they used LIMA grafts in all of the 126 patients under 40 years of age as well as 286 saphenous vein grafts (2.3 grafts per patient). Five of their patients needed IABP support and 1 patient needed left ventricle assist device. They reported their in-hospital mortality rate as 1.6% (2 patients)^[17]. The graft count per patient in our study

was 2.6 and 2.2 for Group 1 and Group 2 respectively. ACC and CPB duration, graft count per patient and LIMA graft utilization rates were higher in Group 1 ($P=0.002$; $P=0.04$; $P=0.04$; $P=0.03$ respectively). IABP support was needed for one patient and 46% of the patients needed inotropic agent support in our study. No mortality happened in either group.

CONCLUSION

Smoking appears to be the most important risk factor for both males and females under 45 years although DM and high BMI appear to be remarkable for the female population. We found that gender does not affect the early mortality rates in younger age population and postoperative period is shorter than for older age patients. We can say that to achieve the higher long term survival rates, at least one arterial bypass graft should be used and risk factors especially smoking, DM and BMI should strictly be kept under control.

Authors' roles & responsibilities

HU	Medical records survey, research director
MA	Reference check, statistic
LA	Research design
PD	Language control, research design
ID	Reference search, Language check
İÖ	Medical records survey

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