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Koroner Bypass Cerrahisi Uygulanan Hastalarda Pompanın Erken Postoperatif Mortaliteye ve Serebrovasküler Olaya Etkisi

ÖZET

Giriş: Bu çalışma, son gelişmelerle pompalı / pompasız Koroner Arter Bypass Grafting (KABGO) uygulanan hastalarda, postoperatif erken dönemde (bir ayda), kardiyopulmoner bypass' ın (KPB) erken mortalite ve serebral olay üzerine etkileri araştırıldı .

Materyal ve Metod: Çalışmamız, kliniğimizde koroner arter baypas greftleme ameliyatı yapılan toplam 260 olguyu içermektedir. KABGO uygulanan hastalar iki farklı cerrahi tekniğe göre gruplandırıldı. Birinci grup (Grup 1), CPB ve X klemp (On-Pump) kullanılarak KABGO uygulanan hastalardan oluştu. İkinci grup (Grup 2), atan kalp (Off-Pump) tekniği ile KABGO uygulanan hastalardan oluştu. Proksimal anastomozlar tüm olgularda yan klemp kullanılarak yapıldı.

Sonuç: Hastalar postoperatif 30' cu güne kadar mortalite açısından takip edildi. Dört ölüm vakası ve altı serebrovasküler olayla karşı karşıya kaldık.

Tartışma: On-pump KABGO ameliyatlarında Off-pump KABGO ameliyatlarına kıyasla serebral kaza oranları (% 2.4' e karşı % 2.1) ve ölüm (% 1'e karşı % 1.8) benzer oranda görülürken istatistiksel olarak anlamlı değildir.

Anahtar Kelimeler: Koroner Arter hastalığı- Koroner Arter Bypas Operasyonu - Off pump Koroner Arter Bypas Operasyonu- Kalp akciğer makinası- Mortalite - Felç

The Affect of Pump on Early Postoperative Mortality and Cerebrovascular Accident in Patients Underwent Coronary Bypass Surgery

ABSTRACT

Introduction: The present study investigated mortality rates with latest development in the postoperative early period (one month) in the patients that underwent on/off- pump Coronary Artery Bypass Grafting (CABG) and explored effects of cardiopulmonary bypass (CPB) on early mortality and cerebral accident.

Materials and Method: The present study comprised a total of 260 subjects that underwent coronary artery bypass grafting surgery in our clinic. Patients that underwent CABG were grouped according to two different surgical techniques. The first group (Group 1) consisted of patients that underwent CABG using CPB and cross-clamp (On-Pump). The second group (Group 2) consisted of patients that underwent CABG by beating heart (Off-Pump) technique. Proximal anastomoses were performed using side clamps in all cases.

Results: The patients were followed until the postoperative day 30 for mortality. We were faced on four dead cases and six cerebrovascular accident.

Conclusion: The rates of cerebral accident (2.4% vs 2.1%) and death (1.8% vs 1%) are encountered same ratio, and not statistically significant, in On-pump CABG surgeries as compared to Off-pump CABG surgeries.

Keywords: Coronary artery disease- Coronary artery bypass- Off pump coronary artery bypass- Heart lung machine- Mortality -Stroke

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The Affect of Pump on Early Postoperative Mortality and Cerebrovascular Accident in Patients Underwent Coronary Bypass Surgery

1. Background

Coronary artery bypass (CABG) surgery is one of the most frequently performed surgeries all over the world. It has risks for central nervous system complications and mortality. Conventional CABG is performed using cardiopulmonary bypass (CPB) device and called as on-pump CABG, CABG performed without using CPB is called as off-pump (Beating-heart).

On-pump CABG is considered as the gold standard, but this method has physiological outcomes including activation of complement system, thrombocytopenia, immune suppression, and inflammatory response that leads to organ dysfunction. Nevertheless, manipulation of ascending aorta during cannulation (cannulation and cross-clamping) poses a risk for embolization and stroke.

Some studies emphasize that mortality and morbidity rates of off-pump and on-pump coronary artery bypass surgeries are different particularly in high-risk patients (1). There are studies reporting differences between these two CABG techniques in terms of incidence of renal insufficiency, postoperative cognitive exposure, prolonged mechanical ventilation, blood loss and prolonged duration of hospital and intensive care unit stays (2-5). But in recent years, sometings have changed at CPB using, surgical experience, management of patients. We have faced on improved in cooperation of specialist among with cardiac surgeon, perphisonist, anesthesist, other technichians.

The present study investigated mortality and cerebral accident rates in the postoperative early period (one month) in the patients that underwent on/off- pump CABG and explored effects of CPB on early mortality and cerebral accident.

2. Methods

2.1 2.1 Clinical Characteristics of Patients

The present study comprised a total of 260 subjects that underwent coronary artery bypass grafting surgery in our clinic. Medical history was questioned. Detailed physical examination was performed in all patients. Transthoracic echocardiography (TTE) (Acuson, Mountain View, Acuson Sequoia C256, Siemens, GERMANY), standard preoperative laboratory analyses, pulmonary function test (Spirobank Spirometry, MIR

medical International Research Product, ITALY), and bilateral carotid artery Doppler ultrasonography (Toshiba XARIO primeultrasound, JAPAN) were performed in our clinic. Ascending aorta, thorax and aortic arch calcification were evaluated by standard telegram prior to the surgery. During surgery, ascending aorta and beginning of aortic arch were examined by manipulation. The patients with plaque detected during manipulation were not included in this study because of their procedure was changed.

Clopidogrel (Plavix® 75 mg, Sanofi Aventis, FRANCE) was discontinued five days and acetylsalicylic acid was discontinued three days before surgery in the patients that would undergo On-Pump (with cross-clamp and CPB) CABG. Clopidogrel was discontinued five days and acetylsalicylic acid (Coraspin® 100,150,200 mg, Bayer Turk, TURKEY) was discontinued one day before surgery in the patients that would undergo Off-pump CABG.

Blood glucose concentration in the patients with type 2 diabetes was regulated using regular insulin before and after surgery. Blood glucose level of the patients was kept below 200 mg/dl.

Dyslipidemia in study participants was defined as fasting serum total cholesterol level ≥ 240 mg/dl, triglyceride level ≥ 200 mg/dl, low-density lipoprotein (LDL) cholesterol level ≥ 160 mg/dl, and/or high-density lipoprotein (HDL) cholesterol level < 40 mg/dl, as well as receiving or not active drug therapy (6). Serum cholesterol level was measured by enzymatic methods.

Serum samples were collected in standard tubes containing ethylenediaminetetraacetic acid (EDTA) as anticoagulant. These serum samples were analyzed via Cell-Dyne 3700 (Abbott, Abbott Park, IL, USA) device. Weight (SECA, Vogel & Holke, Hamburg, GERMANY) and height (SECA, Vogel & Holke, Hamburg, GERMANY) of the participants were measured and body mass index (BMI) was calculated prior to the surgery. Distribution of BMI according to ages in groups were presented in Figure 1 and Figure 2.

Patients that underwent CABG under emergency conditions, that underwent CABG surgery for the second time, that underwent CPB-supported Off-pump CABG, that underwent both valvular and coronary artery surgeries in the same session, and that had chronic renal insufficiency, dialysis patients, were excluded from this study to create more homogeneous groups. Data were collected retrospectively. Stage approach was applied in the patients with carotid artery disease over 70% and under 100%, and carotid artery surgery was delayed until the one month after CABG.

2.2. Study Groups

Patients that underwent CABG were grouped according to two different surgical techniques. The first group (Group 1) included that underwent CABG using CPB and cross-clamp (On-Pump). The second group (Group 2) consisted of patients that underwent CABG by beating heart (Off-Pump) technique. Side clamp was used for proximal anastomosis in all cases.

In a study about CPB duration, it was found that the prolonged CPB duration independently increased mortality and morbidity after CABG (7). Mean duration was 115 min in CABG patients participating in the study. To make a more balanced comparison between groups, the patients who cross-clamping time did not exceed 90 minutes and Cardiopulmonary bypass time did not exceed 120 minutes in the patients that underwent CABG by CPB and cross-clamp technique were included.

Beating heart operation indications in our clinic; the proper diameter of the coronary artery, the epicardial view of the coronary arteries, and the cardiac performance are good enough to allow for cardiac manipulation. Otherwise, on-pump surgery is preferred. This choice obviously increases the number of anastomoses in on-pump surgery.

In order to create homogeneous groups, dialysis patients (or the patients with creatinine level higher than 2gr/dl), patients who surgery procedure has been changed because of aortic pathology was seen during surgery, patients that underwent surgery under emergency conditions, patients that underwent redo-CABG, and the patients that underwent surgery without touching the ascending aorta or underwent LIMA-LAD CABG were not included in the study.

2.3. Surgical procedure

Isolated CABG was performed in all patients that participated in this study. Fentanyl, midazolam and pancuronium bromide were administered for induction of anesthesia. Standard median sternotomy was applied. Vascular conduits (LIMA, saphenous vein and radial artery) were prepared. Heparin sodium (Nevparin® 5000 IU/ml Mustafa Nevzat, TURKEY) was administered (at a dose of 300 IU/kg). CPB and cross-clamp and standard aortic and two-stage venous cannulas were applied. Jostra-Cobe (Model 043213 105, VLC 865, SWEDEN) heart-lung machine was used. Crystalloid cardioplegia during surgery and hot shot cardioplegia at the end of surgery were used in all patients. The left internal mammarian artery (LIMA) was

used in all cases, the right internal artery was not. Great saphenous vein and radial artery have been the preferences for conduit. Meticulous aseptic technique was used in all operations. Unnecessary electrocautery using and luxury perfusion (CPB that enhances postoperative complications and that is unnecessary) were avoided. Heparinization was performed administering 150 IU/kg heparin in the patients that underwent beating heart technique. Octopus and Starfish were applied in distal anastomoses.

In On-pump and Off-pump techniques, side clamp was used for proximal anastomoses. Several data about surgery are demonstrated in Table 1.

2.4. Postoperative Care

Cefazolin sodium (Cefamezin®-IM/IV, Zentiva, TURKEY), which is being used as standard prophylactic antibiotic in our clinic, was administered at a dose of 1 g 30 min. before surgery and continued at 8-hour intervals for 72 hours after surgery. Acetylsalicylic acid (Coraspin® 300, Bayer Turk, TURKEY) was commenced at a dose of 300 mg/day together with enteral nutrition in all study participants. Blood glucose levels in diabetic patients were strictly regulated after surgery using insulin glargine at a dose of 100 IU/ml (Lantus® flacon, Sanofi Aventis, FRANCE) and human soluble regular insulin at a dose of 100 IU/ml (Humulin-R® flacon, Lilly , TURKEY). Insulin infusion was not avoided. Blood glucose concentration was kept below 200 mg/dl in all diabetic patients.

Patients stayed at the CVS intensive care unit for 48 hours. They were admitted to the CVS clinic within the third 24 hours after their drains and arterial catheters were removed. The patients were discharged from the hospital on the postoperative 6 -12 days and followed until postoperative day 30 for mortality and cerebral accident.

2.5. Statistical Analysis

Statistical analyses were made by SPSS program (SPSS Inc., Chicago, IL, USA). Pearson Chi-Square analysis was used in analysis of Statistical significance of nonparametric data between the groups; whereas, Ficher's Exact Test was used for nonparametric data in case between-group values observed were lower than the expected. Whilst parametric data were showed as minimum, maximum, and mean ± standard deviation, independent student t test was used in statistical significance of parametric data between the groups. If two-tailed p value was lower than 0.05 ($p<0.05$), it was considered statistically significant (Table 1).

3. Results

3.1. Subject characteristics

Ages of all participants was minimum (min) 29 years (y) and maximum (max) 89 years (mean ± standard deviation: 62.8±9.7 y). All patients in our study, 166 (63.8%) were male and 94 (36.2%) were female. The number of patients receiving antidiabetic agent was 123 (47.3%) and with hypertension (HT) was 210 (80.8%). There were 69 (26.5%) patients with COPD and 109 (41.9%) patients smokers. 18 (6.9%) patients has stroke history, 1 patient with right carotid artery stenosis (70%≤ lesion<100%)(0.4%), 2 patients with left carotid artery stenosis (70%≤ lesion<100%)(0.8%). In our study, the number of patients that underwent CABG with CPB was 164 (63.1%) and with Beating heart technique was 96 (36.9%). Mortality was observed in 4 (1.5%) patients in post surgery period.

3.2. Groups characteristics

The males in Group 1; Two (1.9%) dead cases was shown; the mean (±standard deviation) preoperative EF was 52.5±9.4; the mean (±standard deviation) age was 62.4±10.3 y; the mean (±standard deviation) BMI was 28.2±4.6 kg/m^2; the mean (±standard deviation) number of bypass grafting performed in CABG was 3.5±0.8; the number of patients with history of CVA before surgery was 9 (8.4%), with right carotid artery stenosis (70%≤ lesion<100%) was 0 (0%) and with left carotid artery stenosis (70%≤ lesion<100%) was 2 (1.9%). There were 67 (62.6%) smokers, 82 (76.6%) hypertensive patients, 29 (27.1%) patients with COPD, 7 (6.5%) patients with PAD, 28 (26.2%) patients receiving oral antidiabetic agent, and 12 (11.2%) patients receiving parenteral antidiabetic agent. The mean (± standard deviation) preoperative leukocyte count was 8.27±6.1 and the mean (±standard deviation) preoperative thrombocyte count was 247.9±74.9.

The females in Group 1; one (1.8%) dead case was shown , the mean (±standard deviation) age was 64.1±7.9 y; the mean (±standard deviation) BMI was 31.8±5.1 kg/m^2; the mean (±standard deviation) preoperative EF was 56±9.8; the mean (±standard deviation) number of bypass grafting performed in CABG was 3.7±0.8; 2 (3.5%) patients has CVA history before surgery, with right carotid artery stenosis (70%≤ lesion<100%) was 1 (1.8%) and with left carotid artery stenosis (70%≤ lesion<100%) was 0 (0%). It was observed that there were, 54 (94.7%) hypertensive patients, 5 (8.8%) smokers, 8 (14%) patients with COPD,

2 (3.5%) patients with PAD, 21 (36.8%) patients receiving oral antidiabetic agent and 17 (29.8%) patients receiving parenteral antidiabetic agent. The mean (± standard deviation) preoperative leukocyte count was 7.89±2.5 and the mean (±standard deviation) preoperative thrombocyte count was 278.9±112.

In the males of Group 2; dead cases was not shown after surgery was 0 (0%); the mean (±standard deviation) age was 61.5±9.5 y; the mean (±standard deviation) BMI was 28.1±3.8; the mean (±standard deviation) preoperative EF was 56.3±7.5; the mean (±standard deviation) number of bypass grafting performed in CABG was 2.7±1; 5 (8.5%) patients has CVA history, with right carotid artery stenosis (70%≤ lesion<100%) was 0 (0%) and with left carotid artery stenosis (70%≤ lesion<100%) was 0 (0%). There were 33 (55.9%) smokers, 42 (71.2%) hypertensive patients, 18 (30.5%) patients with COPD, 2 (3.4%) patients with PAD, 19 (32.2%) patients receiving oral antidiabetic agent and 3 (5.1%) patients receiving parenteral antidiabetic agent. The mean (± standard deviation) preoperative leukocyte count was 8.51±2.1, and the mean (±standard deviation) preoperative thrombocyte count was 256.7±71.8.

The females in Group 2; One (2.7%) dead case was shown after surgery; the mean (±standard deviation) age was 63.9±10.8 y; the mean (±standard deviation) BMI was 32.2±5.6; the mean (±standard deviation) preoperative EF was 51.5±10; the mean (±standard deviation) number of bypass grafting performed in CABG was 2.5±0.8; the number of patients with history of CVA before surgery was 2 (5.4%), with right carotid artery stenosis (70%≤ lesion<100%) was 0 (0%) and with left carotid artery stenosis (70%≤ lesion<100%) was 0 (0%). There were 4 (10.8%) smokers, 32 (86.5%) hypertensive patients, 14 (37.8%) patients with COPD, 1 (2.7%) patient with PAD, 11 (29.7%) patients receiving oral antidiabetic agent, and 12 (32.4%) patients receiving parenteral antidiabetic agent. The mean (± standard deviation) preoperative leukocyte count was 8.1±2, and the mean (±standard deviation) preoperative thrombocyte count was 249±64.1.

The patients were followed until the postoperative day 30 for mortality and cerebral accident. We were faced on four dead cases and six cerebrovascular accidents. Distribution of moratlity in all participants was presented in Figure 3.

4. Discussion

Conventional CABG is performed using cardiopulmonary bypass (CPB) device and called as on-

pump CABG; other side, CABG can be performed without CPB is called as off-pump. On-pump CABG is described as the gold standard; however, this method has some physiological outcomes including thrombocytopenia, activation of complement system, immune suppression, and inflammatory response that leads to organ dysfunction. Manipulation of ascending aorta during cannulation has risk for embolization and stroke.

Puskas et al. reported that beating heart CABG (off-pump) becomes fore front owing to similar number of revascularization, improved time until hospital discharge, and decreased number of patients with low cardiac output as compared to conventional CABG (on-pump) (8). Supporting these data, some authors reported that off-pump CABG might reduce peroperative morbidity as compared to on-pump CABG (9).

Conventional CABG is characterized by precise coronary anastomoses performed by using CPB. However, providing blood-free surgical area and performing precise anastomosis using CPB brings along unfavorable effects for the patient including blood trauma, inflammatory response, negativity of nonpulsatile flow, potential air embolus, and debris embolization arising from aorta (10). Off-pump CABG was considered as an opportunity to get rid of these unfavorable effects of CPB.

Dalen et al. retrospectively reviewed the patients that underwent CABG surgery in Sweden in a mean period of 7.1 years. They emphasized that patients that underwent Off-pump or On-pump surgery had similar outcomes in terms of long-term survival, mortality, re-hospitalization due to myocardial infarction (MI), heart failure, and stroke (11). Hueb et al. prospectively followed 155 patients that underwent off-pump and 153 patients that underwent on-pump CABG surgery for five years and stated no difference between off-pump CABG and on-pump CABG in terms of mortality, MI, revascularization, recurrence of angina, and stroke (12).

Recently, CABG has had to be increasingly performed in many patients with high risk profile. Benefits of Off-pump CABG are obvious in terms of complications due to CPB and aorta. Recent studies have demonstrated improvements in high-risk patients that underwent off-pump CABG (13-16).

Off-pump CABG and the gold standard on-pump CABG have been compared both in large retrospective observational studies and in randomized controlled studies. Results of the manuscripts that have been written and published on both techniques revealed comparable outcomes. However, small,

prospective, randomized, controlled studies are lacking. There is a study reporting that these studies are incapable of demonstrating early- and late-term results concerning incomplete revascularization, decreased long-term graft patency, increased recurrent revascularization, and survival. This has encouraged the researchers that are against off-pump CABG and triggered abandonment of this technique to be brought into agenda. There are studies stating that those who have doubt about applicability and benefit of Off-pump CABG ignore statistically more powerful studies, which demonstrate similar long-term outcomes and more comfortable hospital care period as compared to on-pump (17-22).

Selnes et al. followed 75 patients that underwent off-pump CABG and 152 patients that underwent on-pump CABG for six years and reported that long-term cardiac and cognitive outcomes are generally similar (23). Van Dijk et al. performed 282 off-pump CABG surgeries using octopus stabilizer device and emphasized that it is not different from CPB in terms of 5-year survival rate, MI, recurrence of angina, stroke, re-revascularization and cognitive functions (24).

Van Dijk D. et al., Roy P. et al., Legare J-F et al., and Parolari A. et al. compared short-term outcomes of on-pump and off-pump CABG and found no comparable differences (25). Beckermann J. et al. stated that off-pump CABG is superior to on-pump CABG owing to mildly better hospital discharge rates and lower incidence of some postoperative complications particularly atrial fibrillation, psychotic syndromes and renal dysfunction (1).

In their large-series studies, Plomondon ME et al., reported that off-pump CABG is superior to on-pump CABG in terms of early morbidity and mortality rates (26).

In the present study, it was observed that the rate of death and cerebral accident in hospital or within postoperative 30 days was same, statistically not significant, in the On-pump CABG group (Group 1) versus off-pump group (Group 2). Preoperative evaluation of EF by transthoracic ECHO was not different between the groups. It was observed that EF was over 50% in two of three cases that died and below 50% in the other case in Group 1. EF was below 50% in a case that died in Group 2. Whilst the mortality in Group 1 was due to LCOS (Low Cardiac Output Syndrome) in two cases and to multiorgan failure in one, mortality was due to catastrophic CVA in Group 2. What is conspicuous is; whilst postoperative stroke was not the cause of postoperative death in none of the cases in the on-pump CABG group, stroke was considered to be the

cause of mortality in the off-pump CABG group. Two of the cases that died in Group 1 were under the age of 70 years and one was over the age of 70 years, whereas the case that died in Group 2 was over the age of 80 years. The mean number of bypass grafting was found to be statistically significantly higher in the on-pump group versus off-pump group. However, it was determined that 3 grafts were used in two of three patients, who died in the postoperative period in Group 1, and 4 grafts were used in the other case; whereas, 3 grafts were used in the case that died in the postoperative period in Group 2.

Conclusion

In the present study, no statistically significant difference was determined between on-pump CABG and off-pump CABG in terms of early postoperative mortality rate and cerebral accident rate in the postoperative 30 days. Based on the present study, the results can be summarized under two topics: the first is; the number of bypass grafting performed in On-pump CABG surgeries is statistically significantly higher than the number of bypass grafting performed in Off-pump CABG surgeries. The second is; cerebral accident (2.4% vs 2.1%) and death (1.8% vs 1%) are encountered same ratio, not statistically significant, in On-pump CABG surgeries as compared to Off-pump CABG surgeries. In recent years, some developments were happened in CPB using, surgical experience, management of patients. Additionally, we have faced on improved in cooperation of specialist among with cardiac surgeon, perfusionist, anesthetist, other technichians. All of these helped to surgical team for make better results. We are thinking that current on-pump CABG surgery is safe as much as off-pump CABG, in patients who have criteria mentioned in our study.

Study Limitations

In the present study; all study participants are Caucasians and do not represent other ethnic groups. The present study does not comprise patients with renal insufficiency, dialysis patients or redo-CABG cases.

Abbreviations

CAD: Coronary Artery Disease

BMI: Body Mass Index

COPD: Chronic Obstructive Pulmonary Disease

PAD: Peripheral Artery Disease

CABG: Coronary Artery Bypass Grafting

CPB: Cardiopulmonary Bypass

Ethics approval and conset to partipate: This study is retrospective study. We can carry out some studies which to be a retrospective with verbal approve of ethic committee. For this cause we have no approval paper of Ethics committee.

Consent for Publication: Fatih Aygün and Mehmet Özülkü declarated that the manuscript which name is "The Affect of Pump on Early Postoperative Mortality and Cerebrovascular Accident in Patients Underwent Coronary Bypass Surgery" can be published in your journal.

Availability of data and material: All of these materials for our study are obtained in our clinic.

Competing interest: The authors declare that they have no conflict of interest

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Authors contributions: FA; He carried out this study, participated in the sequence alignment and drafted the manuscript. MÖ; He participated in the design of the study and performed the statistical analysis.

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Figure Legends

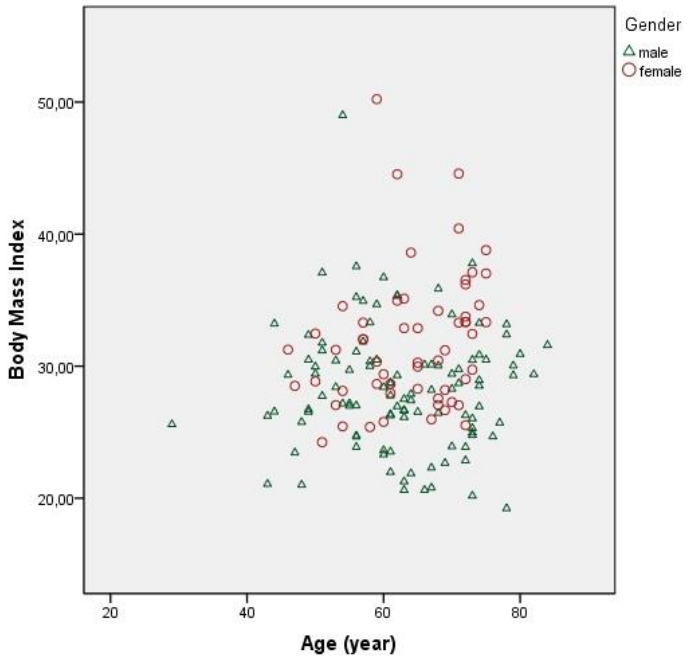

Figure 1 Distribution of BMI according to ages in group 1 were presented

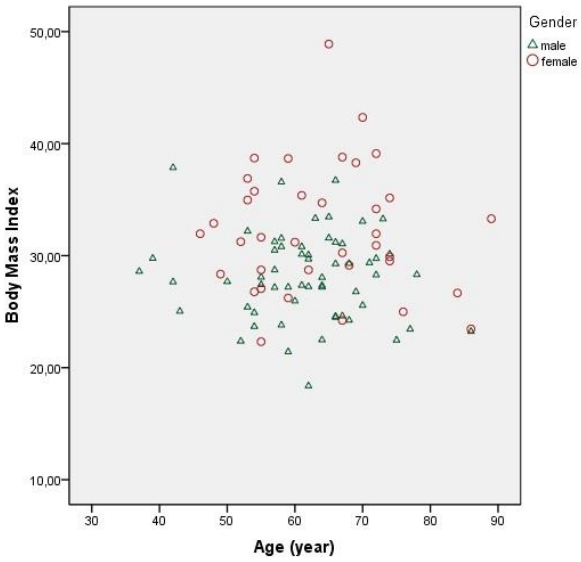

Figure 2 Distribution of BMI according to ages in group 2 were presented

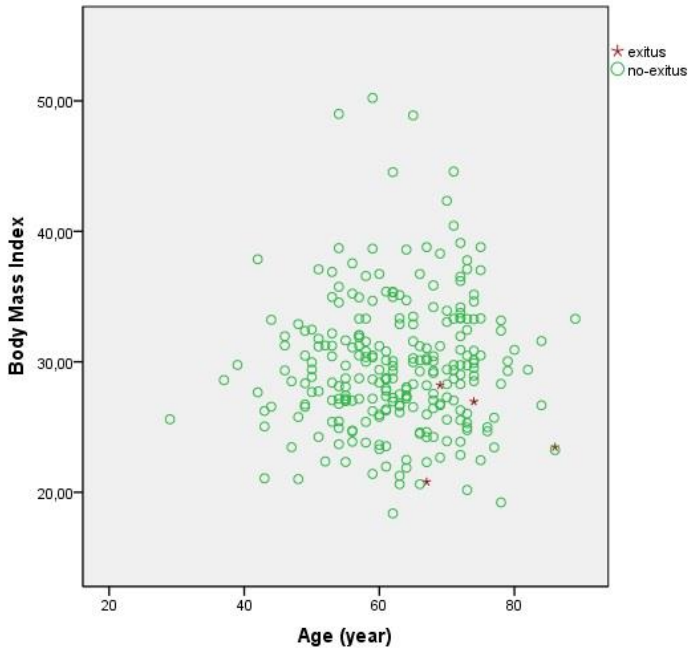

Figure 3 Distribution of moratlity in all participants was presented

Table 1 Datas according to groups

	Group 1 (n=164) (On-pump CABG)	Group 2 (n=96) (Off-pump CABG)	p values
Age (±SD) (year)	63 ±9.5	62.5± 10	0687^{T}
Gender (Male)	107 (65.2%)	59 (61.5%)	0.540^{P}
Smoking	72 (43.9%)	37 (38.5%)	0.398^{P}
COPD	37 (22.6%)	32 (33.3%)	0.058^{P}
Hypertension	136 (82.9%)	74 (77.1%)	0.249^{P}
PAD	9 (5.9%)	3 (3.1%)	0.544^{F}
Preoperative leuykocyt count	8.14±5.2	8.36±2.15	0682^{T}
Preoperative thrombocyst count	258.6±90.4	253.7±68.7	0.647^{T}
Preoperative stroke story	11 (6.7%)	7 (7.3%)	0.858^{P}
Diabet oral a/d parenteral a/d	49 (29.9%) 29 (17.7%)	30 (31.3%) 15 (5.6%)	0.907^{P}
Right carotid artery			
no stenosis	*101 (61.5%)	*61 (63.5%)	*0.753^{P}
stenosis<%50	55 (33.5%)	28 (% 29.2%)	
%50<stenosis≤%70	6 (3.7%)	7 (% 7.3%)	
% 70≤ stenosis<%100	1 (0.6%)	0	
stenosis=%100	1 (0.6%)	0	
Left carotid artery			
no stenosis	*96 (38.5%)	*63 (36.5%)	*0.258^{P}
stenosis<%50	54 (32.9%)	29 (% 30.2)	
%50<stenosis≤%70	10 (6.1%)	4 (% 4.2)	
% 70≤stenosis<%100	2 (1.2%)	0	
stenosis=%100	2 1.2%)	0	
Weigth(kg)	78.3±13.4	77.3±13.1	0.548^{T}
BMI	29.5±5.1	29.7±5	0.768^{T}
Ejection Fraction	53.7±9.7	54.5±8.8	0.536^{T}
Numbers of grafting	3.6±0.8	2.6±0.9	<0.001^{T}
Preopetarive leukocyt count	8.1±5.2	8.3±2.1	0.682^{T}
Preoperative thrombocyt count	258.6±90.4	253.7±68.7	0.647^{T}
Postoperative stroke	4 (2.4%)	2 (2.1%)	1^{F}
Postoperative mortality	3(1.8%)	1 (1%)	1^{F}

[T] : p value as Student-t test result

[P] : p value as Pearson Qi-square test result

*: Student -t test was made according to these values.

[F] **:** Ficher's Exact Test was used because observed values were below the expected values.

BMI: Body Mass Index, SD : Standart deviation. PAD: Peripheral artery disease, COPD: Chronic obstructive pulmonary disease.