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ARAŞTIRMA / RESEARCH

The effect of the number of vessel grafts used in coronary artery bypass grafting surgery to short-term mortality

Koroner arter bypass cerrahisinde kullanılan damar grefti sayısının kısa dönem mortaliteye etkisi

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Abstract

Purpose: The study aimed to share the short-term mortality rates of coronary artery bypass grafting (CABG) experience in a private hospital and to evaluate parameters affecting the clinical outputs following the CABG who were divided according to the number of vessel graft.

Materials and Methods: The study is a longitudinal-term observational clinical study, with a patient follow-up period of 7 years in Turkey. We analyzed 3027 cases with outcomes and short-term mortality according to the number of vessel grafts that we used as 1 (n:608), 2-3 (n:1359), and four or more (n:1060) grafts.

Results: The short-term mortality was found as 1.1% (36/3027) in all the patients. The male population was the highest in the group with the highest number of vascular grafts and its percentage to females was correlated with vessel grafts that we performed. Mean aortic cross-clamp time was 36.6±17.2 minutes, while bypass time was 66.4±21 minutes. The mean number of vessels revascularized was 3.17±0.9 (1-7). The amount of drainage was 419±286 ml. The period of intensive care was 1.2±1.1 days, while the hospital period was 5.2±1.5days. In comparison according to the number of vascular grafts, positive inotrope agent, drainage, blood supply, cross-clamp and pump period showed significant difference.

Conclusion: The number of vessel grafts was related to clinical outputs of CABG operations and Our CABG in the private hospital reached the short-term mortality rates that were below the averages of Turkey and international operations.

Keywords: Coronary bypass, vessel graft, CABG

Öz

Amaç: Çalışmada, özel bir hastanede koroner arter baypas greftleme (KABG) deneyiminin kısa dönem mortalite oranlarının paylaşılması ve damar grefti sayısına göre bölünen KABG sonrası klinik sonuçlarını etkileyen parametreleri değerlendirmeyi amaçladık.

Gereç ve Yöntem: Çalışma, Türkiye'de 7 yıllık hasta takip süresi olan, uzun süreli gözlemsel bir klinik çalışmadır. 1 (n:608), 2-3 (n:1359) ve dört veya daha fazla (n:1060) greft olarak kullandığımız damar greftlerinin sayısına göre sonuçları ve kısa vadeli mortalitesi olan 3027 vakayı analiz ettik.

Bulgular: Kısa dönem mortalite tüm hastalarda 1,1% (36/3027) olarak bulundu. Erkek popülasyonu en fazla damar grefti olan grupta en yüksek idi ve kadınlara oranı yaptığımız damar greftleriyle korele idi. Ortalama aortik kros klemp süresi 36.6±17.2 dakika, baypas süresi 66.4±21 dakika idi. Revaskülarize edilen damar sayısı ortalama 3,17±0,9 (1-7) idi. Drenaj miktarı 419±286 ml idi. Yoğun bakım süresi 1,2±1,1 gün, hastanede kalma süresi 5,2±1,5 gün idi. Vasküler greft sayısına göre karşılaştırıldığında pozitif inotrop ajan, drenaj, kan temini, kros klemp ve pompa periyodu anlamlı farklılık gösterdi.

Sonuç: Damar grefti sayısı KABG ameliyatlarının klinik sonuçları ile pozitif ilişkiliydi. KABG sonuçlarımız başarılı olarak Türkiye ve uluslararası ameliyat ortalamalarının altında kısa dönem mortalite oranlarına ulaştı.

Anahtar kelimeler: Koroner baypas, damar grefti, CABG

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INTRODUCTION

In patients with acute myocardial infarction, as a treatment principle, patient admission to hospital, early administration of thrombolytic agents, intensive monitoring of the patient in terms of complications of infarction, myocardial oxygen are all needed to reduce the damage risk on the myocardial area[1-3]. Today, despite the thrombolytic or interventional cardiologic approaches, many patients undergo coronary bypass surgery (CABG) in patients with ongoing coronary ischemia[4-6].

Preoperative evaluation of the patient is critical in CABG for surgeons and patients. The standard surgical approach for CABG involves the left-internal mammary artery(LIMA), saphenous vein graft (SVG), or radial artery (RA) graft to bypass other coronary arteries[2]. Coronary artery bypass surgery can be performed safely by an experienced team using advanced technology in addition to the timing of the surgery[7,8]. Determining additional risk factors and predicting the possible complications of these factors increases the success of the surgery[9-11].

Surgical mortality rates in the world and our country have decreased to almost 1%[5]. In Turkey, the first open-heart surgery operation was made in 1963[12]. In line with global developments, operation technics improved rapidly in our country and reached success rates in world standards[1]. With the introduction of private hospitals since the early 1990s, the number of places where cardiac surgery is performed has increased and has become a routine applicable service for the majority of the population[13]. In our private hospital, where was located in the south region of Turkey, we have been performed more than 3 thousand successful CABG operations in seven years with very low mortality and morbidity.

Although CABG operations carried out in public institutions in our country are abundant, the data of studies conducted in private health institutions are very limited. In addition, there is no study on the effect of the number of vessels used in operations on CABG results. In the present study, we aimed to share our seven-year CABG experience in the Acıbadem private hospital and to evaluate the significant parameters affecting the short-term mortality in the cardiac bypass surgery in the patients who were divided according to the number of vessel grafts used in CABG.

MATERIALS AND METHODS

The study is a single private-run hospital, longitudinal-term observational clinical study, with a patient follow-up period of 7 years and the Institutional Review Board of the Acıbadem Medical Hospital approved the study. The database of the hospital is constantly updated and all data in the CABG file of the patients are digitally securely stored. All CABG data are stored in accordance with ethical rules and the Declaration of Helsinki within the knowledge of patients and with their consent. The research protocol was approved by the local ethics committee as a retrospective analysis (Date: 16/10/2019 and No: 0175-1019).

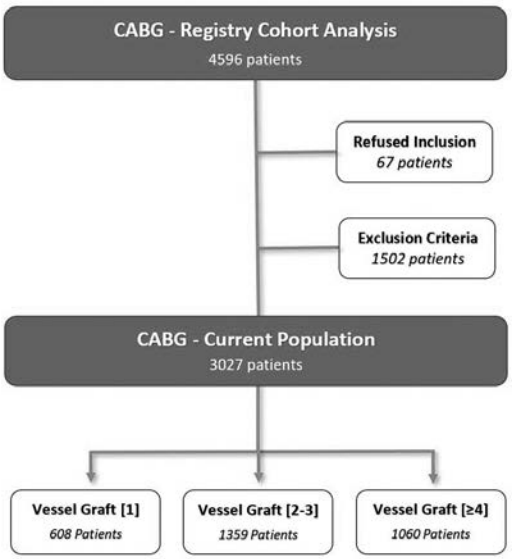

Figure-1. Flow chart for CABG participants

From January 2013 through 2018, 4596 cases who were scheduled for both elective and urgent CABG were assessed for the study enrollment. Of these, 1502 patients were excluded, mostly due to having a major disease, and missing of the patient data, while 67 patients refused to join the study. Three thousand twenty-seven patients were accepted as eligible for the current study as given in the flow chart (Figure-1). The patients were divided according to the number of vessels used in CABG operation. All details proper 3027 cases were analyzed as 1 (n:608), 2-3 (n:1359) and four or more (n:1060) vessel grafts. All patient's information on CABG surgery was obtained from the hospital database retrospectively,

which was recorded by clinicians and covered cardiovascular surgery background and related measures.

Sample

We enrolled cases who received a CABG on-pump with general anesthesia. We excluded those who needed a repeated open sternotomy for surgery. Patients, who underwent a concomitant cardiac or aortic surgical procedure, such as valve replacement, valvuloplasty, or replacement of a valvular prosthesis, were excluded from the study. The population included in the study was limited to patients aged 18 years or older who underwent an open-sternotomy for CABG for the first time. Because patients with common neurocognitive problems are more likely to show recurrences It was limited to patients without a history of neurocognitive disorder to lessen bias at the time of surgery. This exclusion may also lessen the discomfort for patient care approaches of clinicians. Relevant comorbidities such as cerebrovascular events, endocarditis, peripheral vascular problems, immunosuppression, and hypertension were assessed for all patients during CABG, which was saved by physicians at the time of the operation.

Surgical technique

In all patients undergoing CABG, anesthetic and operative techniques were performed through international standards. Anesthesia was performed with both fentanyl(25-50µ/kg) and rocuronium bromur(1mg/kg). We completed proximal anastomoses during the surgery with the heart beating. Distal anastomoses construction during one period of ischemic arrest which was followed this procedure (figure-2 and 3). All blood vessels that had much more stenosis than 50% were bypassed.

Overall, analyzing 3027 grafts: 2850 saphenous vein, 2705 LIMA, 18 radial artery, 6 left-internal thoracic arteries and the right internal mammary artery (RIMA). The solution of antegrade cold blood cardioplegic supplemented under multi infusions with topical and systemic hypothermia was used to maintain myocardial protection.

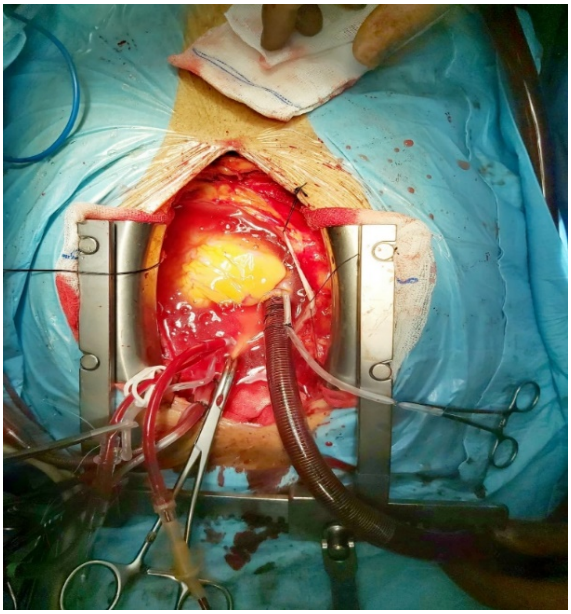

Figure-2. CABG local cooling with cold water and ice after cross-clamp

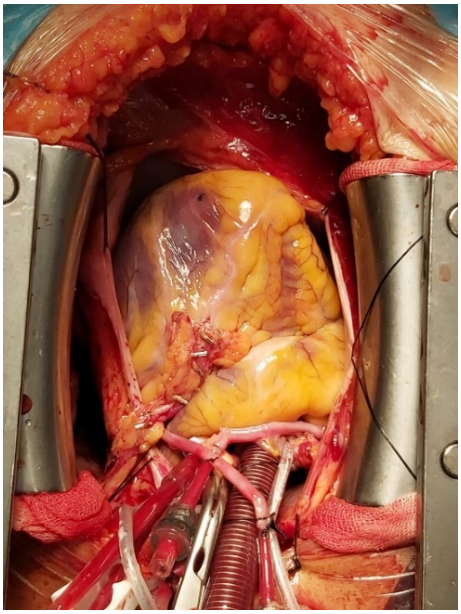

Figure-3. The anastomosis of the Lima-LAD as standard CABG application

Statistical analysis

Statistical assessment was done through SPSS software for Mac OS (v21.0; IBM, USA). Variables are expressed as mean and standard deviation or the number of patients (percentage), where appropriate. The normality of the data was evaluated using the Shapiro-Wilk test. Normally distributed continuous

variables were compared using the ANOVA test for comparin laboratry results of the patients. A Chi-square test was used for categorical variables including the Patients'clinic results according to the number of vessel grafts. All clinically relevant variables were included in the model. Confidence intervals were reported for all outcome measures. Any comparison difference was considered significant at a lower p level of 0.05 values.

RESULTS

According to demographic data, the mean age of the patients was 60.7±9.2 years and did not differ according to the number of vascular grafts (p>0.05). The numbers of female patients were 746 (24.6%), and males were 2281 (75.4%). The male population was the highest in the group with the highest number of vascular grafts and its percentage to females was correlated (r=0.688; p<0.05) with vessel grafts that we performed. All details regarding demographics and laboratory details were given in Table-1.

Table-1. Patients' demographics according to number of vessel grafts

Variables	Number of Vessel Grafts			Total	P-value
	1 (n:608)	2-3 (n:1359)	≥4 (n:1060)		
Age	60.5±9.8	61.4±9.2	61±8.9	60.7±9.2	0,087
Gender (female)	188 (31%)	349 (25.7%)	209 (19.7%)	746 (24.6%)	0,0001
Height	166.4±8.9	166.8±9	168±8.8	167.2±8.9	0,096
Weight	80.8±14.1	81.2±13.2	81.6±12.9	81.1±13.3	0,229
BMI	29.2±4.8	29±4.6	28.9±4.3	29±4.5	0,471
Smoking	370(61%)	864(63.5%)	681(64.2%)	1915(63%)	0,365
Follow-up (days)	6.2±1.6	6.2±1.5	6.2±1.6	6.2±1.6	0,952
Ejection Fraction (%)	59.1±10.2	58.6±9.3	57.9±12.5	58.4±10.7	0,088
Positive Inotrope	123(20.1%)	354(26%)	318(30%)	795(26.3%)	0,0001
Drainage *(PO)*	388±281	426±285	427±289	419±286	0,013
Blood Supply *(PO)*	0.9±1.2	1.1±1.5	1.1±1.9	1.1±1.6	0,004
Intensive Care *(PO)*	1.2±1.2	1.3±1.2	1.2±0.6	1.2±1	0,186
Hospital Stay *(PO)*	5.2±1.6	5.2±1.5	5.2±1.6	5.2±1.5	0,996
Cross Clamp	26.3±16.3	35.3±19.5	44.1±9.5	36.6±17.2	0,0001
Pomp Period	47.7±26.3	64.1±14.7	80.2±14	66.4±21	0,0001
INR	1.09±0.47	1.05±0.12	1.15±3.35	1.1±2	0,464
Glucose *(mg/dL)*	139.3±60.5	141.7±59.7	146.2±64.5	142.8±61.6	0,063
ALT *(U/L)*	30±22.2	29.5±20.9	31.3±20.3	30.2±21	0,09
AST *(U/L)*	27±18.5	27.7±25.1	31.1±40	28.8±30.3	0,006
Urea *(mg/dL)*	32.8±11.7	33.8±14.6	33.3±11.9	33.4±13.1	0,234
BUN	15.4±5.6	16.4±15.8	15.8±6.3	16±11.5	0,15
eGFR	101.5±13.7	101.8±12.9	102±13.7	101.8±13.3	0,725
Creatine *(mg/dL)*	0.8±0.2	0.9±0.2	0.9±0.2	0.9±0.2	0,18
Hemoglobin *(g/dL)*	16.2±67.6	13.7±3.5	14.9±41.4	14.6±39.1	0,398
Platelet *($10^3/mm^3$)*	239±70	246±100	241±68	243±84	0,159

PO: Postoperative, AST: Aspartate aminotransferase, ALT: Alanin aminotransferase, eGFR: Estimated glomerular filtration rate, BUN: Blood urea nitrogen, BMI: Body mass index, INR: International normalized ratio.

Mean aortic cross-clamp time was 36.6±17.2 minutes, while bypass time was 66.4±21 minutes. The mean number of vessels revascularized was 3.17±0.9 (1-7). The amount of drainage was 419±286 ml. The period of intensive care was 1.2±1.1days, while the hospital period was 5.2±1.5days (Table-1).

The short-term mortality was found as 1,1% (36/3027) in all the patients. In comparison according to the number of vascular grafts, positive inotrope agent (p=0.0001), drainage (p=0.013), blood supply (p=0.004), cross-clamp (p=0.0001) and pump period (p=0.0001) showed significant difference.

Hypertension was the most common concomitant disease in 1851 (61.1%) followed by hyperlipidemia 1383 (45.7%) and diabetes mellitus 1229 (40.6%). In the preoperative period, 2 (0.1%) patients had renal dysfunction, and none of them required chronic dialysis. 43 (1.4%) patients had concomitant peripheral arterial disease and 13 (0.4%) cerebrovascular events. The mean ejection fraction (EF) was 58.4±10.7 percent and was found to be 40% or less in 259 cases. The rate of patients with preoperative myocardial infarction was 719 (23.8%), and unstable angina was 203 (6.7%)(Table-2).

In terms of clinical status, there was a significant difference between the number of vascular grafts and diabetes mellitus (p=0.004), preoperative myocardium infarct history (p=0.005), and ACE use (p=0.035).

Table-2. Patients'clinic results according to the number of vessel grafts

Variables	Number of Vessel Grafts			Total	P-value
	1 (n:608)	2-3 (n:1359)	≥4 (n:1060)		
COPD Existence	16 (2.6%)	46 (3.4%)	37 (3.5%)	99 (3.3%)	0,606
Cerebrovascular Event	3 (0.5%)	4 (0.3%)	6 (0.6%)	13 (0.4%)	0,577
Carotid Arterial Disorder	0 (0%)	0 (0%)	1 (0.1%)	1 (0.1%)	0,395
Peripheral Artery Disorder	3 (0.5%)	21 (1.5%)	19 (1.8%)	43 (1.4%)	0,085
Operation Background	10 (1.6%)	19 (1.4%)	8 (0.8%)	37 (1.2%)	0,205
LMC Existence	12 (2%)	25 (1.8%)	25 (2.4%)	62 (2%)	0,661
Hypertension	387 (63.7%)	817 (60.1%)	647 (61%)	1851 (61.1%)	0,33
Diabetes Mellitus	212 (34.9%)	563 (41.4%)	454 (42.8%)	1229 (40.6%)	0,004
Hyperlipidemia	284 (46.7%)	608 (44.7%)	491 (46.3%)	1383 (45.7%)	0,631
Chronic Renal Failure	0 (0%)	1 (0.1%)	1 (0.1%)	2 (0.1%)	0,762
Unstable Angina (PreOp)	37 (6.1%)	92 (6.8%)	74 (7%)	203 (6.7%)	0,774
MI History (PreOp)	127 (20.9%)	305 (22.4%)	287 (27.1%)	719 (23.8%)	0,005
B-Blocker (PreOp)	281 (46.2%)	603 (44.4%)	446 (42.1%)	1330 (43.9%)	0,237
ACE History (PreOp)	203 (33.4%)	390 (28.7%)	292 (27.5%)	885 (29.2%)	0,035
Lipitor History (PreOp)	126 (20.7%)	228 (16.8%)	183 (17.3%)	537 (17.7%)	0,094
Plavix History (PreOp)	63 (10.4%)	120 (8.8%)	90 (8.5%)	273 (9%)	0,417
ARA History (PreOp)	215 (35.4%)	433 (31.9%)	344 (32.5%)	992 (32.8%)	0,301
Anti-coagulant (PreOp)	14 (2.3%)	36 (2.6%)	35 (3.3%)	85 (2.8%)	0,44

PreOp: Preoperative, MI: Myocardium Infarct, LMC: Left main coronary artery, COPD: Chronic obstructive pulmonary disease, ACE: Angiotensin-converting enzyme

Table-3. Patients' data who died after CABG operation in short-term

ID	Age	Sex	BMI	EF	Blood Sup.	IC	Stay	Clamp	Pump T.	Bypass C.	Condition	Time
1	64	F	29.8	56	0	1	1	88	179	1	Aortic Dissection	0
2	69	M	21.8	40	2	1	9	44	75	4	Kidney Failure	8
3	63	F	27.7	32	2	1	11	43	98	4	Kidney Failure	13
4	69	F	47.8	63	4	4	9	71	94	0	Kidney Failure	3
5	71	F	28.9	65	6	11	11	110	138	2	Intestinal Bleeding	11
6	80	M	22.5	51	8	2	4	36	65	3	HF/LF	3
7	68	F	36.7	40	1	1	7	134	182	2	HF/LF	1

8	60	M	34.3	64	0	1	4	62	174	3	HF/LF	2
9	64	M	29.4	60	0	1	4	74	106	2	HF/LF	5
10	63	F	28.0	63	1	1	5	89	142	3	HF/LF	12
11	69	M	29.8	64	12	2	6	35	84	4	HF/LF	2
12	57	M	27.7	68	4	2	4	21	121	3	HF/LF	3
13	75	M	27.3	65	19	1	2	80	121	1	HF/LF	2
14	81	M	32.0	60	2	1	7	30	64	4	HF/LF	6
15	55	F	22.7	58	0	1	3	128	163	2	HF/LF	2
16	75	M	26.0	55	0	1	15	57	102	5	HF/LF	5
17	80	M	23.8	42	6	2	4	36	83	3	HF/LF	2
18	67	M	35.6	57	30	24	0	39	78	3	COPD	24
19	64	M	33.7	65	1	1	5	43	84	4	Mediastinit/Infection	11
20	61	M	28.1	65	1	1	6	41	87	4	Mesenteric Infection	0
21	60	F	27.5	68	2	1	5	72	116	1	Pneumonia/Infection	2
22	67	M	25.0	50	5	30	7	31	73	2	Pneumonia/Infection	23
23	56	M	30.5	50	3	1	8	95	149	0	Pneumonia/Infection	8
24	60	M	26.6	60	45	2	2	47	78	5	Postop Bleeding	2
25	66	F	28.0	50	7	6	8	101	141	2	PB/PT	7
26	50	F	26.1	60	9	6	20	100	133	0	PB/PT	20
27	79	F	29.3	40	5	2	2	107	153	4	PB/PT	2
28	57	F	23.6	55	2	1	1	45	165	0	PB/PT	1
29	64	F	33.8	50	1	1	1	100	157	0	PB/PT	1
30	66	F	37.8	64	3	1	7	62	77	0	PB/PT	2
31	50	M	32.4	30	4	1	4	46	80	4	Rhythm Disorders	3
32	51	M	27.8	68	4	3	0	32	98	0	Rhythm Disorders	32
33	52	F	23.8	65	0	1	1	77	125	0	Rhythm Disorders	0
34	67	F	46.2	48	1	2	4	114	136	0	Rhythm Disorders	4
35	79	M	26.0	35	3	2	4	39	72	4	LVMR	2
36	51	F	30.9	45	1	1	6	49	66	0	Cerebrovascular Event	5

COPD: Chronic obstructive pulmonary disease, PB/PT: Postop Bleeding/Pericardial Tamponate, LVMR: Left Ventricular Myocardial Rupture, HF/LF: Heart Failure/Low Flow

All patients were intubated to the intensive care unit after CABG operation. As a result of the CABG operation, 36 (1,1%) patients lost their lives in the early and short-term periods. Of those, 17 of the patients were female, and 19 were male (p>0,05). Three of these patients were lost due to aortic dissection, dysrhythmias, and mesenteric ischemia during the operation (Table-3). In patients with preoperative renal dysfunction but did not undergo dialysis, urea-creatin levels were elevated in the postoperative period. Five patients died due to infection, while 3 of them were pneumonia. Postoperative bleeding occurred in 7 patients, and pericardial tamponade occurred in 6 of them. Left ventricular myocardial rupture developed in one

patient. In another patient, a cerebrovascular event developed in postoperative follow-up.

Deaths after the first 30 days were accepted as late mortality. Long-term mortality could not be calculated since we could not obtain a long follow-up after CABG performed in our hospital.

DISCUSSION

Currently, cardiovascular diseases are the most important cause of mortality in middle and old age group and constitute 30% of global deaths [14]. In the applications of open-heart surgery, patients of cardiac surgery are widely reported for the government hospitals in Turkey, and there is substantial documentation of successful surgical outcomes in this group of patients [15]. In the present study, we shared our cardiovascular surgery experience throughout a private-run large-capacity hospital in our country and analyzed the short-term mortality rate and its relationship with the number of bypass vessels in these CABG operations.

Bypass surgery continues to be the most common operation in an adult cardiac surgeon and the most common procedure in the world [16]. As in many countries the prevalence of coronary heart disease in Turkey 4%-5%, whereas the incidence is between 0,3-0.4%. Although the controversy over the insufficiency or superiority of off/on-pump CABG continues, it accounts for 15-30% of all CABG cases that vary in different national authorities. In Turkey, private hospital surgeons perform new surgical techniques in major experience and publish articles with great outcomes [17]. In our study, we reported one of the critical parts of the CABG surgery in the south region of Turkey, as covering with a primary capacity private-run cardiovascular surgery hospital.

According to the data of the study conducted by the Turkish Society of Cardiology, it is estimated that there are approximately 3-3.5 million coronary artery patients in our country [18]. The fact that newly opened regional centers shorten the diagnosis and treatment process contributes to the decrease in mortality rates due to coronary artery disease in our country [19]. Since state hospitals are the institutions where all citizens can receive health care services without distinction of social security institutions, open heart surgery and angiography make these hospitals more advantageous for patients. According to recent data, cardiac surgery and angiography services are provided in 207 centers in 46 provinces in Turkey [20]. One hundred twenty-two of these centers are private hospitals, 44 are university hospitals, and 40 are state hospitals [21]. In recent years, significant steps have been taken towards the expansion and localization of health services in our country.

In 2019, most of the open-heart operations in Turkey were coronary bypass operations [6]. In our clinic, 78% of the operations were isolated coronary bypass operations. Coronary bypass surgery was performed on-pump in all CABG cases. Compared with CABG performed with the conventional technique, beating heart technique, which has been increasingly used in recent years, is advantageous in many ways and there are some arguments not using CPB reduces morbidity and mortality [4]. Other patients underwent CABG revascularization using cardio pulmonary bypass. The left internal mamarian artery and saphenous venous grafts were preferred as the primary grafts. The prevalence of coronary artery disease is higher due to the negative habits of people in the region we serve, such as abundant animal fat and red meat consumption. The majority of CABG cases were elderly patients with additional co-morbid health problems and poor vascular structure [22]. Long-segment endarterectomy was performed in 16 patients due to an atheromatous plaque structure involving the entire coronary artery. Although the risk factors of the patients were high, the complication rates were low.

In combined procedures, aort clamp time (ACT) time is generally longer and in many studies, the length of this time has been associated with mortality[13]. In contrast, in our study, no significant difference was found between the patients who died and the patients who were discharged. It has been reported in various sources that the mortality rate in combined and emergency operations is higher than in isolated and elective operations. In many studies, it was reported that left ventricular systolic dysfunction increased mortality[23,24]. In our study, 36 patients lost their lives in the early and short-term periods. Left ventricular myocardial rupture developed in one patient. Three of these patients were lost due to aortic dissection, dysrhythmias, and mesenteric ischemia during the operation. Five patients died due to infection, while 3 of them were pneumonia. Postoperative bleeding occurred in 7 patients, and pericardial tamponade occurred in 6 of them.

It is known that cardiac surgery is performed with higher mortality and morbidity rates in advanced age patients compared to younger patients[12-14]. We could not analyze this topic because our patients who left

their lives ranged between 50 and 80 age. Early mortality was found as 1,1% (36/3027) in all patients. It is known that the female gender is also a risk factor that increases mortality[9-11]. Of those, 17 of patients were female, and 19 were male (p>0,05). As stated in the literature, the expected mortality ranges from 1,11 to 8,78 (17). In Turkey, a recent study performed by Polat et al., the 30-day mortality rate was 2.7% (n=17)[25]. In this study, our mortality rates were found to be 1.1 (n=36) in all 3027 patients. This rate means the lowest short-term mortality in both literature and Turkey.

As limitations, this is a retrospective study conducted in a single private-run center, and the distribution of the patients was not homogeneous. We did not use a scoring method for the present study. Factors affecting mortality were evaluated in our patient group but only covered the short-term. Long-term mortality could not be calculated since we could not obtain follow-up data after CABG operations performed in our hospital. Besides, despite the similarity in skills, unmeasured confounders outside the range of adjustments may have influenced the outcomes.

As a result, our mortality rates were found to be 1.1 (n=36) in all 3027 patients. This rate means the lowest short-term mortality in both literature and Turkey. Our short-term mortality rates suggested that CABG operations performed in our private hospital reached lower mortality rates below the average in Turkey. Besides, the number of vessel grafts was found as related to clinical outputs of CABG operations. The number of vessel grafts was related to clinical outputs of CABG operations. The mortality rates showed the lowest short-term mortality in both literature and Turkey that CABG performed in our private hospital reached lower mortality rates below the average in Turkey and the international side.

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