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A new heart surgery clinic: Open Heart Surgery Outcomes at Karabük Training and Research Hospital: Assessment of the first year

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Abstract

This study aims to assess the one-year outcomes of open heart surgeries performed at the recently established Cardiovascular Surgery Clinic of Karabük Training and Research Hospital. A total of 71 consecutive patients (60 males, 11 females; mean age 63.7±9.3 years; range 42 to 84 years) who underwent open heart surgery were evaluated retrospectively from 21 January 2016 to 21 January 2017. The most common comorbidity was hypertension (64.8%), followed by smoking (61.9%), chronic obstructive pulmonary disease (54.9%), and diabetes mellitus (40.6%). Mean length of stay at the intensive care unit was 3.4±2.9 days, and mean length of stay at the hospital was 10.4±6.9 days. In-hospital mortality occurred in a total of seven patients (9.9%). Early mortality (within the first 30 days) was seen in four (5.6%) patients. We believe our mortality and morbidity rates are acceptable despite the disadvantages of being a recently established center and the presence of multiple comorbid factors of patients. Although our clinic is a new center founded in Karabük province, it is planned to become an important center in the future in terms of heart surgery through the increasing number and variety of surgeries.

Keywords: Coronary artery bypass grafting, new center, open heart surgery

Introduction

Currently, cardiovascular disease is the most important cause of mortality in middle and advanced age, accounting for 31.5% of all deaths and 45% of noncontagious deaths globally [1]. Based on the Turkish Statistical Institute statistics regarding the causes of death for the year 2016, cardiovascular disease has been found to be the cause in 39.4% of all deaths in Turkey [2]. Coronary artery diseases constitute the largest group among cardiovascular diseases, and similar to the case in several countries, the prevalence of coronary heart disease is 4%-5% in Turkey, with an incidence of 0.3%-0.4% [3].

The first successful open heart surgery using the extracorporeal circulation technique was performed by John Gibbon in 1953 during an atrial septal defect closure [4]. In Turkey, serial open heart surgeries with extracorporeal closure were initiated by Dr. Aydın Aytaç in 1962, and together with the global advancements, today cardiac surgery has become a field where all cardiac surgical procedures, including heart transplants, can be performed successfully in our country [4]. With the foundation of new heart surgery centers in university hospitals, state hospitals and private sector, the number of centers performing open heart surgery appears to be increasing every year. The first open heart surgery at Karabük Training and Research Hospital was performed on 21 January 2016 and coordinated by Turkiye Yuksek Ihtisas Training and Research Hospital.

Therefore, in this study, we aimed to assess the one-year outcomes of open heart surgeries performed at the recently established Cardiovascular Surgery Clinic of Karabük Training and Research Hospital.

Material and Methods

A total of 71 patients (60 males, 11 females; mean age 63.7±9.3 years; range 42 to 84 years) who underwent open heart surgery at the Cardiovascular Surgery Clinic of Karabük Training and Research Hospital between 21 January 2016 and 21 January 2017 were included in the study. Patients' data were collected prospectively and evaluated retrospectively. The study protocol was approved by the Karabük University Ethics Committee (Dated 22.02.2017 with decision no: 2/7). The study was conducted in accordance with the principles of the Declaration of Helsinki.

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Open heart surgery was performed in 71 cases, five of which were conducted on the beating heart. Ten patients were transferred from the coronary angiography unit as emergency cases. Coronary artery bypass grafting (CABG) was performed 67 patients , one patient underwent aortic valve replacement (AVR) while AVR+coronary artery bypass grafting (CABG)+atrial septal defect (ASD) repair with primary suture was performed in one patient, one patient underwent CABG+free wall rupture repair with a patch, and one patient underwent CABG+ASD pericardial patching. CABG+subaortic myectomy surgery was performed in one patient.

Preoperative patient preparation

Preoperative physical examination and routine laboratory tests (complete blood count, blood glucose, renal and hepatic function tests, thyroid function tests, electrolytes, lung X-ray) of the patients were performed together with pulmonary function tests, echocardiography and color Doppler ultrasound for carotid and vertebral arteries. Computed tomography angiography was performed for the carotid artery in patients with critical carotid stenosis on Doppler ultrasound. Preoperative mortality risk was calculated for all patients by means of the European system for cardiac operative risk evaluation (EuroSCORE) II scoring system. Preoperative dental examination was routinely performed for each patient planned to undergo open procedures of the heart chambers. Necessary preoperative consultations were requested and patients were prepared for the surgery.

Surgical technique

The patients received anesthesia pre-medication on the previous night of and half an hour before the surgery. General anesthesia was performed in all patients with the intravenous narcotic anesthesia technique. The operation was performed with median sternotomy in all cases. Saphenous vein and/or left internal mammary artery (LIMA) were prepared in the standard manner. Except for the cases for whom CABG was performed on the beating heart, the cardiopulmonary bypass (CPB) technique with aortocaval cannulation was employed ._Mean arterial pressure was maintained at 50-70 mmHg during cardiopulmonary bypass. After achieving cardiac arrest with antegrade and retrograde cold crystalloid cardioplegia and topical hypothermia, continuance of the arrest was ensured with intermittent retrograde cold blood cardioplegia. Operations were completed under mild to moderate hyothermia (30°C-33°C). Warm blood cardioplegia was administered prior to removing the cross clamp. During coronary bypass, proximal anastomoses were performed under cross clamp (XCL) in 16 (22.5%) patients. Only antegrade cardioplegia was used in cases for which the expected intraoperative duration was short.

In all patients undergoing surgery on the beating heart, heparinization was used (100-200 U/kg) to maintain activated clotting time at 200-400 seconds. In order to achieve an immobile anastomosis site during coronary revascularization, myocardial and apical stabilization devices (Octopus ® and Starfish®) were used during the surgeries performed on the beating heart. During the surgery, a selective beta-1 blocker (metoprolol tartrate) was given intravenously to obtain bradycardia and distal anastomoses were performed subsequently. Sterile air blower was used in order to obtain a blood-free anastomosis site. In all patients, target vessel revascularization as initiated with prioritization of the systems that feed the left ventricle. All distal anastomoses were performed using 7/0 prolene and all proximal anastomoses were performed using 6/0 prolene by means of a side clamp to the ascending aorta.

Postoperative follow-up

Following surgery, all patients were taken to the Cardiovascular Surgery Intensive Care Unit that is linked to the operating room for follow-up. On the second postoperative day, drainage and urinal were removed in patients whose general condition and hemodynamics were good, and they were transferred to cardiovascular surgery clinic to continue their follow-up.

Statistical analysis

All statistical analyses were performed using the SPSS (SPSS for Windows 15.0, Inc, Chicago, IL, USA) statistics software. Continuous variables were expressed as mean values±standard deviation. Categorical variables were expressed as numbers and percentage. For demographics and perioperative characteristics, Mann-Whitney-U test was used to compare continuous variables, and Chi-square test was used for categorical variables. $P<0.05$ was considered statistically significant.

Results

According to the demographic data of patients, hypertension (64.8%) was the most common comorbidity followed by chronic obstructive pulmonary disease (54.6%), diabetes mellitus (40.8%) and hyperlipidemia (16.9%). Among the patients, 44 (61.9%) were smokers. Four patients had preoperative renal dysfunction; however, chronic dialysis was not required in any patient. Concomitant peripheral artery disease was present in nine patients, and two patients had a history of cerebrovascular event. Preoperative myocardial infarction (MI) rate was 60.6% among the patients. Mean ejection fraction (EF) was 54.6%±9.5% (range 30%-70 %) (Table 1).

Isolated CABG under CPB was the most common surgical procedure with 59 patients (83.1%). Mean aortic XCL duration of the patients was calculated as 83.6±41.6 minutes and CPB duration was 143.1±67.8 minutes. Seven of the isolated CABG procedures were performed on the beating heart. The rate of using LIMA graft was 93.2% (LIMA-left anterior descending coronary) in patients undergoing isolated CABG. Mean number of revascularized vessels was 2.6±0.9 (range 1-6).

All patients were intubated and taken to intensive care unit. Mean intubation period was calculated as 10.5±6.8 hours. Intubation lasting longer than twenty four hours was considered as prolonged intubation and seen in four patients (5.6%). Mean length of stay at intensive care was 3.4±2.9 days and total in-hospital period was 10.4±6.9 days. Mean amount of drainage was found to be 817.4±353.5 mL. Revision was performed in the early period due to postoperative bleeding in three patients, and the rate of revision was 4.2%. Low cardiac output was noted in five (7%) patients, and 15 (15.1%) required inotropes, and intra-aortic balloon pump was used in a total of five patients, all intraoperatively. In two of the four patients with preoperative renal dysfunction who were not undergoing dialysis, elevation in urea-creatinine values was observed during the postoperative period and they both responded

to medical treatment. Postoperative new onset atrial fibrillation (AF) developed in 17 cases (23.9%) (Table 2). Although normal sinus rhythm was restored by means of medical treatment or cardioversion in all patients, mortality occurred in five cases. None of the patients required permanent pacemaker implantation. Deep sternal wound site infection developed in one patient who was treated with medical treatment and surgical fasciocutaneous flap procedure. None of the patients had any major or minor neurological complications. Mean follow-up duration of the patients was 7.4±3.9 months. No mortality was observed during the polyclinic follow-up.

Table 1. Demographic characteristics

		Number of patients (n=71)	%
Gender	Female	11	15.5
	Male	60	84.5
HT		46	64.8
Smoking		44	61.9
HL		12	16.9
COPD		39	54.9
DM		29	40.8
RFT impairment		4	5.6
Previous MI		43	60.6
TFT impairment		11	15.5
CVE		2	2.8
PVD		9	12.7
Carotis stenosis		10	14.1
EuroSCORE II	Low risk	19	26.8
	Moderate risk	20	28.2
	High risk	32	45.1

HT: Hypertension; HL: Hyperlipidemia; COPD: Chronic obstructive pulmonary disease; DM: Diabetes Mellitus; RFT: Renal function test; MI: Myocardial infarction; TFT: Thyroid function test; CVE: Cerebrovascular event; PVD: Peripheral vascular disease; EuroSCORE: European System for Cardiac Operative Risk Evaluation.

Mortality

In-hospital mortality occurred in a total of seven patients (9.9%). While mortality in the first 30 days was considered as early mortality, deaths that occurred after 30 days were deemed as late mortality. Early mortality was seen in four patients, and late mortality was seen in three. Five patients with a fatal outcome had been taken to operation following coronary angiography as emergency cases. Two of these five patients undergoing emergency operation were taken to surgery under cardiac massage. One of the patients transferred under cardiac massage was received after coronary dissection. Free wall rupture was identified in this patient during operation. The other patient was taken into operation due to acute MI resulting from LMCA lesion during coronary angiography which was performed due to aortic stenosis. Both patients died intraoperatively. One of the other five cases with mortality resulted from pneumonia, and the other three were due to low cardiac output and two of which were related to chronic obstructive pulmonary disease (COPD)-induced respiratory complications. All patients with fatal outcome were males.

According to the additive EuroSCORE II scoring system, 19 of the operated patients (26.8 %) were in the low-risk (0-3 points) group, 20 (28,2%) were in the moderate-risk (4-6 points) group, and 32 (45.1%)were in the high-risk (7 points and higher) group. Among the patients in whom mortality was observed, one (1.4%) was in the low-risk group, none was in the moderate-risk group, and six (8.5%) were in the high-risk group.

Statistically significant differences were seen in terms of age, duration of ventilation and length of stay at intensive care and in-hospital length of stay between patients in whom mortality developed and those discharged from the hospital (Table 3). Chi-square test analysis revealed statistically significant differences between the groups regarding COPD, postoperative AF, emergency operation, smoking, and postoperative inotrope and intra-aortic balloon pump need. (Table 4)

Table 1. Demographic characteristics

	Number of patients (n=71)	%
Early mortality (n)	4	5.6
Late mortality (n)	3	4.2
Emergency operation (n)	10	14.1
Low cardiac output (n)	5	7
Inotrope need (n)	15	21.1
IABP use (n)	5	7
Postoperative AF (n)	17	23.9
Deep sternal wound site infection	1	1.4
Revision due to bleeding	4	5.6
Hospitalization due to pleural effusion	3	4.2
BSA	1.9±0.3	
Mean number of bypasses (n)	2.6±0.9	
Duration of CPB (min)	143.1±67.8	
XCL duration (min)	83.6±41.6	
Amount of drainage (mL)	817.4±353.5	
Intubation period (hours)	10.5±6.8	
Mean length of stay at intensive care (days)	3.4±2.9	
Mean length of stay at the hospital (days)	10.4±6.9	

IABP: Intra-aortic balloon pump; AF: Atrial fibrillation; BSA: Body surface area; CPB: Cardiopulmonary bypass; XCL: Cross clamp.

Table 3. Comparison of continuous variables between survivors and cases with mortality

	Mortality						
	No (n=64)		Yes (n = 7)		Total (n=71)		
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation	
Age	62.72	8.96	72.29	8.54	63.66	9.31	0.014
Length of stay at intensive care	3.47	4.38	27.33	8.69	5.51	8.26	0.000
Total length of stay	8.75	3.96	27.33	8.69	10.36	6.9	0.000
Duration of CPB	133.83	50.23	210.29	139.84	141.94	67.96	0.131
Duration of XCL	79.86	34.9	115.57	73.39	83.65	41.31	0.153
Duration of ventilation	9.77	4.95	21.57	10.21	10.93	6.6	0.000
Drainage	789.5	336.4	1050	439.32	817.41	353.52	0.168
Number of bypasses	2.63	0.88	3	0.58	2.66	0.86	0.186

CPB: Cardiopulmonary bypass; XCL: Cross clamp.

Table 4. Comparison of categorical variables between survivors and cases with mortality

		Mortality				P-value
		No		Yes		
		n	%	n	%	
Gender	Female	11	17.2	0	0.0	0.233
	Male	53	82.8	7	100.0	
HT	No	24	37.5	1	14.3	0.222
	Yes	40	62.5	6	85.7	
DM	No	38	59.4	4	57.1	0.909
	Yes	26	40.6	3	42.9	
COPD	No	42	76.4	2	28.6	0.009
	Yes	13	23.6	5	71.4	
CRF	No	53	94.6	6	85.7	0.361
	Yes	3	5.4	1	14.3	
CAROTID STENOSIS	No	44	78.6	4	57.1	0.209
	Yes	12	21.4	3	42.9	
TFT IMPAIR-MENT	No	46	83.6	5	71.4	0.426
	Yes	9	16.4	2	28.6	
Smoking	No	47	73.4	0	0.0	0.000
		17	26.6	7	100.0	
Recent MI	No	17	31.5	1	14.3	0.348
	Yes	37	68.5	6	85.7	
Emergency oper-ation	No	58	95.2	2	0.0	0.000
	Yes	5	4.8	5	100.0	
Defibrillation	No	35	54.7	3	42.9	0.551
	Yes	29	45.3	4	57.1	
Inotrope need	No	45	70.3	0	0.0	0.000
	Yes	19	29.7	7	100.0	
IABP	No	48	98.0	4	57.1	0.000
	Yes	1	2.0	3	42.9	
Postoperative AF	No	53	82.8	2	28.6	0.001
		11	17.2	5	71.4	
EuroSCORE II	Low	18	28.1	1	14.3	0.064
	Moderate	20	31.3	0	0.0	
	High	26	40.6	6	85.7	
EF	Low	1	1.6	1	14.3	0.158
	Moderate	23	36.5	2	28.6	
	High	39	61.9	5	57.1	

HT: Hypertension; DM: Diabetes Mellitus; COPD: Chronic obstructive pulmonary disease; CRF: Chronic renal failure; TFT: Thyroid function test; MI: Myocardial infarction; IABP: Intra-aortic balloon pump; AF: Atrial fibrillation, EuroSCORE: European System for Cardiac Operative Risk Evaluation; EF: Ejection fraction

Discussion

While cardiac surgeries were performed generally at university hospitals and a limited number of private hospitals in previous years, they have been successfully performed also at hospitals of the Ministry of Health in recent years [5-8]. According to the 2011 data, open heart surgery is performed at a total of 207 centers in 46 provinces in our country [9]. As of 2014, Karabük State Hospital has been affiliated with Karabük University, and its name was changed as Republic of Turkey Ministry of Health Karabük Training and Research Hospital. In the province of Karabük with an approximate population of 240,000, an open heart surgery center was present at a private hospital providing service before the initiation of open heart surgeries at our center [10]. During the period prior to active service at our clinic, the assisting healthcare personnel (operating room and intensive care nurses) were referred to training at our coordinator hospital, Türkiye Yüksek İhtisas Training and Research Hospital. An intensive care unit with five beds and one hybrid operating room were established to enhance the infrastructure of the Cardiovascular Surgery clinic in order to perform open heart surgery.

During the beginning period, our clinic was face with some challenges such as minimal experience of the staffs and distrust of the rural people. Although the assisting healthcare personnel trained at our coordinator hospital, it was not enough to be qualified personnel. Our hospital is a rural hospital, therefore there was lack of doctors who would serve as consultant physicians such as nephrologist, endocrinologist, pulmonologist. Initially, indigenous people of Karabük had no confidence, because they didn't know our clinic. Distrust of the people reduced the number of heart surgery patients. Despite all this negativity, public confidience increased day by day. Experience of the assisting healthcare personnel has increased and this situation brought about high clinical success. The first case of the clinic founded for this purpose was a successful coronary bypass operation to two vessels in a 61-year-old male patient on 21 January 2016. The number of heart surgeries performed at our clinic was initially limited, and increased with enhanced coordination and adaptation of the team. At our clinic where capabilities have been improved under the roof of the university, nearly 1500 peripheral artery and venous surgery procedures per year are performed in addition to cardiac surgery. Patient referrals related to our clinic have been reduced substantially, thereby minimizing patient suffering, economic losses, and most importantly, loss of time.

In the literature, rates of early mortality within 30 days vary from 1.1% to 9% in heart surgery [11-14]. Factors increasing the rate of early morbidity and mortality include severe left ventricular dysfunction, previous MI, serious ischemic mitral regurgitation, renal failure and chronic pulmonary disease. According to the European cardiac surgery risk assessment system, the risk increases with the presence of each factor [14]. Risk calculation in open heart surgery provides the surgical team the opportunity to estimate the rate of morbidity and mortality rate before the surgery. There are several scoring systems used for risk estimation for this purpose, among which the EuroSCORE risk scoring system has been found to be the scoring system affected by surgery-related variables the least [15]. For this reason, risk estimation of our patients has been performed using the additive EuroSCORE II scoring system. In the EuroSCORE II risk estimation, which was updated in 2011, a good correlation was seen for isolated CABG and valvular surgery; however, the correlation between the calculated risk and mortality was weak in combined surgical interventions [16]. Mortality rate in EuroSCORE scoring is 1.4% for patients in the low-risk group, 3% for the moderate-risk group, and 11.2% for the high-risk group. The overall potential mortality across all risk groups is predicted to be 4.7% [17]. Although early mortality was seen in four patients undergoing surgery at our clinic, total number of mortality was seven (9.9%). While the total mortality rate in our clinic appears to be high compared to the literature, our mortality rate is 1.4% in the low-risk group and 8.5% in the high-risk group, similar to the literature. We believe that the reasons of the high total mortality rate in our study include the limited number of patients (n=71), high rate of emergency surgeries (n=10, 14.2%), and the high proportion of high-risk patients (40.6%) although the difference was not statistically significant. Risk factors for operative mortality have been analyzed in a number of studies [15,17-21]. In these studies, the mortality predictors according to decreasing importance were listed as follows: emergency surgical operation, renal dysfunction, re-operation, advanced age (>75 years), low EF (<30%), female gender, other comorbidities (COPD, peripheral vascular disease, Diabetes Mellitus, cerebrovascular diseases, etc.). We think that emergency operation, postoperative atrial fibrillation, chronic obstructive pulmonary disease and advanced age affected mortality rate in our study.

Atrial fibrillation incidence after coronary bypass surgery was reported to vary from 15% to 40% [22,23]. This rate was 23.9% in our case series. Sinus rhythm was restored with medical treatment or cardioversion in all patients. None of the patients experienced major or minor neurological complications. In two of the four patients with preoperative renal dysfunction who were not undergoing dialysis, elevation in urea-creatinine values was observed during the postoperative period and they both responded to medical treatment. Mediastinitis is a rare (1%-3%) but one of the most fatal complications that occur after open heart surgery with a mortality rate of 10%-25% [24]. In our study, deep wound site infection occurred in one patient who was successfully treated with surgical debridement, medical treatment and fasciocutaneous flap interposition.

Our study has some limitations. Firstly, this study is a retrospective study conducted at a single center and the patient distribution is not homogeneous. Another limitation is the fact that although factors influencing mortality were assessed in our patient group, the number of patients was insufficient to generalize mortality predictors.

Conclusions

In conclusion, we believe our mortality and morbidity rates are acceptable despite the disadvantages of being a recently established center and the presence of multiple comorbid factors of the patients . It is important to establish new heart surgery centers with adequate infrastructure and trained staff in order to provide on-site service and reduce healthcare expenditures. Although Karabük Training and Research Hospital, Cardiovascular Surgery Clinic was founded as the second center in the province of Karabük in 2016, it is planned to become an important center in the future through the increasing number and variety of surgeries.

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