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INTRODUCTION

Avoiding coronary artery bypass grafting (CABG) in older individuals is linked to the higher risk of morbidity and mortality within this age band. The primary factors discouraging surgery in this demographic include their limited life expectancy and their reduced ability to withstand the cardiopulmonary bypass procedure, a crucial component of the surgery. Moreover, a significant portion of these patients suffer from various systemic diseases, including conditions like diabetes, renal failure, and neurological issues (1). The increasing life expectancy has led to higher surgical rates in the elderly patient group.

One of the fastest-growing groups of patients requiring CABG operations is the octogenarian population (1). There has been

Is advanced age a barrier to coronary bypass surgery? Our results of coronary bypass surgery in octogenarian patients

Abstract

Aim: The population of octogenarians requiring coronary artery bypass grafting (CABG) procedures has been growing rapidly. We aimed to evaluate the outcomes of CABG in patients aged 80 and over.

Material and Methods: Included in the study were all consecutive patients undergoing CABG between 2002 and 2022. A total of 4650 patients were present; 70 of them were octogenarians. From patient medical records age, gender, use of an intra-aortic balloon pump, left ventricular ejection fraction, left main disease, use of CPB, number of distal coronary grafts, and comorbid conditions like diabetes, hypertension, preoperative renal failure, chronic obstructive pulmonary disease (COPD), prior myocardial infarction (MI), and postoperative bleeding necessitating repeat, postoperative ICU length of stay, 30-day mortality and morbidity information were gathered.

Results: Patients had an average age of 81.47 years, with 71.43% being male. Octogenarians commonly presented with unstable angina (35.71%) and previous myocardial infarction (61.43%), while 10 had left main coronary lesions. Cardiac pathologies included aortic, mitral, and tricuspid valve issues in 5 cases, post-MI VSD in 3, and left ventricular aneurysms in 4. Postoperatively, 21 patients needed inotropes, 4 required an intra-aortic balloon pump, and the average intensive care unit stay was 2.5 days. Mortality was 1.42% in elective CABG.

Conclusion: Although the operative risk is relatively high in octogenarian patients, isolated CABG can be performed with acceptable mortality rates in selected elective patients who do not require concomitant cardiac surgery.

Keywords: Coronary artery bypass surgery, octogenarians, morbidities, mortality rate

a noticeable rise in the number of heart procedures on senior patients over the previous 20 years. We aimed to evaluate the outcomes of CABG in patients aged 80 and over. The relevant outcomes that are being examined include the amount of time that is needed for endotracheal extubation, the duration of hospitalization in the intensive care unit (ICU), the duration of hospitalization following surgery, and evaluated postoperative morbidity.

MATERIAL AND METHODS

Included in the study were all consecutive patients undergoing coronary artery surgery at this hospital between 2002 and 2022, a period of 20 years. The approval of the institutional review board was obtained (İnönü University Health Sciences Non-invasive

Clinical Research Ethics Committee, Number of Decisions: 2023/5145) to collect data from patient records and has been performed in accordance with the ethical standards detailed in the Declaration of Helsinki. A total of 4650 patients were present; 70 of them were octogenarians, or more than 80 years old, while 4580 were younger. The study included individuals who were having median sternotomy incisions made to have primary coronary bypass surgery. 60 octogenarians had coronary artery bypass graft (CABG) on-pump, while 10 had off-pump CABG (OPCAB).

The day before surgery, patients in the hospital were given premedication with morphine before going into the operating room. Midazolam was given to patients who arrived on the day of surgery as premedication. Every patient underwent a typical fast-track anesthetic induction utilizing a combination of midazolam (0.05–0.1 mg/kg) and fentanyl (5–10 mg/kg). For neuro-muscular blockage, vecuronium (0.1 mg/kg) or rocuronium (1 mg/kg) was administered. The anesthesiologist supplemented propofol, isoflurane, and sevoflurane as needed to maintain anesthesia.

Cardiopulmonary bypass (CPB) was instituted after the active coagulation time (ACT) was maintained at more than 400 seconds, and patients receiving on-pump CABG were given 300 U/kg of heparin. 100–200 U/kg of heparin were given to patients undergoing OPCAB to keep their ACT levels over 350 seconds. In order to keep ACT at the appropriate levels, both groups received extra heparin when needed. A second conduit was made from saphenous veins, and the left internal mammary artery (IMA) was taken as surgically indicated.

An aortic cannula and a 2-stage venous cannula were inserted into patients undergoing on-pump CABG before CPB was instituted. For the purpose of protecting the heart, an antegrade intermittent cold (6°C) blood cardioplegia solution was used. During CPB, the systemic temperature was let to drop to between 30 and 32 degrees Celsius. A single cross-clamp approach was used to produce all proximal and distal anastomoses. Off-pump coronary retractors and stabilizers were used during distal coronary anastomosis in patients undergoing OPCAB. A single cross-clamp procedure was used to produce proximal anastomoses. To keep their core temperatures warm, all the patients received active warming. Epsilon-aminocaproic acid was administered to all patients receiving on-pump operations during the surgical process. For patients with normal hemodynamics and ventricular function, the goal of blood transfusion was to maintain a hematocrit of at least 25%; for those with impaired hemodynamics and ventricular function, the goal was to stay above 30%.

All clinical and demographic data were gathered using uniform data-collecting forms. Age, gender, use of an intra-aortic balloon pump, left ventricular ejection fraction, left main disease, use of CPB, number of distal coronary grafts, and comorbid conditions like diabetes, hypertension, preoperative renal failure, chronic obstructive pulmonary disease (COPD), prior myocardial infarction (MI), and postoperative bleeding necessitating repeat

surgery were found.

From patient medical records, postoperative ICU length of stay, 30-day mortality and morbidity information were gathered.

Statistical Methods

The data of study are presented as frequency distributions and simple percentages. Values of continuous variables are expressed as the mean±standard deviation.

RESULTS

Demographic and clinical data of the patients are presented in Table 1. There were 70 octogenarian patients. The mean age of the patients was 81.47±1.66 years, and 71.43% were male. The most common preoperative risk factor was COPD (27.14%). 22 patients (31.43%) had carotid artery stenosis and 5 patients (7.14%) had a history of cerebrovascular disease.

Table 1. Demographic and clinical data

Demographic and clinical data of patients (n=70)		
	n	%
Gender		
Male	50	71.43
Female	20	28.57
Age (Mean, SD)	81.47±1.66	
Diabetes mellitus	11	15.71
BMI>30 kg/m ²	8	11.43
Hypertension	18	25.71
COPD	19	27.14
Preoperative renal failure	7	10.00
Carotid artery stenosis	22	31.43
Prior cerebrovascular accident	5	7.14
Peripheral vascular disease	1	1.43
Unstable angina	25	35.71
Prior MI	43	61.43
LVEF (%. Mean, SD)	44.67±10.02	
Left main disease	10	14.29
Status		
Elective	55	77.14
Urgent	5	7.14
Emergent	10	14.29

BMI: body mass index, COPD: chronic obstructive pulmonary disease
MI: myocardial infarction, LVEF: left ventricular ejection fraction

In Octogenarians, 25 patients (35.71%) had unstable angina and 43 (61.43%) had previous myocardial infarction. 10 patients had left main coronary lesions.

Of the 70 patients who underwent CABG, 5 had aortic valve, mitral valve, and tricuspid valve pathologies requiring surgical intervention, 3 had post MI VSD, and 4 patients had left ventricular aneurysm.

The mean cardiopulmonary bypass time was 101.5 ± 22.47 minutes and the cross-clamp time was 87.7 ± 24.8 minutes. IMA grafts were used in 60 of the patients and the mean number of distal anastomoses was 2.57 ± 0.76 . Postoperative 21 patients required inotropes, and 4 patients required intra-aortic balloon pump (Table 2).

Table 2. Surgical data of the octogenarians

		n	%
CABG	Off-pump	10	14.29
	On-pump	60	85.71
	LIMA-LAD	52	74.29
Target vessels	LAD	18	25.71
	D	15	21.43
	OM	41	58.57
	RCA	13	18.57
Isolated CABG		55	77.14
CABG+AVR		2	2.86
CABG+MVR		1	1.43
CABG+Tricuspid Annuloplasty		2	2.86
CABG+Post MI VSD		3	4.29
Coronary endarterectomy (RCA)		4	5.71
CABG+Left Ventricular aneurysmectomy		4	5.71
Pump duration (min, Mean, SD)		101.5 $\pm$ 22.47	
Cross-clamp time (min, Mean, SD)		87.7 $\pm$ 24.8	
No. of distal grafts Mean SD		2.57 $\pm$ 0.76	
Internal mammary artery		60	85.71
Postoperative inotropic		21	30.0
Intra-aortic balloon pump		4	5.71
Bleeding requiring exploration		1	1.43
Post operative			
CVA		3	4.29
Infection		2	2.86
GI complication		1	1.43
Renal failure		1	1.43
AF		25	35.71
Time to extubation (h)		12.07 $\pm$ 4.05	
ICU stay (d)		2.5 $\pm$ 0.7	
Postoperative stay (d)		8.2 $\pm$ 2.27	
Mortality			
Elective isolated CABG		1	1.42
Emergent CABG		2	2.85
CABG+Concomitant cardiac surgery		4	5.71
Total		7	10.0

CABG: coronary artery bypass graft, LIMA: left internal mammary artery, D: diagonal artery branch, OM: obtuse marginal branch of circumflex artery, RCA: right coronary artery, Ao: aorta, SVG: saphenous vein graft, AVR: aortic valve replacement, MVR: mitral valve replacement, VSD: ventricular septal defect, GI: gastrointestinal, AF: atrial fibrillation, ICU: intensive care unit

Postoperative intensive care unit stay was 2.5 ± 0.7 days. Total mortality was observed in 7 (10%) patients, while mortality was 1 (1.42%) in electrical CABG patients.

DISCUSSION

With the increasing human life expectancy, the need for CABG in older ages also increases (2). More comorbid diseases and a lower physiologic reserve are linked to advanced age. These characteristics might cause octogenarians to use resources more frequently (3). This study aimed to investigate outcomes use in octogenarians undergoing CABG surgery.

The most striking finding in our study is that mortality rates are as high as 10%. According to the Euro SCORE, just being 80 years or older contributes an additional 5 points on its own, indicating a high mortality risk. This rate seems to be significantly higher when compared to patients under 80 years of age (4). In the literature, mortality rates are reported as 2.4% in patients under 80 years of age and 4.1% in patients over 80 years of age (5,6). The mortality rates found in our study were significantly higher than in both patients under and over 80 years of age. However, when the characteristics of the patients with mortality are examined in detail, it is seen that most of the patients with mortality in our study consisted of patients who were operated under emergency conditions and/or performed concomitant cardiac surgeries. Of these, 2 patients underwent post-MI VSD with CABG, and 2 patients underwent valve surgery with CABG, and two patients underwent emergent surgery in cardiogenic shock situation. However, the mortality rate of patients who underwent elective surgery and received only CABG was observed to be 1.42%. Considering the comorbidities, the mortality rates determined in our study can be considered within acceptable limits.

Rapid tracheal extubation is our standard goal in all our patients undergoing cardiac surgery, unless specific intraoperative and postoperative events require alternative treatment. However, in our study, we found that the postoperative extubation time was longer than expected in patients over 80 years of age. In our study, the extubation time was found to be 12.07 hour. In the literature, extubation times are reported as 9 hours on average (7). We think that long extubation times may be due to COPD in 27.14%, prior cerebrovascular accident in 7.14%, and preoperative renal failure in 10% of our patients.

Another important finding, we found in our study was that the intensive care unit duration of the patients was longer than expected. The intensive care unit duration of our patients was found to be 2.5 ± 0.7 days. In the literature, intensive care duration is reported as 1.6-2.2 days (7,8). Although intensive care periods are longer than patients aged 80 and under, it is seen that the intensive care periods in our study are consistent with the literature.

When the data obtained from our study were compared with the literature, it was seen that they were similar in terms of predisposing risk factors for coronary artery disease except for

COPD (9-11). In our study, it was found to be 27.14%. This rate seems to be higher according to the literature. In the literature, COPD is reported as 7.6% in CABG patients under 80 years of age and 12.4% in patients over 80 years of age.

CONCLUSION

In conclusion, with advancements in technology and surgical experience in cardiac surgery today, mortality and morbidity rates continue to decrease. This has allowed for interventions in high-risk and elderly patients who were previously considered inoperable. Despite the increased risk of coronary surgery with advancing age and the presence of comorbidities, not only the chronological age of the patient but also their preoperative condition, the urgency of the operation, and concomitant cardiac intervention requirements can influence the risk and indications for CABG. Although the operative risk is relatively high in octogenarian patients, isolated CABG can be performed with acceptable mortality rates in selected elective patients who do not require concomitant cardiac surgery.

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