



Turkish Journal of Geriatrics
2017;20 (1):17-22

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Received: 02/11/2016
Accepted: 04/01/2017

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RESEARCH

PREDICTORS OF MORTALITY IN OCTOGENERIANS WHO UNDERWENT CORONARY ARTERY BYPASS GRAFTING AFTER AN ACUTE CORONARY SYNDROME

ABSTRACT

Introduction: Coronary artery bypass grafting is increasingly being performed on patients with advanced age. We aimed to investigate the outcomes of early coronary artery bypass grafting in octogenarians within the first month of an acute coronary syndrome.

Materials and Method: This study enrolled 94 octogenarian patients who underwent early coronary artery bypass grafting after acute coronary syndrome between March 2005 and May 2015. The pre-operative and post-operative variables were assessed retrospectively.

Results: Mean age of the patients was 81.8 ± 2.39 years; 53 patients (56.3%) were men and 41 (43.7%) were women. In-hospital mortality rate was 14.8% (14 patients). The factors related with mortality were pre-operative chronic obstructive pulmonary disease ($p=0.009$); elevated creatinine levels ($p=0.004$); decreased left ventricular ejection fraction ($p=0.045$) and use intra-aortic balloon pump support ($p<0.001$), as well as prolonged post-operative intensive care unit stay ($p=0.010$). The independent predictors of mortality were pre-operative elevated creatinine level and chronic obstructive pulmonary disease.

Conclusion: Although the mortality rate of coronary artery bypass grafting in octogenarians was higher than that of a younger population, it can be reduced if pre-operative kidney dysfunction and chronic obstructive pulmonary disease are treated with appropriate medications.

Key Words: Aged; Coronary artery bypass; Octogenarians; Mortality

ARAŞTIRMA

OKTOGENERYANLARDA AKUT KORONER SENDROM SONRASI YAPILAN KORONER ARTER BAYPAS CERRAHİSİ MORTALİTE PREDİKTÖR ANALİZİ

Öz

Giriş: Koroner arter baypas greftleme (CABG) operasyonları, ileri yaş grubu hasta grubunda gittikçe artan sıklıkta yapılmaktadır. Bu çalışmada akut koroner sendrom sonrası CABG uygulanan 80 yaş ve üstü hasta grubunda mortalite prediktörlerinin analiz edilmesi amaçlanmıştır.

Gereç ve Yöntem: Kliniğimizde Mart 2005 ile Mayıs 2015 tarihleri arasında CABG uygulanan 94 hasta çalışmaya dahil edildi. Hastaların preoperatif ve postoperatif verileri retrospektif olarak incelendi.

Bulgular: Hastaların ortalama yaşı 81.8 ± 2.39 idi. Elli üç (% 56.3) hasta erkek, 41 (%43,7) hasta ise kadındı. Hastane içi mortalite % 14.8 (14 hasta) olarak gerçekleşti. Preoperatif Kronik Obstruktif Akciğer Hastalığı (KOA) olanlarda ($p=0.009$), kreatinin yüksekliği olanlarda ($p=0.004$), düşük sol ventrikül ejeksiyon fraksiyonu olanlarda ($p=0.045$), yoğun bakım kalış süreleri uzun olanlarda ($p=0.010$) ve İntraaortik Balon Pompası (İABP) ihtiyacı olanlarda ($p=0.000$) mortalite daha yüksek bulundu. Ayrıca, preoperatif yüksek kreatinin değerleri ve KOAH varlığı postoperatif mortalite için bağımsız prediktörler olarak bulunmuştur.

Sonuç: Oktogeneryanlarda CABG sonrası mortalite gençlere oranla daha yüksek bulunmasına rağmen preoperatif dönemde böbrek fonksiyon bozukluğu ve KOAH'ın uygun medikasyonlarla tedavi edilmesi ile mortalite oranları daha da düşürülebilir.

Anahtar Sözcükler: Yaşlı; Koroner arter baypas; Oktogeneryanlar; Mortalite



INTRODUCTION

Coronary artery bypass grafting (CABG) is usually avoided in the elderly population because of the increased morbidity and mortality in this age group. The main factors influencing this decision of avoiding CABG are low life expectancy and intolerance to cardiopulmonary bypass (CPB), which is an important component of the operation. Furthermore, most of these patients have multiple comorbidities, such as diabetes mellitus, renal failure and neurologic disorders (1). Compared with younger patients, older patients may be overwhelmed by the detrimental effects of surgery and post-operative intensive care unit (ICU) stay. Despite this fact, the most appropriate clinical management for this subset of patients has never been determined and is left mainly to the physicians' clinical discretion. In this study, we aimed to investigate the main factors affecting mortality and morbidity of octogenarian patients who underwent early CABG within the first month after an event of acute coronary syndrome.

MATERIALS AND METHODS

The local ethics committee approval was obtained for this study.

Patient profile

Ninety-four octogenarian patients who underwent CABG within 30 days after an event of acute coronary syndrome between March 2005 and May 2015 were retrospectively enrolled. Patients who needed additional surgical procedures other than coronary bypass were excluded. The following variables were recorded: 1) pre-operative data, including age, gender, diabetes mellitus, left ventricular ejection fraction (LVEF), hypertension, chronic obstructive pulmonary disease (COPD; defined as $FEV1/FVC < 70\%$ and/or $FVC < 80\%$ and $FEV1/FVC > 70\%$), hyperlipidaemia, obesity, heredity, active smoking, elevated creatinine level (> 1.3 mg/dl), carotid artery stenosis, history of cerebrovascular disease and emergent surgery; 2) peri-operative data, including off-pump or on-pump revas-

cularisation, cross clamp time, CPB time, number of revascularised vessels, need for inotropic support and intra-aortic balloon pump (IABP) support; and 3) post-operative data, including mortality, duration of ICU stay and duration of hospital stay.

Surgical technique

All patients were operated via median sternotomy incision. In all patients, the left internal mammary artery was anastomosed with the left anterior descending artery, whereas the great saphenous vein was anastomosed with the rest of the coronary vessels. There were 84 (89.3%) patients who were operated under CPB with mild hypothermia ($32\text{ }^{\circ}\text{C}$). Cardiac arrest was achieved by antegrade cardioplegia. All patients were operated with single cross clamp technique. Off-pump CABG was used for 10 (10.6%) patients. Patients were divided into group 1 (survivors) and group 2 (non-survivors).

Statistical analysis

Statistical analyses were performed with the Statistical Package for the Social Sciences (SPSS, Chicago, IL, USA). Comparisons of categorical variables were analysed by the χ^2 test. The Fisher exact test was used if the expected frequency in a contingency table was < 5 . Independent samples t-test was used to assess differences in continuous variables between groups 1 and 2. Variables associated with post-operative mortality at a P value of < 0.05 in the univariate analysis were included in the multivariate logistic regression analysis to determine the independent predictors of mortality after CABG.

RESULTS

The mean age of the patients was 81.8 ± 2.39 years; 53 patients (56.3%) were men and 41 (43.7%) patients were women. The CABG utilised a single vessel in 8 (8.5%) patients, two vessels in 20 (21.2%) patients, three vessels in 41 (43.6%) patients, four vessels in 19 (20.2%) patients and five vessels in 6 (6.3%) patients. The rest of the pre-operative demographic data are

listed in Table 1. Operative and post-operative data are shown in Table 2. In-hospital mortality was observed in 14 (14.8%) patients because of ventilator-as-

sociated pneumonia related with prolonged intubation (n=5), renal insufficiency (n=5) and low cardiac output syndrome (n=4).

Table 1. Pre-operative demographic data of the study population

Characteristics	value
Age (years±sd)	81.8 ±2.39
Gender (male) n(%)	53 (56.3%)
Diabetes mellitus n(%)	40 (42.5%)
COPD n(%)	50 (53.1%)
Hyperlipidemia n(%)	44 (46.8%)
Obesity n(%)	16 (17%)
Heredity n(%)	11 (11.7%)
Active smoking n(%)	52 (55.3%)
Elevated creatinine (≥1.3 mg/dl) n(%)	16 (17%)
Carotid artery stenosis n(%)	12 (12.7%)
LVEF (%)	43.5±10.1
Emergent surgery n(%)	7 (7.4%)
Cerebrovascular disease n(%)	8 (8.5%)

COPD: chronic obstructive pulmonary disease, LVEF: left ventricular ejection fraction

Table 2. Operative and post-operative data of the study population

CABG × 1	8 (8.5%)
CABG × 2	20 (21.2%)
CABG × 3	41 (43.6%)
CABG × 4	19 (20.2%)
CABG × 5	6 (6.3%)
Number of bypass vessels	2.9±1
On-pump (n)	84 (89.3%)
Off-pump (n)	10 (10.6%)
CPB time (n=84) (minutes)	102.8±41.1
Cross clamp time (n=84) (minutes)	73.6±33
ICU stay (days)	6.9±9.7
Inotropic support	85 (94.2%)
IABP support	30 (31.9%)
Hospital stay (days)	12.6±9.7

Data are presented as n (%) or mean±sd.

CABG: coronary artery bypass grafting, CPB: cardiopulmonary bypass, IABP: intra-aortic balloon pump, ICU: intensive care unit

Analyses of pre-operative data revealed statistically significant differences between the two groups in terms of COPD (p=0.009), low LVEF (p=0.045) and elevated creatinine levels (p=0.004) in the pre-operative period. No differences were detected between the groups in terms of number of vessels anastomosed, total CPB time and cross clamp time. Compared with group 1, group 2 had significantly longer duration of ICU stay (p=0.010) and more need of IABP support (p<0.001) (Table 3).

DISCUSSION

The mortality rate of CABG has been reported to be higher in octogenarians than in younger populations (2). In particular, post-operative 30-day mortality rates after elective CABG in various age groups were 0.5% for patients younger than 50 years, 0.7% for patients 50–59 years old, 1.3% for patients 60–69 years old, 2.9% for patients 70–79 years old and 5.3% for octogenarians (3). In this



Table 3. Survivors vs. Non-survivors

Pre-operative characteristics	Survivors		Non-survivors		p
	Mean	n (%)	Mean	n (%)	
Age, years	81.77±2.17		82.21±3.46		0.51 [‡]
Male sex		46(57.5%)		7(50%)	0.60 [‡]
Diabetes mellitus		31(38.75%)		9(64.28%)	0.07 [‡]
Hypertension		48 (60%)		9(64.28%)	0.76 [‡]
COPD		38(47.5%)		12(85.71%)	0.00 [‡]
Hyperlipidemia		34(42.5%)		10(71.42%)	0.07 [‡]
Obesity		13(16.25%)		2(21.42%)	0.63 [‡]
Family history		9(11.25%)		2(14.28%)	0.74 [‡]
Active smoking		45(56.25%)		7(50%)	0.66 [‡]
Creatinine level	1.1±0.35		1.4±0.42		0.00 [‡]
Carotid artery stenosis		9(11.25%)		3(21.42%)	0.37 [‡]
Pre-operative LVEF %	44.47±10.45		38.57±6.62		0.04 [‡]
Emergent surgery		6(7.5%)		1(7.14%)	1.00 [‡]
Pre-operative CVA		7(8.75%)		1(7.14%)	1.00 [‡]
Operative characteristics					
Number of vessels bypassed	2.95±0.96		2.92±1.26		0.94 [‡]
CPB time (n=84)	100.63±37.1		116.25±59.9		0.22 [‡]
On-pump CABG		72(90%)		12(85.71%)	0.64 ^{††}
Off-pump CABG		8(10%)		2(14.28%)	
Cross clamp time (n=84)	72.26±30.44		81.83±46.72		0.35 [‡]
Post-operative characteristics					
ICU stay, days	5.8±8.02		13.07±15.42		0.01 [‡]
Inotropic support		71(88.75%)		14(100%)	0.34 [‡]
IABP support		18(22.5%)		12(85.71%)	0.00 [‡]
Hospital stay, days	12.1±8.16		15.50±16.13		0.23 ^{††}

Data are presented as n (%) or mean±SD.

‡: χ^2 test

†: Fisher exact test

††: Independent samples t test

CABG: coronary artery bypass grafting, COPD: chronic obstructive pulmonary disease, CPB: cardiopulmonary bypass, CVA: cerebro vascular attack, IABP: intra-aortic balloon pump, ICU: intensive care unit, LVEF: left ventricle ejection fraction.

study on early CABG for octogenarians, the in-hospital mortality rate was 14.8%. The presence of COPD, low LVEF and elevated creatinine level in the pre-operative period were found as predictors of mortality. We considered that the high mortality rate of our study population might have been related with the performance of early CABG after an acute coronary syndrome.

Since the 1980's, the number of cardiac surgical procedures performed on octogenarians had been increasing. An increase in the number of elderly population in Western countries was reported to cause the increase in the number of these patients that are suitable for surgical procedures (4). In addition, the superiority of revascularisation over optimal medical treatment has been shown in patients 75 years or older (5,6). As a result of the recent improvements in surgical techniques, myocardial preservation, extracorporeal perfusion techniques and post-operative care, octogenarians can now undergo operations more safely (7,8). Off-pump CABG is known to be less invasive and has lower mortality and post-operative complication rates than on-pump CABG (9). However, a multi-centre study on 1993 elderly patients showed no difference between on-pump and off-pump CABG patients (10). Similarly, we did not find any statistically significant difference in mortality between off-pump and on-pump CABG patients.

Ozen et al stated that prolonged CPB was an independent risk factor for post-operative mortality in 101 octogenarian patients who underwent CABG and additional procedures (11). In addition, they found that post-operative mortality was associated with emergent surgery, but not with pre-operative variables. On the contrary, our results revealed that post-operative mortality was independently predicted by the presence of elevated creatinine level

and COPD in the pre-operative period, but was not related with the duration of CPB. The difference between this present study and that by Ozen et al might be related with the prolonged CPB time due to additional surgical procedures performed on the latter's study population. On the other hand, these two studies had similar results on prolonged ICU stay in the mortality group or non-survivors Ozen et al. found that ICU stay time was longer in the mortality group. Similarly ICU stay time was longer in the non survivors in our study (13.07 ± 15.42 days). Scandroglio et al reported that the mortality rate among 260 octogenarian patients who underwent major cardiac surgical procedures (CABG, mitral valve surgery, aortic valve surgery and ascending aorta surgery) was higher when surgery was unplanned (14%) compared to when surgery was planned (3.8%) (12). In addition, similar to our study, their results showed that pre-operative COPD was an independent risk factor for predicting post-operative mortality. Studies by Peterson et al, Likosky et al and Alexander et al showed that mortality rates after CABG in octogenarians were ranged from 7.7% to 11.5% (13-15). The mortality rate of our study population was higher than the mortality rates of these three large-scale studies. An acute coronary syndrome event preceding CABG might account for this relatively higher mortality rate in our study.

The relatively small number of patients and the single-centre, retrospective design were the limitations of our study. Nevertheless, in this study population that comprised octogenarians, mortality rate from CABG after an acute coronary event was acceptable. This post-operative mortality risk can be further decreased by appropriate pre-operative treatment of underlying COPD and renal insufficiency such as breathing exercises and avoiding from nephrotoxic agents.



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