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Cent. Eur. J. Med. • 4(2) • 2009 • 218-221
DOI: 10.2478/s11536-008-0077-z

Central European Journal of **Medicine**

Coronary artery bypass graft surgery in the elderly patients

Research Article

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Received 1 May 2008; Accepted 17 September 2008

Abstract: The purpose of this retrospective study was to determine the results of coronary artery surgery in the elderly patients and to compare the outcome with a younger group. Two hundred thirteen patients aged 70 years and older who underwent on-pump coronary artery surgery were retrospectively studied and data were compared with those of 524 patients aged 50-69. The groups were similar with respect to preoperative characteristics except for sex distribution and the incidences of peripheral vascular disease and prior cerebrovascular accident. The use of internal mammarian artery grafts was significantly lower in the elderly patients (80.3% versus 91.6%, $p<0.001$). The 30-day mortality for the elderly group was 4.7% while that of younger group was 2.3%. The elderly patients had a significantly higher incidence of postoperative low cardiac output, pulmonary complications and acute renal failure. The elderly group also had also significantly longer intensive care unit length of stay (1.9 versus 1.7 days, $p=0.006$) and postoperative length of stay (10.1 versus 7.4 days, $p<0.001$). Although mortality and complication rates are higher, coronary artery surgery can be performed with acceptable risk in the elderly patients. Old age alone should not be a deterrent factor for surgical revascularization in coronary artery disease.

Keywords: *Coronary artery bypass graft • Cardiopulmonary bypass • Elderly patients • Mortality*

1. Introduction

The number of cardiac operations in the elderly patients has been rising over the last two decades [1]. The ageing surgical population, not unexpectedly, has a relatively greater prevalance of comorbidities, such as cerebrovascular disease, left ventricular dysfunction, diabetes mellitus, chronic obstructive pulmonary disease, renal impairment and peripheral arterial disease [2-4]. Recent advances in myocardial preservation and perioperative management have enabled cardiac operations to be performed in the septuagenarian and octogenarian with acceptable mortality and morbidity, despite notably higher risks than in younger patients [5-7].

The purpose of this retrospective study was to determine the results of coronary artery bypass graft operations in patients aged 70 years and older and to compare the outcome with a younger group of patients aged 50 to 69 years.

2. Material and Methods

Seven hundred and thirty seven consecutive patients aged 50 years and older undergoing on-pump coronary artery bypass graft surgery at our institution within a period of 5 years (January 2002- January 2007) were included in this study. Patients undergoing off-pump coronary artery surgery and patients in whom conversion from off-pump to on-pump surgery was necessary were excluded. The data included for analysis were age, sex, extent of coronary artery disease, preoperative left ventricular ejection fraction, previous CABG or sternotomy, myocardial infarction within 4 weeks prior to surgery, risk factors for cardiac surgery (diabetes mellitus, chronic obstructive pulmonary disease, left ventricular dysfunction, myocardial infarction, hypertension, renal failure, cerebrovascular accident, hyperlipidemia, history of smoking), operative and postoperative data (number of grafts, use of internal mammarian artery (IMA), cardiopulmonary bypass and

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Table 1. Preoperative characteristics of the patients.

	Age 50-69	Age > 70	P value
Number of patients	524	213	
Age (mean ± SD)	59.6±5.9	74.7±4.0	
Female	145 (27.7)	90 (42.2)	p<0.001
Prior MI	222 (42.4)	96 (45.1)	NS
Atrial fibrillation	17 (3.2)	3 (1.4)	NS
LVEF (%)	50.1±9.7	49.8±9.5	NS
Left main coronary artery disease	85 (16.2)	40 (18.8)	NS
Acute coronary syndrome	33(6.3)	15 (7.0)	NS
Diabetes mellitus	135 (25.8)	46 (21.6)	NS
Hypertension	345 (65.8)	127 (59.6)	NS
Hyperlipidemia	317 (60.5)	115 (54.0)	NS
Smoking	361 (68.9)	129 (60.6)	NS
PVD	73 (13.9)	68 (31.9)	p<0.001
Prior cerebrovascular accident	40 (7.6)	28 (13.1)	p=0.034
Renal failure	10 (1.9)	6 (2.8)	NS
COPD	42 (8.0)	13 (6.1)	NS
Malignant disorder	6 (1.1)	3 (1.4)	NS

SD, Standard deviation; MI, myocardial infarction; LVEF, left ventricular ejection fraction; PVD, peripheral vascular disease; COPD, chronic obstructive pulmonary disease

aortic cross-clamping times, use of intraaortic balloon pump (IABP), perioperative complications and mortality, duration of intubation, length of intensive care unit (ICU) stay and length of postoperative hospitalization).

2.1. Surgical Technique

Operations were performed under standard anesthesia protocol via median sternotomy by different surgeons. All patients underwent cardiopulmonary bypass via an aortic cannula and a two-stage venous cannula and moderate hypothermia and antegrade cold blood cardioplegia were used. Distal and proximal anastomoses were performed using a single cross-clamping technique.

2.2. Statistical Methods

Continuous variables are expressed as the mean ± standard deviation of the mean. Student's t test and Fisher's exact χ^2 test were used for statistical analysis. A p value < 0.05 was defined as statistically significant.

3. Results

There were 213 patients aged 70 and older (mean, 74.7 ± 4.0 years; range 70 to 89 years) in the elderly group of patients and 524 patients aged 50 to 69 years (mean, 59.6 ± 5.9 years) in the younger group. There are 30 octogenarians in the elderly group. Preoperative patient characteristics of the groups were presented in

Table 2. Operative and postoperative data.

	Age 50-69	Age > 70	P value
Number of grafts	2.4±0.9	2.4±0.8	NS
CPB time (min)	92.9±41.8	101.6±57.4	NS
Cross-clamp time (min)	51.8±27.4	54.4±37.2	NS
IMA usage (%)	480 (91.6)	171 (80.3)	p<0.001
IABP (%)	46 (8.8)	30 (14.1)	p=0.025
Ventilation time (hours)	10.1±3.4	14.6±5.9	p<0.001
ICU stay (days)	1.7±1.0	1.9±0.8	p=0.006
Postoperative hospital stay (days)	7.4±3.6	10.1±6.2	p<0.001
Mortality (%)	12 (2.3)	10 (4.7)	NS

CPB, cardiopulmonary bypass; IMA, internal mammarian artery; IABP, intraaortic balloon pump; ICU, intensive care unit.

Table 1. The elderly group of patients were more likely to be of female gender when compared with the younger group (42.2% versus 27.7%, p<0.001). There were no statistically significant differences between the groups with respect to preoperative risk factors except for the incidence of peripheral vascular disease (31.9% versus 13.9% in the elderly and younger group of patients, respectively, p<0.001) and prior cerebrovascular accident (7.6% versus 13.1% in the elderly and younger group of patients, respectively, p=0.034).

Table 2 shows the operative and postoperative data of the groups. There were no statistically significant differences between the 2 groups in the mean number of grafts per patient and the cardiopulmonary bypass and cross-clamping times. The use of IMA grafts was significantly lower in the elderly group (76.5% versus 89.9%, p<0.001). The use of IABP in the elderly group was significantly higher than the younger group (14.1% versus 8.8%, p=0.025). Postoperative ventilation times were 14.6 hours in the elderly group, versus 10.1 hours in the younger group (p<0.001). The elderly patients had also longer ICU length of stay and postoperative length of stay. The overall 30-day mortality rates were 2.5% and 7.0% in the younger and elderly groups, respectively (p=0.016).

The elderly patients had a significantly higher incidence of postoperative low cardiac output (10.3% versus 3.1%, p=0.003), pulmonary complications (10.8% versus 2.3%, p<0.001) and acute renal failure (8.9% versus 1.3%, p<0.001). The frequency of other major complications was comparable in both groups. Postoperative complications are presented in Table 3.

Table 3. Postoperative complications.

	Age 50-69 N (%)	Age > 70 N (%)	P value
Low cardiac output	16 (3.1)	22 (10.3)	p=0.003
Bleeding requiring re-exploration	11 (2.1)	4 (1.9)	NS
Cerebrovascular accident	9 (1.7)	5 (2.4)	NS
Atrial fibrillation	87 (16.6)	41 (19.2)	NS
Pulmonary complications	12 (2.3)	23 (10.8)	p<0.001
Wound infection	12 (2.3)	6 (2.8)	NS
Gastrointestinal complications	4 (0.8)	3 (1.4)	NS
Acute renal failure	7 (1.3)	19 (8.9)	p<0.001

4. Discussion

The number of septuagenarians and octogenarians referred for coronary interventions has increased with rapid growth of the elderly segment of the population. Elderly patients, compared with patients of a younger age group, present for surgery with a greater prevalance of risk factors and reduced functional levels. CABG is generally considered in the elderly patients when maximal pharmacological treatment fails to limit the symptoms of angina and dyspnea, and percutaneous coronary intervention is either feasible or is relatively less beneficial [8].

The physiological changes associated with ageing should be understood in order to construct a risk-benefit analysis that is specifically tailored to each patient and this analysis should take into account a patient's life expectancy and quality of life both before and after the procedure. Discrepancies between chronological and biological ages should also be considered [8].

Sollano and colleagues compared the outcomes of a cohort of octogenarians undergoing CABG with those of a cohort of octogenarians treated medically and a subset of that cohort who were offered CABG but declined the procedure. The survival rates to 3 years were 80% and 64% in surgically and the medically managed groups, respectively [9]. Graham et al also confirmed these data [10]. They reported that elderly patients undergoing CABG or angioplasty procedures had better outcomes than those treated medically.

Numerous factors have been identified that increase mortality rates in the elderly patients, including surgical complexity, ventricular function, and the number of preexisting comorbid conditions [6,11,12]. Our data showed that the elderly group of patients had a significantly higher incidence of peripheral vascular disease and cerebrovascular accident preoperatively and were more likely to be of female gender. Gender has been identified as an independent risk factor for complications after coronary artery bypass graft surgery. Female patients experience greater complications and early mortality after revascularization procedures [13]. The significantly higher proportion of female patients in the elderly group could be one of the reasons of high mortality ans complication rates in this group of patients.

There were no statistically significant differences between the groups in the mean number of grafts per patient and the cardiopulmonary bypass and cross-clamping times. The use of IMA grafts was significantly lower in the elderly patients than in the younger group. In elderly patients, IMA has been used less often for coronary artery bypass grafts because of the belief that greater morbidity and mortality are associated with this procedure, but there are several reports that advocate the use of IMA as the conduit of choice in this group of patients when applicable [14,15]. Our use of IMA grafts in 80.3% of the elderly patients is similar to that of previous reports [1,16].

The elderly patients had a significantly higher incidence of low cardiac output, pulmonary complications and acute renal failure in the early postoperative period. The other postoperative complications were comparable between the two groups. The elderly group of patients experienced a higher mortality rate of 4.7%, when compared with the younger patients who had a mortality rate of 2.3%, but this difference was not .

Our data showed that ICU length of stay and postoperative length of stay were significantly longer in the elderly group of patients possibly due to higher incidence of postoperative complications. These data are in agreement with previous reports [1,16,17].

Although our data do not address the cost effectiveness of coronary artery surgery in the elderly patients, it is obvious that the resource use in the elderly patients normally exceeds that of younger patients, because of higher incidence of postoperative complications and longer durations of postoperative intubation, postoperative ICU and hospital stay. Hospital costs have previously been reported to be 20 to 26% higher in the elderly patients [1,17,18].

There are some important limitations to our study. Our institution is a university hospital where mostly complicated patients are referred. This may be the cause of relatively high mortality in our patient groups. Moreover, in this study, short-term outcomes are presented and long-term results have not been studied. The small sample size of our study is another limitation. Surgical outcomes obtained in multi-institutional studies with greater sample size will be more accurate [19,20].

Coronary artery bypass graft surgery in the elderly patients is now safer than ever before, owing to surgical

and pharmacological improvements [8]. Decision for coronary artery bypass surgery should be made after a careful evaluation of benefits and potential risks. The patient's motivation and lifestyle are also important factors for decision of surgical treatment. Careful evaluation of coexisting noncardiac disorders is also very important. Although mortality and complication rates are higher, coronary artery surgery can be performed with acceptable risk in most of the elderly patients. Targeted strategies, such as minimally invasive procedures and off-pump coronary artery surgery in high risk patients, may result in additional lives saved [1]. Old age alone should not be a deterrent factor for surgical revascularization in coronary artery disease.

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