Cardiac Surgery in Octogenarians – A Better Prognosis in Coronary Artery Disease

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Key words: octogenarian, cardiac surgery, coronary, prognosis

Abstract

Background: Cardiac surgery is being performed with increasing frequency in patients aged 80 years and older.

Objectives: To examine the long and short-term results of surgery in this age group.

Methods: We retrospectively investigated 202 consecutive patients aged 80 years or older who underwent cardiac surgery between 1991 and 1999. Ninety-six operations (48%) were urgent.

Results: The study group comprised 140 men (69%) and 62 women (31%) with a mean age of 82.1 years (range 80–89). Preoperatively, 120 patients (59%) had unstable angina, 37 (18%) had left main coronary artery disease, 22 (11%) had renal failure, 17 (8.5%) had a history of stroke, and 13 (6.5%) had previous cardiac surgery. Hospital mortality for the whole group was 7.4%. Postoperative complications included: re-exploration for bleeding in 15 (7.4%), stroke in 8 (4%), sternal wound infection in 3 (1.5%), low cardiac output in 17 (8.4%), new Q wave myocardial infarction in 5 (2.5%), renal failure in 17 (8.5%), and atrial fibrillation in 71 (35%). The actuarial survival for patients discharged from the hospital was 66% at 5 years and 46% at 8 years. The type of surgical procedure was significantly associated with increased early mortality (coronary artery bypass grafting only in 2.9%, CABG + valve in 16.1%, valve only in 16.7%; $P = 0.01$). Significant predictors ($P < 0.05$) for late mortality included type of surgical procedure, congestive heart failure, and postoperative low cardiac output.

Conclusions: When appropriately applied in selected octogenarians, cardiac surgery can be performed with acceptable mortality and good long-term results.

IMAJ 2003;5:713–716

Cardiac disease is the leading cause of death in adults in western countries. With improvement in life expectancy, the number of elderly patients with significant cardiac disorders has steadily increased [1]. Despite optimal medical therapy, many patients older than 80 years of age are severely symptomatic and a significant number of them may benefit from surgical therapy [2].

Due to refinements in cardiac anesthesia, surgical technique and myocardial protection as well as improved perioperative care, cardiac surgery can be performed safely in patients over the age of 80 [3,4]. According to the findings of a recent study [2], octogenarians undergoing cardiac surgery have a reasonable operative risk, and a remarkable improvement in their symptoms, functional status and quality of life can be expected. The present study describes our growing experience with this age group of patients, and identifies risk factors for early and late outcome.

Patients and Methods

Between January 1991 and December 1999, 202 consecutive patients aged 80 years and older underwent cardiac surgical procedures at the Hadassah University Hospital. During the same period 5,726 operations were performed in patients under the age of 80. All patients were evaluated at a peer review conference before being accepted for surgery. The selection criteria and indications for surgery in the older age group were the same as for the younger cohort, except that attention was directed towards preoperative neurologic and functional status in the octogenarians.

Hospital records were reviewed retrospectively for patients' demographic characteristics, preoperative status and co-morbidity, intraoperative variables, and postoperative course. All postoperative complications were recorded, including:

- low cardiac output (cardiac index <2.0 L/min/m^2 requiring inotropic agents or intraaortic balloon pump)
- perioperative MI (a new Q wave on the postoperative electrocardiograph)
- re-exploration for bleeding
- stroke or transient ischemic attack
- sternal wound infection
- atrial or ventricular arrhythmias requiring treatment.

Hospital mortality was defined as death occurring within 30 days of operation, and late mortality if the patient did not leave the hospital during the index hospitalization.

Surgery was considered elective if the patient was admitted electively on the day preceding the operation, and urgent if a patient's condition necessitated operation within 24 hours from diagnosis to minimize risk of life or major related complications. Emergent operation was defined as immediate surgical intervention in critically ill patients.

Surgery was performed in 169 patients using a standard cardiopulmonary bypass technique with an ascending aortic canula and a single two-stage right atrial cannula, or double venous cannulation, with mild to moderate hypothermia (32–28°C). Myocardial protection was achieved with antegrade and retrograde warm or cold blood cardioplegia. Coronary artery bypass grafting without cardiopulmonary bypass was performed in 33 patients. The operation technique for off-bypass surgeries in this group of patients was the same as in the younger age group. These operations were performed for bypass grafting on a beating heart after injection of half a dose of heparin as for on-bypass surgeries.

CABG = coronary artery bypass grafting

MI = myocardial infarction

Statistical analysis

The data were analyzed using both the univariate and multivariate approach. For evaluating the association between two qualitative variables, the chi-square as well as the Fisher exact tests (when needed) were used. The Pearson correlation coefficient was calculated in order to assess the linear association between two quantitative variables. For comparing quantitative variables between groups the two-sample *t*-test was used when two groups were compared, and the one-way analysis of variance (ANOVA) for more than two groups. For assessing the simultaneous effect on a quantitative variable (the dependent variable) of more than one qualitative variable (independent variables), the multiway analysis of variance (ANOVA) was applied. All variables known as preoperative patient characteristics [Table 1] were tested for multivariable analysis. The Kaplan-Meier method was used to compare survival curves using the Log-rank test. Cox regression was applied for assessing simultaneously the effect of a few variables on the survival curve. All tests applied were two-tailed, and a significance level of 5% or less was considered statistically significant.

Results

Preoperative data

During the specified time period 202 consecutive patients aged 80 years and older (mean 82.1 $\pm$ 2.12, range 80–89 years) underwent cardiac surgery in our hospital and were included for analysis. Sixty-nine percent of the patients were men, 49% had documented acute or previous MI, 14% had a history of severe heart failure, and 59% were in unstable angina at the time of operation. Urgent operation was performed in 96 (48%) patients and emergent operation in 5 (2.5%), as illustrated in Table 1.

Table 1. Preoperative and operative data (n = 202)

Characteristic	No. (%)
Female	62 (31)
Diabetes mellitus	46 (23)
Hypertension	89 (44)
COPD	18 (9)
Renal failure	26 (13)
Hypercholesterolemia	36 (18)
Prior CVA/TIA	17 (8.5)
PVD	29 (14.5)
MI	99 (49)
LM disease	37 (18)
Previous cardiac surgery	13 (6.5)
CHF class IV	29 (14.5)
Unstable angina	120 (59.5)
Urgent operation	96 (48)
Emergent operation	5 (2.5)
LV function	
Good	92 (45.5)
Moderate	65 (32.2)
Poor	45 (22.2)
CABG	138 (68)
CABG + AVR	23 (11)
CABG + MVR	8 (4)
AVR	26 (13)
MVR	1
TVR	1
MVR + TVRepair	1
MVRepair + TVRepair	1
Asc aortic aneurysm	2
Repair of LV rupture	1

Asc = ascending, AVR = aortic valve replacement, CABG = coronary artery bypass grafting, CHF = congestive heart failure, COPD = chronic obstructive lung disease, CVA = cerebral vascular accident, LM = left main, LV = left ventricle, MI = myocardial infarction, MVR = mitral valve replacement, MVRepair = mitral valve repair, PVD = peripheral vascular disease, TIA = transient ischemic attack, TVR = tricuspid valve replacement, TVRepair = tricuspid valve repair

Operative data

Surgical procedures included primarily CABG (138 patients, 68%), CABG with aortic or mitral valve replacement (31 patients, 15%), and valve operation (30 patients, 15%) [Table 1]. In 33 patients CABG was performed without using the cardiopulmonary bypass technique. In four patients concomitant carotid endarterectomy was performed (3 CABG, 1 CABG + aortic valve replacement). The mean cardiopulmonary bypass time was 98.29 $\pm$ 60 minutes (range 65–341 min), and the mean cross-clamp time 62.17 $\pm$ 37.6 minutes (range 33–170). The mean number of distal anastomoses was 2.9 $\pm$ 1.3.

Mortality and morbidity

The in-hospital mortality was 7.4% (15/220). Causes for death were as follows: low cardiac output in seven patients, multi-organ failure in two, and sepsis, cerebrovascular accident, ventricular arrhythmia and bleeding in one each; the cause was unknown in two patients. The type of surgical procedure was found to be the only significant predictor for hospital mortality (CABG in 2.9%, CABG+valve replacement in 16.1%, valve surgery in 16.7%; P = 0.019). Of all preoperative factors, left main coronary artery disease was the major risk factor (75%) in CABG patients who died. Of five patients who underwent emergent surgery only one survived the perioperative course. Of the other 11 cases of mortality, 7 were urgent surgeries and 4 elective.

Postoperative complications included low cardiac output in 17 (8.4%), re-exploration for bleeding in 15 (7.4%), sternal wound infection in 3 (1.5%), stroke in 8 (4%), new Q wave MI in 5 (2.5%), renal failure (not requiring dialysis) in 17 (8.4%), and atrial fibrillation in 71 (35%). Forty-seven patients had no postoperative complications. The remaining patients had minor and non-cardiac related problems including rehabilitation, fine tuning of medical therapy for other co-morbidities, and social issues. The postoperative complications in the group of 33 patients undergoing off-bypass surgery included sternal wound infection in 1 (3%), new Q wave MI in 1 (3%), and atrial fibrillation in 10 (30%). Compared to a similar random cohort of patients younger than 80, octogenarian patients had a higher rate of re-exploration: 7.4% vs. 2.2% (P = 0.01), and stroke 4% vs. 1.1% (P = 0.02). The rate of other complications in octogenarian patients was similar to that in the younger patients (wound infection in 1.8%, atrial fibrilation in 32%, new Q wave MI in

2%, and renal failure in 6%) ($P > 0.05$).The mean hospital stay was 16.6 ± 12.7 days (range 4–78 days).

Of the 33 patients undergoing off-bypass surgery there were 3 cases of in-hospital mortality (9%). The causes for death in this group were multiorgan failure in one, sepsis in one and unknown in one. This group had a mean hospital stay of 16.7 ± 14.1 days.

Long-term survival

Actuarial survival for all patients was 85% at 6 months, 83% at 1 year, 77% at 3 years, 66% at 5 years, and 45% at 8 years [Figure 1]. There was a significant difference in survival between patients who underwent CABG only and patients who underwent other surgical procedures [Figure 2] ($P = 0.001$).

There were 49 late deaths, of which 22 (45%) were cardiac related. The major causes of non-cardiac related late mortality were cancer and stroke. The long-tem survival of patients with non-cardiac related late mortality was significantly better than in patients with cardiac related mortality [Figure 3] ($P = 0.0006$). Type of surgical procedure ($P = 0.001$), congestive heart failure ($P = 0.04$), and postoperative low cardiac output ($P = 0.007$) were significant predictors on a multivariate analysis for long-term survival.

Discussion

This study retrospectively reviewed early and late outcome in 202 patients aged 80 years old or older who underwent cardiac surgery at a single institution over a 9 year period. The patients' profile, perioperative mortality and morbidity, and long-term survival were similar to those of other recent studies [5–7], confirming that cardiac surgery can be performed successfully in most octogenarians.

Assessment of long-term survival indicates that complex cardiovascular interventions, including cardiac surgery, in selected octogenarians have a positive impact on their quality of life [2,8,9]. However, these patients represent a high risk group, with mortality and morbidity being significantly higher than in younger patients [2,3]. In recent studies, the hospital mortality for octogenarians ranges from 6 to 11% in those undergoing CABG and from 8 to 14% in those undergoing aortic valve replacement [3,5]. The longer hospital stay, almost double that in younger patients, may also reflect the complexity of cardiac surgery in this age group. Both of these rates are higher than those reported for younger patients. Previous reports identified numerous risk factors associated with increased mortality in octogenarians undergoing cardiac surgery, including surgical complexity [10], New York Heart Association functional class IV, poor left ventricular function, urgency of operation, renal failure, preoperative intraaortic balloon pump counter-pulsation, and female gender [11,12]. In our study we found the type of surgery to be the only significant predictor for early mortality.

Our incidence of postoperative complications is comparable with the recent literature. Atrial fibrillation was the most common complication, occurring in 35% of the patients, and lower than the 55% incidence recently reported by Avery et al. [3] and the 43% by Fruitman et al. [2]. We do not have a preoperative preventive protocol therapy for atrial fibrillation, but we use beta-blockers and

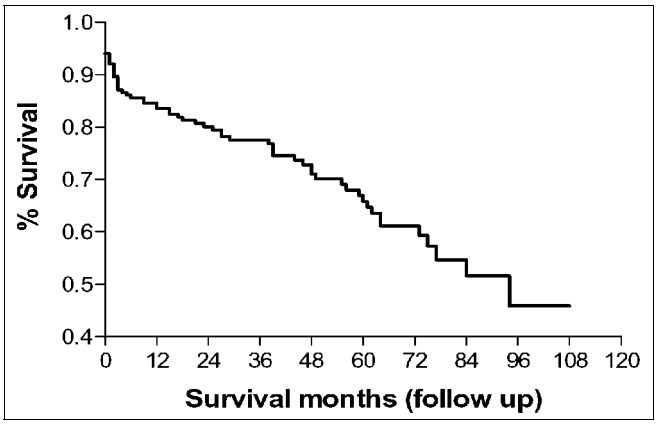

Figure 1. Actuarial survival for all octogenarian patients undergoing cardiac surgery during the follow-up period. As demonstrated, actuarial survival was 85% at 6 months, 83% at 12 months, 77% at 36 months and 45% at 96 months.

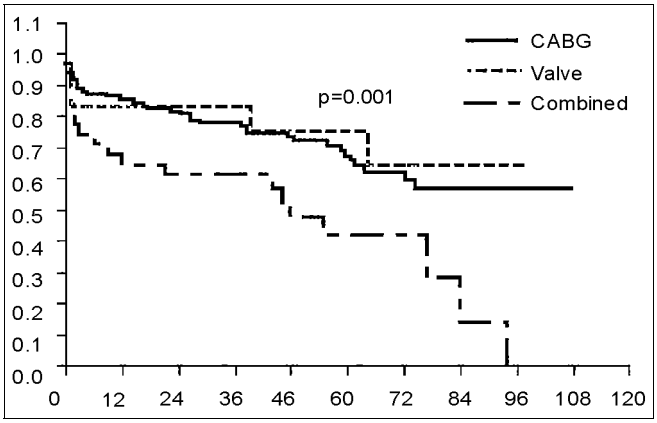

Figure 2. Comparison of survival among octogenarian patients undergoing different types of surgery: CABG, valve surgery and combined (CABG and valve). As shown here, patients undergoing CABG surgery alone have a significantly better survival.

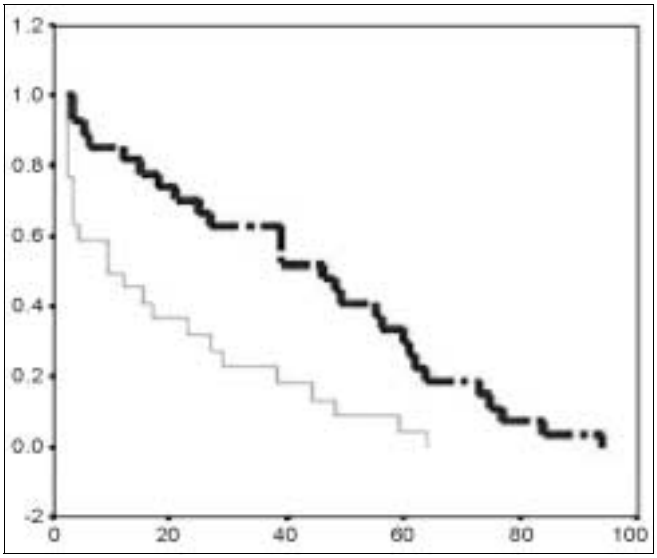

Figure 3. Comparison of long-term survival among octogenarians with regard to different types of mortality: cardiac related versus non-cardiac related. As shown, the long-term survival of patients with non-cardiac related mortality was significantly better than of patients with cardiac related mortality.

amiodarone postoperatively, which might reduce the incidence of this common complication [13]. In our series 8 patients (4%) had a preoperative stroke, which is lower than other recent reports: 7.8% found by Avery et al. [3], 5.7% by Craver et al. [4], and 9.4% in the study of Kirsch et al. [6]. In order to reduce this serious complication, our recent practice is to screen all octogenarian patients for possible severe atherosclerotic disease of the ascending aorta and the carotid arteries. These tests include carotid artery Doppler, transesophageal echocardiography, intraoperative periaortic echo, and chest computerized tomography scan without contrast. Like others [14], we have also increased the number of CABG cases without using cardiopulmonary bypass technique in order to decrease postoperative complications and hospital stay. In this report, 33 patients underwent CABG with this technique, and none of them had a stroke. This has tipped the scale for an increasing proportion of patients who undergo off-bypass CABG in our practice. We believe we need experience with a large number of patients and long-term follow-up to draw further conclusions.

For all our procedures the actuarial survival of 80% at 2 years is comparable to the 85% expected survival in an age and gender-matched western population not undergoing surgery [3]. Type of surgical procedure, congestive heart failure, and postoperative low cardiac output were significant predictors for late outcome. Patients with coronary artery disease who underwent CABG only, had a significantly better early and late outcome than patients with combined coronary and valvular, or only valvular disease.

An important limitation of our study is that it did not collect data on quality of life among survivors. Fruitman and colleagues [2] recently reported that 84% of the survivors among octogenarians undergoing cardiac surgery were living in their own home, 75% rated their health as good or excellent, and 83% would undergo surgery again in retrospect [2].

Given the generally positive results noted here and in other studies, we conclude that severely symptomatic octogenarians should not be denied the benefit of cardiac surgery if they are reasonably good surgical candidates. These operations can be safely performed with acceptable higher mortality and morbidity rates as in younger patients. In addition, targeted strategies such as minimally invasive and off-pump CABG may improve results in this high risk group. It is clear that with the constant demographic changes, cardiologists and cardiac surgeons will be faced with an increasing number of elderly patients in need of operative interventions. An important task in the continuation of surgical care is an ongoing analysis of outcome for octogenarians with surgically treated heart disease, which will assist us in making decisions as to the appropriate therapy.

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