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Urgent cardiac surgery in octogenarians

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Akute Herzchirurgie bei über 80jährigen Patienten

Zusammenfassung. *Grundlagen:* Dringliche Operationen oder Notoperationen in der Herzchirurgie bei älteren Patienten sind durch hohe operative Mortalität und inakzeptabel postoperative Lebensqualität belastet.

Methodik: Zwischen 1998 und 2007 erhielten 251 Patienten über 80 Jahren eine dringliche ($n = 229$) oder Notoperation ($n = 22$). Um Risikofaktoren für den postoperative Tod zu identifizieren, wurde eine logistische Regression durchgeführt.

Ergebnisse: Die Gesamtsterblichkeit lag bei 12 %, 8 % im Falle dringlicher Operationen und 45 % bei Notoperationen. Die häufigsten Todesursachen waren Infektionen, insbesondere Pneumonie (23 %), Nierenversagen (20 %), CVA (17 %), respiratorische Insuffizienz (10 %) und Multiorganversagen (10 %). Inkrementelle Risikofaktoren für Tod waren Alter, Notoperationen, Aortenchirurgie, Perfusionszeit und postoperativen Komplikationen. Die mittlere Nachbeobachtungszeit lag bei 5,4 + 3,2 Jahre.

Schlussfolgerungen: Akute Herzoperationen können auch bei Achtzigjährigen mit akzeptabler operativer Mortalität und mit gutem Langzeitüberleben durchgeführt werden.

Schlüsselwörter: Herzchirurgie, Alter, Notoperation.

Summary. *Background:* Urgent or emergent cardiac surgery in the elderly is burdened by high operative mortality and unacceptable postoperative quality of life.

Methods: From 1998 to 2007, 251 patients aged 80 years underwent nonelective cardiac surgery for urgent ($n = 229$) or emergent ($n = 22$) indications. A logistic regression to identify incremental risk factors for postoperative death was performed.

Results: The overall early mortality was of 12%, with 8% in urgent and 45% in emergent cases. The most frequent causes of death were infections, particularly pneumonia (23%), renal failure (20%), CVA (17%), respiratory failure (10%), and multisystem organ failure (10%). Incremental risk factors for early mortality were age, emergent procedure, aortic procedure, cardiopulmonary bypass time, and the presence of a major postoperative complication. Mean follow-up time was 5.4 ± 3.2 years.

Conclusions: An urgent cardiac surgery can be performed in octogenarians with acceptable operative mortality and good long-term survival.

Keywords: Cardiac, surgery, elderly, urgent, emergency.

Introduction

According to the data from the last census, in Italy on January 2001 among a population of 56,995,744 people, 2,475,638 (4.34%) were 80 years of age and over. In the same report, life expectancy of an octogenarian was estimated at 7.5 years for males and 9.3 for females; while for persons aged 90 years that estimate reaches the value of years 3.8 and 4.5, respectively for men and women. Therefore, it is estimated that in Italy, the share of people above 80 years out of the general population will experience a rapid increase from about 6% in 2010 to 9% in 2030 and over 14% in 2050 [1]. These predictions are not dissimilar to those effected by the demographics of other European countries and even by U.S. government organizations, according to which, the octogenarians, now amounting to 4.2 million people in the United States of America, will increase to 8.9 trillion in 2030 [2]. As there is an increase of the elderly, cardiac surgery in octogenarian or nonagenarian patients is becoming increasingly common [3–6]. However, still cardiac surgery in elderly patients is considered high risk and with a reduced expectancy and quality of life after surgery [7, 8]. For these reasons, elderly patients are more likely to present with symptoms of hemodynamic instability compared with younger patients, often forcing urgent or emergent heart surgery [9, 10]. Although several studies have shown good survival and quality of life in elderly patients

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undergoing elective cardiac surgery [11] little information is available on elderly patients operated for nonelective surgery. In this subset of patients an increased general perioperative surgical risk is reported, but few data are available on the incremental risk factors for death, long-term survival, and quality of life [3, 12–15]. The objective of this study is to review our experience in the treatment of patients older than 80 years operated at our center on urgent or emergency basis.

Materials and methods

Patients

During the interval between January 1998 and December 2007 at the Division of Cardiac Surgery, University of Verona, Italy, 667 patients 80 years of age or older underwent cardiac surgery. Of these 251 (37%) underwent urgent or emergent surgery and are being studied in this work. In this group were enrolled patients operated on for acute myocardial infarction (MI) and its mechanical complications, unstable angina, critical coronary anatomy, cardiogenic shock, aortic dissection or rupture and embolic myxoma.

Definitions

All preoperative, operative, and postoperative data were retrieved from the database of the Division of Cardiac Surgery, University of Verona and reported on studies designed forms.

The preoperative variables analyzed were: age, sex, hypertension, diabetes, obesity (body mass index > 30 kg/m^2), left ventricular function (LVEF), myocardial infarction (MI), previous cardiac surgery (Reoperation) chronic atrial fibrillation (CAF), previous permanent pacemaker (PM), chronic obstructive pulmonary disease (COPD: FEV1 < 70% or chronic use of bronchodilators or steroids), pulmonary hypertension (systolic pulmonary artery pressure > 40 mmHg), carotid artery disease (stenosis > 75% of at least one internal carotid artery), previous cerebral vascular accident (CVA), peripheral vascular disease (PVD: intermittent claudicatio or significant hemodynamic stenosis at Doppler examination), the value of preoperative serum creatinine, chronic renal failure (CRF: serum creatinine > 140 µmol/I), preoperative dialysis. For all patients the preoperatively Euroscore was calculated [16].

The early mortality was defined as death within 30 days after surgery or before hospital discharge. Postoperative complications were defined as follows: cerebrovascular accident (CVA) including stroke, transient ischemic attack, and coma; acute renal failure (ARF) of new onset was defined as a creatinine value greater than 2.5 mg/dL in patients without previous history of renal failure; pneumonia was identified in patients with positive sputum cultures or imaging findings compatible with bacterial lung infection; postoperative myocardial infarction was defined as the presence of at least two of the following: prolonged typical chest pain not relieved by nitrate, increased level of enzymes, new ventricular wall motion abnormalities, ST segment abnormalities or ECG changes with Q waves in 2 or more contiguous leads.

Outcomes

We evaluated the frequency of postoperative complications, length of stay (LOS) in ICU and hospital mortality, early and long-term survival.

Follow-up

All patients discharged were evaluated at our outpatient clinic to assess the clinical status and to record type and frequency of postoperative events. Last follow-up information on hospital survivors was collected during a 6-month interval ending in January 2010. Unsuccessful attempts to trace patients were followed by contact with a family member or with the referring physician.

Statistical analysis

The data are presented as mean ± standard deviation for continuous variables and as percentage for simple categorical variables. Student's *t*-test or Wilcoxon test for continuous data and 2 or Fisher's test for discrete variables were used, as appropriate. All variables with a *p*-value of less than at 0.10 at univariate analysis were entered in the multivariate analysis. Predictors of hospital mortality were identified by means of a logistic regression with forward selection and with a selection cut off set at 0.05. A *p*-value less than 0.05 was considered statistically significant. The survival curves were calculated using the Kaplan – Meier method. The statistical analysis was performed with SPSS software version 16.0.1 (SPSS Inc., Chicago, Ill.).

Results

Patient demographics

Patient characteristics and comorbidities are summarized in Table 1. The mean age of patients at the time of surgery was 83 ± 3 years, with a range from 80 to 91 years. Before surgery, 33% of the patients showed New York Heart Association Class III or IV heart failure. The most frequent comorbidities were hypertension (55%), diabetes (21%), history of CVA (16%), and chronic renal failure (9%). CABG alone which is the most common surgical procedure, was performed in 49% of patients. Isolated valve surgery was performed in 22% of patients, while valvular surgery associated with CABG was done in 19% of cases. Aortic surgery was performed in 6% of patients, including 6 cases of acute aortic dissection and 9 with an aneurysm of the ascending aorta associated to aortic valve dysfunction. One patient was operated for the removal of left atrial myxoma, two for postinfarction ventricular septal rupture, and one for postinfarction left ventricular free wall rupture. The most common indication for emergency surgery was unstable angina (29%) and heart failure (14%). Twenty-one (8%) patients had

Tab. 1: Patient preoperative and surgical data

	No.	%
No. of patients	251	
Mean age (range) (yrs)	83 ± 3	
Male sex	136	54
Hypertension	138	55
Diabetes	53	21
Obesity	15	6
Atrial fibrillation	36	14
NYHA class 3/4	83	33
Chronic renal failure	21	8
Dialysis	4	2
CVA	39	16
PVD	50	20
COPD	24	10
Previous MI	94	37
LVEF (mean)	53.6 ± 13.8	
LVEF < 30%	46	18
Previous cardiac surgery procedures	21	8
Emergent surgery	22	9
Reason for nonelective status		
Unstable angina	72	29
Coronary anatomy	29	12
Acute or evolving MI	23	9
Hemodynamic unstability with IABP	27	11
Valve dysfunction	31	12
Shock w/pressors	18	7
CHF	36	14
Aortic aneurysm	10	4
Aortic dissection	5	2
Procedures		
CABG alone	124	49
CABG + valve		
Mitral	6	2
Aortic	41	16
Mitral + aortic	1	0
CABG + other procedures	6	2
Valve surgery		
Mitral	9	4
Aortic	44	18
Mitral + aortic	1	0
Aorta	15	6
Other procedures	4	2
Mean cardiopulmonary bypass time (min)	113 ± 23 (58–185)	
Mean aortic crossclamp time (min)	67 ± 12 (55–156)	

NYHA New York Heart Association; *CVA* cerebrovascular accident; *PVD* peripheral vascular disease; *COPD* chronic obstructive pulmonary disease; *MI* myocardial infarction; *LVEF* left ventricular ejection fraction; *IABP* intra-aortic balloon pump; *CHF* congestive heart failure; *CABG* coronary artery bypass grafting.

Tab. 2: Postoperative course, morbidity, and mortality

	No.	%
No. of patients	251	
Mean intubation time (h)	14.4 ± 2.8 (9–46)	
Mean ICU LOS (d)	4.3 ± 1.3 (2–12)	
Mean hospital LOS (d)	10.5 ± 2.4 (8–25)	
Postoperative IABP	9	4
Low cardiac output	21	8
Postoperative AF	113	45
Postoperative MI	10	4
CVA	16	6
Renal failure	17	7
Respiratory failure	23	9
Pneumonia	27	11
Reoperation for bleeding	14	6
MSOF	3	1
Early mortality	30	12
Patients discharged	221	88
Late deaths	77	
Survivors	146	
Mean follow-up (y)	5.2 + 3.2	
Range follow-up (y)	0.1 – 12.4	

ICU intensive care unit; *LOS* length of stay; *IABP* intra-aortic balloon pump; *AF* atrial fibrillation; *MI* myocardial infarction; *CVA* cerebrovascular accident; *MSO* multisystem organ failure.

undergone previous cardiac procedures. All procedures were performed on cardiopulmonary bypass with a mean time of perfusion of 113 ± 23 minutes and mean time of aortic clamping of 67 ± 12 minutes.

Postoperative complications and early mortality

Postoperative morbidity, mortality, and LOS are summarized in Table 2. The overall early mortality was of 12%, namely 8% in urgent patients, and 45% in emergent cases. The most frequent causes of death were infections, particularly pneumonia (23%), renal failure (20%), CVA (17%), respiratory failure (10%), and multisystem organ failure (10%). Overall, the most common postoperative complication was atrial fibrillation (45% of patients), followed by pneumonia (11%), respiratory failure (9%), low cardiac output (8%), renal failure (7%), reoperation for bleeding (6%), and CVA (6%). The average time of hospital stay after surgery was 10 ± 3 days, while staying at the ICU was 4 ± 2 days. All discharged patients were transferred to a rehabilitation unit.

Predictors of hospital mortality

The logistic regression analysis of risk factors for early mortality is presented in Table 3. The significant risk

Tab. 3: Risk factors for early mortality

	No. of patients	Univariate				Multivariate	
		Hospital survivors	Hospital deaths	Hospital mortality (%)	*p*-value	*p*-value	Hazard ratio
Total patients	251	221	30	12			
Preoperative data							
Age		82.4 ± 2.3	83.1 ± 3.6		0.042	0.029	1.152
Female sex	115	95	20	17	0.041		
Hypertension	138	119	19	14	0.433		
Diabetes	53	40	13	25	0.003	0.026	1.194
Obesity	15	11	4	27	0.161		
Atrial fibrillation	36	25	11	31	0.001	0.28	1.197
NHYA class III or IV	83	66	17	20	0.007		
LVEF (mean)		56.2 ± 12.1	50.2 ± 14.2		0.027		
LVEF < 30%	46	33	13	28	0.044		
Previous MI	94	78	16	17	0.086		
Previous cardiac surgery	21	13	8	38	0.001	0.025	2.561
COPD	24	19	5	21	0.28		
CVA	39	32	7	18	0.32		
PVD	50	39	11	22	0.028		
Chronic renal failure	21	13	8	38	0.001	0.016	2.76
Dialysis	4	3	1	25	0.973		
Preoperative IABP	16	11	5	31	0.64		
Operative data							
CABG surgery	124	113	11	9	0.196		
CABG + valve	48	45	3	6	0.268		
CABG + other procedures	6	4	2	33	0.319		
Valve surgery	54	51	3	6	0.879		
Aortic surgery	15	7	8	53	0.001	0.001	8.574
Other procedures	4	1	3	75	0.002		
Emergent surgery	22	12	10	45	0.001	0.001	7.523
Bypass time (min)		101.6 ± 9.3	124.4 ± 18.5		0.001	0.036	2.154
X-clamp time		60.1 ± 9.8	64.6 ± 13.8		0.07		
Postoperative data							
Postoperative IABP	9	6	3	33	0.136		
Low cardiac output	21	18	3	14	0.994		
Postoperative AF	113	102	11	10	0.433		
Postoperative MI	10	7	3	30	0.194		
CVA	16	11	5	31	0.039	0.001	5.236
Renal failure	17	11	6	35	0.007	0.001	9.453
Respiratory failure	23	20	3	13	0.867		
Pneumonia	27	20	7	26	0.04	0.001	4.428
Reoperation for bleeding	14	9	5	36	0.017		
MSOF	4	1	3	75	0.0001	0.001	10.159

NYHA New York Heart Association; *LVEF* left ventricular ejection fraction; *MI* myocardial infarction; *COPD* chronic obstructive pulmonary disease; *CVA* cerebrovascular accident; *PVD* peripheral vascular disease; *IABP* intra-aortic balloon pump; *CABG* coronary artery bypass grafting; *AF* atrial fibrillation.

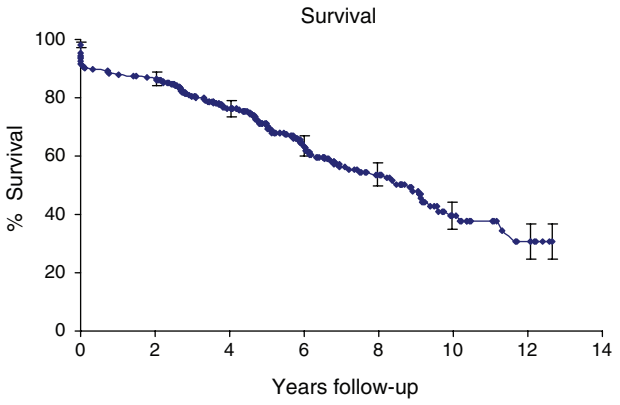

Fig. 1: Kaplan–Meier survival analysis

factors were age, emergent aortic surgery, previous cardiac surgery, prolonged bypass time, and some postoperative complications such as renal failure, postoperative pneumonia, CVA, and the development of multisystem organ failure. The latter was the major risk factor for early mortality, with a hazard ratio of 10, followed by new onset postoperative renal failure with a hazard ratio of 9, aortic surgery (HR = 8), emergent surgery (HR = 7), and CVA (HR = 5).

Long-term survival

During follow-up there were 77 deaths, with 146 current survivors. Mean follow-up time was 5.4 + 3.2 years, ranging from 0.2 to 12.3 years. The survival at 1, 5 and 10 years was 88.0%, 68.6%, and 37.6%, respectively (Fig. 1). Survival estimates by type of procedure show that patients undergoing CABG have a higher long-term survival. Patients undergoing aortic procedures have a higher early mortality; however, the 10-year survival is similar to that observed in patients undergoing valve surgery.

Discussion

The reason for this study was to evaluate our experience in the treatment of elderly patients referred for cardiac surgery on urgency in order to refine our diagnostic and therapeutic guidelines. In these critically ill patients surgery is often denied because of the assumption of high operative mortality and the conviction of a poor quality of life after surgery. Certainly one of the limitations of this study is the fact that it comes from a single center, that is retrospective, and refers to a small sample of patients. However, there is little information about the surgical treatment of this particular subset of patients [12, 14]. Cardiac surgery in elderly patients performed on urgent or emergent basis is associated with a risk of hospital death from 2 to 3 times higher than that of elective surgery patients [15, 17]. In our experience the operative mortality rate was 12% similar to all rates of operative mortality in previous studies of patients including octogenarians undergoing cardiac surgery, where mortality ranges from 9% to 20% [3, 6]. Moreover in our series all patients were in critical conditions such as unstable angina, acute myocardial infarction in evolution, valve dysfunction and congestive heart failure, shock, ruptured aortic aneurysm or acute aortic dissection. Although there are no randomized comparisons with medical treatment alone, the expected mortality in these patients is still considered high. Without surgery, certainly most of them die in hospital after being admitted. As expected, the operative mortality rate was much higher with emergent procedures than that observed after urgent surgery. Patients who needed an emergency surgery had an operative mortality of 45%, almost 5 times higher than the 8% operative mortality observed in the group of patients underwent urgent surgery. Therefore, in octogenarian patients who present with emergency character, particularly with acute aortic dissection, clinical decisions regarding surgery should consider this high mortality rate. For these patients, less invasive options, such as medical management or endovascular stent graft, might be more appropriate [18, 19]. In our study we found that age, although it is an incremental risk factor for operative death, is still the lowest among all factors with a hazard ratio of 1.152. This reinforces the idea that age alone cannot be considered a contraindication for surgery in this particular subset of patients. Whereas significantly heavier is the impact on the risk of early mortality of an emergency procedure, acute aortic dissection, the reoperation, prolonged bypass time, and the occurrence of a postoperative complication. Given this population of elderly patients at high risk, it is not surprising that any postoperative complication is poorly tolerated and it may results in death of the patient. As recently reported by Zingone et al. [20] in 355 octogenarians undergoing cardiac surgery, the occurrence of a single postoperative complication doubles the risk of hospital death. Therefore, to maximize results in this patient population, we need a good surgical technique associated with a meticulous postoperative management. Preventive measures to minimize pneumonia associated with mechanical ventilation, such as early extubation and postural bronchial drainage are recommended [21]. In addition, nephrotoxic drugs should be minimized, and renal function should be closely monitored [22]. The occurrence of postoperative renal failure is highly predictive of mortality, further emphasizing the importance of protecting the kidney. Finally, as reported by several authors, it should be noted that the existing stratification risk models for hospital death, as Euroscore and STS score, are limited in this subgroup of high risk elderly patients [18, 23, 24]. Therefore, a new set of preoperative variables for elderly patients is needed to improve on current models of risk stratification after cardiac surgery. In our study, despite the high operative mortality patients discharged showed a good long-term survival. As demonstrated for elderly patients with elective cardiac surgery these patients late after surgery are living as their peers [12, 13, 17]. One of the limitations of this study is not assessing the quality of life late after surgery. However, several authors have evaluated the quality of life at 2 and 5 years after surgery using the assessment

questionnaire SF-12 and compared responses with those of the general population. In these studies, patients after surgery showed equivalent physical and mental health scores to those of their peers [25]. Moreover Huber et al. [14] recently reported in octogenarians after cardiac surgery a better quality of life than their age peers. Therefore, even patients undergoing cardiac surgery on emergency can return after surgery to normal physical and mental capacity [12, 17].

Conclusions

Urgent cardiac surgery can be performed in octogenarians with acceptable operative mortality and good long-term survival. Emergency procedures and in particular those for type A aortic dissection or rupturing aortic aneurysm have the highest rate of operative mortality. The occurrence of a major complication is strong incremental risk factor for postoperative death. Therefore every effort must be used to minimize complications, especially renal failure and neurologic damage. The long-term survival is good and comparable to that of general peer population.

Conflict of interest

The authors declare that there is no conflict of interest.

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