Original Article

Early and Long-term Results of Cardiovascular Surgery in Octogenarians

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The purpose of this study was to evaluate characteristics and outcomes of octogenarians undergoing cardiovascular surgery with cardiopulmonary bypass in a Japanese population. Thirty-one consecutive patients over 80 years of age underwent coronary artery bypass grafting (CABG), 19 (61%), 1 (3%) combined CABG and ventricular septal perforation closure, 3 (10%) valve replacement, and 8 (26%) prosthetic graft replacement. The early mortality rate was 16.1%. Survival estimates were 74% after 1 year, 74% after 3 years, and 64% after 5 years. Emergency and urgent cases involved 16 (51.6%), and 2 patients (6.5%), respectively. Multivariate analyses revealed that a predictor of early mortality was preoperative left ventricular ejection fraction. Predictors of hospital death (within 3 months of surgery) were preoperative renal dysfunction, intraaortic balloon pumping, and age. Predictors of late mortality were chronic lung disease and age. Twenty-one patients expected to have died before surgery were living at home, and 9 (40.9%) patients were completely autonomous. Multivariate analyses revealed diabetes mellitus and a small number of bypass grafts were predictive risk factors for postoperative autonomy. Thus, cardiovascular surgery can be performed in octogenarians under 85 years of age with a favorable long-term outcome, when appropriately applied in selective octogenarians without significant comorbidity. If patients are over 85 years of age or have significant comorbidity, clinical treatment recommendations should be individually tailored while evaluating the risk of having or not having surgery and their life expectancy. Quality of life (QOL) of survivors was mostly satisfactory and significantly improved compared with the preoperative state. (Ann Thorac Cardiovasc Surg 2001; 7: 223–31)

Key words: aged 80 and over, cardiac surgical procedures, thoracic aortic aneurysm, comorbidity, autonomy

Introduction

The Japanese government's estimate suggests that the ratio of elderly people over 75 years old for all populations are increasing from 5.7% in 1995 to 18.8% in 2050 in Japan, because of increasing longevity and decreasing birthrates.[1)] According to Japanese abridged life tables for 1998, the survival ratios until 80 years of age are 50.8% for male and 73.1% for female.[2)] Life expectancies at 80 are 7.68 years for male and 10.27 years for females. Japanese society is aging faster than ever before. On the other hand, cardiovascular disease is the main cause of death, including cerebrovascular diseases.[2)] Octogenarians referred for consideration of cardiovascular surgical procedures are increasing, with better outcomes than before. However, the indication and outcome of cardiovascular surgery for octogenarians are not fully clear in Japanese populations. The purpose of the present report was to evaluate the characteristics and outcomes of octogenarians undergoing cardiovascular surgery.

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Received January 5, 2001; accepted for publication April 20, 2001.
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Patients and Methods

Patients

The subjects were 31 consecutive patients aged 80 or older undergoing heart or thoracic aorta surgery with a cardiopulmonary bypass at Oita Medical University hospital, Oita, Japan between January 1988 and June 1999. No octogenarians had had cardiovascular surgery with cardiopulmonary bypass before 1988.

Study protocol

Patient records were reviewed for patient characteristics, preoperative status, intraoperative course, and postoperative course. Perioperative factors included in the study are shown in Table 1. The left ventricular ejection fraction was assessed by cardiac catheterization or echocardiogram. Patients with cerebrovascular disease included those with a history of stroke, transient ischemic attacks, or both. Preoperative renal dysfunction was determined as serum creatinine levels higher than 1.5 mg/dl. Atherosclerosis of the ascending aorta was checked by preoperative chest computed tomography (CT), coronary angiography, and intraoperative digital palpation of the aorta. Ascending aorta disease was graded according to Mills and Everson[3] as absent, mild (small diseased areas of the aorta that could easily be avoided with aortic cannula and bypass grafts), moderate (disease extensive enough to cause concern for possible embolization, yet adequate soft, disease-free areas could be found for cannulation or placement of bypass grafts), or severe (clearly significant circumferential disease that would necessitate aortic cannulation, aortic cross-clamping and placement of bypass grafts into the diseased ascending aorta).

Surgery was considered elective if the patient was admitted to our department electively in a stable condition. Urgent operations were defined as operative procedures performed in patients whose accelerated symptoms prompted urgent hospital admission for evaluation, and who were judged to be too unstable to discharge before the operation. Emergency operations were defined as procedures performed in patients whose cardiovascular instability either required operative intervention outside of normal operating hours or those which displaced another patient on the surgical schedule.

For Stanford type A dissecting aneurysms, a cardiopulmonary bypass was started via the right subclavian artery as the main inflow, the femoral artery and the right atrium to obtain antegrade systemic circulation and to enable easy changes to selective cerebral perfusion. Cerebral flow in cases of selective cerebral perfusion was basically defined as 500 ml/min from the right subclavian artery and left common carotid artery with deep systemic hypothermia (20°C). In other cases, a standard cardiopulmonary bypass was established through the ascending aorta or the femoral aorta and the right atrium with moderate systemic hypothermia (30-32°C). We used hemodilution and did blood transfusions if necessary to maintain the patient's hematocrit over 20% during extracorporeal circulation. Myocardial protection was achieved with antegrade cold blood hyperkalemic cardioplegia (modified St. Thomas solution) and topical cooling with ice slush. Bioprostheses were used preferentially for valve replacement (2 patients) because anticoagulant therapy was not required, and a mechanical valve was used in 1 patient. Coronary artery bypass grafting (CABG) was performed using only a reversed saphenous vein graft in 14 patients, a left intrathoracic artery graft in 6 patients, and a right gastroepiploic artery graft in 1 patient.

Table 1. Perioperative variables

Variables	
Preoperative	Age
	Sex
	New York Heart Association (NYHA) classification
	Left ventricular ejection fraction (LVEF)
	IABP use
	Tobacco use
	Systemic hypertension
	Diabetes mellitus
	Cerebrovascular disease
	Chronic bronchopulmonary disease
	Preoperative renal dysfunction
Intraoperative	Procedure
	Emergency , urgent, or elective operation
	Aortic cross-clamping time
	Atherosclerosis of the ascending aorta
Postoperative	Stay in intensive care unit (ICU)
	Low output syndrome (LOS)
	Congestive heart failure (CHF)
	Perioperative myocardial infarction (PMI)
	Supraventricular arrhythmia
	Conduction disorder
	Pulmonary complications
	Renal dysfunction
	Cerebrovascular accident
	Gastrointestinal complications
	Infection
	Volume of blood transfusion
	Reexploration

Table 2. Rosser index

Disability	Score
No disability	1
Slight social disability	2
Severe social disability/slight impairment of work, able to do all housework except very heavy tasks	3
Able to do light house work only, but able to go out shopping	4
Confined to home except for escorted outings and short walks and unable to do shopping	5
Confined to chair or to wheelchair or able to move around in the home only with support from an assistant	6
Confined to bed	7
Unconsciousness	8
Distress	
No distress	1
Mild	2
Moderate	3
Severe	4

Early death was defined as death occurring within 30 days of the operation. All postoperative complications were recorded. Infection included any postoperative infectious complication requiring antibiotic therapy. Pulmonary complications included all those leading to prolonged mechanical ventilation of more than 3 days.

Follow-up information was obtained in January 2000 by a telephone interview of the patient, the patient's relatives, or the referring physician. Questions were asked about the date and cause of death, the patient's autonomy, and a subjective judgment of his or her quality of life (QOL). The recent QOL of the survivors was assessed using the Rosser index (Table 2) consisting of two dimensions, a disability score (1 to 8: no disability to unconsciousness) and a distress score (1 to 4: no distress to severe distress).[4] Late death was defined as death occurring more than 30 days after surgery. Fully autonomous patients were defined as those able to live on their own and handle their daily routine.

Statistical analysis

All statistical analyses were performed on a personal computer with the statistical package STATISTICA (Statsoft Inc.). Continuous variables were expressed as the mean ± one standard deviation and were compared using an unpaired two-tailed t-test. Categorical variables, expressed as percentages, were analyzed with a Chi-square test and Fisher's exact test. A two-tailed *p* value of less than 0.05 was considered significant. Survival data were analyzed with standard Kaplan-Meier actuarial techniques for estimation of survival probabilities. To identify risk factors for early death, univariate analyses of preoperative, intraoperative, and postoperative variables were performed by comparing two or more independent subsets of patients using the log-rank test (Mantel-Cox test). To evaluate independent risk factors for early death, preoperative and intraoperative variables were examined by multivariate analysis using forward stepwise logistic regression. Coefficients were computed using the method of maximum likelihood. In a subsequent analysis, significant preoperative, intraoperative, and postoperative variables, were introduced into the logistic model. We included variables identified to be major clinical predictors in other models and variables identified as univariate predictors with significance levels of less than 0.05. Analysis of preoperative, intraoperative, and postoperative factors influencing long-term survival (survival longer than 1 month) was done with multivariate proportional hazard regression analysis (Cox model).

To identify risk factors for impaired autonomy among long-term survivors, univariate analysis of perioperative variables was performed by comparing two groups of patients; patients with impaired autonomy (group 1) and fully autonomous patients (group 2). Independent predictors of impaired autonomy were subsequently determined by forward stepwise regression.

Results

Patient characteristics and operative details

Figure 1 shows changes in the percentage of operations performed on septuagenarians and octogenarians during the 11-year study period. The series of octogenarians comprised 22 men and 9 women. The figures show the annual percentage of septuagenarians and octogenarians for all cardiovascular operative patients undergoing cardiopulmonary bypass.

The preoperative variables are listed in Table 3. The mean patient age was 82.5±2.6 years (range, 80-92 years). Most patients (96.8%) were in the New York Heart Association (NYHA) functional class III or IV at the time of surgery.

Preoperative coronary arteriography was performed in 23 patients (74.2%). The left ventricular ejection fraction (LVEF) was evaluated in all patients (100%) and averaged 58.7±14.5%. Table 4 shows operative details. The number of cases of ischemic heart disease, valvular disease, and aortic aneurysm were 20, 3, and 8, respec-

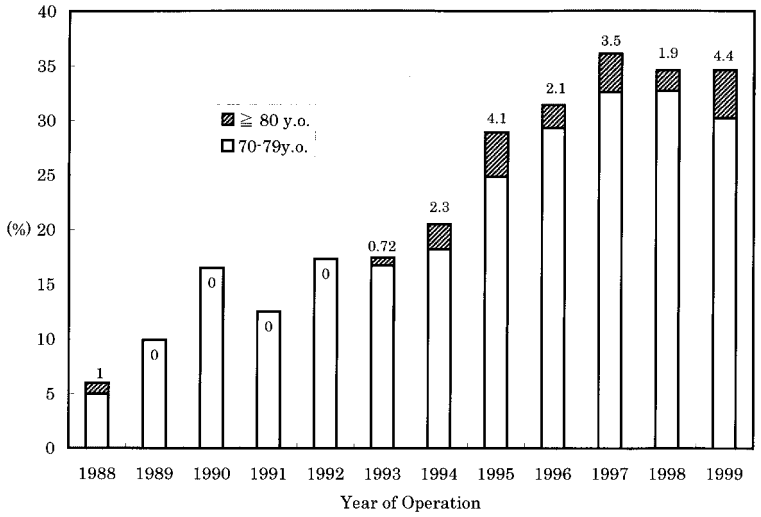

Fig. 1. Changes in the percentage of operations performed on septuagenarians and octogenarians in all patients having cardiovascular surgery during the 11-year study period.

tively. Patients with ruptured Stanford type A dissection were 2 cases who had massive hematoma in the pericardial cavity.

Hospital morbidity and mortality

The early mortality rates for surgical procedures performed in octogenarians were CABG 15%, valve replacement 33%, and aortic replacement 13%, respectively. The mortality of aortic aneurysm operative patients tended to be lower than patients who received CABG or valve replacement, but these did not reach statistical significance. The postoperative intensive care unit (ICU) stay averaged 7.5±11.6 days, and the mean duration of postoperative hospitalization in our department was

Table 3. Clinical characteristics of the 31 patients[a,b]

Variables	No. of patients[c]
Age (year)	
Mean	82.5
Range	80-92
Sex (male / female)	22 / 9
NYHA classification	
I	0 (0)
II	1 (3.2)
III	15 (48.4)
IV	15 (48.4)
LVEF	61.0 ± 15.4
Cardiovascular risk factors	
Tobacco use	8 (25.8)
Systemic hypertension	17 (54.8)
Diabetes mellitus	7 (22.6)
Old myocardial infarction	7 (22.6)
Cerebrovascular disease	10 (32.3)
General risk factors	
Chronic pulmonary failure	4 (12.9)
Renal dysfunction	7 (22.6)

[a]: Where applicable, data are shown as the mean ± one standard deviation. [b]: Numbers in parentheses are percentages. [c]: Number provided is number of patients unless otherwise indicated. NYHA: New York Heart Association; LVEF: left ventricular ejection fraction.

Table 4. Operative details[a,b]

Variables	No. of patients[c]
Procedure	
CABG	18 (58.1)
CABG + VSP closure	1 (3.2)
CABG + AVR	1 (3.2)
AVR	2 (6.5)
MVR	1 (3.2)
Aortic root remodeling	1 (3.2)
Replacement of ascending aorta	4 (12.9)
Replacement of partial arch	1 (3.2)
Replacement of total arch	1 (3.2)
Koster-Collins	1 (3.2)
Timing of intervention	
Emergency	16 (51.6)
Urgent	2 (6.5)
Elective	13 (41.9)
CPB time (min) n=30	157 ± 56
Aortic cross-clamp time (n=27)	69 ± 35
No. of coronary bypass grafts per patient	2.1 ± 0.8
Range	1-4

[a]: Where applicable, data are shown as the mean ± one standard deviation. [b]: Numbers in parentheses are percentages. [c]: Number provided is number of patients unless otherwise indicated. AVR: aortic valve replacement; CABG: coronary artery bypass grafting; CPB: cardiopulmonary bypass; MVR: mitral valve replacement; VSP: ventricular septal perforation.

Table 5. Incidence of postoperative complications

Postoperative complications	No. of patients (%)	
Cardiovascular	43	(139.0)
Low cardiac output syndrome	7	(22.6)
Congestive heart failure	10	(32.3)
Perioperative myocardial infarction	3	(9.7)
Supraventricular arrythmia	19	(61.3)
Reexploration for bleeding	4	(12.9)
Pulmonary[a]	11	(35.5)
Cerebrovascular accident	3	(9.7)
Abdominal[b]	3	(9.7)
Renal dysfunction	10	(32.3)
Infection[c]	4	(12.9)

[a]: These included any pulmonary complications requiring prolonged mechanical ventilation. [b]: These included any intraabdominal complication requiring any intervention. [c]: This was defined as any postoperative infection requiring antibiotic therapy.

30.2±16.1 days. Postoperative complications occurred in 26 patients (83.9%) (Table 5). Overall hospital mortality was 22.6% (7 deaths). Early mortality was 16.1% (5 deaths).

Late survival

Follow-up information regarding vital status was available for all patients. The mean follow-up for all patients was 743±681 days (range, 1-2219 days). At the time of the study, 22 patients were alive (70.1%). The overall mortality rate (including hospital mortality) was 29.0% (9 deaths). For the overall group of patients, survival estimates were 81% after 1 month, 74% after 1 year, 74% after 3 years, 64% after 5 years (Fig. 2).

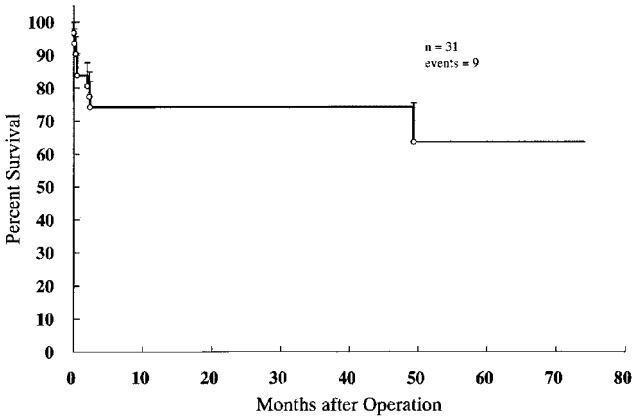

Fig. 2. Actuarial survival for the entire patient population. Error bars represent ± one standard error of the mean.

Table 6. Causes of the nine early and late deaths

	Early death (< 1 month)		Late death (> 1 month)	
	No.	% of 5	No.	% of 4
Cardiac[a]	2	40	1	25
Neurological	1	20	1	25
Pulmonary	1	20		
Infection	1	20		
Renal			1	25
Other			1	25
Total	5	100	4	100

[a]: This is death from low cardiac output syndrome or congestive heart failure.

Causes of death

The most common cause of death after surgery was cardiac related (3/9 deaths, 30%). The second most common cause of death after surgery was neurologically related (2/9 deaths, 22.2%). The time distribution of the causes of death is shown in Table 6.

Risk factors for death

Univariate analysis of factors influencing overall postoperative survival (Table 7) revealed that patients older than 85 years (n=5) had significantly lower rates than patients 80 to 84 years old (n=26) (p=0.009) (Fig. 3). Patients with preoperative renal dysfunction and chronic lung disease had significantly lower overall postoperative survival (p=0.002) (Fig. 4). Patients with a preoperative LVEF lower than 0.5 had a significantly lower survival rate than patients with a LVEF of 0.5 or greater. The preoperative use of IABP was also a significant risk factor. Patients with New York Heart Association func-

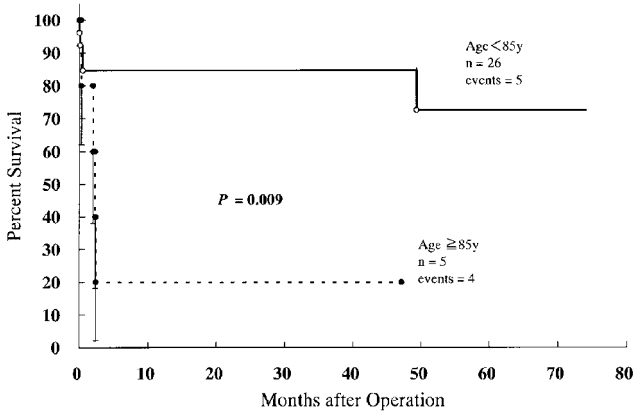

Fig. 3. Actuarial survival for patients who were over 80 and below 84 years of age compared with those aged over 85. Error bars represent ± one standard error of the mean.

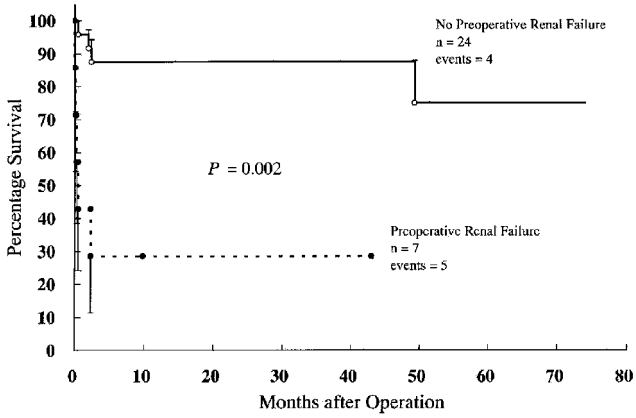

Fig. 4. Actuarial survival curves for patients with preoperative renal dysfunction compared with those without preoperative renal dysfunction. Error bars represent ± one standard error of the mean.

tional class IV tended to show a lower survival, but the difference did not achieve significance (p=0.054). Patients with atherosclerosis of the ascending aorta tended to have a lower survival, but this did not reach significance (p=0.066). Univariate analysis of postoperative variables showed that low cardiac output syndrome, congestive heart failure, renal dysfunction, re-exploration, and infection were significant predictors of mortality (p=0.002, 0.003, 0.01, 0.027, 0.028, respectively). However, other cardiovascular risk factors or general risk factors did not significantly influence postoperative survival. Patients undergoing emergency operations tended to have a lower postoperative survival compared with patients having urgent or elective interventions, but this did not reach statistical significance. Cardiopulmonary bypass time and aortic cross-clamp time had no significant effect on postoperative survival.

Logistic regression analysis revealed that the preoperative left ventricular ejection fraction was significant predictor of early mortality (Table 8). Moreover, logistic regression analysis revealed that preoperative renal dysfunction, preoperative intraaortic balloon pump (IABP), and age were significant predictors of hospital mortality (within 3 months of surgery). Multivariate proportional hazard regression analysis revealed that age and chronic lung disease were independent risk factors for late death (Table 8).

Table 7. Univariate predictors of postoperative death

Incremental risk factor	p value
Preoperative	
Renal dysfunction	0.002
Chronic lung disease	0.006
Age 85	0.009
LVEF < 0.5	0.021
Intraaortic balloon pumping	0.046
NYHA class IV	0.054
Intraoperative	
Atherosclerosis of the ascending aorta	0.066
Postoperative	
Low cardiac output syndrome	0.002
Congestive heart failure	0.003
Renal dysfunction	0.01
Reexploration	0.027
Infection	0.028

LVEF: left ventricular ejection fraction; NYHA: New York Heart Association.

Autonomy and quality of life

At last follow-up, 14 (63.6%) of 22 patients (male/female = 14/8) were completely autonomous for the patients' present age of 84.6±2.8 years (male versus female, 84.6±2.8 and 84.8±7.6, respectively; p=0.888). Univariate analysis of perioperative variables revealed a smaller number of bypass grafts (group 1 versus group 2, 1.33±0.52 and 2.36±0.81, respectively; p=0.013) was a significant predictor of impaired postoperative autonomy. The presence of preoperative diabetes mellitus (DM) tended to impair postoperative autonomy, but did not reach statistical significance (p=0.055). However, multivariate analysis revealed that the presence of preoperative DM and a small number of bypass grafts were independent risk factors. Preoperative disability score and distress score of all patients were 5.4±1.6 and 2.5±0.8, respectively. Disability of survivors at present changed from 5.0±1.7 to 2.8±1.5 (p<0.001). Distress of survivors at present changed from 2.4±0.6 to 1.5±0.5 (p<0.001). Disability score of total survivors, patients with CABG, aortic surgery, and valvular surgery were 2.8±1.5, 3.0±1.4,

Table 8. Multivariate analysis of risk factors for death

Incremental risk factors	p value		
	Early	Hospital (< 3M)	Late
Preoperative LVEF	< 0.01		
Preoperative renal dysfunction		< 0.01	
Preoperative IABP		0.022	
Age		0.028	0.015
Chronic lung disease			<0.01

LVEF: left ventricular ejection fraction; IABP: intraaortic balloon pumping.

2.8±2.5, and 1.0±0, respectively, at present (p=0.207). The distress score of total survivors, the patients with CABG, aortic surgery, and valvular surgery were 1.5±0.5, 1.5±0.5, 1.4±0.5, and 1.0±0, respectively, at present (p=0.394). Subjective evaluation of quality of life showed that 18 survivors (81.8%) were satisfied, and 4 (18.2%) were less satisfied with their present quality of life.

Discussion

Until the latter half of the 1980s, performing surgery on the heart or thoracic aorta with cardiopulmonary bypass was an uncommon occurrence, mainly because of theoretical concerns about incomplete appreciation of the life expectancy of octogenarians, elderly patients' ability to tolerate cardiopulmonary bypass, fear of weakness of tissue or severe atherosclerosis, and anxiety over multi-organ dysfunction in elderly patients. However, in the past decade the number of octogenarians having heart and thoracic aorta surgery with cardiopulmonary bypass has grown with acceptable morbidity and mortality.

In our series, there were many emergency cases; over 50% of the total cases as compared with other reports.[5-7] In addition, most patients were in the NYHA functional class III or IV. Most cases of Blanche et al.[5] and Mullany et al.[6] were also over NYHA functional class III. However, Akins et al.[7] reported that patients with NYHA functional class III or IV decreased to 32% from 78%, and preoperative renal insufficiency increased to 28% from 8% compared with their study 8 years ago. They concluded these observations reflected earlier patient referral and better patient selection. Many Japanese doctors may hesitate to actively refer a patient for an operation for octogenarians because of prejudice that octogenarians have a high operative mortality and low life expectancy with or without surgery.

The early mortality and the late survival probability in our patient population were similar to those reported by others.[5-12] Overall early mortality in the present study was as good at 16.1% despite including 5 emergency aortic surgery cases. In the present study, the 1, 3, and 5 year survival rates were 74%, 74%, 64%, respectively. The 5 year survival rate of our patients was also as good at 64%, compared with the 63% of Akins et al.[7] However, our ratio of serious cardiac function cases was higher than theirs. We could not prove that this outcome was superior to other reports because of the different population and smaller patient group. When appropriately applied in selected octogenarians without significant comorbidity, mortality approached that seen in younger patients.[11,12] However, after 5 years, it showed a more rapid decline in octogenarians than in a younger group.[11]

From univariate statistical analyses for preoperative factors, we found that renal dysfunction, chronic lung disease, age over 85, LVEF lower than 0.50, and use of IABP were significant incremental risk factors for overall postoperative mortality. In addition, low cardiac output syndrome, congestive heart failure, renal dysfunction, reexploration, and infection were significant risk factors after surgery. Multivariate statistical analyses revealed that risk factors of early mortality was preoperative left ventricular ejection fraction. Moreover, multivariate analyses revealed that preoperative renal dysfunction, preoperative IABP, and age were significant predictors of hospital mortality (within 3 months of surgery). Akins et al. reported that multivariate predictors of hospital death were chronic lung disease, postoperative stroke, preoperative IABP, and congestive heart failure from studies on 600 octogenarians with ischemic heart disease and valvular disease. They also reported multivariate predictors of late death were renal insufficiency, postoperative stroke, chronic lung disease, and congestive heart failure. Other investigators found that predictors of early death were reported preoperative renal failure,[8] urgent or emergency operations,[8,13] a long extracorporeal bypass time exceeding 95 minutes,[9] left main stem disease,[9] preoperative use of IABP,[7,14] preoperative pulmonary hypertension,[10] and a low left ventricular ejection fraction.[7,9,10,15] The predictors of late death were reported to be cerebrovascular disease,[8] prolonged ventilation,[8] LVEF,[9] cases of combined CABG + valve replacement,[10,12,14] being female,[10] and renal dysfunction.[15] More than 50% of early and late death cases in our study were cardiac and neurologically related. Reduced preoperative left ventricular ejection fraction appeared to be a significant predictor of early death in our study. A preoperative left ventricular ejection fraction of less than 0.50 resulted in excessive early mortality rates of 33.3%. Therefore, elderly patients should be referred and have operations sooner before developing severe cardiac dysfunction. Preoperative renal dysfunction, IABP, and age also appeared to be significant predictors of hospital death in our study similar to other investigators. Patients who had emergency operations or atherosclerosis of the ascending aorta tended to have higher early mortality, but this did not reach statistical significance in our series. In elderly cases with ischemic heart disease which would require emergency surgery in the

near future, an elective operation should be recommended in stable conditions. Risk factors of late mortality were chronic lung disease and age in our study. The indication of cardiovascular surgery for patients older than 85 years should be decided more discerningly, because the prognosis is poor at present.

We were aware of no published reports that described thoracic aortic surgery for octogenarians only. Okita et al.[16] reported 261 patients, 70 years old or older, including octogenarians who had surgery for thoracic aortic aneurysms. Their early mortality was 21% (54/261 patients), which was greater than that of the younger group (113/896 patients, 13%, $p<0.01$). Hayashi et al.[17] reported early mortality of aortic arch replacement was 39% in over 70 year-old patients. Our early mortality for octogenarians with thoracic aortic aneurysms was as good at 12.5% (1/8 patients) though it was a small patient group. Their significant risk factors for hospital death using logistic regression analysis, were surgery before 1991, age over 70, preoperative cardiac problems, aneurysm rupture, postoperative stroke, low output syndrome, bleeding, and acute renal failure. Except for aneurysm rupture, other predictors were similar in cases of coronary bypass grafting or valve replacement.

The main postoperative complications were cardiovascular related. One of main causes of early and late death was also cardiac related. Therefore, we think it is important to check preoperative cardiac function, including an evaluation of the coronary artery. It was reported that the prevalence of ischemic heart disease increased dramatically with age.[18] Therefore, when elderly patients have an operation, ischemic heart disease must be considered in order to estimate perioperative cardiac function. However, coronary angiography can not be performed before major operations in emergency cases or those with severe renal dysfunction. In elective cases, we routinely performed coronary angiography for major cardiopulmonary bypass surgery.

At follow-up, 21 patients (95.5%) expected to have died before surgery were living at home, and although 12 patients (54.5%) needed some support postoperatively, 9 (40.9%) were completely independent. Only one patient was admitted to another hospital for evaluation of the coronary artery. 18 (81.8%) patients rated their present health as excellent, very good, or good. These results were similar to other investigators[5-10] and were encouraging. By multivariate analysis, diabetes mellitus and a small number of bypass grafts were found to be predictive risk factors for postoperative autonomy. Hlatky et al.[19] also reported that the degree of improvement in physical function was similar among patients with and without diabetes after one year, but there was significantly less improvement among the diabetic patients after four years. Patients who have CABG with a small number of grafts may not be able to achieve full autonomy because of incomplete revascularization of coronary arteries. However, as Gaudino et al.[20] mentioned, in the high-risk group (patients with severe internal carotid artery stenosis or severely atherosclerotic ascending aorta), the reduction of neurological risk may be considered more important than the achievement of total revascularization. The Rosser index as QOL assessment is simple and easy to answer for octogenarians compared to other assessments which require descriptive answers. The disability score of survivors was 2.8, and distress score was 1.5 at the late period after operation. The survivors with cardiovascular surgery for octogenarians resulted in significant improvements in the Rosser index. Also the midterm QOL demonstrated an almost satisfactory QOL for a mean age of 84.6 years old in the present study.

In conclusion, the cardiovascular operations can be performed on octogenarians under 85 years with a favorable long-term outcome, when appropriately applied in selective cases without significant comorbidity. If patients are over 85 years of age or have significant comorbidity, clinical treatment recommendations should be individually tailored while evaluating the risk of having or not having surgery and their life expectancy. QOL of survivors was almost satisfactory and significantly improved compared with a preoperative state.

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