CORONARY ARTERY BYPASS IN THE SEPTUAGENARIANS AND OCTOGENARIANS*

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There is controversy whether short and long term results of coronary artery bypass grafting (CABG) in elderly patients justify performing the procedure. Between January 1985-September 1992, 3357 patients underwent CABG. Of these patients 2903 were isolated CABG procedures, of whom 94 (2.8%) were 70 years. There were 70 men and 24 women and 62 (66%) were in NYHA class IV. Sixty six patients (70.2%) had had at least one preoperative AMI. All of the operations were performed under elective conditions. The thorasic mammary artery was used in 55%. The mean number of bypass grafts was 2,3 per patient. The hospital mortality was 12.8% and late mortality was 6.1%, in contrast to the 3.2% mortality of the younger patient group. Preoperative concomittant chronic pulmonary and renal disease were predictors of mortality (p< 0.001), (p< 0.05). Of the patients discharged from the hospital, 59 (62.8%) were followed up for a mean of 35.9 months (7 to 68). Postoperatively 94% were for cardiac problems. Although elderly patients have a somewhat increased operative mortality rate, particularly if operated urgently or emergently, long term survival and freedom from angina are excellent and justify continued performence of CABG in selected patients over 70 years of age. In this group of patients every effort should be made to operate the elder in elective condition.

Key words: Coronary artery bypass, mortality, aged.

The number of elderly patients who may be.candidates for CABG for severe coronary artery disease has increased. Many of these elderly patients still enjoy productive lives, limited only by their symptomatic coronary artery disease. Cardiac surgery in the elderly is a higher risk procedure because so many patients have concomittant systemic disease and other disabilities. Considering the high mortality risk of the operation, the question arises whether the long trem results of CABG in the elderly who survive the operation justity the procedure.

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Table 1. Preoperative Clinical Characteristics of Patients Undergoing Isolated CABG

Characteristics	n of patients < 70 years old	(%)	n of patients ≥70 years old	%	p value
Total					
Men	2146	86	70	74.5	NS
Women	393	14	24	25.5	<0.05
Age (years)					
Mean	54.8		73.4		
Range	25.69		70.82		
Previous AMI	1657	59	66	70.2	NS
Diabetes Mellitus	337	12	57	60.1	<0.001
Hypertension	1067	38	32	34	NS
Hyperlipidemia	674	24	28	30	NS
Congestive Heart Failure	309	11	62	66	<0.001
Stable Angina	1264	45	21	22.1	<0.05
Unstable Angina	1180	42	52	55.3	<0.05
Unstable Angina with recent AMI*	225	8.1	14	15	<0.05

NS: Non Significant (p> 0.05)
*Defined as a transmural Q-wave infarction or non transmural infarction (CPK-MB≥60 Units) within 8 weeks of surgery.

Material and Methods

Between January, 1985, and September 1992, 3357 patients underwent CABG procedures at the Koşuyolu Heart and Research Center. 2903 (86%) of these procedures were isolated CABG operations. Of these isolated CABG procedures 2.8% (94) patients were older than, and 97.2 (2809) were younger than 70 years of age (Table I). Patients having concomittant ventricular aneurysmectomy, valve replacement or repair aortic resection or peripheral vascular procedures were excluded. Patients who were selected to be operated with normothermia and antegrade-retrograde normothermic continuous blood cardioplegia technique were also excluded from thes study. 74.5% of the elder patients were male (Table I). Preoperative evaluation of both of the patient groups included history of diabetes mellitus, hypertension, previous AMI, congestive heart failure, renal failure, hyperlipidemia, chronic obstructive pulmonary disease (Table I and II). Indications for surgery included chronic stable angina, which was defined as angina with effort that had remained stable for 60 days before surgery; unstable angina, which was defined as recent angina onset; angina at rest; and angina with progressive frequency or prolonged myocardial ischemia characterized by ST-T wave changes. AMI was defined as electrocardiographic detection of a Q wave that was greater than or equal to 0.4 seconds long or a normal ECG-with elevated enzyme levels. There were no emergency operations. All of the patients were operated electively in the elder group. Left ventricular cathaterization and coronary angiorafic data is given in Table III. Left ventricular end diastolic pressure (LVEDP), and ejection fraction (EF) was measured in every patient. Left ventricular wall motion was classified as normal if all segments coutracted normally and had only minimal hypokinesia, or if moderate wall motion impairment indicated at least one moderately hypokinetic segment but no akinetic or dyskinetic segment. Severe wall motion impairment was indicated if at least one

Table II. Serious Concomittant İllneses in the elderly 94 patients

Concomittant	n	(%)	Mortality (%)	p value
Chronic pulmonary disease	21	22	12	<0.001
Cardiac disease[a]	7	7.2	4.3	<0.05
Chronic renal disease[b]	4	4.3	3.2	<0.05
Severe degenerative or connective tissue disease	1	1.1	–	NS
Psychiatric illness	1	1.1	–	NS
Other[c]	4	4.2	–	NS

[a] cardiac disease include heart bloke requiring pacemaker, VT, atrial fibrilation, asymmetrical ventricular hypertrophy.

[b] chronic renal failure was accepted when creatinin > 2 mg/dl and creatinine clerence < 60 mg/hour

[c] others include active peptic ulcer, central nervous system disease, severe iron deficiency anemia, hypothyroidism, prastate Ca.

segment was akinetic or aneurysmal. Patients who need an additional aneurysmectomy were excluded from this study.

Coronary stenosis was considered significant if the stenosis was at least 70% in the luminal diameter in any view. The decision of operation was made by cardiology and cardiac surgery teams together.

All patients had pulmonary artery thermodilution cathaters inserted before anesthetic induction. Patients were anesthetized using a narcotic anesthetic technique.

Surgical techniques included standart cardiopulmonary techniques with simultaneus harvesting of saphaneous veins, use of IMA or both. In all cases centrifugal pumps and membrane oxygenators were used. Myocardial protection was provided with cold potassium cardioplegia initially, and continued with intermittent cold blood cardioplegia, and warm blood cardioplegia was applied before the cross clamp was removed. In critical LMC patients cardioplegia was also delivere retrogradely via the coronary sinus. Systemic (24-30°C) and topical hypothermia was applied.

All distal anastomosis were coustructed during a single period of aortic occlusion, and proximal anastomosis were constructed after removal of aortic cross clamp during rewarming. IMA flow was tested in every case and was utilized if flow was over 50 ml/minute. All group data are expressed as mean±standart error of the mean. Statistical differences between groups, that is,old versus young, were determined by chi square analysis with application of the Fischer exact test. A p value of 0.05 was identified as the significance level.

Results

Tables I, II and III summarize preoperative clinical features. A higher percentage of elderly patients had a history of diabetes mellitus (60.1% vs 12%, p< 0.001), congestive heart failure (66% vs 11%, p< 0.001), unstable angina (55.3% vs 42%, p< 0.05), and unstable angina with recent AMI (15% vs 8.1, p< 0.05). Previous AMI history rate was nonsignificant among the both groups.

In the elderly group, serious concomittant illnesses such as chronic pulmonary disease (p< 0.001), cardiac disease other than coronary artery occlusion (p<0.05), and chronic renal disease (p<0.05) influenced the out-come. The factors could be accepted as predictors of mortality.

Table III. Preoperative Angiographic and Hemodynamic Characteristics

Characteristics	n of patients < 70 years old	(%)	n of patients ≥70 years old	%	p value
Single vessel disease	112	4	22	23.4	NS
Double vessel disease	702	25	33	35.1	<0.05
Triple vessel disease	1994	71	39	41.5	NS
LMC ≥ 50%	449	16	29	31	<0.05
Left ventricular wall motion					
Normal	1573	56	15	16	<0.001
Moderate	449	16	51	54	<0.001
Severe	786	28	28	30	<0.05
LVEDP ≥ 20 mmHg	477	17	39	41.1	<0.001
EF ≤ 40%	1123	40	42	44.1	<0.05

NS: Not Significant

A significantly greater percentage of patients in the elder group had LMC obstruction (31% vs 16%, p<0.05), left ventricular dysfunction characterized by LV performence score, EF (44.1% vs 40%, p< 0.05), and LVEDP (41.1% vs 17%, p<0.001). It is suprising that the triple vessel disease incidence was significantly more encountered in the younger patient group. This is probably due to the fact that the triple vessel diseased patients could not survive until the seventh decade of life span.

The mean number of bypass grafts was greater in patients in the young group (3.4±1.0). This is a significant disadventage for the elder group, which suqqests that, although elderly patients in general had a greater number of diseased vessels, the seventy of coronary artery disease in these patients often precluded complete revascularization. The significantly higher incidence of coronary endarterectomy (64% vs 36%, p<0.001) and perioperative AMI (10.6% vs 4%, p< 0.001) also verifies this finding. The LIMA utilization in the elder group which was significantly lesser than the younger patients (55% vs 92%, p<0.001) probably was the main cause of deaths in the long follow up period. The mean periods of aortic occlusion and of CPB did not differ significantly between the two groups (Table IV).

Patients 70 years of age and older had an increased incidence of perioperative AMI (which was mentioned above (10.6% vs 4%, p<0.001), requirements for inotropic and IABP support (23% vs 8%, p<0.001) (7.2% vs 2%, p<0.05), cerebrovascular accident (8% vs 1.8%, p<0.001), prolonged ventilatory support (15% vs 3.4%, p<0.001), and postoperative renal failure (5.3% vs 0.8%, p<0.001).

Table IV. Technical Details of the CABG procedures

Parameters (Mean)	Patients < 70 years old	Patients ≥ 70 years old	p value
Number of grafts per patient	3.4±1.0	2.3±1.1	p<0.001
Number of LİMA	92%	55%	p<0.001
Coronary endarterectomy	36%	64%	p<0.001
Cross-clamp time (min)	48±7.3	40±5.9	NS
Bypas time (min)	78±12.3	71±13.9	NS

Table V. Postoperative complications

Complication	n of patients < 70 years old	(%)	n of patients ≥70 years old	%	p value
Perioperative AMI	112	4	10	10.6	<0.001
Postoperative IABP	56	2	7	7.2	<0.05
Postoperative inotropik supp.	224	8		23	<0.001
Cerebrovascular accident	51	1.8		8	<0.001
Postoperative respiratory failure	95	3.4	14	15	<0.001
Postoperative renal failure	22	0.8	6	5.3	<0.001

Preoperative concomittant pulmonary ($p< 0.001$), cardiac ($p<0.05$), and renal status ($p<0.05$) had a significant correlation with these post-operative complications and mortality (Table III, V).

The hospital mortality rate was significantly higher in patients of the elder age group (12.8% vs 3.2%, $p<0.001$). Late mortality rates were also higher in the patients 70 year of age or older, but was not statistically significant. The main cause for death in the majority of the elder patients was multiorgan failure which was triggered by posoperative low cardiac output or respiratory failure 3 patients died because of congestive heart failure, 1 from lung Ca, 1 from gastrointestinal Ca in the long follow up period. Follow up was obtained with 59 of the surviving total 77 patients, and ranged from 7 to 68 months (mean 35.9). Ninety four percent of the patients were NYHA I or II at long term controles (Table VII). Six percent patients were rehospitilized for cardiac reasons. All most all of these patients had a serious concomittant illness preoperatively.

Discussion

As the population ages, more elderly patients have signs and symptoms of coronary artery disease syndromes. With the increasing benefits of direct myocardial revascularization, more of these patients are considered possible condidates for CABG. However this group of ptients represent a significantly increased preoperative risk factors and can be expected to have increased postoperative mortality and morbidity. It appears that the increased mortality and morbidity is related to an increased susceptibility to serious postoperative complications and to provide complete revascularization. Studies of CABG surgery in patients 70 years and older have demonstrated a mortality ranging from 1.6% to 22% (1-4).

In this study the hospital mortality of patients older than 70 years was 12.8% compared with the younger group of 3.2% ($p< 0.001$). Although the late mortality rates were higher in the former group, this did not show statistical significance. It has been stated that 94% of the

Table VI. Mortality rates

	Patients < 70 years old n=2809	Patients ≥ 70 years old n=94	p value
Hospital mortality	3.2% (90)	12.8(12)	<0.001
Late mortality	3.5% (87)	6.1% (5)	NS
Overall mortality	61%(177)	18.1%(17)	<0.001

Table VII. Preoperative and postoperative functional status of the 59 patients from the total surviving 77 patients.

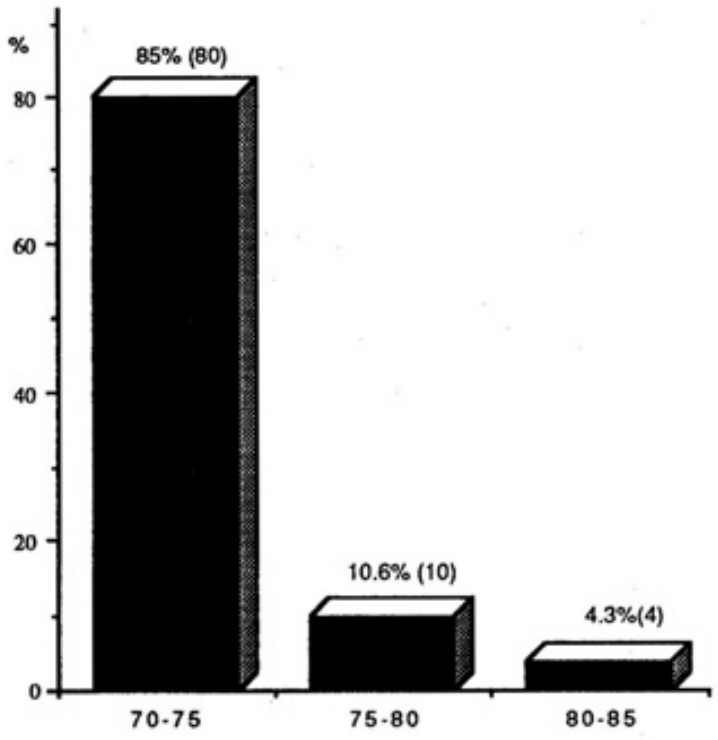
NYHC	% Preoperative n	% Post operative
I	1.8	69.1
II	23.0	24.9
III	53.2	6.0
IV	22.0	—

59 survivors which could be contacted (59% of the total patient population) has an improved life style. Although short term morbidity is much higher than in youngers patients, long term studies support the significant enhancement of the quality of life postoperatively (5-10).

It has been stated that mortality of coronary artery bypass surgery in the elderly are adversely influenced by NYHA functional class status and need of mechanical support preoperatively, urgent or emergency operation, concomittant serious illness, development of major postoperative complications such as respiratory renal failure or hemorrhage, prolanged aortic cross clamp time, extensive coronary artery disease (4, 12, 13).

In this serie congestive heart failure ($p< 0.001$), unstable angina with or without recent AMI ($p< 0.05$), moderate to severe left ventricular wall motion dysfunction ($p< 0.05$) and LMC disease ($p< 0.05$) incidence was sigificantly higher in the elder patient group.

All of the patients in the elder group were operated electively, following aggresive medical treatment. Like the others we do



Graphic 1: Distribution of the ages of the 94 patients operated over age of 70.

beleive that urgent or emergency operations in the elderly increase the operative mortality significantly. It has been stated that the mortality rate for emergency operations is about ten times grater than the rate for elective operations (10, 13-15). Therefore careful selection of patients is critical, especially in the emergency situation. In evaluating older patients for urgent or emergency CABG findings of other organ dysfunction should be carefuly considered.

Extensive coronary atherosclerosis was another handicap in the elder patient group, which suggests that in every case complete revascularization could not be performed ($p< 0.001$). The significantly higher incidence of coronary endarterectomy performed ($p< 0.001$), and perioperative AMI ($p< 0.001$) also verifies this situation. Aortic corss-clamp time was not a significant fact in this group of patients.

The increased morbidity and mortality in the elder age group is largely attributable to concomittant non-cardiac disease. (4, 10, 11, 14-17). It appears that the elderly patients is more susceptible to serious neurological, pulmonary, renal or septic complications. These complications are more likely to results in death in older patients than young ones. In this serie neurological or septic complications did not seen to influence the out-come significantly. However preoperative concomittant pulmonary disease ($p< 0.001$), and chronic renal disease ($p< 0.05$) were predictors of mortality.

Operative survival is not the only factor relevant to asses the feasibility of CABG in the patients over 70 years old. The quality of life and long term freedom from angina are equally important. Our serie and others, document acceptable post operative improvement (16-18). It is important to try every efort to operate in elective conditions.

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