CABG In Elderly - The AFIC Experience

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Summary:

CABG surgery in elderly is reported to be associated with higher morbidity and mortality. Exact reasons are not known but age itself has been proposed as an independent risk factor. We report our experience with 50 cases of CABG surgery between ages of 70-75, at AFIC/NIHD. We observed a 30-day mortality of 12% which is slightly higher than some of the reported series. We had one intra-operative death and 18% peri-operative infarction rate. The most important factor affecting mortality appeared to be non-elective surgery and pre-operative left ventricular function. Age alone, functional status, diabetes, other co-morbid conditions, and "learning-curve effect" had no statistically significant impact on mortality in our study population.

Key Words:

CABG-in-elderly, mortality-after-CABG, cardiac-surgery-in-elderly.

Introduction:

Coronary artery bypass graft surgery in elderly population has been viewed with skepticism in past. Most studies have been reporting an increased morbidity and mortality in elderly population undergoing CABG surgery ranging from 3.5% to as high as 22%[1]. With increasing mean population age, rising incidence of coronary artery disease and greater availability of cardiac surgery facilities to our population, more and more old people are coming to, and are being accepted for sugery.

Reasons for this apparent increased risk are not entirely clear. Advancing age has been proposed as an independent risk factor for excess mortality[2], but other co-morbid conditions like diabetes, hypertension, COAD and renal impairment may also be contributory.

The defining limit for 'old' has remained somwhat arbitrary; some studies have used 65 years as a cut-off point, others 70 while still others use 75 years. Some studies have described subgroups as 'young elderly' (75-80 years) and 'old elderly' (> 80 years). These differences make the comparison difficult.

CABG surgery in elderly is being performed in Pakistan at various centers but the results are generally not available for analysis/comparison. We report our experience of CABG surgery in elderly, defined as age above 70 years, in our population, with an attempt to define pre-operative as well as peri-operative predictors of higher risk in short-term follow-up.

Patients & Methods:

We retrospectively studied records of all patients above the age of 70 years, operated at Armed Forces Institute of Cardiology between 1982 & 1997. A total of 50 cases were identified and all of their available clinical data was analyzed.

TABLE 1

Pre-operative characteristics of study population

Parameter	Percentage/Value	
Mean Age	71.72±7.15	(Range 70-75)
Sex	Males 49	(98%)
	Female 01	(02%)
Pre-operative myocardial infarction		100%
Pre-operative angina status	CSS-I	4%
	CCS-II	18%
	CCS-III	58%
	CCS-IV	20%
Echocardiographic LV function	Good	48%
	Moderate	48%
	Poor	4%
LVEDP on ventriculography	<8	20%
	8-20	60%
	>20	20%
Concomitant disease	Diabetes	36%
	Renal disease	26%
	Pulmonary	08%
	Others	10%
Operative status	Urgent surgery	80%
	Elective Surgery	20%

Standard cardio-pulmonary bypass procedure with membrane oxygenator were used in all cases except one. Single venous and ascending aortic cannulas were routinely used. Left ventricular vent was not used. Different myocardial protection methods were used; cold crystalline cardioplegia, fibrillation with intermittent cross-clamping and Luke-warm Oxygenated Blood Cardioplegia.

Most cases in our series were elective procedures. Urgent surgery was perfomed in left main stem disease cases and those with unstable angina. None of our cases received mammary artery grafts.

Data was analyzed using standard statistical package. Chi-square test (with Yate's correction where required) and unpaired T-test were used for comparison. A p value of 0.05 was considered significant.

Results

Our population consisted of 50 patients, 98% males, with a mean age of 71.72 years and a standard deviation of 1.75. of them, 36% were known diabetics, 26% had deranged renal function, 8% had lung function impairment and 10% had other associated diseases.

Pre-operatively, only 4% had no angina, 18% had CCS-II, 58% CCS-III and 20% had CCS-IV angina. On transthoracic echocardiography, 48% had good LV function, 48% moderate and 4% had poor LV function.

Angiography had shown triple vessel disease in all cases: left main stem disease was present in 20%, LAD in 92%, first diagonal 40%, second diagonal 6%, left circumflex 76%, first obtuse marginal in 30%, second obtuse marginal in 32%, right coronary artery in 70% and posterior descending branch was involved in 16% of the cases. 20% of the patients had left ventricular end-diastolic pressure of <8mm, 60% has pressure between 8-20 mm, while 20% had LVEDP of > 20mm.

All patients had had at least one electro-cardiographically documented myocardial infarction. Indications for surgery were angina refractory to medical therapy, triple vessel disease not amenable to PTCA and left main stem or equivalent.

During surgery, saphenous vein grafts were employed in all cases. No internal mammary artery grafting was done. 4% of patients received only one graft, 18% had 2 grafts, 46% had 3 grafts, 24% had 4 grafts while 8 had five vein grafts. During surgery, LAD was grafted in 98% of cases, first diagonal in 34%, second diagonal in 4%, left circumflex in 50%, first obtuse marginal in 36%, second obtuse marginal in 30%, RCA in 52% and Posterior Descending Artery in 24% while other vessels were grafted in 8% cases.

Post operatively, 4% cases required IABP. 92% had smooth CPB recovery. 52% patients required ventilatory support for more than 12 hours. 18% sustained peri-operative infarction, 2% suffered cerebral damage and 20% had psychosis lasting more than 2 days.

We had one intra-operative death who was the only female in our study. 10% of the patients died within 30 days of operation. Out of a total of 6 deaths in the

TABLE 2

Operative characteristics of study population

Parameter	Percentage/Value	
Conduits	Vein grafts	100%
	IMA	0%
Cardiopulmonary bypass	Non pulsatile	100%
CPB recovery	Smooth	92%
	IABP use	04%
Ventilatory support	>12 hours	52%
	<12 hours	48%
Number of grafts	1	4%
	2	18%
	3	46%
	4	24%
	5	08%
Complications	Peri-op infarction	18%
	Operative death	02%
	30 day mortality	10%
Cause of death	Pump failure	50%
	Renal failure	17%
	Infection	17%
	Peri-op infarction	17%

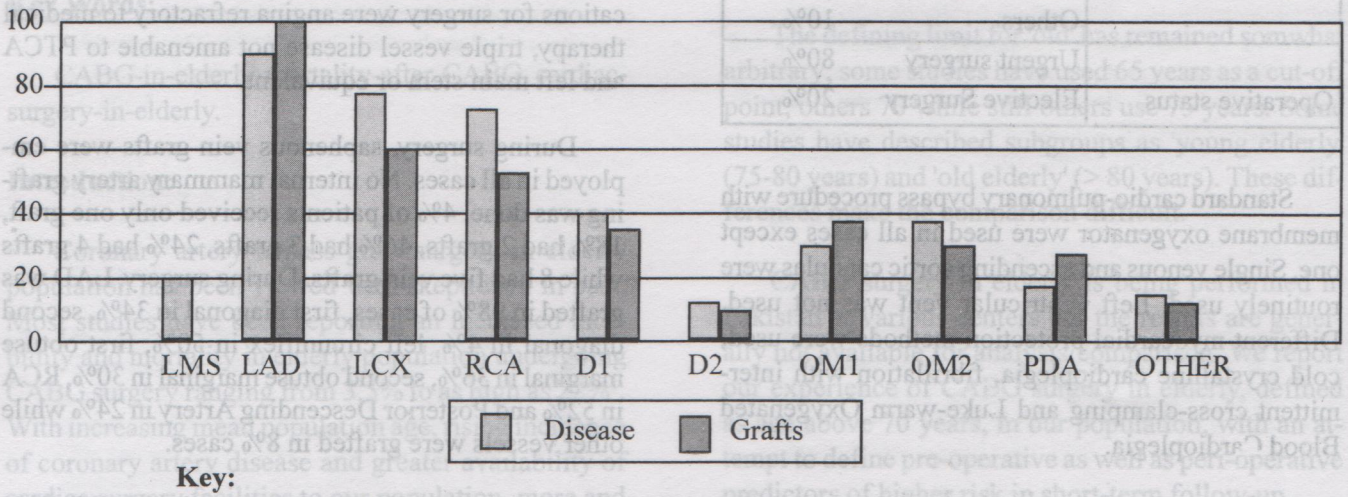
series, 3 died because of myocardial pump failure, and 1 each because of renal failure, infection and peri-operative infarction.

Mean follow-up period in our study was 2 years. During this period, 86% of the patients were angina free while 2% were still having angina but there was definite improvement in scale of angina.

Important aspects of the results are tabulated in Tables 1&2 and Figure-1 below.

Discussion:

Increased morbidity and early mortality after CABG sugery in elderly is well documented in almost all reported series, though the exact reasons are not clear. Of all the known or suspected factors contributing to high mortality after CABG in elderly, age itself has been most consistently incriminated. The Coronary Artery Survival Study (CASS)[2] clearly established the fact: people above the age of 75 years had a mortality of 9.5% as opposed to 3.5% in those below 75 years. In our study, however, advancing age was not found to be associated with corresponding rise in mortality (p=0.4). This could be explained by the



Key:

LMS	Left main stem	D2	Second diagonal
LAD	Left anterior descending artery	OM1	First obtuse marginal
LCX	Left circumflex artery	OM2	Second obtuse marginal
RCA	Right coronary artery	PDA	Posterior descending artery
D1	First Diagonal		

Figure: 1
Patterns of coronary artery disease & grafts

fact that there was very little variance in age (70-75) and relatively small numbers in each age group.

Various authors have given different mortality figures for their series as summarized in Table-3. Our mortality figure of 12% ranks among the highest. However, this needs to be interpreted with caution for reasons described below.

In our population the mean age is about 50 years. This is 20 years shorter than the American population mean of 70 years and even more so as compared to certain European populations. Moreover, general health status of those nations is comparatively better. Therefore two population with chronologically similar ages may not be comparable indeed. This fact is supported by common observation that in our population, the age of presentation of almost all cardiovascular diseases is generally 10-15 years earlier than American or European populations. Our 70-75 years old patients, perhaps ought to be compared with above 80 population in west. Thus considered, our results are similar or even better[1].

Another important difference in our study population and those reported elsewhere is higher proportion of pre-operative myocardial infarction rate which may have important prognostic implications. Moreover, most of the studies have reported an overall low mortality figure and data has not been analyzed with a view to indicate mortality in older and younger patients separately. Those who have done so, have reported significantly higher mortality in older age subsets which are closer to our reported mortality. (Table-3)

TABLE 3

Comparison of results of various series

Study	N	Mean Age	MI Rate	Mortality
Acinapura	685	74	61%	7%
Gardner	72.3	73.7	66%	9.7%
Horneffer	228	73	61%	9.3%
Huysmans	220	73	59%	7.7%
Montague	597	73	45%	2.7%
Noyez	102	74.2	60%	2.9%
Rahimtula	178	75-84	46%	3.0%
Rich	60	77.6	78%	3.3%
Rose	201	73.8	60%	5.9%
Saldanha	73	76.2	45%	2.7%
Tsai	693	70-86	55%	6.2%
Shafkat et al.	50	71.72	100%	12%

Modified from Keith et al.

TABLE 4

Characteristics of non-survivors

Parameter	Percentage
Urgent surgery	80%
LV dysfunction	60%
LVEDP > 8	100%
Diabetes	33%
Angina CCS-III/IV	60%
2 or more grafts	100%
TVCAD	100%
Prolonged ventilation	60%
Prolonged psychosis / cerebral damage	60%
Peri-operative infarction	40%
Pre-operative risk factors	3 risk factors 66% 4 risk factors 33%
Peri-operative risk factors	1 risk factor 16% 2 risk factors 68% 4 risk factors 16%

Emergent or urgent surgery has been consistently reported to be associated with higher mortality. In fact, the results of elective surgery in elderly patients may be comparable to younger patients. In one study, mortality for elective surgery in patients above 80 years was 0% while for emergency surgery the mortality was 75%[3]. In our series, 20% patients had left main-stem disease, 20% had angina CCS-IV and another 58% had angina CCS-III. Combined, these account for 80% of our cases. This group was offered urgent surgery. Our sole intra-operative death and 4 of the remaining five belonged to this group. This group had a mortality of 12.5% as compared to 10% in non-urgent group. The difference, however, did not reach statistical significance because of small sample size and disproportionate group sizes.

Poor ejection fraction preoperatively, greater functional disability, higher LVEDP, diabetes and extent of coronary disease, all contribute towards poor prognosis[4]. Of all these, poor ejection fraction was the only predictor of poor outcome in our study; patients with poor ejection fraction had 50% mortality, those with moderate ejection fraction had 16.5% mortality while patients with good ejection fraction had 9% mortality. The case of inter-operative death in our series was an obese female with poor ejection fraction. Her LVEDP was more than 20; she was severely symptomatic (CCS-III) and required 3 grafts, all indicators of bad prognosis. Consequently, she had bad CPB recovery and sustained a peri-operative infarct. Of the other 5 cases of early mortality, 3 (60%) had moderately poor ejection fraction, 2 (40%) had LVEDP of > 20 and 3 (60%) had LVEDP of 8-20 mm. 3 (60%) were having angina CSS-III/IV and all had extensive coronary disease. 2 (40%) required 3 grafts, 2 (40%) had 4 grafts while 1 (20%) had 5 grafts implanted. 1 (20%) required IABP support, 2 (40%) sustained peri-operative infarcts, 2 (40%) had prolonged psychosis while 1 (20%) sustained cerebral damage. However, when surviors were compared with the dead as a group, there was no statistically significant difference in occurrence of any preoperative or peri-operative parameter when studied individually. This is most likely due to small sample size. However, when we analyzed our data with regards to presence of multiple pre-operative or peri-operative risk factors, we found that presence of two or more risk factors was strongly predictive of poor outcome. The data are tabulated in Table-4.

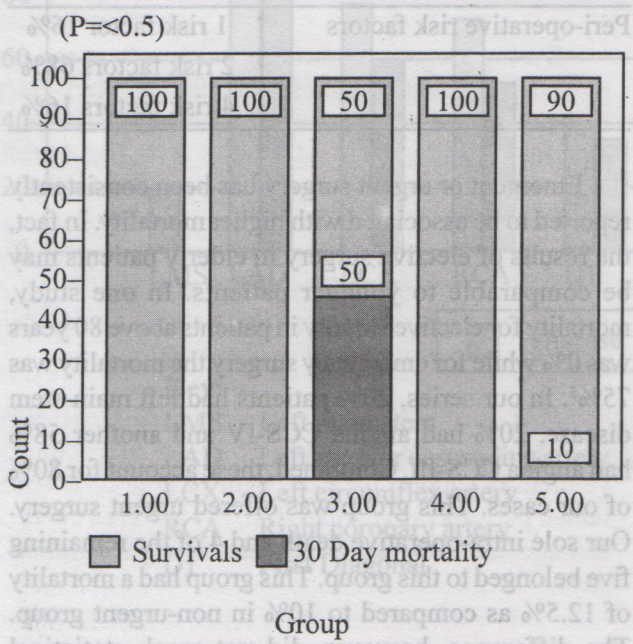


Figure 2.
The "learning curve effect"

Internal mammary artery grafting has been shown to be associated with better short-term as well as long term prognosis[5]. In our study, none of the patients was offered IMA graft mainly for concern of sternal dehiscence, longer operative timings and infection. It is known that bilateral IMA grafting adversely affects sternal wound healing due to reduced blood supply in the area and predisposes to infection, especially in diabetics with a relative risk of 5[6]. IMA deprivation and extensive use of cautery, especially in older age may contribute towards increased incidence of sternal dehiscence and wound infection (3.1% in > 70, 0.2% in <60)[7]. Taking number of grafts and CPB timing as an indicator of operation time, no significant difference was noted among surviours and the deceased. After observing that unilateral IMA deprivation does not significantly affect wound healing, we have now started employing IMA for grafting.

In order to assess the impact of learning-curve effect, we analyzed our data in five groups of 10 each in chronological order. However, the mortality was not found to be significantly different among these five groups as shown in Figure-2.

The outcome of the surgery in survivors has been excellent. Overall, 86% of the study population are angina free till last follow up. Excluding fatalities, the figure becomes 98%. However, the follow up period in our study is rather short and it would be too early to draw definite conclusions.

Conclusion:

CABG surgery in elderly, though associated with a modestly higher mortality, has an acceptable risk-benefit ratio in properly selected patients. A symptomatic patient, who has no other therapeutic option should not be denied of potential benefits of surgery solely because of his age. As far as possible it should be performed as an elective procedure after careful preparation of the patient, in which instance, the results may be comparable to younger patients.

Presence of pre-operative risk factors should alert the surgeon of the potential of future complications. IMA grafts may be preferred. Extensive peri-operative monitoring with special emphasis on proper tissue oxygenation is required. Surgery offers excellent short and long term symptomatic improvement in survivors.

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