Predictors of Outcome After Coronary Bypass Surgery in Patients with Left Ventricular Dysfunction

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Objective: The aim of this study was to determine the risk factors affecting the mortality and morbidity after coronary artery bypass grafting (CABG) in patients with LV dysfunction and without any viability assessment.
Methods: The preoperative, perioperative, and postoperative early and mid-term follow-up data of 252 patients with left ventricular ejection fraction (LVEF) of ≤30% who underwent isolated CABG from 1995 through 2000, were evaluated. No preoperative viability study was performed for patient selection. Preoperative echocardiography and cardiac catheterization, and postoperative control echocardiography were performed in all patients. Follow-up data after the discharge of these patients were obtained via monthly periodical examinations in the first 6 months, and thereafter via telephone interviews. As preoperatively, 229 (90.87%) patients were in NYHA class III or IV, and the mean LVEF was 26.58±3.66%.
Results: Overall mortality and late mortality rates were 16.27% and 5.16%, respectively. Postoperative complications were observed in 61 (24.21%) patients. During 49.06±15.17 months of follow-up, 185 (93.43%) of 198 (78.57%) survived patients were in NYHA class I or II and the mean LVEF was 39.64%±5.68%. Advanced age, diabetes, hypertension, cross-clamp time >60 min, bypass time>120 min, severity of angina and functional classes (class III-IV of NYHA and CCS) were found to be the determinants of mortality. However, by multivariate analysis only older age and class III-IV of NYHA and CCS were detected as predictors of mortality.
Conclusion: The low mortality and morbidity rates as well as postoperative improvements in functional capacity and in LVEF support the use of CABG without the need of any viability assessment in patients with left ventricular dysfunction. Advanced age, severe angina and functional symptom status seem to be the predictors of poor prognosis in these patients after CABG. *(Ana Kar Der, 2002;2:26-34)*
Key words: Coronary artery bypass, left ventricular dysfunction, risk factors

Introduction

Coronary artery bypass grafting (CABG) in patients with poor left ventricular (LV) function remains a surgical challenge and an arguable matter. Despite the poor long-term survival and unsatisfactory results in controlling angina with medical management, cardiologists have still moved hesitantly to refer such patients for coronary revascularization as well as surgeons have been indecisive in determining the most suitable operation type (1-3). These patients were regarded as inoperable, because mortality rate of surgical revascularization in early reports was as high as 50% (4). More recent studies reported lower mortality rates in surgical revascularization of such patients. However, because CABG in these patients is associated with an increased risk of perioperative mortality, the long-term survival benefit is dependent on low mortality rates (5, 6). Although risk factors for mortality after CABG have been defined by several studies (7-11), only few studies have focused on predictors of mortality in patients with LV dysfunction (6, 12, 13). Moreover, most of them have used selection criteria to exclude high-risk patients or those least likely to benefit from revascularization. Some studies suggested that patients with angina had

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more favorable outcome in surgical revascularization than the ones with symptoms of heart failure (14), while others recommended the use of positron emission tomographic scanning (PET) or dobutamine echocardiography to demonstrate reversible ischemia or viability of myocardium in selecting patients for CABG (3, 15). However, some other centers still have recommended that the presence of graftable vessels is adequate for CABG indication in such patients with poor LV function (16).

The present study was designed to determine the risk factors affecting postoperative mortality and morbidity rates of CABG which had been performed in patients with LV dysfunction and without any viability assessment.

Patients and Methods

Patient Population and Data Collection: We studied 252 patients with left ventricular ejection fraction (LVEF) ≤30% who underwent isolated CABG between 1995 and 2000. The selection criteria for study group were the detection of coronary artery disease (CAD) suitable for revascularization on angiography and the LVEF ≤30% calculated by both 2-dimensional echocardiography (Hewlett-Packard Sonos ultrasound imaging system-Hewlett-Packard Company, Palo Alto, CA) and uni- or biplane contrast left ventriculography. Patients who had prior CABG, LV aneurysm, CAD unsuitable for CABG, moderate to severe mitral insufficiency (greater than 1+), and associated heart valve disease were excluded from the study. Patients were grouped according to timing of operation as elective, urgent or emergent. Elective patients who had been determined as CABG candidates were operated in stable conditions. Urgent patients were operated within 72 hours of an event because of left main coronary artery (LMC) disease or continuing unstable conditions despite intensive medical management. Emergency patients who had congestive heart failure (CHF) symptoms underwent CABG by intensive medical inotropic support within 6-12 hours of an ischemic event. Data were collected by trained chart reviewers by using standard data forms. As variables that might affect the mortality and morbidity, age (≥70 years), sex, angina class, symptom class, timing of operation, extent of CAD, LMC disease, chronic obstructive lung disease (COPD), diabetes, hypertension, renal failure, hypercholesterolemia, peripheral vascular disease, preoperative intraaortic balloon pump (IABP) usage, use of digitalis, diuretics or angiotensin-converting enzyme (ACE) inhibitors, preoperative ventricular tachyarrhythmias (VTs), prior myocardial infarction (MI) and percutaneous balloon angioplasty (PTCA) interventions were analyzed (Table 1). Canadian Cardiovascular Society (CCS) and New York Heart Association (NYHA) classifications were used for determination of angina and CHF status of patients, respectively. Preoperative echocardiography and cardiac catheterization were performed in all patients. The narrowing of coronary artery diameter ≥50% was considered significant (Table 1). Moreover, control echocardiographic evaluation was performed in all patients. In the preoperative determination of health status of patients, hypercholesterolemia was defined as the blood cholesterol level above 240 mg/dL and diabetes was defined as receiving antidiabetic medication or insulin for control of blood glucose level. Hypertension was defined as systemic arterial pressure >140/90 mmHg or usage of at least one antihypertensive medication. Renal failure was defined as serum creatinine level >1.5 mg /dL. Ventricular arrhythmia was determined as premature ventricular contractions, ventricular tachycardia, or ventricular fibrillation. Early-hospital mortality and late mortality terms were used to refer the deaths occurring within 30 days postoperatively and thereafter, respectively.

Perioperative MI was defined by CK-mB levels ≥90 IU/L and the presence of a new Q wave or R wave loss at least in two derivations of ECG. Respiratory distress indicated the need for mechanical ventilatory support exceeding postoperative 24 hours. Neurologic complication was referred as occurrence of a new transient ischemic attack (TIA) or stroke continuing more than 24 hours.

Operative Technique: After the induction of anesthesia, a radial artery cannula and a Swan-Ganz catheter were inserted to monitor the systemic pressure, and the cardiac filling pressures (Horizon XL-Mennen Medical Inc, Clarence, NY). All operations were performed through median sternotomy incision. Cardiopulmonary bypass (CPB) was established via standard aortic and single venous cannulation using a Sarns modified roller pump (Sarns, Ann Arbor, MI, USA). During CPB, oxygenation was achieved with a D708 Simplex adult hollow-fiber membrane oxygenator (Dideco, Mirandola, Italy), and a 40 mm blood filter (Dideco, Mirandola, Italy) was used on the arterial line. Besides antegrade cardioplegia delivery cannulas (Sarns, Ann Arbor, MI, USA) inserted in aortic root in all patients, retrograde cardioplegia cannulas (Gundry, DLP, Inc, Grand Rapids, MI) were inserted in 21 patients with

severe proximal CAD. During bypass, the hematocrit was maintained between 20% and 25%, nonpulsatile pump flow between 2.0 and 2.5 L/min/m2, and mean arterial pressures between 50 and 65 mmHg. After the aortic cross-clamping, the high-potassium (20 mEq/L), warm (37ºC) blood cardioplegia was infused into the aortic root at 10 mL/kg until diastolic arrest was achieved. Diastolic arrest was maintained by delivery of intermittent, moderately hypothermic blood cardioplegia. Topical hypothermia with cold crystalloid ice-slush solution was used in all operations. Body temperature was maintained between 28°C and 30°C during CPB. Distal anastomoses were performed during aortic cross-clamping and proximal anastomoses were performed with partial clamping during re-warming. Complete revascularization was aimed in all operations by using only internal thoracic artery (ITA) and saphenous vein grafts. Before the removal of cross-clamp, a last

Table 1: Preoperative demographic, symptomatic, clinical, and cardiac variables

Patient characteristics	n	%
Age (y)	61.14± 8.04 (39-83)	
Age ≥ 70 (y)	48	19
Male	229	90.87
Female	23	9.13
Elective operation	185	73.41
Urgent operation	58	23.02
Emergent operation	9	3.57
Diabetes	63	25
Hypercholesterolemia	98	38.89
Hypertension	102	40.5
Renal failure	2	0.8
COPD	35	13.89
Peripheral vascular disease (PVD)	29	11.51
Preoperative IABP	0	0
Preoperative digitalis therapy	121	48.01%
Preoperative ventricular arrhythmia	48	19.05
Prior PTCA	11	4.37
Previous MI	166	65.87
Single vessel disease in catheterization	5	1.98
Two-vessel disease in catheterization	40	15.87
Three-vessel disease in catheterization	207	82.15
LMCA disease in catheterization	33	13.10
Mean LVEF in echocardiography, %	-	26.58±3.66
NYHA class I	8	3.18
NYHA class II	15	5.95
NYHA class III	81	32.14
NYHA class IV	148	58.73

Diabetes: Insulin dependent or not; Hypercholesterolemia; blood total cholesterol level ≥ 240 mg/dL; IABP: Intraaortic balloon pump; LMCA: Left main coronary artery; LVEF: Left ventricular ejection fraction; MI: Myocardial infarction; NYHA: New York Heart Association PTCA: Percutaneous coronary angioplasty; Renal failure: Creatinine level > 1.5 mg/dL.

Table 1: Preoperative demographic, symptomatic, clinical, and cardiac variables

	mean	min - max
Average number of grafts	3.43 ± 0.66	1 - 5
CPB time (min)	87.76 ± 24.58	20 - 192
Cross-clamp time (min)	48.44 ± 13.86	11 - 106
Use of ITA (%)	86.9	219
Antegrade cardioplegia	91.67 %	231
Antegrade + retrograde cardioplegia	8.33 %	21

CPB: Cardiopulmonary bypass; ITA: Internal thoracic artery.

cardioplegic solution (hot-shot) at 37ºC containing 20% Mannitol was delivered in dose of 10 mL/kg. Intraoperative data are depicted in Table 2.

Follow-up data were obtained via monthly periodical examinations in the first 6 months, and thereafter via telephone interviews. Mean follow-up time was 42.14±19.96 months.

Statistical Analysis: Statistical analyses were performed by SPSS/PC+ (ver 8.0) computer program. The probabilty (p) less than 0.05 was considered significant. Frequency and % values of categorical variables, and mean, average and standard deviation values of continuous variables were determined. Patient characteristics and hospital outcomes were compared univariately by using t tests for continuous variables and chi-square or Fisher exact test for categorical variables. Differences between preoperative and postoperative symptom status were compared via linear trend analysis. Postoperative survival, mortality and morbidity were evaluated by Kaplan-Meier analysis. Correlates of survival, and risk factors affecting mortality and morbidity were analyzed by using Cox proportional hazards model and multivariate stepwise logistic regression analyses.

Results

Clinical Outcome, In-Hospital Events, and Late Follow-up: Overall mortality, 1-year mortality, and hos-

Table 3: Predictors of cardiac (arrhythmia, CHF, MI) and overall complications

Vriable		Cardiac Morbidity		p value	Total Morbidity		p value
		Yes	No		Yes	No	
Age	≥ 70	36	12	<0.0001	39	9	<0.0001
	<70	2	202		22	182	
NYHA	I-II	0	23	<0.031	0	23	<0.004
	III - IV	38	191		61	168	
CCS	I-II	0	38	<0.005	0	38	<0.0001
	III -IV	38	176		61	153	
Emergent operation	Yes	10	57	<0.758	25	42	<0.004
	No	28	157		33	152	
COPD	Yes	25	10	<0.0001	28	7	<0.0001
	No	13	204		33	184	
Diabetes	Yes	15	48	<0.025	24	39	<0.003
	No	23	166		37	152	
Hypertension	Yes	36	66	<0.0001	41	61	<0.0001
	No	2	148		20	130	
Preop VTs	Yes	13	35	<0.010	13	35	<0.887
	No	25	178		48	156	
Preop MI	Yes	31	135	<0.032	40	126	<0.912
	No	7	79		21	65	
Hypercholesterolemia	Yes	32	66	<0.018	25	73	<0.854
	No	6	148		36	118	
Cross-clamp time	>60 min	16	48	<0.039	23	41	<0.011
	≤ 60min	22	166		38	150	
Bypass time	>120 min	18	51	<0.012	25	44	<0.010
	≤ 120min	20	163		36	147	

CSS: Canadian Cardiovascular Society; COPD: Chronic obstructive pulmonary disease; MI: Myocardial infarction; NYHA: New York Heart Association; VTs: Ventricular tachyarmythmias.

pital mortality rates were 54 (21.43%), 19 (7.54%), and 13 (5.16%) patients, respectively. Four patients with LVEF of 25%, and >80 years old died of CHF within postoperative 24 hours. There were also 9 other hospital deaths because of multiorgan failure in which four occurred following the acute renal failure and the primary cause triggering the organ failures was detected as a low-output. There were 41 late deaths (15 sudden deaths, 9 deaths of noncardiac origin, 9 deaths of cardiac origin and 8 deaths of unknown cause). There were overall 105 postoperative events in 61 (24.21%) patients. The most frequent event was tachyarrhythmia seen in 29 (11.51%) patients. Twenty-five (86.2%) of 29 arrhythmias were severe ventricular tachyarrhythmias. Perioperative MI was detected in 4 (1.58%) patients who died within postoperative first 24 hours. Low-output syndrome with severe LV failure developed in 14 (5.55%) patients of whom 4 at perioperative period and 9 at postoperative early period died because of subsequently developed multiorgan failure. Multiorgan failure developed in 9 (3.57%) patients. Acute renal failure was detected in 10 (3.96%) patients. Respiratory distress developed in 23 (9.13%) patients. Stroke was seen in 12 (4.76%) patients in whom 7 patients had also multiorgan failure. Hemiparesis that was seen in 5 patients almost entirely recovered without any sequels. Mediastenitis developed in 4 patients cured with antibiotic therapy. The need for IABP to support LV function postoperatively was in 9 (3.57%) patients died at early postoperative period. Inotropic support with dopamine, dobutamine, or adrenaline was used in 108 (42.9%) patients at early postoperative period.

Factors Predictive of Morbidity: As determined by using univariate analysis, both cardiac (arrhythmia and CHF) and overall morbidities were related with older age (>70 years old). There was no clear association between sex and morbidity (p=0.614). Severe angina and functional symptoms (Class III-IV of CCS and NYHA) demonstrated strong correlations with both cardiac and overall complications. Although emergency in operation had no impact on cardiac events, it was a risk factor for total morbidity. Diabetes, hypertension, and COPD were significant risk factors for both cardiac and total complications. There was not any relationship between PVD and postoperative complications (p=0.264). Preoperative digitalis, beta-blocker or ACE inhibitor usage did not relate to cardiac (p=0.246) and overall (p=0.328) morbidity. The presence of preoperative VTs and prior MI demonstrated significant correlation with only cardiac complications. Previous PTCA was not a significant risk factor (p=0.226). Hypercholesterolemia was a significant predictor of cardiac morbidity, but not of overall morbidity. The extent of CAD with number of affected vessels (p=0.622) and LMC disease (p=0.55) were not significant risk factors. As perioperative factors, cross-clamp time >60 min and bypass time >120 min correlated with postoperative complications. Because perioperative or postoperative IABP support was used only in patients with failed medical inotropic support to improve the hemodynamic status, it seemed to be a significant risk factor for postoperative cardiac complications (p<0.0001) (Table 3). By multivariate analysis, the only predictors of morbidity were age, angina and NYHA functional class of III or IV (Table 4).

Factors Predictive of Mortality: The cause of hospital deaths in all patients were of cardiac origin (arrhythmias, CHF-low-output syndrome). By univariate analyses, older age, diabetes, hypertension, severe anginal and functional symptomatology (class III-IV of CCS and NYHA), cross-clamp time >60 min, CPB time>120 min, and the need for IABP support were found as determinants of mortality. As indicated before, IABP was used only when the other inotropic regimens failed to improve the hemodynamic status, it seemed to be a risk factor in early mortality. By multivariate analysis, however, the only predictors of mortality were age, anginal and functional symptom class of III-IV (Table 5).

Long-Term Survival and Changes in Anginal and Heart Failure Symptoms: The Kaplan-Meier estimated survival curves showed that patients without severe angina had a significant survival advantage over patients with severe angina (Figure 1). There was no any cardiac event in survived all 198 (78.57%) patients, but 9 patients died with MI, during follow-up period of 49.06±15.17 (13-72) months. Cardiac event-free survival was 95.65%. Control echocardiographic evaluations performed in a mean control time of 48±19.27 (13-56) months showed that mean postoperative LVEF of patients (39.64%±5.68%) was significantly better than that of preoperative (26.58±3.66%) (p=0.0002). In the preoperative period, 229 (90.87%) patients were in NYHA class III or IV (mean NYHA class of 3.464±0.749). One-hundred and eighty-five (93.43%) of the survived 198 patients have been in NYHA class I or II (mean NYHA class of 1.439±0.616) postoperatively and this improvement was significant (p<0.0001).

Discussion

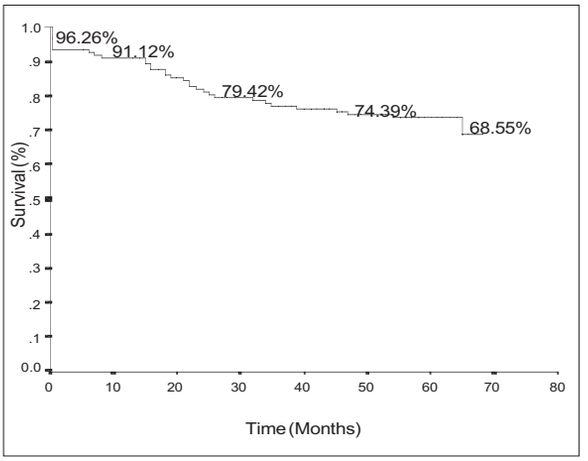
Medical therapy of patients with CAD and LV dysfunction has often been unsatisfactory and carries a poor prognosis. Louie and colleagues (17) reported a survival rate of less than 25% in 3 years. Luciani and colleagues (18) reported that the 5-year survival was 28% in patients with mean LVEF of 22% who received medical treatment. Although cardiac transplantation is an effective alternative method, the number of transplants is limited by donor availability so that only 10% of patients could be transplanted (19). Cardiomyoplasty which had been reported as another alternative method improving LV functions in experimental studies, is not so effective in human studies (20). Thus, there remains many patients with LV dysfunction for whom CABG may be the only alternative for symptomatic relief and survival. The Coronary Artery Surgery Study (CASS) having a historical importance in this field reported that there was an apparent surgical benefit for patients with LVEF <26% who had a 43.5% 5-year survival with medical therapy versus 63% with surgery (21). Mickleborough and colleagues reported 4%, 90%, and 72% of rates of hospital mortality, 1-year survival, and 5-year survival, respectively in a study in which 125 patients with LVEF <20% were evaluated (22). Our results on 5.16% of hospital mortality rate, and 78.57% of survival rate in 42.14±19.96 months of follow-up time were also compatible with results of current studies (23).

Many factors, such as case selection, coronary anatomy, myocardial preservation techniques, perioperative MI, graft competence, and age might influence the

Table 4: Predictors of overall morbidity by univariate and multivariate analyses

Variable	Univariate p value	Risk ratio	95% Confidence limits	Multivariate p value
Age (≥70)	< 0.0001	0.074	0.038 - 0.143	< 0.0001
CCS class III-IV	< 0.0001	0.801	0.746 - 0.860	0.0001
NYHA class III-IV	0.004	0.880	0.835 - 0.927	0.0257
Diabetes	0.003	0.519	0.341 - 0.789	0.2819
COPD	< 0.0001	0.080	0.037 - 0.174	0.4640
Hypertension	< 0.0001	0.475	0.362 - 0.623	0.0504
Emergent operation	0.004	0.820	0.760 - 0.880	0.3734
Cross-clamp time	0.011	0.569	0.374 - 0.868	0.3745
CPB time	0.010	0.548	0.340 - 0.863	0.4236

CCS: Canadian Cardiovascular Society; COPD: Chronic obstructive pulmonary disease; Cross clamp time > 60 min; CPB time: Cardiopulmonary bypass time > 120 min; Diabetes: Insulin dependent or not; NYHA: New York Heart Association.



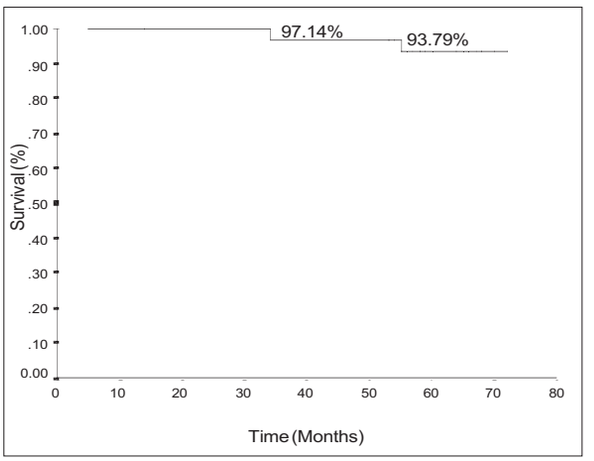


Figure 1: Kaplan-Meier estimated survival after coronary artery bypass grafting in patients with left ventricular dysfunction. A: Actuarial survival for patient subgroup without severe angina (Canadian Cardiovascular Society class I-II); B: Actuarial survival for patient subgroup with severe angina (Canadian Cardiovascular Society class III-IV)

outcome. Many authors suggest that myocardial viability tests, such as dobutamine echocardiography, thallium-201 imaging and PET must be performed in case selection, whereas others still recommend that the results of left ventriculography are adequate (24-26). Di Carli and colleagues reported that survival and symptom improvement after CABG performed on 93 patients with low LVEF without evidence of viability were apparent only in patients with severe angina, thereby emphasized the importance of viability tests and angina (3). However, results of other studies have indicated that there was no correlation between the presence of angina and severity, and extent of CAD or ischemia (27). Besides the studies showing the falling importance of angina in case selection, it has also been implied recently that the amount of dysfunctional myocardium had not a significant effect. Mickleborough and colleagues suggested that all patients with graftable CAD, LV dysfunction, and akinetic or dyskinetic segments of LV would benefit from CABG, and the intraoperative assessment of regional wall thickness and contractility was adequate in operability of such cases. If the myocardial region was scarred, thinned and nonfunctioning at intraoperative observation, ventricular remodelization to decrease LV volume and wall stress was recommended (16). All patients of the present study were selected for CABG according to results of preoperative ventriculography and echocardiography without performing any viability test, and coronary arteries of all patients were detected as graftable by angiography. Postoperative control echocardiographic evaluations showed significant improvements in LVEFs. Our results suggest that CABG can be performed safely in patients with LV dysfunction.

Postoperative 5-year survival rates have ranged from 60% to 80% in many of the recent studies (13, 16, 22). Majority of late deaths in these patients caused by progressive CHF symptoms and to a lesser extent events related to ischemia or sudden death (13, 15, 22). All of the hospital deaths occurred in our patients because of multiorgan failure developed secondary to low LV output, and late mortalities were related mostly to sudden death and somewhat ischemic cardiac events.

All of the former studies have emphasized the need to identify preoperative risk factors and predictors that have effects on long-term survival, mortality, and morbidity (13, 22). In an early study, Kennedy and colleagues performed discriminant analyses of data from the CASS. In 6176 patients who underwent isolated CABG from 1975 through 1978, overall operative mortality was 2.3% and was increased by age, LMC occlusion, female sex, poor LV function, and the presence of CHF findings (8). Myers and colleagues performed another analysis of 8991 patients in the CASS study who underwent isolated CABG, and identified CCS angina class and CHF score as additional determinants of mortality (9). Notably, the CASS study excluded patients with LVEF<35%. More recently, Christakis and colleagues studied 7334 patients who underwent isolated CABG between 1982 and 1986. Overall mortality was 3.7% and was significantly higher with emergency surgery, low LVEF, older age, and previous CABG (7). However, relatively few studies have focused on patients selected on the basis of LV dysfunction. In a study performed by Hochberg and colleagues on 466 patients with LVEF<40% in 1983, overall mortality after CABG increased progressively as LVEF decreased, from 11% in patients with LVEFs between 20% and 39% to 37% in patients with LVEFs <20% (6). A decade later, Hausmann and colleagues reported a prospective study of 224 patients with LVEFs of 10% to 30% who underwent isolated CABG. Overall operative mortality was 8.9%, and left

Table 5: Predictors of mortality by univariate and multivariate analyses

Variable	Univariate p value	Risk ratio	95% Confidence limits	Multivariate p value
Age (≥70)	< 0.0001	0.090	0.055 - 0.150	< 0.0001
CCS class III-IV	0.002	0.106	0.015 - 0.745	0.0023
NYHA class III-IV	0.023	0.188	0.027-1.296	0.0026
Diabetes	0.003	0.485	0.305-0.770	0.5111
Hypertension	0.025	0.586	0.366-0.940	0.1080
Cross-clamp time	0.01	0.535	0.335-0.854	0.6290
CPB time	0.013	0.545	0.341-0.859	0.8366

CCS: Canadian Cardiovascular Society; Cross clamp time > 60 min; CPB time: Cardiopulmonary bypass time > 120 min; Diabetes: Insulin dependent or not; NYHA: New York Heart Association.

ventricular end-diastolic pressure >24 mmHg, number of prior MIs, and NYHA class III or IV symptoms were significantly associated with mortality (12). Trachiotis and colleagues found that clinical predictors of mortality were older age, female sex, diabetes, severity of angina class, hypertension, and CHF (25). Some of these factors correlated with poor survival, such as diabetes, hypertension, CHF and previous MI were also predictors of postoperative angina (25). Mickleborough and colleagues showed that predictors of decreased survival were advanced age, functional symptom class IV, and poorly visualized coronary vessels unsuitable for CABG (16). Other factors identified in former studies (12, 14) including female sex, hypertension, absence of angina, VTs, and mitral regurgitation were not related to poor outcome in this series (16). Argenziano and colleagues studied 900 randomized patients with LVEF ≤35%, and identified that the presence of CHF symptoms as well as previous CABG were determinants of mortality, and advanced age, implantable cardioverter-defibrillator (ICD) implantation, and the presence and severity of CHF symptoms were determinants of increased length of stay in hospital (28). Whang and colleagues investigated the relationship between the diabetes and outcomes of CABG in patients with LV dysfunction, and reported that diabetes was not a predictor of mortality, but it was associated with increased postoperative complications and re-hospitalization (29). In the present study, advanced age, diabetes, hypertension, cross-clamp time >60 min, CPB time>120 min, and severe angina and functional classes (class III-IV of NYHA and CCS) were found as determinants of mortality as compatible with results of former studies. However, by multivariate analyses only older age and class III-IV of NYHA and CCS were detected as predictors of mortality, while gender was not a significant factor. Furthermore, IABP usage was a predictor of early mortality. However, a fact should be emphasized that the effectiveness and safety of IABP usage in patients with LV dysfunction to stabilize and improve the hemodynamic functions has been clearly demonstrated (13, 25). Since IABP used when all other medical inotropic supports had failed in majority of our patients, desired beneficial effects could not be seen and it was found statistically determinant of mortality and morbidity. In our study, cardiac morbidity was influenced by advanced age, class III-IV of NYHA and CCS, COPD, diabetes, hypertension, preoperative VT, previous MI, hypercholesterolemia, prolonged bypass and cross-clamp time, and IABP usage. Moreover, urgency in operation timing was the predictor of morbidity events like respiratory and neurologic complications. By multivariate analysis, the only predictors of morbidity were age, and severe anginal and functional symptom class III-IV.

In conclusion, CABG without case selection on the basis of preoperative viability tests can be performed with low mortality and morbidity and should be considered in suitable patients with LV dysfunction because it considerably improves the LVEF and the functional capacity. Advanced age, and severe angina and functional symptom status seem to be the predictors of poor prognosis in these patients after the CABG.

Limitations of The Study: This study was not a randomized controlled trial, therefore we did not compare the efficacy of CABG performed according to results of viability tests with the ones without any viability assessment. The results of this study should not implied that assessment of myocardial viability was not important and should not be pursued. Moreover, the duration of follow-up of this study was somewhat more limited than those of some current multi-center based trials. Although the results of this study are encouraging, it need corroboration in a larger population with longer follow-up.

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