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Major Predictors of Long-Term Clinical Outcomes After Coronary Revascularization in Patients With Unprotected Left Main Coronary Disease

Analysis From the MAIN-COMPARE Study

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Background—The clinical characteristics that identify high-risk subsets of patients with unprotected left main coronary artery disease undergoing percutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG) have not been well established.

Methods and Results—Between January 2000 and June 2006, 2240 patients with unprotected left main coronary artery disease underwent PCI (n=1102) or CABG (n=1138). Twenty-six preprocedural parameters were evaluated by univariate and multivariate Cox regression analysis to identify independent predictors of all-cause mortality and target-vessel revascularization. Interaction tests were performed to compare heterogeneities of effects of preprocedural parameters depending on the revascularization methods. During follow-up (median of 3.1 years), 187 patients died (78 PCI and 109 CABG) and 149 patients had target-vessel revascularization (121 PCI and 28 CABG). EuroSCORE ≥6 was an independent predictor of death in both groups. Additional independent predictors were chronic renal failure and previous congestive heart failure in the PCI group and age ≥75 years, atrial fibrillation, right coronary artery disease, and left main distal bifurcation disease in the CABG group. Interaction analysis showed no heterogeneities of the effects of variables depending on the revascularization methods. Independent predictors of target-vessel revascularization were acute coronary syndrome and left main distal bifurcation disease in the PCI group and history of coronary intervention in the CABG group. The interaction between previous PCI and treatment remained after adjustment for all independent predictors of target-vessel revascularization (interaction $P=0.0345$).

Conclusions—Several clinical characteristics were identified as important preprocedural predictors of long-term adverse outcomes after percutaneous or surgical revascularization in patients with unprotected left main coronary artery disease. **(*Circ Cardiovasc Interv*. 2010;3:127-133.)**

Key Words: predictors ■ mortality ■ risk factors ■ target-vessel revascularization ■ left main coronary disease

Although coronary artery bypass grafting (CABG) has been considered a standard therapy for patients with unprotected left main coronary artery (LMCA) disease,[1,2] recent studies have reported that percutaneous coronary intervention (PCI) with stent implantation is also feasible and effective in such patients.[3,4] Several studies have identified risk factors for major adverse outcomes after percutaneous or surgical coronary revascularization.[5–8] However, factor analyses for unprotected LMCA revascularization remain limited. Moreover, the currently used risk-scoring systems (ie, EuroSCORE and Parsonnet score) were originally designed for preoperative risk stratification of CABG patients.[9,10]

Clinical Perspective on p 133

This study sought to identify major determinants of adverse outcomes in patients with unprotected LMCA disease undergoing bypass surgery or stent implantation.

Methods

Study Population and Procedures

We investigated a total of 2240 consecutive patients from the MAIN-COMPARE registry who underwent PCI or CABG between January 2000 and June 2006 for unprotected LMCA disease (defined as stenosis >50% with no patent graft to the left coronary system).[4] Patients who had undergone previous CABG or concomitant valvular or aortic

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surgery and those who had ST-segment elevation myocardial infarction or presented with cardiogenic shock were excluded.

The choice of PCI over CABG was based on patient or physician preference or if a high risk was associated with CABG. From January 2000 to May 2003, coronary stenting was performed with bare-metal stents (BMSs) only, whereas from May 2003 to June 2006 drug-eluting stents (DESs) were used exclusively.[4] The choice of the specific type of DES (either sirolimus-eluting stents [Cypher, Cordis, Johnson & Johnson, Miami Lakes, Fla] or paclitaxel-eluting stents [Taxus, Boston Scientific, Natick, Mass]) was at the discretion of the operator. Stent implantation methods for left main (LM) disease have been previously described.[11,12] All patients undergoing PCI were prescribed aspirin and clopidogrel (loading dose, 300 or 600 mg) or ticlopidine (loading dose, 500 mg) before or during coronary intervention. Aspirin was continued indefinitely after the procedure. Patients treated with BMSs were prescribed clopidogrel or ticlopidine for at least 1 month, and patients treated with DESs were prescribed clopidogrel for at least 6 months. Surgical revascularization was performed with standard bypass techniques.[1] Whenever possible, the internal thoracic artery was preferentially used for revascularization of the left anterior descending artery.

The local ethics committee of each participating institution approved the use of clinical data for this study.

Study End Points and Definitions

End points of this study were all-cause mortality and first target-vessel revascularization (TVR). TVR was defined as repeat revascularization (either repeat PCI or reoperation) of the treated vessel, including any segment of the left anterior descending artery or left circumflex artery.[13] Previous PCI was defined as a history of coronary intervention with any coronary device before the index PCI or CABG. Chronic renal failure was defined as a serum creatinine value >2.0 mg/dL. Atrial fibrillation (AF) was defined as a history of either ECG or a therapeutic intervention before the index PCI or CABG. An LM distal bifurcation lesion was defined as a visually determined significant LMCA stenosis (>50%) at the distal bifurcation.

Data Collection and Follow-Up

Clinical and angiographic data were collected by using a dedicated Internet-based reporting system. All outcomes of interest were confirmed by source documentation collected at each hospital and were centrally adjudicated by the local events committee at the University of Ulsan College of Medicine, Asan Medical Center, Seoul, Korea. For validation of complete follow-up data, information on vital status was obtained through July 15, 2007, from the National Population Registry of the Korea National Statistical Office from unique personal identification numbers. All patients were evaluated clinically by office visits or telephone interviews at 1 month, 6 months, and 1 year after intervention and annually thereafter.

Statistical Methods

Continuous variables were compared with the *t* test or Wilcoxon's rank-sum test, and categorical variables were compared with the χ^2 test or Fisher's exact test, as appropriate. Univariate and multivariate Cox regression analyses were used to identify predictors of all-cause mortality and TVR.[14] Two statistical models were used in this study, 1 each for the PCI and CABG groups. Cox proportional-hazards regression analysis was performed for each treatment group as follows. First, the variables with a *P* value <0.20 in univariate analyses among potential confounders listed in Table 1 were candidates for inclusion in multivariate Cox proportional-hazards models. The multivariate models were determined by backward elimination. Second, the variables found to be independent predictors for each model were entered into the final model by the "enter" method, and the model fit was confirmed. In addition, interaction tests were performed to compare the heterogeneity of effects of risk variables between the models. These interactions were evaluated by stratified Cox models and the likelihood ratio test. All *P* values were 2 sided, and those <0.05 were considered statistically significant. All statistical analyses were performed with SAS version 9.1 (SAS Institute, Cary, NC).

Table 1. Baseline Demographic, Clinical, and Angiographic Characteristics

Variable	PCI (n=1102)	CABG (n=1138)	*P*
Age, y			
Median (interquartile range)	62 (52.2 to 69.5)	64 (56.9 to 69.7)	<0.001
≥75 y	13.4	9.8	0.008
Male sex	70.7	72.9	0.241
Body mass index >30 kg/m^2	3.2	3.6	0.641
Previous PCI	18.1	11.0	<0.001
Previous myocardial infarction	8.1	11.6	0.006
Previous congestive heart failure	2.5	3.3	0.257
Diabetes mellitus	29.7	34.7	0.011
Hypertension	49.5	49.4	0.966
Current smoking	25.6	29.8	0.027
Hypercholesterolemia	28.8	29.9	0.546
Cerebrovascular disease	7.1	7.3	0.87
Peripheral vascular disease	1.5	5.4	<0.001
Chronic renal failure, creatinine >2 mg/dL	2.7	3.0	0.8
Chronic lung disease	2.0	2.0	1.0
Acute coronary syndrome	65.0	77.9	<0.001
AF	2.0	2.7	0.269
Left ventricular ejection fraction, %			
Median (interquartile range)	60 (44 to 66)	57 (37 to 64)	0.004
Ejection fraction <40%	4.1	8.0	<0.001
Extent of diseased vessel			<0.001
Left main only	22.6	6.2	
LM+1-vessel disease	26.6	10.5	
LM+2-vessel disease	26.0	26.3	
LM+3-vessel disease	24.8	57.0	
Right coronary artery disease	35.9	70.7	<0.001
LM distal bifurcation disease	49.5	51.3	0.22
In-stent restenosis	2.3	0.5	<0.001
Total occlusion	1.2	2.2	0.066
Moderate to severe calcification	10.9	9.6	0.329
Thrombus containing	2.8	1.5	0.039
Ulceration	0.9	3.6	<0.001
EuroSCORE			
Mean±SD	3.8±2.4	4.5±2.2	<0.001
≥6	22.9	29.9	<0.001

Data are medians (with interquartile ranges), means±SDs, or percentages (%).

Results

Baseline Characteristics and Outcomes

Of the 2240 consecutive patients with unprotected LMCA disease, 1102 underwent PCI and 1138 were treated by

CABG. Of the PCI patients, 1073 (97%) had clinical and angiographic conditions that made them eligible for either PCI or CABG. In addition, 318 (29%) PCI patients received BMSs, whereas 784 (71%) received DESs (78% sirolimus-eluting stents and 22% paclitaxel-eluting stents). The median follow-up period for the overall population was 3.1 years (interquartile range, 2 to 4.5 years); during which time 187 patients (8.3%: 78 PCI patients and 109 CABG patients) died of any cause and 149 (6.7%: 121 PCI patients and 28 CABG patients) had TVR. Baseline demographic, clinical, and angiographic characteristics for the PCI and CABG groups are summarized in Table 1. The median ages of the PCI and CABG groups were 62 years (interquartile range, 52.2 to 69.5 years) and 64 years (interquartile range, 56.9 to 69.7 years), respectively, which included 13.4% and 9.8%, respectively, of patients age 75 years or older. Patients undergoing CABG were significantly older and had a higher prevalence of smoking, diabetes, and history of myocardial infarction or peripheral vascular disease than those receiving PCI. Furthermore, patients undergoing CABG had a lower ejection fraction and were more likely to present with acute coronary syndrome (ACS), to have 3-vessel disease, and to have ulcerated plaque and involvement of the right coronary artery. A history of coronary intervention and lesion characteristics such as restenotic or thrombus-containing lesions were more common in the PCI than in the CABG group.

Predictors of All-Cause Mortality

Table 2 shows the independent predictors of death after unprotected LMCA revascularization in the overall population. The revascularization method was not a predictor of death in either univariate or multivariate analysis. Multivariate analysis also identified independent predictors of death in the 2 treatment groups (Table 3). Chronic renal failure, previous congestive heart failure, and EuroSCORE ≥6 were independent predictors of death in PCI patients, whereas age ≥75 years, AF, right coronary artery disease, EuroSCORE ≥6, and LM distal bifurcation disease were independent predictors of death in CABG patients. Interaction analysis showed no heterogeneities in the effects of variables on the type of revascularization method (Table 3).

Predictors of TVR

Table 2 shows the independent predictors of TVR after unprotected LMCA revascularization in the overall population. Revascularization with PCI was a strong and independent predictor of repeat revascularization after adjusting for all other variables. The other independent predictors of TVR in the overall population were ACS, extent of coronary artery disease, and involvement of LM distal bifurcation. Multivariate Cox regression analysis showed that disease presenting as ACS and involvement of LM distal bifurcation were independent predictors of TVR after PCI. Age ≥75 years was negatively correlated with TVR in PCI. In the CABG group, history of coronary intervention was the only independent predictor of TVR. The interaction between previous PCI and treatment methods remained after adjustment for all independent predictors of TVR of each treatment group, including age ≥75 years, presentation as ACS, and involvement of LM distal bifurcation (Table 4).

Table 2. Independent Predictors of All-Cause Mortality and TVR After Unprotected LMCA Revascularization in the Overall Population

	Overall Population	
Variables	HR (95% CI)	*P*
All-cause mortality		
Age ≥75 y	1.70 (1.09 to 2.65)	0.02
Chronic renal failure, creatinine >2 mg/dL	2.75 (1.56 to 4.83)	<0.001
Chronic lung disease	2.33 (1.22 to 4.44)	0.011
AF	2.89 (1.59 to 5.27)	0.001
Left ventricular ejection fraction <40%	1.93 (1.25 to 2.99)	0.003
Disease extent		0.009
LM only	1.00	
LM+1-vessel disease	1.55 (0.74 to 3.27)	0.245
LM+2-vessel disease	1.20 (0.58 to 2.49)	0.625
LM+3-vessel disease	2.22 (1.13 to 3.38)	<0.001
EuroSCORE ≥6	2.19 (1.41 to 3.38)	<0.001
TVR		
PCI*	5.35 (3.44 to 8.33)	<0.001
ACS	1.63 (1.11 to 2.39)	0.012
Disease extent		0.036
LM only	1.00	
LM+1-vessel disease	0.61 (0.34 to 1.09)	0.092
LM+2-vessel disease	1.28 (0.77 to 2.11)	0.344
LM+3-vessel disease	1.01 (0.60 to 1.71)	0.975
LM distal bifurcation	1.49 (1.04 to 2.13)	0.029

*Compared with CABG.

Discussion

This observational study identified several clinical and angiographic risk factors of adverse clinical outcomes in patients with unprotected LMCA disease undergoing PCI or CABG. In addition, interaction tests compared heterogeneities of effects of independent predictors depending on the revascularization methods. Recent advances in PCI technology, such as DESs and antiplatelet medications, have resulted in several large cohort studies finding similar survival rates after stenting or bypass surgery for unprotected LMCA disease.[13,15] These 2 therapeutic strategies are currently routine in clinical practice, and risk-prediction models such as EuroSCORE and Parsonnet score are often used in periprocedural risk assessment.[16–18] However, these risk-stratification models were developed primarily for patients undergoing CABG.[9,10,19] Although previous studies reported that decreased left ventricular function, significant mitral regurgitation, cardiogenic shock, renal failure, multivessel coronary disease, and postprocedural stent diameter were independent predictors of mortality after PCI for LMCA disease, the cited studies had limitations, including small study populations and relatively short follow-up periods.[20,21] More recently, patients with high SYNTAX scores were

Table 3. Independent Predictors of All-Cause Mortality After Unprotected LMCA Revascularization With an Interaction Analysis

	PCI		CABG		
Variable	HR (95% CI)	*P*	HR (95% CI)	*P*	Interaction *P**
Age ≥75 y	1.41 (0.77 to 2.60)	0.2694	1.94 (1.17 to 3.21)	0.0097	0.4300
Previous congestive heart failure	2.98 (1.41 to 6.31)	0.0044	1.45 (0.66 to 3.21)	0.3540	0.2000
Chronic renal failure, creatinine >2 mg/dL	4.28 (2.10 to 8.73)	<0.0001	1.72 (0.22 to 0.73)	0.2160	0.1100
AF	2.01 (0.81 to 5.02)	0.1335	3.08 (1.47 to 6.45)	0.0029	0.4800
Right coronary artery disease	1.26 (0.33 to 0.79)	0.3330	1.78 (1.09 to 2.92)	0.0217	0.3200
LM distal bifurcation disease	0.89 (0.56 to 1.41)	0.6279	1.49 (1.01 to 2.18)	0.0425	0.0950
EuroSCORE ≥6	2.57 (1.44 to 4.58)	0.0013	2.31 (1.49 to 3.56)	0.0002	0.7700

*For the interaction test with a proportional-hazards model.

shown to have significantly higher rates of major adverse cardiac events (MACE) after PCI compared with patients with low or intermediate scores.[22] The Synergy between PCI with Taxus and Cardiac Surgery (SYNTAX) score is an angiographic tool for grading the complexity of coronary artery disease.[23] However, clinical characteristics, in addition to angiographic findings, should be considered when assessing patient risk. Moreover, outcomes in patients randomized to surgery were not influenced by the SYNTAX score.[22]

We found that treatment method, either PCI or CABG, did not predict long-term mortality in the overall population, whereas revascularization with PCI was a strong and independent predictor of TVR, findings similar to those of other studies comparing these 2 treatment methods. We also sought to identify the treatment-specific predictors that could assist in developing risk-assessment strategies for each revascularization method. In addition, we performed interaction analysis to assess the heterogeneities of the effect of independent predictors between 2 treatment methods.

All-Cause Mortality

We found that, in patients with unprotected LMCA disease, the independent predictors of death after PCI were chronic renal failure, previous congestive heart failure, and EuroSCORE ≥6; the independent predictors of death after CABG were age ≥75 years, AF, right coronary artery disease, EuroSCORE ≥6, and LM distal bifurcation disease. Although the described variables in the PCI group have been frequently shown to predict death after PCI, interaction analysis showed no heterogeneities in the effect of variables depending on the revascularization method. Moreover, although a EuroSCORE ≥6 has been used to identify high-risk patients in both treatment groups, there was no interaction between treatment method and EuroSCORE. These findings were similar to those of a pooled analysis of 3051 patients (in 4 randomized trials) treated for multivessel coronary artery disease, in that there were no heterogeneities in the effects of treatment among several high-risk subgroups, such as age, sex, hypertension, diabetes, previous myocardial, left ventricular ejection fraction, number of diseased vessels, or peripheral vascular disease.[24]

One remarkable finding of our study was that LM distal bifurcation disease was associated with death after CABG, but not after PCI, although the interaction analysis did not show a higher relative risk for CABG compared with PCI. LM distal bifurcation was found to be an independent predictor of death after adjustment of all covariates with a *P* value <0.2 by univariate analysis. There are several controversies about the prognosis of LM distal bifurcation lesion. According to the report of Valgimigli et al,[25] percutaneous treatment was found to be a major predictor of poor long-term outcome in patients with LM distal disease; the difference was primarily attributable to differences in TVR rate. Furthermore, the recent report of Chen et al[26] concluded that the rates of death were similar between patients with LM distal bifurcation and those with nonbifurcation lesions but that the incidence of MACE was significantly higher in patients with LM distal bifurcation lesions, mainly because of a higher incidence of TVR. In fact, another report showed that the location of the lesion in LM stenosis did not influence mortality or MACE after LMCA stenting.[27] In our PCI group, we observed a positive correlation between the presence of LM distal bifurcation lesions and TVR but not with mortality or MACE (data not shown). Moreover, to the best of our knowledge, no previous studies have shown that clinical outcomes after CABG are affected by LM lesion location.[28]

Table 4. Independent Predictors of TVR After Unprotected LMCA Revascularization With an Interaction Analysis

	PCI		CABG		
Variable	HR (95% CI)	*P*	HR (95% CI)	*P*	Interaction *P**
Age ≥75 y	0.50 (0.25 to 0.99)	0.0476	0.82 (0.19 to 3.46)	0.7846	0.5929
Previous PCI	1.21 (0.78 to 1.88)	0.3984	3.38 (1.48 to 7.71)	0.0038	0.0345
ACS	1.69 (1.12 to 2.54)	0.0123	1.73 (0.60 to 4.99)	0.3136	0.9467
LM distal bifurcation disease	1.58 (1.09 to 2.27)	0.0146	1.37 (0.65 to 2.91)	0.4128	0.7288

*For the interaction test with a proportional-hazards model.

In our cohort, the patients who underwent CABG with LM distal bifurcation lesion received more vessel grafts (bifurcation 3.0±1.0 versus nonbifurcation 2.8±1.0, $P=0.023$) and on-pump CABG (bifurcation 352 [66.0%[versus nonbifurcation 308 [50.9%], $P<0.001$). A previous study suggested that the important complications that occurred with on-pump CABG were stroke, and kidney or liver failure.[29] These more complex operations might be related to the incidence of adverse clinical outcomes. Therefore, our findings seem to provide additional evidence of the significance of LM distal bifurcation lesions. In addition, in terms of stent type at the LM distal bifurcation, the LE MANS registry showed that the implantation of a DES significantly decreased the risk of MACE and major adverse cerebral events and particularly improved survival in patients with distal LM disease.[30] However, according to our data, stent type (DES versus BMS) was not associated with mortality (hazard ratio [HR]=0.937, 95% CI: 0.411 to 2.139, $P=0.878$) in distal LM disease, even though DES use can reduce the TVR rate (HR=0.440, 95% CI: 0.267 to 0.726, $P=0.001$).

AF was a significant risk factor in patients undergoing CABG but not PCI. Preoperative AF in patients undergoing cardiac surgery was found to be significantly associated with postoperative complications, including stroke, postoperative delirium, low–cardiac output syndrome, and increased mortality.[31] We found that postoperative complications, especially immediate postoperative CNS dysfunction, acute renal failure, and low–cardiac output syndrome, occurred more often in patients with AF who underwent CABG.

Although the extent of coronary artery disease was associated with increased mortality in the PCI group, this positive correlation was observed only in univariate analysis. Moreover, the extent of coronary artery disease was not associated with mortality in the CABG group, in either univariate or multivariate analysis, but was associated with increased mortality in the overall population. Recently, pooled data from 10 randomized trials to compare PCI and CABG showed that the treatment effect was not modified by the number of diseased vessels.[32] We did not observe an independent relation between disease extent and treatment methods in either group and observed no interaction as well. Because of the advancement of DESs and procedure-related adjunctive pharmacotherapies, the long-term results have improved in patients undergoing PCI for complex lesions. Large randomized, comparative studies are required to explore this issue further.

Repeat Revascularization

We also found that disease presenting as ACS and involvement of LM distal bifurcation were associated with TVR after stenting. Previous studies have reported associations between ACS and malapposition, restenosis, and TVR.[33,34] Unlike the conflicting results on the association of LM distal bifurcation lesions with MACE, a positive correlation between LM distal bifurcation presence and TVR after stenting has been consistently reported, a finding confirmed in this study.[13,15,24,26,35] Advanced age showed a negative correlation with TVR in the PCI group, confirming earlier results showing that older patients were less likely than younger patients to undergo coronary reintervention.[36] This may be because of the higher rates of death and supportive care and the lower incidence of symptoms because of minimal workload in older patients. However, in patients who underwent CABG, previous PCI was the only independent predictor of TVR. In addition, interaction analysis indicated that, in patients with unprotected LMCA disease, the hazard ratio of previous PCI used as a variable was significantly higher in the CABG group than in the PCI group. Therefore, previous PCI was more associated with increased TVR in patients with unprotected LMCA disease undergoing CABG compared with those treated by PCI. This association may be attributable to differences in baseline characteristics; for example, the incidence of severe coronary artery disease was higher in CABG patients than in PCI patients. Although we could not perform an interaction analysis by stent type (DES versus BMS) or different types of DESs (sirolimus-eluting stent versus paclitaxel-eluting stent), we found that use of a DES was also an independent negative predictor of TVR (HR=0.419, 95% CI: 0.282 to 0.622, $P<0.001$) in patients who underwent PCI. However, stent type (DES versus BMS) was not associated with mortality (HR=0.808, 95% CI: 0.436 to 1.497, $P=0.498$), and DES type (sirolimus-eluting stent versus paclitaxel-eluting stent) was not associated with either mortality (HR=0.816, 95% CI: 0.414 to 1.607, $P=0.556$) or TVR (HR=0.787, 95% CI: 0.447 to 1.386, $P=0.407$) in univariate or multivariate analysis.

Clinical Implications

We found that age ≥75 years, AF, right coronary artery disease, and LM distal bifurcation disease were treatment-specific risk factors for death in the CABG group and that chronic renal failure and previous congestive heart failure were treatment-specific risk factors for death in the PCI group. However, we were unable to identify any specific preprocedural factor that could provide guidance for the selection of a revascularization method that would reduce the risk of death. A risk-scoring system, including all of those factors, may therefore be needed. For TVR, a history of coronary intervention can more strongly predict repeat revascularization in patients who underwent CABG compared with those who underwent PCI.

Study Limitations

This nonrandomized, observational study was designed to identify preprocedural or preoperative risk factors in patients undergoing CABG or PCI. The findings can be used to assess patient risk, advise patients, and determine optimal therapeutic approaches. Therefore, operative and procedural factors, as well as detailed quantitative coronary angiographic data, were not analyzed, although they may influence long-term clinical results. In addition, LM distal bifurcation lesions were found to be an important point of our results to risk prediction of mortality. However, there are several limitations on the interpretation of these results. First, the follow-up duration differed for the 2 treatment groups, with a median follow-up of 1017 days (interquartile range, 688 to 1451 days) for the PCI group and 1252 days (interquartile range, 781 to 1790 days) for the CABG group. Second, the input

variables used for multivariate analysis were covariates with P values <0.2 in univariate analysis for PCI or CABG, thus introducing an inherent limitation into multivariate analysis. Third, we did not analyze findings by detailed bifurcation type, indicating a need for studies that include quantitative coronary angiographic data analysis of bifurcation lesions, to confirm our results. Thus, the clinical significance of LM distal bifurcation disease in this article needs to be interpreted carefully.

Conclusions

We identified several clinical and angiographic characteristics as important preprocedural predictors of adverse long-term clinical outcomes after percutaneous or surgical treatment of LMCA disease. Knowledge of these risk factors may be useful when performing individual risk stratification for patients with unprotected LMCA disease.

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Disclosures

None.

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CLINICAL PERSPECTIVE

The clinical characteristics that identify high-risk subsets of patients with unprotected left main coronary artery disease undergoing percutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG) have not been well established. This study sought to identify major determinants of adverse outcomes in patients with unprotected left main coronary artery disease undergoing bypass surgery or stent implantation. Twenty-six preprocedural parameters were evaluated by univariate and multivariate Cox regression analysis to identify independent predictors of all-cause mortality and target-vessel revascularization. During follow-up (median of 3.1 years), 187 patients died (8.3%: 78 PCI patients and 109 CABG patients) and 149 patients had target-vessel revascularization (6.7%: 121 PCI patients and 28 CABG patients). EuroSCORE $\geq$6 was an independent predictor of death in both groups. Additional independent predictors were chronic renal failure and previous congestive heart failure in the PCI group and age $\geq$75 years, atrial fibrillation, right coronary artery disease, and left main distal bifurcation disease in the CABG group. Interaction analysis showed no heterogeneities of the effects of variables depending on the revascularization methods. Independent predictors of target-vessel revascularization were acute coronary syndrome and left main distal bifurcation disease in the PCI group and history of coronary intervention in the CABG group. The interaction between previous PCI and treatment remained after adjustment for all independent predictors of target-vessel revascularization (interaction $P=0.0345$).