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Impact of a combination of full coverage stenting and proximal optimization technique on long term outcome for unprotected distal left main disease

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ABSTRACT

Background: There is no consensual opinion regarding the percutaneous coronary intervention (PCI) procedure for unprotected distal left main (UDLM) lesion.
Methods: Between April 2005 and August 2011, 586 consecutive patients with UDLM stenosis treated with drug-eluting stents were recruited for this study to clarify the impact of combination of full-coverage stenting and proximal optimization technique (POT) for UDLM lesion. An optimal strategy of full-coverage stenting and POT was performed in 353 patients and the other 233 patients were not optimally treated. Major adverse cardiovascular events (MACEs) were defined as all-cause death, myocardial infarction, or target lesion revascularization (TLR) during follow-up period. TLRs were also evaluated for main branch (MB) restenosis.
Results: At 1615 days of follow-up, MACE occurred in 166 (28.3%) patients. The occurrence of MACE and TLR had a trend to being lower in the optimal strategy [propensity score-adjusted HR, 0.73 (95% CI, 0.53–1.01), $p = 0.05$ and propensity score-adjusted HR, 0.69 (95% CI, 0.46–1.02), $p = 0.06$, respectively]. TLR of the MB occurred significantly less frequently in the optimal strategy [propensity score-adjusted HR, 0.34 (95% CI, 0.15–0.76), $p = 0.008$]. Cardiac death occurred in 28 (4.8%) patients. There was no significant difference in cardiac death between the two groups. These results were sustained after propensity-score matching.
Conclusions: An optimal PCI strategy of full-coverage stenting and POT might be effective for UDLM lesion to reduce the occurrence of MACE, especially driven by TLR of the MB.

1. Introduction

Percutaneous coronary intervention (PCI) has been widely used to treat unprotected distal left main (UDLM) lesions using drug-eluting stents (DES) [1–4]. However, there is no consensual opinion regarding the procedural technique in PCI for UDLM lesions. Traditionally, restenosis in the ostial left circumflex artery (LCx) has been considered a major limitation for the use of PCI for UDLM lesion, particularly with a two-stent strategy [3,5]. However, LCx restenosis has less impact on mortality than previously thought [6,7]. In contrast, despite being less common, the occurrence of main branch in-stent restenosis (MB-ISR) in the unprotected left main (ULM) and proximal left anterior descending (LAD) arteries is clinically more relevant [6]. It has been suggested that full-coverage stenting over the left main (LM) ostium and proximal optimization technique (POT) may reduce the development of MB-ISR following PCI for UDLM lesion [6,8,9]. However, there is limited information on the impact of this combination strategy in PCI for UDLM lesion. Therefore, we aimed to investigate the outcomes of this procedure in our cohort of patients to standardize PCI maneuver for UDLM lesion.

2. Methods

Between April 2005 and August 2011, a retrospective cohort analysis was performed with 586 consecutive patients with de novo UDLM disease undergoing DES implantation at our institute. Study population is described in Fig. 1. The decision to perform PCI rather than coronary artery bypass graft (CABG) was guided by the presence of suitable anatomy and lesion characteristics for PCI, and the absence of contraindications to at least 12 months of dual antiplatelet therapy (DAT).

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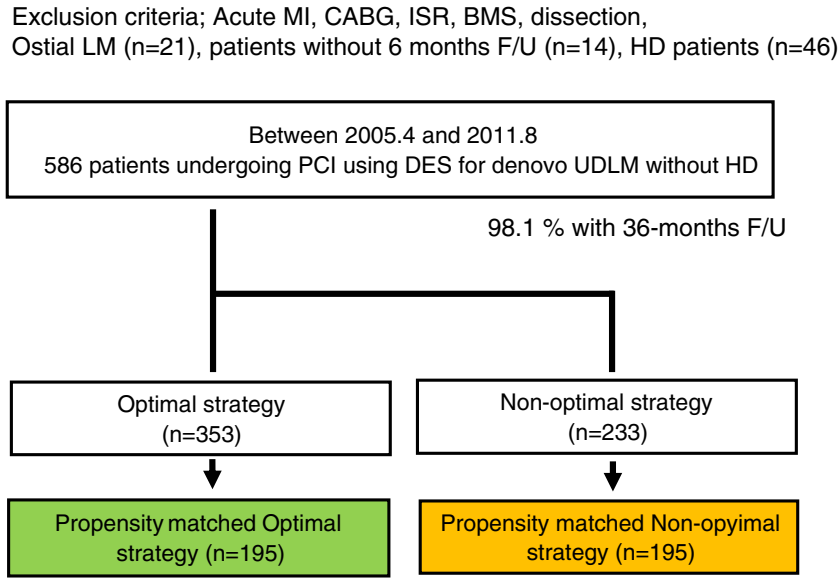

Fig. 1. Stratification of patients with unprotected left main disease enrolled in this study. MI, myocardial infarction; CABG, coronary artery bypass graft; ISR, in-stent restenosis; BMS, bare metal stent; LM, left main; PCI, percutaneous coronary intervention; UDLM, unprotected distal left main; DES, drug-eluting stent; HD, hemodialysis.

All patients were carefully informed about the alternative treatment options and the PCI-related risks before being asked to give written informed consent for the procedure. UDLM disease was defined as a stenosis of at least 50% by visual assessment involving the body and distal segment of LM, with or without the ostium of LM, or within the proximal 5 mm of the LAD or LCx ostium. The definition of the lesions and procedural characteristics have been previously detailed [6,7].

Full-coverage stenting was defined as the coverage of the entire LM, including the ostium, irrespective of whether the ostium was diseased. POT was defined as the inflation of a noncompliant balloon larger than the stent implanted in UDLM disease at the end of procedure, in the entire LM toward the ostial LAD. The optimal strategy was defined as a combination of full-coverage stenting and POT. The non-optimal strategy was defined as neither full-coverage stenting or POT, or either full-coverage stenting or POT, but not both.

The antiplatelet regimens were life-long low dose aspirin (100 mg daily) and a thienopyridine (200–250 mg of ticlopidine bid or 75 mg of clopidogrel daily) for a minimum of 12 months after PCI. Clinical data were collected during a hospital visit or by telephone contact at 6-month intervals. Angiographic follow-up was scheduled between 6 and 12 months or earlier, if clinically indicated. In-stent restenosis (ISR) was defined as luminal diameter stenosis of >50% within the stented segment or within 5 mm of the stent edges as evaluated by offline quantitative coronary angiography (QCA) or visual assessment. ISR was classified into two groups depending on the segments involved: 1) MB-ISR defined as ISR involving any LM segment from the LM ostium to the proximal LAD [with/without side branch (SB) involvement], and 2) SB-ISR defined as ISR involving LCx. Target lesion revascularization (TLR) was defined as either PCI or CABG performed to treat ISR or stent thrombosis (ST) of the target lesion including the proximal and distal edge of the stent and/or the ostium of SBs.

2.1. Study endpoints

The study endpoints were major adverse cardiovascular events (MACE) during the follow-up period. MACEs were defined as all-cause death, myocardial infarction (MI), or TLR. Furthermore, individual components of MACE, cardiac death and TLR for MB-ISR were also evaluated. Death was considered to be of cardiac origin unless obvious noncardiac causes could be identified. Periprocedural MI was defined as the presence of pathological and new Q waves on an electrocardiogram or an increase in the creatine kinase-myocardial band level to >3 times the upper limit of the normal range. Spontaneous MI and ST were defined according to the ARC definitions [10].

2.2. Statistical analysis

Continuous variables are expressed as mean ± standard deviation (SD). Comparisons of clinical, echocardiographic, angiographic, or procedure-related characteristics of patients were performed using the Student *t*-test, Wilcoxon rank-sum test (continuous variables), or chi-square test (categorical) and according to the optimal strategy. Comparisons of event-free survival (Kaplan–Meier curves) were performed with the log-rank test. Because of the nonrandomized nature of the study, a propensity score analysis was performed to minimize any selection bias caused by differences in clinical characteristics between the two groups. In brief, for each patient, a propensity score indicating the likelihood of having optimal strategy was calculated using a nonparsimonious multivariable logistic regression model. A propensity score, indicating the predicted probability of receiving a specific treatment conditional on the observed covariates, was then calculated from the logistic equation for each patient. Variables with $p < 0.20$ on univariate analysis were included in the logistic regression model to calculate the propensity score. These were age, gender, hypertension, diabetes mellitus (DM), CKD, EuroScore, ejection fraction, three-vessel disease (3VD), and initial chronic total occlusion (CTO) lesions. The *C*-statistic was 0.63 and Hosmer–Lemeshow test *p* value was 0.58. The individual propensity score was incorporated into Cox proportional hazards regression models as a covariate with treatment group as the variable of interest to calculate the adjusted hazard ratio (HR). In addition, to reduce the effect of treatment-selection bias and potential confounding in this observational study, we performed rigorous adjustment for significant differences in the baseline characteristics of patients with propensity score matching. Clinical outcomes in the matched population were analyzed with Cox proportional hazards regression stratified on matched pairs. Results are reported as HR with associated 95% confidence intervals (CIs) and *p* values. Analyses were conducted using SPSS for Windows, version 21.0 (IBM SPSS Inc., Chicago).