Paclitaxel- Versus Sirolimus-Eluting Stents for Treatment of ST-Segment Elevation Myocardial Infarction

With Analyses for Diabetic and Nondiabetic Subpopulation

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Objectives The aim of this study was to determine which drug-eluting stent (DES) is preferable for the treatment of ST-segment elevation myocardial infarction (STEMI) and to elucidate the impact of diabetes mellitus on the outcome of each DES.

Background Recent studies have shown the benefit of DES in patients with STEMI. Diabetes mellitus might differentially affect outcomes of each DES.

Methods We analyzed the large-scale, prospective, observational KAMIR (Korea Acute Myocardial Infarction Registry) study, which enrolled 4,416 STEMI patients (26% with diabetes) treated with paclitaxel-eluting stent (PES) or sirolimus-eluting stent (SES). Primary outcome was major adverse cardiac event (MACE), defined as a composite of mortality, nonfatal myocardial infarction, and target lesion revascularization (TLR).

Results In the overall population, the MACE rate at 1 year was significantly higher in the PES than the SES group (11.6% vs. 8.6%, p = 0.014), which was mainly due to increased TLR (3.7% vs. 1.8%, p < 0.001). In the diabetic subgroup, however, the MACE rate was not significantly different between PES and SES (14.5% vs. 12.3%, p = 0.217), in contrast to the nondiabetic subgroup, where PES was inferior to SES as in the overall population. Matching by propensity-score did not significantly alter these results. For TLR, there was interaction between the type of stents and diabetes mellitus (unadjusted: p = 0.052; after propensity-score matching: p = 0.035).

Conclusions The PES was inferior to the SES in the overall population, with regard to the occurrence of MACE and TLR. However, subgroup analysis for diabetic subjects showed no differences in clinical outcomes between PES and SES. These results suggest that diabetes differentially affects the outcome of first-generation DES.   (J Am Coll Cardiol Intv 2010;3:498–506) © 2010 by the American College of Cardiology Foundation

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The presence of diabetes mellitus is 1 of the compelling indications to use drug-eluting stents (DES) over bare-metal stents during elective percutaneous coronary intervention (PCI) (1,2). Recently, data from randomized trials (3,4) and the large Massachusetts PCI registry (5) have shown the benefit and safety of DES even in patients with ST-segment elevation myocardial infarction (STEMI), which might lead to a significantly increased penetration of DES use in such patients. However, data comparing different DES in patients with STEMI are scarce, and furthermore, the impact of diabetes in the performance of each DES in these high-risk patients is mostly unknown.

Therefore, we sought to determine which DES is preferable for the treatment of STEMI in diabetic patients and to elucidate the impact of diabetes mellitus on outcome of each DES by analyzing the largest acute myocardial infarction (AMI) database registry in Korea.

Methods

Study population and KAMIR (Korean Acute Myocardial Infarction Registry). In Korea, a nationwide effort was launched in 2005 to collect data from patients with AMI admitted to major cardiac centers capable of primary PCI, which was named the KAMIR. It is a large-scale, multi-center, Internet-based AMI registry, where 49 institutions are actively enrolling patients. It is the largest AMI registry in Korea and, to the best of our knowledge, one of the largest in the world. Since November 2005 to January 2008, 14,049 patients with AMI have been enrolled in the KAMIR. The general characteristics of KAMIR have been described elsewhere (6), and the study protocol was approved by the ethics committee at each participating institution.

For the present study, patients who underwent PCI with paclitaxel-eluting stent (PES) or sirolimus-eluting stent (SES) for STEMI were selected, which comprised 4,816 of the 14,049 total registered patients. With exclusion of 400 patients lost to follow-up within 1 month, a total of 4,416 patients—of which 1,137 (26%) had diabetes mellitus—were finally analyzed (Fig. 1). The proportions of patients receiving each DES at specified time periods were not significantly different (Online Fig. 1).

Study definitions. The presence of diabetes mellitus and type of diabetes treatment (insulin or oral antidiabetic agents) was documented through self-reporting by the patient. The level of glycosylated hemoglobin (HbA1c) during hospital stay and the information on the diabetic microvascular complications (nephropathy, retinopathy, or neuropathy) were additionally collected at the time of the

analysis, with retrospective review of medical records. Data on other cardiovascular risk factors such as hypertension, smoking, and prior ischemic heart disease were also reported by the patients themselves, except dyslipidemia, which was defined as a composite of self-reported history, prior statin usage, and fasting cholesterol ≥200 mg/dl. Angiographic parameters such as Thrombolysis In Myocardial Infarction (TIMI) flow grade or American College of Cardiology/American Heart Association lesion type were assessed by the operator. Successful procedure was defined as <20% residual stenosis after procedure in this study.

Major adverse cardiac event (MACE) was defined as a composite of mortality from any cause, nonfatal myocardial infarction, and target lesion revascularization (TLR). Myocardial infarction was defined as the presence of at least 2 of the following 3 conditions: 1) ischemic symptoms; 2) elevation of cardiac markers at least twice the upper limit of normal; or 3) new ST-segment elevation. The TLR was defined as a repeated intervention (surgical or percutaneous) resulting from restenosis or re-occlusion within the stent or in the adjacent 5-mm segments.

PCI and follow-up. Coronary interventions were performed according to current standard procedural guidelines. The choice of PES or SES was left to the operator's discretion. Aspirin and clopidogrel (loading dose, 300 mg, or 600 mg) were prescribed before or during the coronary intervention. After the procedure, clopidogrel was prescribed for at least 6 months, and aspirin was continued indefinitely. All patients were scheduled to be followed clinically at 1 month, 6 months, and 1 year after the index procedure. Routine angiographic follow-up for asymptomatic patients was not mandatory. Primary outcome in this study was cumulative MACE rate within 1 year after PCI.

Statistical analysis. Student *t* test and chi-square (or Fisher's exact) test were used to compare means and proportion of baseline clinical and angiographic characteristics between 2 stent groups. After checking for the violation of propor-

Abbreviations and Acronyms

AMI = acute myocardial infarction

CI = confidence interval

DES = drug-eluting stent(s)

HbA1c = glycosylated hemoglobin

HR = hazard ratio

MACE = major adverse cardiac event

mTOR = mammalian target of rapamycin

PCI = percutaneous coronary intervention

PES = paclitaxel-eluting stent(s)

SES = sirolimus-eluting stent(s)

STEMI = ST-segment elevation myocardial infarction

TIMI = Thrombolysis In Myocardial Infarction

TLR = target lesion revascularization

Figure 1. Study Population Diagram

AMI = acute myocardial infarction; BMS = bare-metal stent(s); DES = drug-eluting stent(s); KAMIR = Korean Acute Myocardial Infarction Registry; NSTEMI = non–ST-segment elevation myocardial infarction; PCI = percutaneous coronary intervention; PES = paclitaxel-eluting stent(s); SES = sirolimus-eluting stent(s); STEMI = ST-segment elevation myocardial infarction.
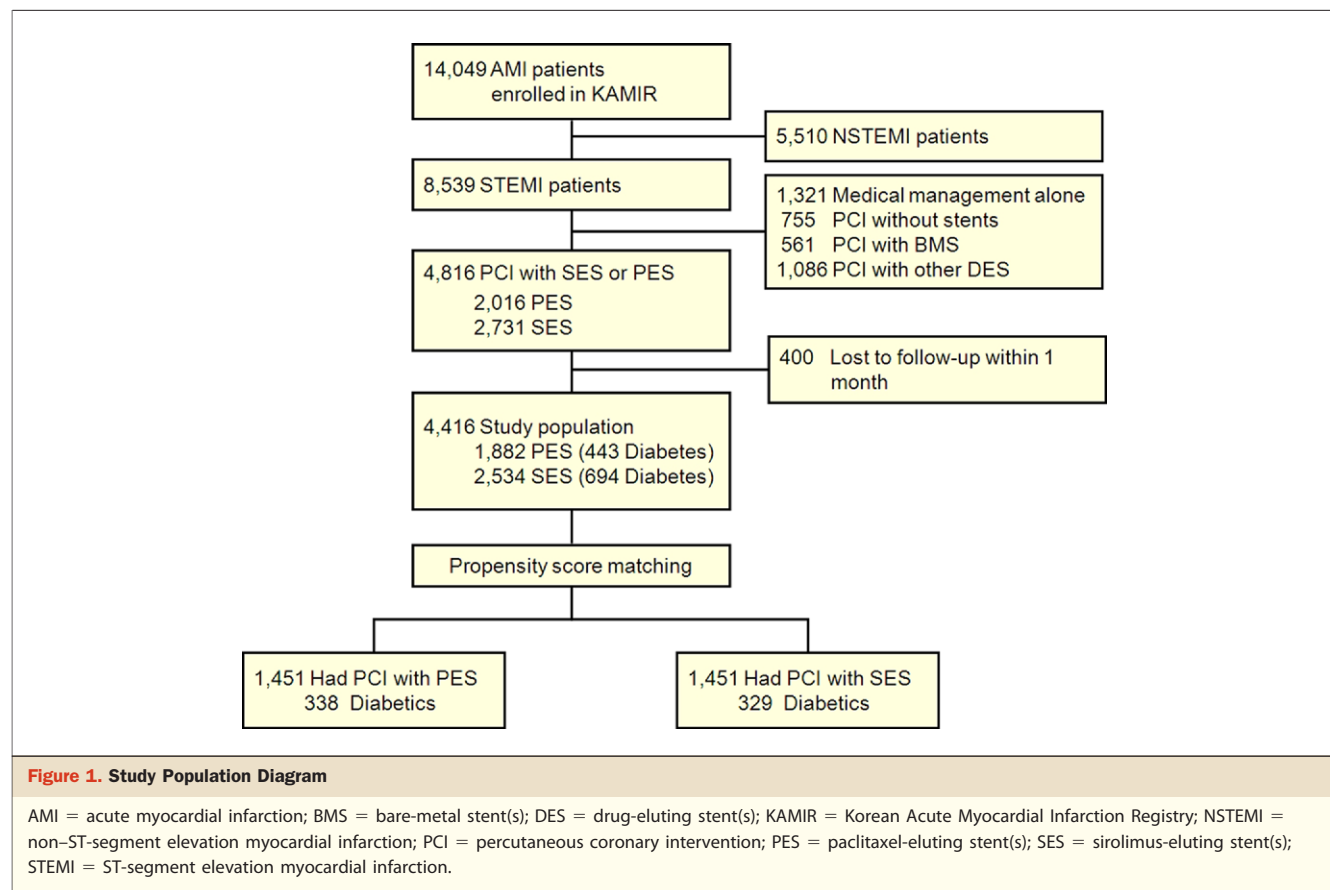
tional hazard assumption, the Cox proportional hazard model was used to estimate the hazard ratio (HR) and 95% confidence interval (CI) for clinical outcomes between 2 stent groups in crude study population. The p value for interaction between the stent type and the presence of diabetes mellitus was calculated by testing significance with a likelihood ratio test in the Cox regression model, including an interaction term.

To address potential sources of bias and confounding in this observational study, rigorous adjustment was conducted by the use of propensity analysis (7,8). Propensity score for stent choice was computed by nonparsimonious logistic regression model (c-statistics = 0.640). Except outcome variables and prescribed medications after stenting, baseline clinical and angiographic features listed in Table 1 were incorporated for this model. Morbidity of diabetes mellitus was also excluded from this calculation, because it was an interested independent variable. We confirmed the model reliability with goodness-of-fit test (p = 0.101) and then performed 1:1 match iteration by propensity score from initial 8 to 1 digit. Baseline covariates were compared again in this matched population with paired *t* test or McNemar test (or marginal homogeneity test). With the robust sandwich covariance matrix estimation, the HR (95% CIs) of clinical outcomes between PES and SES group were

estimated with the Cox proportional hazard model, adjusted for covariates as follows: lesion type B2/C, stent length, stent diameter, number of implanted stents that were well-known predictors for revascularization of DES (9), post-procedural TIMI flow grade 3, achievement of procedural success, and prescribed medication at the time of discharge. The HbA1c level, diabetic microvascular complication, and insulin requirement were additionally adjusted for the diabetic subgroup. Hazard ratio of recurrent myocardial infarction was estimated without adjustment for these covariates, because it interfered with the development of reliable regression model. All of these statistical analyses were performed with SAS version 9.1.3 (SAS Institute, Cary, North Carolina), and p value <0.05 was considered as significant.

Results

Baseline characteristics of crude study population. Baseline clinical and angiographic characteristics of crude study population are presented in Table 1. The SES group was slightly younger, had a higher incidence of diabetes mellitus, and underwent stent implantation more frequently as primary angioplasty. With respect to angiographic features, the left anterior descending artery was more often the infarct-related artery for the SES group, and B2/C lesions defined by

Table 1. Baseline Characteristics of Patients in Crude Population

Characteristics	PES (n = 1,882)	SES (n = 2,534)	p Value
Age, yrs	63 ± 12	62 ± 12	0.01
Male	1,407 (75)	1,885 (74)	0.77
Initial hypotension	225 (12)	315 (13)	0.62
LVEF	51 ± 12	50 ± 11	0.33
Symptom to door time <12 h	1,506 (81)	2,005 (80)	0.58
Smoking	927 (49)	1,219 (48)	0.45
Hypertension	843 (45)	1,140 (45)	0.90
Dyslipidemia	663 (35)	945 (37)	0.16
Diabetes mellitus	443 (24)	694 (27)	0.004
Previous myocardial infarction	49 (3)	52 (2)	0.23
Previous PCI	52 (3)	95 (4)	0.07
Previous CABG	9 (0.5)	9 (0.4)	0.53
Malignancy	19 (1)	30 (1)	0.58
Primary PCI	1,440 (77)	2,044 (81)	0.001
Glucose, mg/dl	173 ± 81	177 ± 78	0.08
Creatinine, mg/dl	1.1 ± 1.1	1.1 ± 1.0	0.38
Creatine kinase-MB fraction, IU/l	200 ± 301	203 ± 283	0.72
Infarct-related coronary vessel			<0.001
LM	22 (1)	36 (1)	
LAD	924 (49)	1,446 (57)	
LCX	199 (11)	219 (9)	
RCA	731 (39)	828 (33)	
Number of diseased vessels			0.94
1	852 (46)	1,141 (45)	
2	581 (31)	790 (32)	
3	439 (24)	580 (23)	
ACC/AHA lesion type B2/C	1,488 (82)	1,785 (76)	<0.001
Pre-procedural TIMI flow grade 3	381 (21)	545 (22)	0.28
Glycoprotein IIb/IIIa inhibitor	403 (21)	373 (15)	<0.001
Stent length, mm	25 ± 6	26 ± 6	<0.001
Stent diameter, mm	3.2 ± 0.4	3.1 ± 0.4	<0.001
Number of implanted stents	1.6 ± 0.9	1.4 ± 0.7	<0.001
Post-procedural TIMI flow grade 3	1,704 (94)	2,273 (94)	0.59
Successful procedure	1,836 (98)	2,459 (98)	0.46
Discharge medication			
Aspirin	1,852 (99)	2,499 (99)	0.56
Clopidogrel	1,845 (98)	2,487 (98)	0.81
Beta-blocker	1,345 (72)	1,802 (71)	0.79
ACEi or ARB	1,528 (81)	2,031 (80)	0.38
Statin	1,523 (81)	1,999 (79)	0.09
Duration of F/U days, median (IQR)	369 (201–409)	366 (196–418)	0.74
Angiography F/U	645 (34)	859 (34)	0.80

Values given as percentage unless otherwise indicated. Data might not sum to total due to missed values.

ACC/AHA = American College of Cardiology/American Heart Association; ACEi = angiotensin-converting enzyme inhibitor; ARB = angiotensin receptor blocker; CABG = coronary artery bypass graft; F/U = follow-up; IQR = interquartile range; LAD = left anterior descending; LCX = left circumflex; LM = left main; LVEF = left ventricular ejection fraction; PCI = percutaneous coronary angioplasty; PES = paclitaxel-eluting stent(s); RCA = right coronary artery; SES = sirolimus-eluting stent(s); TIMI = Thrombolysis In Myocardial Infarction.

the American College of Cardiology was more frequent in the PES group. The SES group tended to use longer stents with smaller diameter, whereas the PES group tended to implant more stents during the index procedure. The use of glycoprotein IIb/IIIa inhibitor was higher in the PES group.

Clinical outcomes of crude study population up to 1-year follow-up. With median follow-up of 365 days in crude study population, a cumulative total of 396 events occurred. The estimated 1-year MACE rate was 9.5%. Unadjusted analysis revealed that the PES usage as well as diabetes mellitus was associated with increased MACE. Diabetes mellitus definitely augmented the risk (p < 0.001), with regard to mortality from any cause, but the type of DES was not a significant risk factor (p = 0.543). The PES usage was associated with higher TLR rate (p < 0.001), whereas diabetes mellitus increased the risk for TLR only with borderline statistical significance (p = 0.092) (Fig. 2). The interaction between diabetes mellitus and the type of DES was noteworthy only for TLR (p = 0.052).

Subgroup analysis in diabetic and nondiabetic population.
BASELINE CHARACTERISTICS. Given the results described in the preceding text, we performed subgroup analysis for the diabetic and nondiabetic populations. Baseline characteristics of each population are presented in Online Table 1. In diabetic patients, diabetic microvascular disease was more frequent and the level of HbA1c tended to be higher in the SES group. In the nondiabetic population, which constituted 74% of the total study population, clinical and angiographic features followed the trend of the overall population.

CLINICAL OUTCOMES OF DIABETIC AND NONDIABETIC POPULATION. In diabetic patients with STEMI, there was no significant difference in MACE (p = 0.217) or TLR (p = 0.448) between the 2 stent groups. However, in the nondiabetic population, PES use was associated with higher incidence of MACE (HR: 1.36; 95% CI: 1.06 to 1.74, p = 0.016), mainly due to increased TLR (HR: 3.21, 95% CI: 1.83 to 5.63, p < 0.001). The 2 groups did not differ from each other, with respect to the hard end points such as all-cause mortality, regardless of the presence of diabetes mellitus (for diabetic, p = 0.300; for nondiabetic, p = 0.820) (Fig. 3).

Analysis in patients matched for propensity score. BASELINE CHARACTERISTICS. We performed propensity analysis as described in the Methods section, and 1,451 patients from each stent group were matched for propensity score. Of these, 667 (23%) were diabetic; other baseline characteristics are listed in Table 2. All baseline clinical and angiographic features became comparable after propensity score matching. Baseline characteristics of the diabetic and nondiabetic subpopulations are provided in Online Table 2.

CLINICAL OUTCOMES UP TO 1 YEAR. With median follow-up of 368 days, a total of 212 MACE occurred in the matched population, and the estimated 1-year MACE rate was 9.4% in the PES group and 6.5% in the SES group (p = 0.007). The
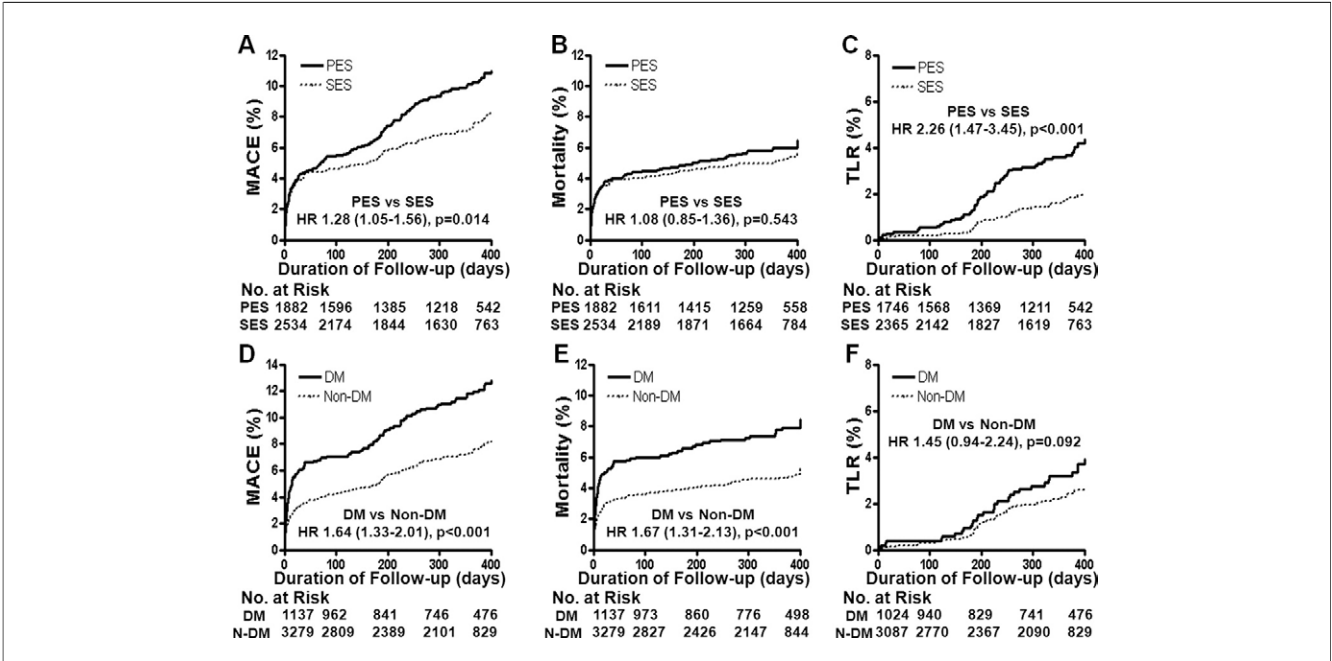
Figure 2. Cumulative Incidences of MACE, All-Cause Mortality, and TLR in Crude Study Population

Cumulative incidences of major adverse cardiac events (MACE) **(A, D)**, all-cause mortality **(B, E)**, and target lesion revascularization (TLR) **(C, F)** in crude study population: comparison of PES versus SES or diabetes mellitus (DM) versus non-DM patients. The PES usage as well as DM was associated with increased MACE. Diabetes mellitus augmented the risk for death, and PES usage increased the TLR rate. HR = hazard ratio; other abbreviations as in Figure 1.

Cox proportional hazard regression model for this matched population revealed results similar to the crude study population with more significant interaction p value between the

DES type and diabetes mellitus (Figs. 4 and 5). The estimated 1-year TLR rates for each group were as follows: 4.1% for PES and 4.4% for SES group in diabetic patients (p =
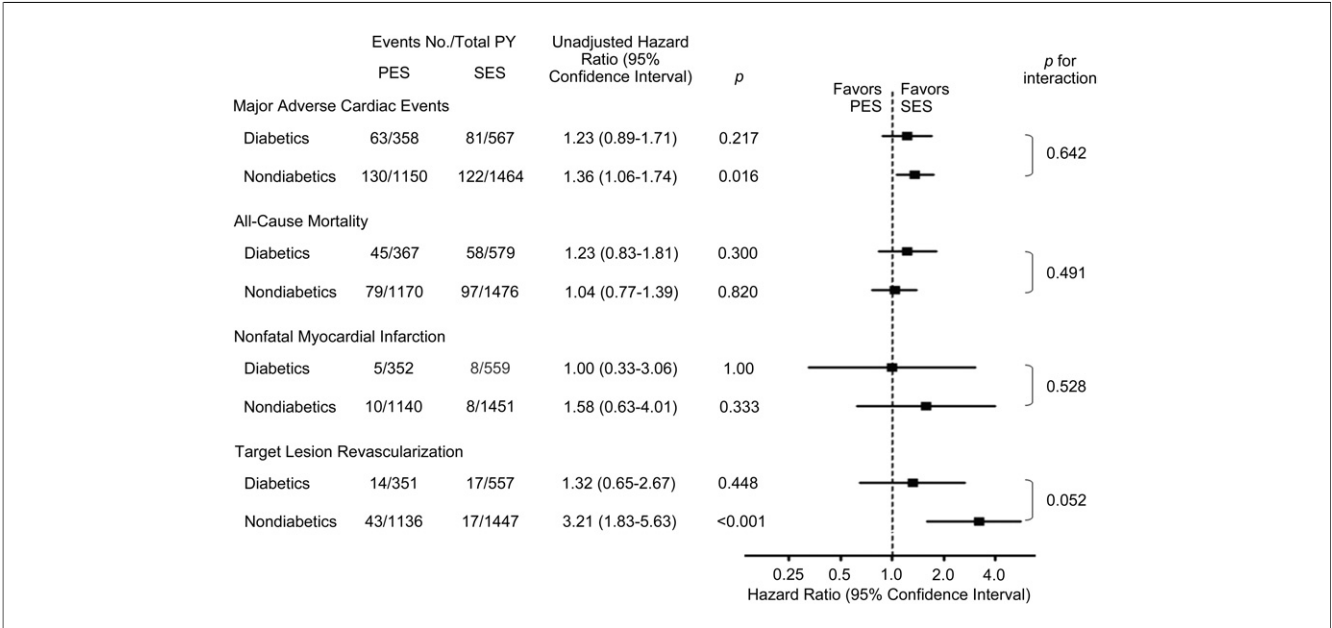

Figure 3. Clinical Outcomes of Diabetic and Nondiabetic Population

Note that the inferiority of PES to SES regarding MACE and TLR rates in the nondiabetic population disappears in the diabetic population. There is borderline significant interaction between DM and the type of DES for TLR (p = 0.052). PY = patient-year; other abbreviations as in Figures 1 and 2.

Table 2. Baseline Characteristics of Patients Matched for Propensity Score

Characteristics	Total Patients		
	PES (n = 1,451)	SES (n = 1,451)	p Value
Age, yrs	62 ± 12	63 ± 12	0.781
Male	1,094 (75)	1,095 (76)	1.000
Initial hypotension	162 (11)	163 (11)	1.000
LVEF	50 ± 12	50 ± 11	0.702
Symptom to door time <12 h	1,173 (81)	1,157 (80)	0.478
Smoking	728 (50)	735 (71)	0.824
Hypertension	634 (44)	643 (44)	0.761
Dyslipidemia	523 (36)	538 (37)	0.591
Diabetes mellitus	338 (23)	329 (23)	0.725
Previous myocardial infarction	35 (2)	33 (2)	0.901
Previous PCI	40 (3)	54 (4)	0.175
Previous CABG	8 (0.6)	6 (0.4)	0.791
Malignancy	15 (1)	15 (1)	1.000
Primary PCI	1,101 (76)	1,107 (76)	0.819
Glucose, mg/dl	170 ± 74	168 ± 68	0.451
Creatinine, mg/dl	1.1 ± 0.9	1.1 ± 1.2	0.608
Creatine kinase-MB fraction, IU/l	205 ± 323	199 ± 305	0.589
Infarct-related coronary vessel			0.489
LM	15 (1)	10 (1)	
LAD	760 (52)	753 (52)	
LCX	150 (10)	145 (10)	
RCA	526 (36)	543 (37)	
Number of diseased vessels			0.797
1	693 (48)	689 (48)	
2	446 (31)	443 (31)	
3	312 (22)	319 (22)	
ACC/AHA lesion type B2/C	1,172 (81)	1,164 (80)	0.739
Pre-procedural TIMI flow grade 3	309 (22)	339 (24)	0.215
Glycoprotein IIb/IIIa inhibitor	283 (20)	268 (19)	0.476
Stent length, mm	25 ± 6	26 ± 6	0.485
Stent diameter, mm	3.2 ± 0.4	3.2 ± 0.3	0.955
Number of implanted stents	1.5 ± 0.8	1.5 ± 0.8	0.895
Post-procedural TIMI flow grade 3	1,367 (95)	1,367 (95)	0.797
Successful procedure	1,426 (99)	1,414 (98)	0.203
Discharge medication			
Aspirin	1,433 (99)	1,435 (99)	0.864
Clopidogrel	1,429 (99)	1,428 (98)	1.000
Beta-blocker	1,059 (73)	1,051 (72)	0.775
ACEi or ARB	1,201 (83)	1,197 (83)	0.886
Statin	1,195 (82)	1,188 (82)	0.776
Duration of F/U days, median (IQR)	372 (224–412)	368 (207–413)	0.880
Angiography F/U	532 (37)	545 (38)	0.646

Values given as percentage unless otherwise indicated.
  Abbreviations as in Table 1.

0.767); and 4.0% for PES and 1.5% for SES group in nondiabetic patients (p = 0.003). And the incidence curve of TLR in the SES group of the nondiabetic population was located in the lowest area from index procedure to final follow-up time (Fig. 6). The risk for the composite of all-cause mortality was not significantly different between 2 stent groups, with regard to the hard end point (p = 0.875 for diabetic, p = 0.259 for nondiabetic).
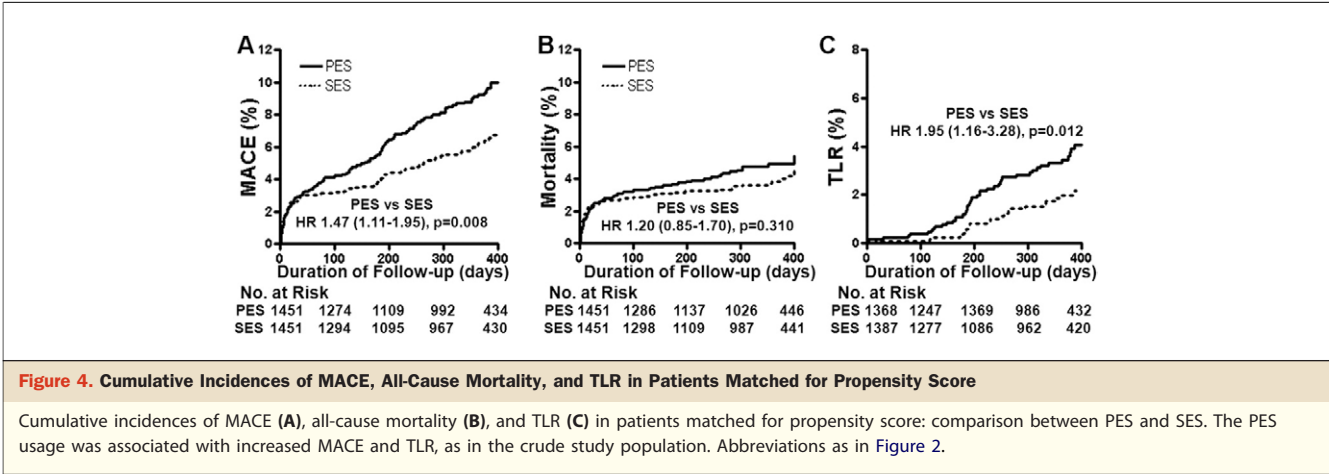
Discussion

The current study represents the largest multicenter comparison of PES and SES implantation for patients with STEMI in Korea. The main finding of this study was that in the overall and nondiabetic population SES showed lower risk of MACE than PES up to 1 year, mainly due to a reduction in TLR. However, among diabetic patients there was no significant difference, suggesting that diabetes might differentially affect the outcomes of PES and SES in patients with STEMI. This was statistically tested by interaction p value, which revealed borderline significance. Propensity analysis made this implication more convincing, with evident statistical significance.

The PES group showed, with respect to the hard end point represented by all-cause mortality in this study, slightly more events than the SES group, which was not significant. Regarding the nonfatal myocardial infarction, the incidence was too low to make any solid comparison between the 2 DES groups.

Comparison with previous studies. The estimated 1-year MACE rates for the overall population of this study were 11.6% in PES and 8.6% in SES group. These were comparable to the results from the AMI subgroup of the European RESEARCH/T-SEARCH (Rapamycin-Eluting Stent Evaluated at Rotterdam Cardiology Hospital/ Taxus-Stent Evaluated At Rotterdam Cardiology Hospital) registry, which reported 1-year MACE as 15.4% in PES and 9.7% in SES group (10). After matching for propensity score the estimated 1-year MACE rates became 9.4% in PES and 6.5% in SES group, which were also similar to the results of randomized trials conducted for AMI patients such as the PASSION (Paclitaxel-Eluting Stent Versus Conventional Stent in ST-Segment Elevation Myocardial Infarction) (8.8% in PES group), TYPHOON (Trial to Assess the Use of the Cypher Stent in Acute Myocardial Infarction Treated with Angioplasty) (7.3% in SES group) or SESAMI (Sirolimus-Eluting Stent Versus Bare-Metal Stent in Acute Myocardial Infarction) trials (6.8% in SES group). Comparing the baseline characteristics of the current study with these randomized trials also suggested that the study populations were not different for the most part (3,4,11).

There had been many studies about relative efficacy of PES versus SES (12,13), and recent collaborative network meta-analysis comprising 40 randomized trials concluded that the patients receiving SES had a lower risk for repeat

Figure 4. Cumulative Incidences of MACE, All-Cause Mortality, and TLR in Patients Matched for Propensity Score

Cumulative incidences of MACE (A), all-cause mortality (B), and TLR (C) in patients matched for propensity score: comparison between PES and SES. The PES usage was associated with increased MACE and TLR, as in the crude study population. Abbreviations as in Figure 2.

revascularization compared with patients receiving PES (14). Only a few studies directly compared SES and PES previously, with regard to the patients with AMI, mostly being limited in size (10,15). Our group previously reported that SES, compared to PES, was associated with remarkably lower 1-year MACE rate in the AMI subgroup of the Korean VERITAS (VERIfy Thrombosis risk ASsessment) registry (16), and the current study again confirmed the superior efficacy of SES over PES in STEMI patients.

Meanwhile, superiority of SES was not apparent in patients with diabetes mellitus. Although Dibra et al. (17) reported that SES had lower late loss than PES in diabetic patients, several registry data showed conflicting results

(15,18,19). The most recently reported meta-analysis of the diabetic patients concluded that there were no significant differences in clinical outcomes between SES and PES (20). We also addressed comparability between 2 DES in diabetic STEMI patients in this study, which implied extrapolation of the results from the overall diabetic population to the diabetic STEMI population.

Insights into the possible mechanisms. Each drug eluted by DES has its specific site of action to suppress proliferation and migration of vascular smooth muscle cells, thus reducing neointimal hyperplasia. It is microtubule for paclitaxel and mammalian target of rapamycin (mTOR) for sirolimus (21,22).
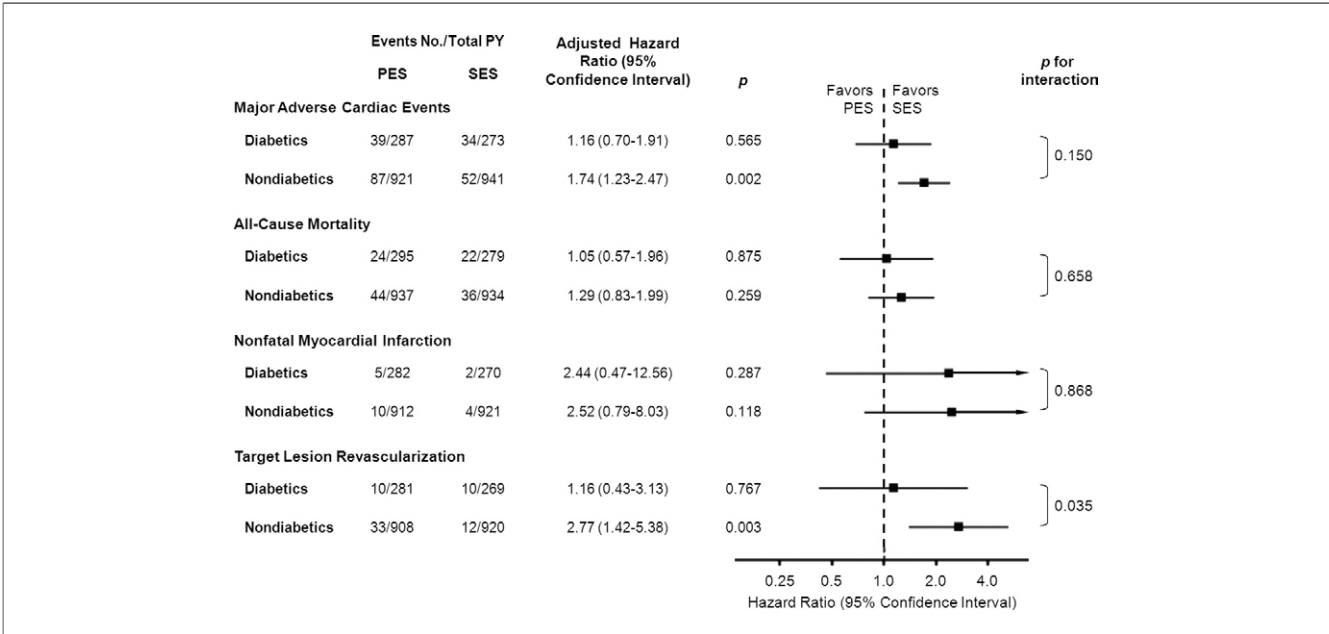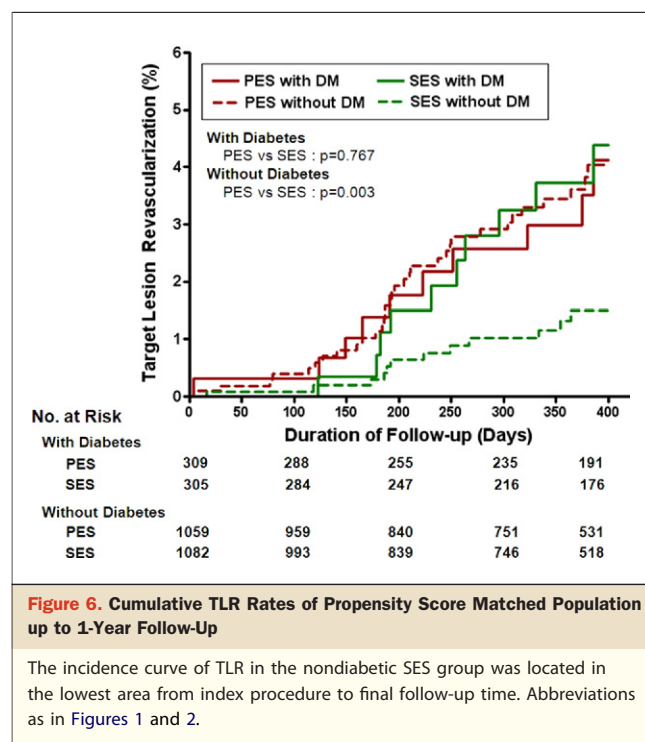

Figure 5. Clinical Outcomes of Patients Matched for Propensity Score

The analysis for the propensity-score matched population shows results similar to those of the crude study population. Note that the interaction between the DES type and DM for target lesion revascularization is significant. Abbreviations as in Figures 1 and 3.

Figure 6. Cumulative TLR Rates of Propensity Score Matched Population up to 1-Year Follow-Up

The incidence curve of TLR in the nondiabetic SES group was located in the lowest area from index procedure to final follow-up time. Abbreviations as in Figures 1 and 2.

There are 2 possible explanations for the different response to diabetes mellitus according to the stent type. One is that phosphatidylinositol-3-kinase/AKT/mTOR signal axis activated via insulin receptor substrate 1 is already weakened by the characteristic insulin resistance of type II diabetes (23), and this attenuates the effect of sirolimus, which blocks mTOR. The other is that mTOR blockade by sirolimus induces AKT activation paradoxically and enhances migration of vascular smooth muscle cells via signal pathways bypassing mTOR, like FOXO1 or p27. Patterson et al. (24) reported that this paradoxical AKT activation becomes even more striking under insulin resistance, which emphasizes the attenuated efficacy of sirolimus in diabetic patients.

Theoretically, reduced efficacy of sirolimus in the diabetic condition could be a class effect of "-limus" drugs. In fact, there was a positive interaction between diabetes and stent type for MACE in a recent randomized trial comparing everolimus-eluting stent versus PES (25), supporting the aforementioned explanation.

Clinical implications. There might be differences in the relative efficacy between PES and SES according to the specific subgroups. And for the patients who have 2 of the major high-risk factors, diabetes and STEMI, it had not been fully evaluated due to the difficulty in enrollment of sufficient patients to test the difference in clinical outcomes between 2 stents. Therefore, the current study analyzing the large AMI registry, KAMIR, has important implications as the first study that compared PES with SES for the treatment of diabetic STEMI patients in the real-world

setting with adequate power. In addition, it adds evidence to previous observations on the possible interaction between diabetes and the type of DES.

Furthermore, it is noteworthy that theoretically the impact of diabetes on TLR of SES could be extrapolated to newer "-limus"-coated stents: zotarolimus-eluting and everolimus-eluting stents. Thus, the current study emphasizes dedicated analysis in a diabetic subgroup when verifying the efficacy of newer "-limus"-eluting stents, because it might differ from the results of the overall population.

Study limitations. This is a nonrandomized registry-based study. Although we conducted propensity analysis to overcome this limitation, there still remains the possibility of bias from unmeasured variables.

Another limitation is the lack of long-term follow-up data. Our recent data revealed that the late "catch-up" phenomenon was more prominent in SES than in PES (26). Moreover, the SIRTAX (Sirolimus-Eluting Stent Compared With Paclitaxel-Eluting Stent for Coronary Revascularization) trial at 5 years showed no difference in clinical outcomes between SES and PES, in contrast to the superior efficacy of SES at 1-year follow-up (27). Thus, further observation is needed to draw more definite conclusions on the long-term clinical outcomes. Also the KAMIR lacks quantitative coronary angiography data. Instead, stent diameter and length, which reflect vessel diameter and lesion length, were adjusted.

Incomplete data on stent thrombosis is another limitation. At the beginning of the KAMIR investigation, occurrence of stent thrombosis was not measured. With increasing concerns about DES thrombosis (28,29), the KAMIR database was updated to include this item in November 2006. Available data from 1,812 STEMI patients indicated that PES did not differ from SES with regard to the risk for stent thrombosis within 1 year (1.7% vs. 1.4%, p = 0.650). Among 1,506 patients whose data on antiplatelet drug prescription during follow-up was fully available, 103 patients ceased clopidogrel before 6 months from index procedure (6.7% in PES vs. 6.9% in the SES group; p = 0.641), and instead, cilostazol or ticlopidine was prescribed for 36 patients.

Although angiographic follow-up was not mandatory, more than 30% of the study population underwent follow-up angiography. We cannot absolutely rule out the possibility of bias caused by "oculo-stenotic reflex," which could have influenced unfavorably on the outcomes of the PES group, due to more late-luminal loss.

Finally, because almost all patients enrolled in the KAMIR were Korean, it might be difficult to generalize the results of the present study to other ethnic groups. However, because data from oriental patients were relatively insufficient to date, our data are at least a good supplementation.

Conclusions

In the overall and nondiabetic Korean STEMI population, PES was inferior to SES in terms of MACE, mostly due to a higher rate of TLR up to 1 year after PCI. However, in a diabetic Korean STEMI population, PES was as good as SES with regard to mortality, recurrent myocardial infarction, TLR, and a composite of these. Our data suggest that diabetes mellitus might differentially affect the risk of TLR according to the type of DES.

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Key Words: diabetes mellitus ■ myocardial infarction ■ stents.

▷ APPENDIX

For supplementary figures and tables, please see the online version of this article.