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Journal of the Chinese Medical Association 79 (2016) 239–247

www.jcma-online.com

Original Article

One-year cardiovascular outcomes of drug-eluting stent versus bare-metal stent implanted in diabetic patients with acute coronary syndrome

Chi-Cheng Lai [a,b,c,d], Tsung-Hsien Lin [e,f], Hon-Kan Yip [g,h], Chun-Peng Liu [i], Ai-Hsien Li [j], Kou-Gi Shyu [k], Shu-Chen Chang [l], Guang-Yuan Mar [a,m,*]

[a] *Cardiovascular Center, Kaohsiung Veterans General Hospital, Kaohsiung, Taiwan, ROC*
[b] *Department of Internal Medicine, Tri-Service General Hospital, National Defense Medical Center, Taipei, Taiwan, ROC*
[c] *Department of Biological Sciences, National Sun Yat-Sen University, Kaohsiung, Taiwan, ROC*
[d] *School of Medicine, National Yang-Ming University, Taipei, Taiwan, ROC*
[e] *Division of Cardiology, Department of Internal Medicine, Kaohsiung Medical University Hospital, Kaohsiung, Taiwan, ROC*
[f] *Department of Internal Medicine, Faculty of Medicine, College of Medicine, Kaohsiung Medical University, Kaohsiung, Taiwan, ROC*
[g] *Division of Cardiology, Department of Internal Medicine, Kaohsiung Chang Gung Memorial Hospital, Kaohsiung, Taiwan, ROC*
[h] *Chang Gung University College of Medicine, Kaohsiung, Taiwan, ROC*
[i] *Department of Internal Medicine, Kaohsiung Veterans General Hospital, Kaohsiung, Taiwan, ROC*
[j] *Division of Cardiology, Department of Internal Medicine, Far Eastern Memorial Hospital, Taipei, Taiwan, ROC*
[k] *Shin Kong Wu Ho-Su Memorial Hospital, Taipei, Taiwan, ROC*
[l] *Research Services Center for Health Information, Chang Gung University, Taoyuan, Taiwan, ROC*
[m] *College of Health and Nursing, Meiho University, Pingtung, Taiwan, ROC*

Received June 25, 2015; accepted September 7, 2015

Abstract

Background: The outcomes of drug-eluting stent (DES) versus bare-metal stent (BMS) use in patients with diabetic mellitus (DM) and acute coronary syndrome (ACS) are rarely reported in Taiwan. This study aimed to investigate the 1-year cardiovascular outcomes of DESs versus BMSs implanted in Taiwanese patients with DM and ACS.

Methods: For this study, we collected and analyzed patient information from the database of the Taiwan ACS Full Spectrum registry regarding characteristics and cardiovascular events in participants with DM and ACS who received implantation of either BMS (BMS group) or DES (DES group) from October 2008 to January 2010.

Results: We found that several characteristics significantly varied between the groups. Compared with the BMS group ($n = 575$), the DES group ($n = 199$) had significantly lower rates of in-hospital cardiogenic shock (1.5% vs. 4.9%, $p = 0.037$) and acute renal failure (0.5% vs. 4.5%, $p = 0.008$), all-cause mortality (5.0% vs. 8.9%, $p = 0.048$), and major adverse cardiac events (MACEs) at 1 year (11.1% vs. 18.6%, $p = 0.006$) with an identical target vessel revascularization (TVR) rate (6.0% vs. 7.3%, $p = 0.395$). The BMS group had significantly higher risk-adjusted all-cause mortality [hazard ratio (HR) = 2.4, 95% confidence interval (CI) 1.0–5.7; $p = 0.048$] and MACE (HR = 2.2, 95% CI 1.2–3.9; $p = 0.011$) at 1 year with identical risks of TVR (HR = 1.3, 95% CI 0.6–2.9; $p = 0.505$) and nonfatal myocardial infarction (HR = 1.5, 95% CI 0.5–4.4; $p = 0.478$).

Conclusion: The results of this study support the use of DES over BMS in Taiwanese patients with DM and ACS, providing the clinical benefits of lower rates of total mortality and MACE, and without increased TVR at 1 year in a real-world setting.

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Keywords: acute coronary syndrome; bare-metal stent; diabetes mellitus; drug-eluting stent; outcome; percutaneous coronary intervention

Conflicts of interest: The authors declare that they have no conflicts of interest related to the subject matter or materials discussed in this article.

* Correspondence author. Dr. Guang-Yuan Mar, Cardiovascular Center, Kaohsiung Veterans General Hospital, 386, Ta-Chung 1st Road, Kaohsiung 813, Taiwan, ROC.

E-mail address: philipmar0119@gmail.com (G.-Y. Mar).

http://dx.doi.org/10.1016/j.jcma.2015.09.004

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1. Introduction

Acute coronary syndrome (ACS) is generally caused by acute atherothrombosis, and it characteristically presents with ST-segment elevation myocardial infarction (STEMI), non-STEMI (NSTEMI), or unstable angina (UA). Both ACS and diabetes mellitus (DM) are powerful independent predictors for adverse cardiovascular events such as target lesion revascularization, target vessel revascularization (TVR), major adverse cardiac events (MACEs), or mortality after percutaneous coronary intervention (PCI).[1–9] Studies including randomized controlled trials (RCTs),[10,11] observational trials,[3,8,9,12–21] and meta-analysis trials[22–24] have well-established that use of drug-eluting stents (DESs) is safe and effective in patients with acute myocardial infarction (AMI)[3,12,13] or in patients with DM,[12–21] as compared with use of bare-metal stents (BMSs). Placement of DES primarily benefits patients with lower repeat revascularization, but inconsistent results have been observed concerning mortality, myocardial infarction (MI), or MACE.[3,8–24] Studies comparing the impact of implantation of DES versus BMS on cardiovascular outcomes in patients with both DM and ACS are very rare,[12,13] especially those in Taiwan, although DES has been popularly used in Taiwan. This study was therefore designed to analyze real-world data involving Taiwanese patients with DM and ACS who received either BMS or DES implantation. Patient data were collected from the database of the Taiwan ACS Full Spectrum (ACS FS) registry, which was a multicenter, prospective, and observational registry study performed to evaluate real practices in ACS management.[25–27] This study aimed to describe patterns of use of BMS and DES for Taiwanese patients with DM and ACS, and to investigate the 1-year clinical outcome between the BMS and DES groups in a real-world setting.

2. Methods

2.1. Study design

The Taiwan ACS FS registry study was performed in accordance with guidelines set forth in the Declaration of Helsinki and local regulatory guidelines. The Medical Ethics Committee (Joint Institutional Review Board Number: 08-070-A) approved the study protocol at each participating site, and written informed consent was obtained from all participants. The study protocol was reviewed and allowed by the Publication Committee of the Taiwan ACS FS registry. In addition, the authors were authorized to collect the relevant data from the database of the registry and report the analysis. This study was designed to analyze the data involving participants with DM and ACS undergoing either DES or BMS implantations and to compare 1-year clinical outcomes between the DES and BMS groups. The registry study was a multicenter, prospective, nonrandomized, observational study with an intention to recruit over 3000 ACS participants and evaluate real practices in ACS management. The names of the principal investigators who participated in the registry study are listed in Appendix 1.

2.2. Study population

Participants were recruited from 39 participating sites, which were distributed throughout the country and selected by the Scientific Committee of the Taiwan Society of Cardiology according to the annual volume of PCI performed. Approximately 50–200 consecutive ACS patients were recruited as eligible patients in each participating site. Eligible patients were aged 20 years or older, were hospitalized within 24 hours after the onset of ACS symptoms, or transferred in from a nonparticipating site with less than a 12-hour stay. Diabetic participants were confirmed clinically according to the guidelines and treated by diet control alone, oral hypoglycemic agents, insulin, or a combination of these. Participants with DM and ACS implanted with either DES alone or BMS alone were categorized as the DES group and the BMS group, respectively. Any type of BMS or DES available in the domestic health care system was allowed at the interventionists' discretion. One or more stents implanted were also permitted in the index PCIs. The classes of DES used in the study included sirolimus-, paclitaxel- (PES), zotarolimus-, and everolimus-eluting stent during the registry period. Excluded patients were those who presented with ACS secondary to comorbidity such as trauma or bleeding, or participated in an investigational drug study. Patients who were not diagnosed with DM, did not undergo coronary stenting, or received hybrid stenting with both BMS and DES were also excluded. Physicians independently determined the treatment strategies and made all clinical decisions. Thereafter, all participants were followed at scheduled 3 months, 6 months, 9 months, and 12 months after discharge. Participant data with respect to characteristics, clinical presentations, index PCI procedures, medication prescriptions, and relevant adverse events between groups were gathered from the case record forms. Medication prescriptions of aspirin, clopidogrel, dual antiplatelet therapy (DAPT) with aspirin plus clopidogrel, beta-blockers, angiotensin-converting enzyme inhibitors or angiotensin receptor blockers, and statins were also compared during the 1-year follow-up between groups.

2.3. In-hospital and 1-year events

The in-hospital and 1-year relevant adverse events were compared between the stent groups. Cardiovascular end points at 1 year including mortality, nonfatal MI, nonfatal hemorrhagic or ischemic stroke, ischemia-driven TVR, and composites of cardiovascular events such as MACE (defined as a composite of total mortality, nonfatal MI, and TVR) were primarily observed. In-hospital adverse events included mortality, nonfatal MI, unplanned revascularization, nonfatal hemorrhagic or ischemic stroke, cardiogenic shock, ventricular arrhythmia, and acute renal failure. A study end point was clinically confirmed by investigators at study sites and headquarters according to the symptoms, electrocardiographic findings, cardiac enzymes, and/or images. Acute renal failure was defined as a rise (>0.5 μg/dL) in serum creatinine level beyond the baseline value.[28]

2.4. Statistical analysis

All variables were analyzed using SAS software version 9.2 (SAS Institute Inc., Cary, NC, USA) in the analytic center. All categorical data and rates are displayed as percentages and numbers, and continuous data are shown as means ± standard deviation. Baseline and outcome data were compared between the two groups using the Chi-square test or Fisher exact test for categorical variables, and using the analysis of variance test for continuous variables. Kaplan–Meier analysis with log-rank test was used to detect differences in cumulative event-free survival at 1 year between the two groups. Hazard ratios (HRs) and 95% confidence interval (CI) were calculated from a Cox regression model in an unadjusted or adjusted manner for other covariates. Demographic characteristics (age, sex, and body mass index), stent type, Killip class, hypertension, smoke, family history of atrial fibrillation, history of heart failure and cerebrovascular accident, history of MI, PCI, or bypass surgery, use of insulin, and ACS type were included. Each of the aforementioned variables was used for its univariate association with 1-year total mortality in the Cox regression model. Covariates that were significantly associated with 1-year mortality with a significance level of $p < 0.05$ were selected for the multivariate Cox model. Stepwise model selection with critical value of $p < 0.15$ and $p > 0.25$ was used for variable selection and for variable elimination. A p value less than 0.05 with two-sided 95% CI was considered statistically significant for all tests. Analyses were conducted as time to first event without double counting of events within analyses involving composite end points. In the registry, patients who were lost to follow-up were censored at the time of last contact, with their vital status deemed as alive and event-free at that time.

3. Results

3.1. Demographics and characteristics of the BMS and DES groups

From the cohort of 3183 ACS participants enrolled between October 2008 and January 2010, data on 1122 participants with DM and ACS were collected. Among them, 232 participants who did not receive PCI were excluded for analysis. In the remaining 890 participants, 80 who did not receive coronary stenting and 36 who received coronary hybrid stenting with both BMS and DES were also excluded. Finally, 774 participants with a mean age of 64.7 ± 12.0 years who received implantations of either BMS or DES (1 or more stents) were ultimately enrolled as the BMS group ($n = 575$, 74.3%) and the DES group ($n = 199$, 25.7%), respectively (Fig. 1). The study population included 51.3% STEMI patients, 37.0% NSTEMI patients, and 11.7% UA patients.

There were apparent demographic and characteristic variations between the stent groups. The DES group was more likely to have a family history of vascular disease, prior PCI, presentation as non-ST-segment elevation ACS (NSTEACS), PCI at the left main trunk, and persistent prescriptions of DAPT ($p < 0.05$). By contrast, current smoking, presentation as STEMI, PCI at the right coronary artery, thrombolysis in MI 0/1 blood flow, and use of intra-aortic balloon pump (IABP) were more common in the BMS group ($p < 0.05$). In addition,

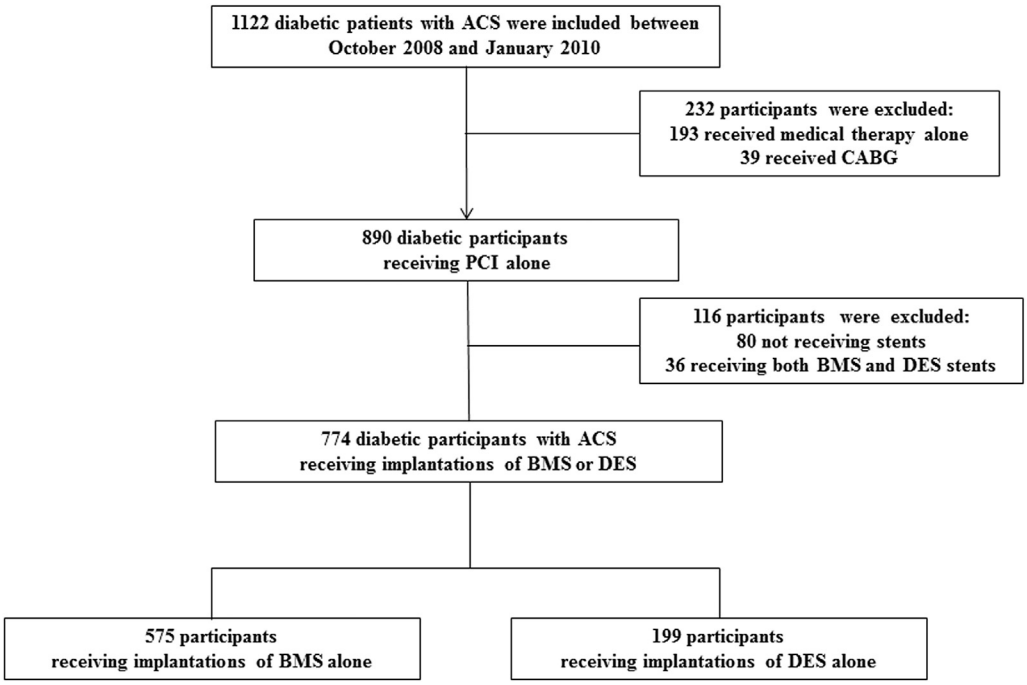

Fig. 1. Participant selection flowchart. Data on 1122 eligible participants with diabetes mellitus (DM) and acute coronary syndrome (ACS) were collected. Among these participants, 232 who did not receive percutaneous coronary intervention (PCI) and 116 who did not receive stentings with bare-metal stent (BMS) alone or drug-eluting stent (DES) alone were excluded. The remaining 774 participants with DM and ACS were divided into the BMS group (n = 575) and the DES group (n = 199). CABG = coronary artery bypass grafting.

Table 1
Baseline characteristics between the BMS and DES groups.

	BMS (n = 575)	DES (n = 199)	p
Age (y)	64.4 ± 11.9	65.7 ± 12.6	0.203
Male, *n* (%)	417 (72.5)	141 (70.9)	0.651
Body mass index, (kg/m^2)	25.6 ± 4.0	25.9 ± 4.0	0.345
History of, *n*/*N* (%)			
Diabetic treatment			
Diet control	55/555 (9.9)	26/191 (13.6)	0.156
Oral hypoglycemic agents	466/553 (84.3)	161/192 (83.9)	0.893
Use of insulin	79/575 (13.7)	33/199 (16.6)	0.326
Dyslipidemia	277/571 (48.5)	105/199 (52.8)	0.302
Hypertension	421/569 (74.0)	151/199 (75.9)	0.599
Cigarette smoker	214/567 (37.7)	53/195 (27.2)	0.008
Family history of vascular disease	89/420 (21.2)	47/147 (32.0)	0.008
Known CAD, *n*/*N* (%)	151/575 (26.3)	68/199 (34.2)	0.033
MI	55/149 (36.9)	21/66 (31.8)	0.471
PCI	101/149 (67.8)	55/67 (82.1)	0.030
Coronary artery bypass surgery	19/149 (12.8)	10/67 (14.9)	0.665
Congestive heart failure	32/575 (5.6)	12/199 (6.0)	0.807
Atrial fibrillation	15/574 (2.6)	6/199 (3.0)	0.764
Cerebrovascular accidence	74/575 (12.9)	19/199 (9.6)	0.214
Blood pressure/heart rate at ED			
Systolic blood pressure (mmHg)	140.7 ± 33.6	142.8 ± 31.9	0.443
Diastolic blood pressure (mmHg)	80.9 ± 21.5	80.4 ± 20.4	0.776
Heart rate (bpm)	85.5 ± 24.1	84.8 ± 22.8	0.693
ACS types, *n*/*N* (%)			<0.001
ST elevation MI	321/575 (55.8)	76/199 (38.2)	
Non-ST elevation MI	200/575 (34.8)	86/199 (43.2)	
Unstable angina	54/575 (9.4)	37/199 (18.6)	
Killip classification, *n*/*N* (%)			0.121
I	252/476 (52.9)	93/153 (60.8)	
II	98/476 (20.6)	23/153 (15.0)	
III	63/476 (13.2)	24/153 (15.7)	
IV	63/476 (13.2)	13/153 (8.5)	
Median time to CAG (h)	4.9	25.5	<0.001
Culprit coronary artery, *n*/*N* (%)			
Left main	9/575 (1.6)	9/199 (4.5)	0.017
LAD	290/575 (50.4)	103/199 (51.8)	0.747
LCX	108/575 (18.8)	43/199 (21.6)	0.386
RCA	227/575 (39.5)	55/199 (27.6)	0.003
TIMI artery flow before PCI, *n*/*N* (%)			0.005
TIMI 0/1	291/503 (57.9)	77/173 (44.5)	
TIMI 2	122/503 (24.3)	49/173 (28.3)	
TIMI 3	90/503 (17.9)	47/173 (27.2)	
Peak cardiac enzymes (in-hospital)			
CK (U/L)	917.6 ± 1546.3	839.2 ± 1246.7	0.544
CK-MB (U/L)	56.6 ± 90.9	40.7 ± 62.9	0.032
Troponin I or T (μg/L)	15.6 ± 52.5	10.0 ± 17.5	0.167
Echocardiography (in-hospital if obtained), *n*/*N* (%)			0.494
Normal	269/464 (58.0)	91/146 (62.3)	
Mild	117/464 (25.2)	35/146 (24.0)	
Moderate	56/464 (12.1)	17/146 (11.6)	
Severe	22/464 (4.7)	3/146 (2.1)	
Estimated EF (if done)	52.7 ± 12.6	54.1 ± 13.1	0.262
PCI, *n*/*N* (%)			
Done within 48 h	426/569 (74.9)	123/195 (63.1)	0.002
Median time to PCI (h)	5.3	26.0	<0.001
Number of lesions treated	1.4 ± 0.7	1.6 ± 0.8	0.026
Intra-aortic balloon pump, *n*/*N* (%)	130/574 (22.7)	31/199 (15.6)	0.034

ACS = acute coronary syndrome; BMS = bare-metal stent; CAD = coronary artery disease; CAG = coronary angiogram; CK = creatine kinase; CK-MB = creatine kinase-myocardial band; DES = drug-eluting stent; ED = emergency department; EF = ejection fraction; LAD = left anterior descending artery; LCX = left circumflex artery; MI = myocardial infarction; PCI = percutaneous coronary intervention; RCA = right coronary artery; TIMI = thrombolysis in myocardial infarction.

the BMS group had significantly shorter time to PCI compared with the DES group (5.3 hours vs. 26.0 hours, $p < 0.001$). Baseline characteristics were outlined between the stent groups as noted in Table 1.

3.2. One-year cardiovascular outcome

Compared with the BMS group, the DES group appeared to have significantly lower cumulative 1-year incidence of total mortality (5.0% vs. 8.9%; $p = 0.048$; Fig. 2A), but identical incidence of nonfatal MI (3.5% vs. 3.8%; $p = 0.745$; Fig. 2B), TVR (6.0% vs. 7.3%; $p = 0.395$; Fig. 2C), or nonfatal stroke (2.5% vs. 1.6%; $p = 0.162$; Fig. 2D) using Kaplan–Meier analysis and the log-rank test. Significant reductions with the DES-associated treatment were shown in the cumulative 1-year incidence of MACE (11.1% vs. 18.6%; $p = 0.006$; Fig. 3A) and the composite of total mortality, nonfatal MI, TVR, and nonfatal stroke (12.6% vs. 19.8%; $p = 0.009$; Fig. 3B) with a decreasing trend noted in the composite of total mortality, nonfatal MI, and nonfatal stroke (9.1% vs. 13.4%; $p = 0.062$; Fig. 3C).

3.3. In-hospital outcome

In-hospital cardiogenic shock (4.9% vs. 1.5%; $p = 0.037$), use of IABP (22.7% vs. 15.6%; $p = 0.034$), and acute renal failure (4.5% vs. 0.5%; $p = 0.008$) occurred more commonly in the BMS group compared with the DES group. The other in-hospital adverse events were equivalent between the DES and BMS groups including total mortality (1.7% vs. 1.5%; $p = 1.000$), cardiac mortality (1.6% vs. 1.0%; $p = 0.738$), nonfatal MI (0.9% vs. 1.5%; $p = 0.431$), unplanned revascularization (0.2% vs. 1.0%; $p = 0.164$), and nonfatal stroke (0.5% vs. 0%; $p = 0.573$). In-hospital adverse events are shown in Table 2.

3.4. Relative risk of cardiovascular events

After adjusting for confounding variables, the BMS group had significantly higher 1-year risk-adjusted total mortality (HR = 2.4, 95% CI 1.0–5.7, $p = 0.048$), MACE (HR = 2.2, 95% CI 1.2–3.9, $p = 0.011$), and the composite of total mortality, nonfatal MI, TVR, and nonfatal stroke (HR = 1.9, 95% CI 1.1–3.2, $p = 0.026$) compared with the DES group. There were no differences in the 1-year risk-adjusted TVR (HR = 1.3, 95% CI 0.6–2.9, $p = 0.505$), nonfatal MI (HR = 1.5, 95% CI 0.5–4.4, $p = 0.478$), and the composite of total mortality, nonfatal MI, and nonfatal stroke (HR = 1.9, 95% CI 1.0–3.6, $p = 0.064$). Unadjusted and adjusted risks of cardiovascular events between the two groups at 1 year are summarized in Table 3.

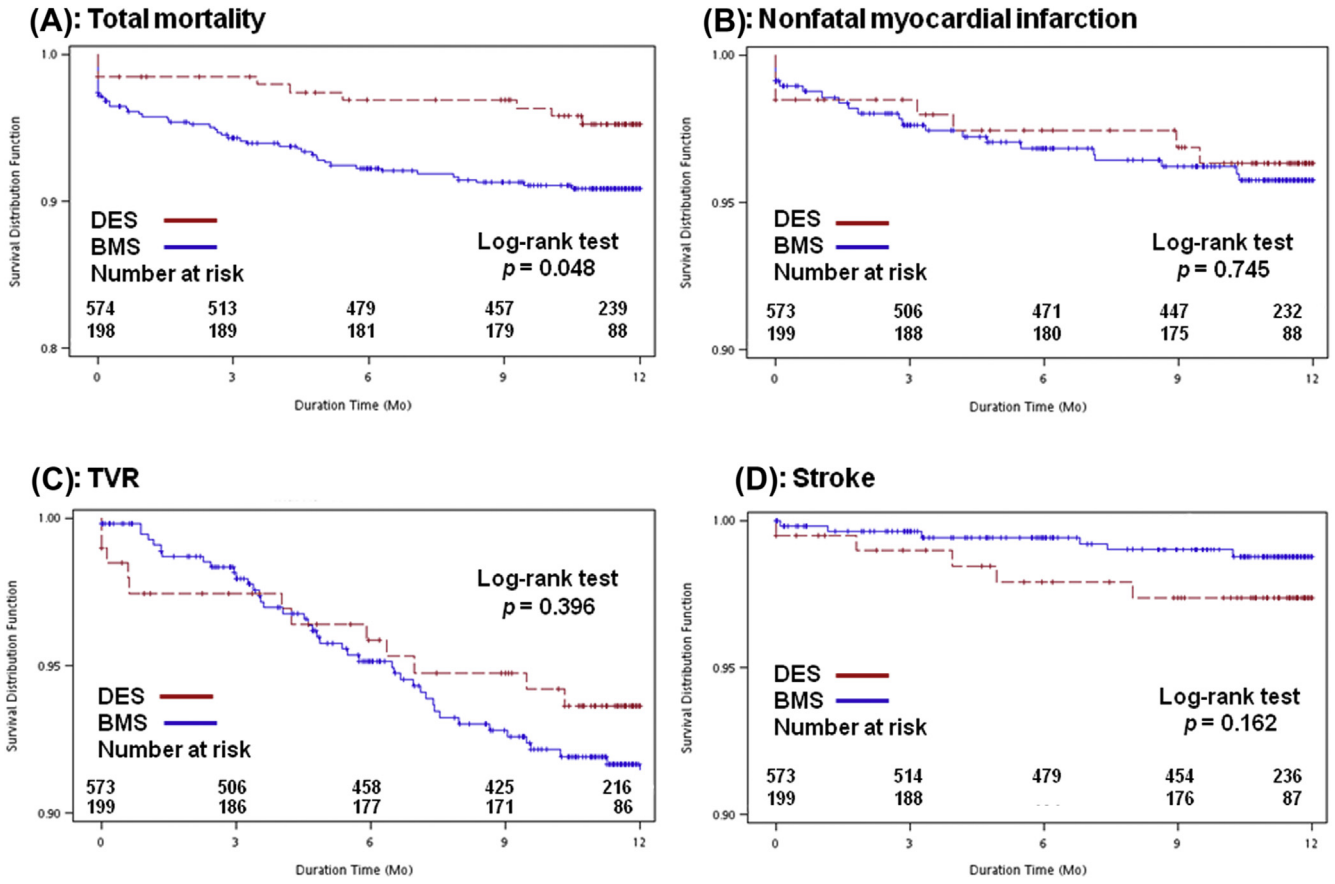

Fig. 2. One-year cardiovascular events including (A) all-cause mortality, (B) nonfatal myocardial infarction, (C) target vessel revascularization, and (D) stroke are shown between the bare-metal stent (BMS) and drug-eluting stent (DES) groups using Kaplan–Meier analysis with log-rank test. TVR = target vessel revascularization.

3.5. Pharmacologic therapy

During the 1-year follow-up, medication prescriptions differed significantly between the groups. In-hospital use of any glycoprotein IIb/IIIa inhibitors (18.4% vs. 8.5%; $p = 0.001$) was more common in the BMS group. Prescriptions of DAPT with aspirin plus clopidogrel dramatically declined in both stent groups, especially in the BMS group (89.0% in-hospital, 56.1% at 6 months, and 23.0% at 1 year), although our health-care system would provide reimbursement for 9 months of DAPT in patients with ACS. DAPT with aspirin plus clopidogrel was more commonly prescribed in the DES group, for example at 6 months (73.3% vs. 56.1%; $p < 0.001$). The prescription rates of relevant medications during the 1-year follow-up are presented in Fig. 4.

4. Discussion

This observational study was based on data from the national ACS FS registry, and depicts the clinical outcomes of the DES and BMS groups in 774 patients with DM and ACS. The major findings of the study are as follows: (1) The DES group appears to have significantly lower cumulative 1-year incidences of MACE and total mortality as compared with the BMS group; (2) in comparison with the DES group, the BMS group had significant annual increases in risk-adjusted total mortality by 140% (absolute risk increases by 3.9%) and MACE by 120% (absolute risk increases by 7.6%); (3) for Taiwanese patients with DM and ACS, there is no difference in cumulative 1-year incidence of cardiac mortality, nonfatal MI, TVR, or stroke between the two stent groups; and (4) DAPT with aspirin and clopidogrel was underused for patients with DM and ACS in Taiwan.

Coronary artery stenosis and cardiovascular events occur commonly in patients with DM or ACS.[1–9] DESs designed to elute antihyperplasic drugs to retard neointimal growth have been proven to reduce the incidence of coronary artery restenosis, repeat revascularization,[8–24] mortality,[17,20] or MACE.[8,10,17,18,20,21] A large RCT enrolling 3009 AMI patients receiving primary PCI demonstrated that the paclitaxel-eluting stent (PES) group ($n = 2257$) compared with the BMS group ($n = 749$) had lower rates of TVR at 1-year ($p = 0.006$) and at an extended 3-year ($p = 0.0003$) follow-up.[12,29,30] However, the subanalysis of 478 diabetic patients with AMI disclosed no differences in 1-year rates of TVR, total mortality, MI, stroke, and stent thrombosis between the PES group ($n = 364$) and the BMS group ($n = 114$).[12] Those findings are compatible with

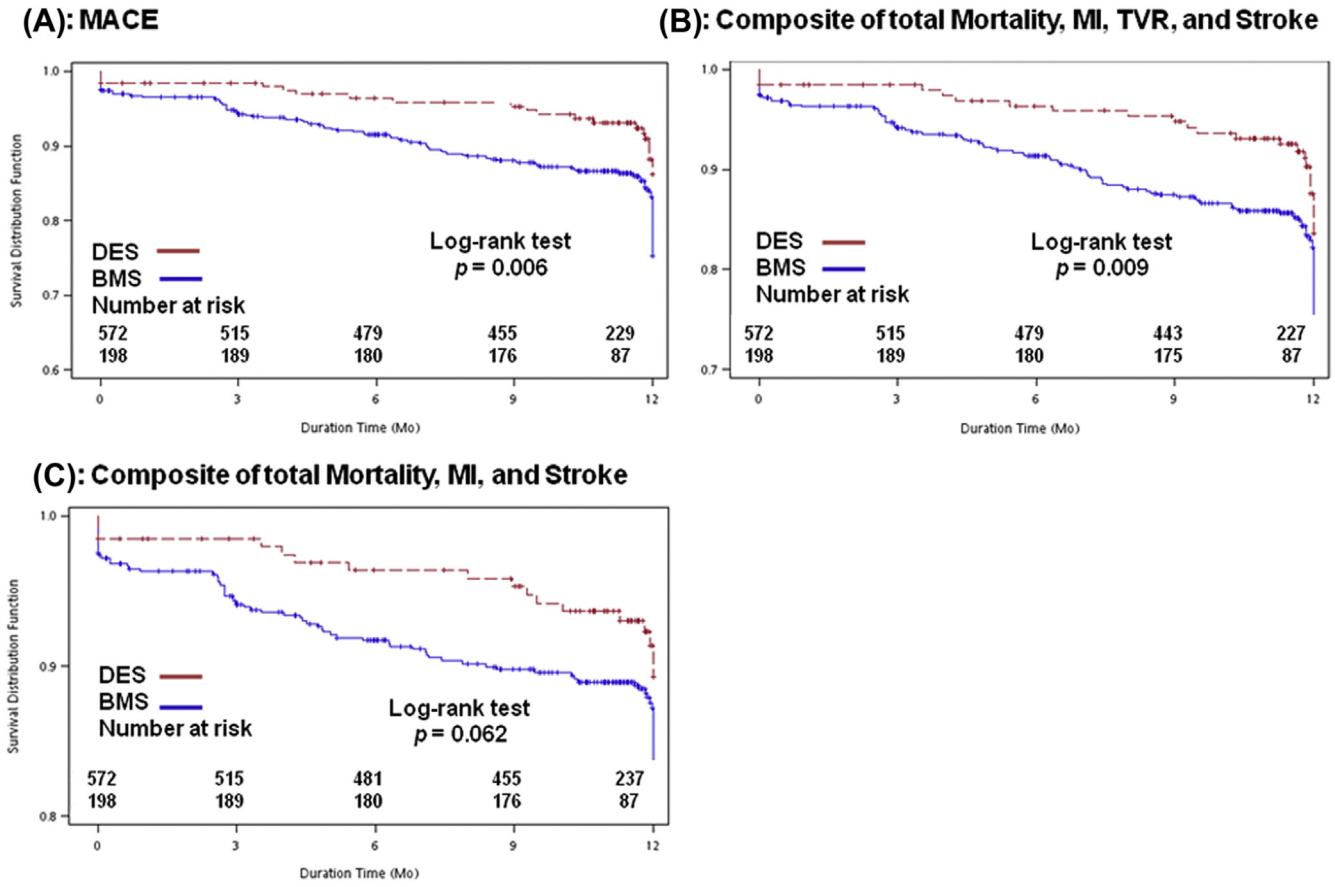

Fig. 3. Kaplan–Meier plots illustrate 1-year cardiovascular composite events between the bare-metal stent (BMS) and drug-eluting stent (DES) groups including (A) MACE (total mortality, nonfatal MI, or TVR), (B) the composite of total mortality, MI, or stroke, (C) the composite of total mortality, MI, TVR, and stroke. MACE = major adverse cardiac event; MI = myocardial infarction; TVR = target vessel revascularization.

Table 2
In-hospital and 1-year outcomes between the BMS and DES groups.

	BMS (n = 575)	DES (n = 199)	p
In-hospital outcomes, *n/N* (%)			
Total death	10/575 (1.7)	3/199 (1.5)	>0.99
Cardiac	9/10 (90.0)	2/3 (66.7)	0.423
Re-MI	5/575 (0.9)	3/199 (1.5)	0.431
Unplanned revascularization	1/575 (0.2)	2/199 (1.0)	0.164
Hemorrhagic or ischemic stroke	3/575 (0.5)	0/199 (0.0)	0.573
TIMI bleeding	14/575 (2.4)	4/199 (2.0)	>0.99
Cardiogenic shock	28/575 (4.9)	3/199 (1.5)	0.037
Ventricular arrhythmia	27/575 (4.7)	6/199 (3.0)	0.312
Atrial fibrillation	14/575 (2.4)	7/199 (3.5)	0.418
Acute renal failure	26/575 (4.5)	1/199 (0.5)	0.008
1-y CV outcomes, *n/N*, (%)			
Total death	51/575 (8.9)	10/199 (5.0)	0.048
Cardiac	20/51 (39.2)	4/10 (40.0)	>0.99
Re-MI	22/575 (3.8)	7/199 (3.5)	0.745
TVR	42/575 (7.3)	12/199 (6.0)	0.395
Hemorrhagic or ischemic stroke	9/575 (1.6)	5/199 (2.5)	0.168
Death/Re-MI/stroke	77/575 (13.4)	18/199 (9.1)	0.062
Death/Re-MI/TVR	107/575 (18.6)	22/199 (11.1)	0.006
Death/Re-MI/TVR/stroke	114/575 (19.8)	25/199 (12.6)	0.009

BMS = bare-metal stent; CV = cardiovascular; DES = drug-eluting stent; MI = myocardial infarction; TIMI = thrombolysis in myocardial infarction; TVR = target vessel revascularization.

Table 3
Cox regression analysis in stent types for estimating risk of 1-year cardiovascular outcomes.

	HR (unadjusted)	p *	HR (adjusted) [a]	p *
Total death	2.0 (1.0–4.0)	0.053	2.4 (1.0–5.7)	0.048
Cardiac death	1.8 (0.6–5.3)	0.283	1.8 (0.5–6.4)	0.340
MI	1.2 (0.5–2.8)	0.745	1.5 (0.5–4.4)	0.478
Hemorrhagic or ischemic stroke	0.7 (0.2–2.0)	0.450	0.4 (0.1–1.7)	0.232
TVR	1.3 (0.7–2.5)	0.397	1.3 (0.6–2.9)	0.505
Death/re-MI/TVR (MACE)	1.9 (1.2–3.0)	0.008	2.2 (1.2–3.9)	0.011
Death/re-MI/stroke	1.6 (1.0–2.8)	0.066	1.9 (1.0–3.6)	0.064
Death/re-MI/TVR/stroke	1.8 (1.1–2.8)	0.011	1.9 (1.1–3.2)	0.026

HR = hazard ratio (95% confidence interval; reference as the DES group); MACE = major adverse cardiac event; MI = myocardial infarction; TVR = target vessel revascularization.

* Risk estimation of 1-year cardiovascular outcomes in the bare-metal stent group referenced as the drug-eluting stent group using Cox regression analysis for categorical variables and using analysis of variance test for continuous variables.

[a] Cox regression analysis adjusted for the confounding factors including age, body mass index, Killip class, hypertension, smoker, history of atrial fibrillation, heart failure, cerebrovascular accident, and use of insulin.

the present results suggesting that the clinical benefit of DES implantation are primarily demonstrated through lower repeat revascularization, and may be attenuated or abolished in patients with coexisting DM and ACS.[12,13] One Taiwan study of patients with ACS recently exhibited significant reductions in TVR and cardiovascular composites in the DES group as compared with the BMS group.[27] Similarly, the present results reinforced that any superiority of DES over BMS, particularly in terms of declining TVR, was eliminated in a patient population with both DM and ACS who might have multivessel coronary diseases and complex coronary lesions requiring repeat revascularization. In addition, a large registry trial selecting diabetic patients treated with at least one DES or BMS with a median follow-up of 2.5 years showed a significant reduction in the rate of propensity score risk-adjusted coronary restenosis in the NSTEACS group implanted with DES, but not in the STEMI group.[13] Thus, implantation of DES compared with BMS may have different effects on clinical outcomes in various patient populations. The present data showed that the DES group compared with the BMS group, at a minimum, was not associated with increased nonfatal MI and TVR during the 1-year follow-up.

Cardiovascular events are more prevalent in a diabetic population than in a general population or nondiabetic population.[4–9,21,22] Based on the registry data, patients with DM and ACS compared with ACS patients receiving coronary stentings (n = 2322) had a higher cumulative 1-year incidence of cardiovascular events.[27] The DES group compared with the BMS group showed a significant reduction in total mortality by 2.4% in an ACS population, by 3.9% in a population with both DM and ACS, and in MACE by 5.5% and 7.6%, respectively.[27] In other words, the BMS group was associated with greater than twofold adjusted risk for total mortality or MACE as compared with the DES group. There is no doubt that DM comorbidity deteriorates patient outcomes. Consistent results obtained from several registry studies revealed a mortality benefit of the DES group over the BMS group in diabetic patients receiving PCI.[17,20] Furthermore, use of DES with a longer duration of DAPT may partially account for a mortality benefit in high-risk patients. A couple of studies have emphasized that the use of DAPT improves cardiovascular outcomes in patients with ACS.[31,32] The current guidelines recommend at least 1-year DAPT in patients with ACS, regardless of whether or not a stent was actually implanted.[33] A longer duration of DAPT may reduce cardiovascular events and, conversely, early discontinuation of DAPT may increase cardiovascular events,[31,34–36] although the duration of DAPT remains controversial.[37–39]

This observational study had several limitations. First, patients might have an elevated chance of selection because of relatively low mortality rates and cardiovascular event rates in the registry. Second, even after adjusting for confounding factors, unmeasured confounders possibly existed. Third, coronary lesion and stent characteristics such as vessel or stent size, lesion or stent length, and thrombus burden were not recorded. Fourth, angiographic follow-up was not mandatory in the registry, and therefore, ischemia-driven events were not optimally accurate because the events might be underreported. Fifth, uneven prescriptions levels of DAPT might in part contribute to outcome differences between the groups. Sixth, rare stent thrombosis was not investigated, which could impact

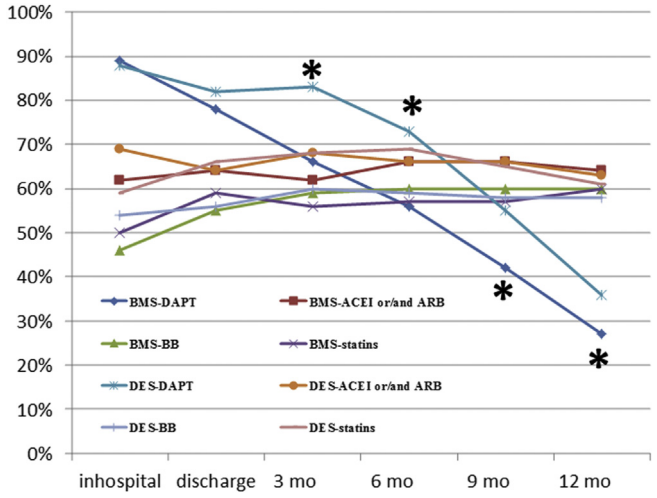

Fig. 4. Prescription rates of relevant medications during the 1-year follow-up. Prescription rates of dual antiplatelet therapy decline overtime in the two stent groups, especially in the bare-metal stent (BMS) group. ACEI = angiotensin-converting enzyme inhibitor; ARB = angiotensin receptor blocker; BB = beta-blocker; DAPT = dual antiplatelet therapy; DES = drug-eluting stent. * = Significant differences in prescription rates of DAPT between the DES and BMS groups.

the number of cardiovascular events in the DES group. Lastly, using a 1-year follow-up period might not be sufficient to fully evaluate the safety and efficacy of DES.

In conclusions, this study supports the continued current use of DES in patients with both DM and ACS in terms of reduced total mortality or composite cardiovascular events at 1 year in a real world setting, without increased adverse cardiac events.

Acknowledgments

This study was supported by Sanofi-Aventis and Bristol-Myers Squibb. We would like to thank the participating physicians and nurses for their contributions to conducting the registry including Chuen-Wang Chiou, Kuan-Rau Chiou, Hsiang-Chiang Hsiao, Shih-Hung Hsiao, Tung-Chen Yeh, Shih-Kai Lin, Hwong-Ru Hwang, and Feng-Yuo Kuo (all from the Cardiovascular Center of Kaohsiung Veterans General Hospital).

Appendix 1. Principal investigators who participated in the registry study.

The following principal investigators participated in the registry study: Kuan-Chen Chang, China University Medical Hospital; Chia-Lin Chao, Taoyuan General Hospital, Department of Health; Yi-Jen Chen, Wan-Fang Hospital; Chien-Cheng Chen, Show Chwan Memorial Hospital; Cheng-Yun Chen, Chia-Yi Christian Hospital; Chung-Yin Chen, Kuang Tien General Hospital; Fu-Tien Chiang, National Taiwan University Hospital; Shao-Yueh Chiang, Cheng Ching Hospital; Li-Ping Chou, Sin Lau Hospital The Presbyterian Church of Taiwan; Ching-Chang Feng, Tainan Municipal Hospital; Charles Jia-Yin Hou, Mackay Memorial Hospital; Kwan-Li Hsu, E-Da Hospital; Tsuei-Yuan Huang, Chi-Mei Hospital; Gwo-Ping Jong, Taichung Armed Forces General Hospital; Yu-Lin Ko, Taipei Tzu Chi General Hospital; Wen-Ter Lai, Kaohsiung Medical University Chung-Ho Memorial Hospital; Wen-Lieng Lee, Taichung Veterans General Hospital; Chun-I Lee, Pingtung Christian Hospital; Meng-Huan Lei, Lo-Tung Po-Ai Hospital; Ai-Hsien Li, Far Eastern Memorial Hospital; Yi-Heng Li, National Cheng Kung University Hospital; Jou-Wei Lin, National Taiwan University Hospital, Yunlin Branch; Tin-Kwang Lin, Dalin Tzuchi General Hospital; Jih-Min Lin, Kee-lung Hospital, Department of Health; Shing-Jong Lin, Taipei Veterans General Hospital; Hung-Shun Lo, Cathay General Hospital; Guang-Yuan Mar, Kaohsiung Veterans General Hospital; Chun-Ming Shih, Taipei Medical University Hospital; Kou-Gi Shyu, Shin Kong Wu Ho-Su Memorial Hospital; Cheng-Dao Tsai, Changhua Christian Hospital; Chuen-Den Tseng, National Taiwan University Hospital; Kwo-Chang Ueng, Chung Shan Medical University Hospital; Ji-Hung Wang, Hualien Tzu Chi General Hospital; Kuang-Te Wang, Mackay Memorial Hospital, Taitung Branch; Ming-Shien Wen, Linkou Chang Gung Memorial Hospital; Szu-Chi Wen, Hsin Chu General Hospital, Department of Health; Chiung-Jen Wu, Kaohsiung Chang Gung Memorial Hospital; Shih-Peng Yang, Tri-Service General Hospital; Wei-Hsian Yin, Cheng-Hsin Hospital.

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