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Practice Pattern and Prognostic Effect of Dual Antiplatelet Therapy for Left Main Coronary Artery Disease

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Abstract

The aim of this study was to investigate the practice pattern and long-term prognostic effect of dual antiplatelet therapy (DAPT) duration in patients undergoing percutaneous coronary intervention (PCI) with second-generation drug-eluting stent (DES) for left main coronary artery (LMCA) disease. Using individual patient-level data from the IRIS-MAIN and KOMATE registries, 1,827 patients undergoing PCI with second-generation DES for LMCA disease with valid information on the DAPT duration were included. The primary outcome was major adverse cardiovascular events (MACE, a composite of cardiac death, myocardial infarction, stent thrombosis) and the safety outcome was major bleeding. The DAPT duration was < 6 months (n = 273), 6–12 months (n = 477), 12–24 months (n = 637), and ≥ 24 months (n = 440). The median follow-up duration was 3.9 years (interquartile range, 3.01–5.00 years). The prolonged DAPT duration was associated with lower incidences of MACE. In multi-group propensity score analysis, adjusted hazard ratios (HRs) for MACE were significantly higher for DAPT < 6 months and DAPT 6–12 months than for DAPT 12–24 months (HR, 4.51; 95% confidence interval [CI], 2.96–6.88 and HR 1.92; 95% CI, 1.23–3.00)]. There was no difference in the HRs for major bleeding among the assessed groups. In real world registries data, DAPT duration following PCI for LMCA disease varies depending on the characteristics of the patient. Overall, the prolonged DAPT duration was associated with lower incidence of MACE without increased major bleeding.

Introduction

Recent extended follow-up of landmark randomized clinical trials (RCTs) showed that percutaneous coronary intervention (PCI) with drug-eluting stents (DES) is associated with similar incidences of hard endpoints and mortality compared to coronary-artery bypass grafting in patients with left main coronary artery (LMCA) disease and low-to-intermediate anatomic complexity[1–3]. Current practice guidelines recommend the dual antiplatelet therapy (DAPT) duration in patients undergoing PCI with DES on the basis of initial clinical presentation, including DAPT for at least 6 months for chronic stable angina and 12 months for acute coronary syndrome (ACS)[4]. However, there are limited data on the optimal duration of DAPT in patients receiving PCI for complex lesions, including multi-vessel, bifurcation, and chronic total occlusions, or LMCA disease.

Although some prior studies suggested that prolonged duration of DAPT might be associated with better clinical outcomes in patients undergoing complex PCI[5,6], the proportion of LMCA-PCI was limited and most studies used first-generation DES. In this clinical context, we investigated the practice pattern and long-term prognostic effect of DAPT duration in patients undergoing PCI with second-generation DES for LMCA disease using merged individual patient-level data from two large-sized, real-world contemporary PCI registries.

Methods

Participants and study design

The design and enrollment characteristics of two multicenter registries (Interventional Cardiology Research Incorporation Society-Left Main Revascularization [IRIS-MAIN] and the Korean Multicenter Angioplasty Team [KOMATE]) have been published previously[7,8]. Briefly, the IRIS-MAIN is a nonrandomized, multinational, observational registry wherein consecutive patients with unprotected LMCA disease who were treated with PCI, CABG, or medication alone are enrolled (NCT01341327). The KOMATE registry is a nonrandomized, multicenter, cohort registry wherein patients with DES implantation (NCT03908463). A flow diagram of the current analysis is shown in Fig. 1. Among merged individual-level data, we only included patients with LMCA who were treated with second-generation DES with available accurate information on post-procedural DAPT duration. This study was approved by the institutional reviewer board of each participating center (Asan Medical Center and Severance Hospital) for merged data use and all patients provided written informed consent. The study was performed in accordance with the Declaration of Helsinki.

PCI procedures and data collection

All PCI procedures were conducted in accordance with local guidelines using standard techniques. Intra-procedural anticoagulation was maintained with unfractionated or low molecular weight heparin to achieve an activated clotting time of 250–300 sec. Other procedural factors, such as access location, stent strategy, stent technique, and use of intravascular ultrasound, were left to the operator's discretion. Although the duration of DAPT (aspirin plus P2Y12 inhibitors [clopidogrel, ticagrelor, or prasugrel]) was usually recommended according to the current practice guidelines[4], the final duration of DAPT was left to the treating physician's discretion with consideration of patient clinical and procedural characteristics and other comorbid medical conditions. All clinical, angiographic, procedural, and outcome data were collected using a web-based reporting system. To identify the status of antiplatelet therapy, the dates and duration of prescribed antiplatelet agents were obtained from the electronic prescribing system of each hospital. Additional information was obtained by further inquiry into medical records or telephone contact, if necessary.

Clinical outcomes and definitions

The primary outcome of the study was major adverse cardiovascular events (MACE), defined as a composite of cardiac death, fatal or nonfatal acute myocardial infarction (MI), stent thrombosis (ST) events, and each induvial component of these outcomes, all-cause mortality, and target vessel revascularization. Fatal or nonfatal acute MI was defined as an increase in the creatine kinase-myocardial band or troponin level to the 99th percentile of the upper limit of normal with ischemic symptoms or electrocardiographic findings indicative of ischemia not related to the index procedure (i.e., procedural MI was disregarded). ST was defined as definite ST according to the Academic Research Consortium definition[9]. The safety outcome was major bleeding. The bleeding event was defined as minor or major bleeding as per the TIMI (Thrombolysis in Myocardial Infarction) bleeding criteria[10]. All clinical outcomes were independently adjudicated by an independent group of clinicians who were unaware of the DAPT duration and types of DES.

Statistical analysis

Continuous variables are reported as mean ± standard deviation and were analyzed using one-way ANOVA. Categorical variables are reported as frequencies (percentages) and were analyzed using chi-squared tests. Survival curves were prepared using Kaplan-Meier analysis and analyzed using log-rank tests. Cox proportional hazard regression analysis was used to identify independent predictors of primary endpoints and to estimate hazard ratios (HRs) and 95% confidence intervals (CIs) for clinical outcomes. To minimize confounding and residual selection bias in observational treatment comparisons, a propensity score weighting method was applied to control imbalances in various baseline characteristics across different groups of DAPT duration. For multi-group comparisons, multiple propensity scores were estimated using the TWANG (Toolkit for Weighting and Analysis of Nonequivalent Groups) method, and the corresponding inverse probabilities of treatment weight (the reciprocals of the propensity scores) were estimated by using generalized boosted models through an iterative estimation procedure[11]. To calculate the propensity score, key clinical, anatomic, and procedural characteristics, such as age, sex, hypertension, diabetes mellitus, dyslipidemia, smoking, ACS, chronic kidney disease, multi-vessel disease, stent strategy, previous PCI, and intravascular ultrasound (IVUS), were included. The balance of the pretreatment covariates was assessed, and significant improvement in baseline was achieved after weighting. Furthermore, the performance of this propensity model was confirmed by comparing the distributions of standardized mean differences of covariates and propensity scores between these groups before and after inverse probabilities of treatment weight.

In addition, to define the optimal DAPT duration as a continuous variable in the model, we investigated several cutoff durations and estimated the sensitivity and specificity for predicting MACE according to each cutoff duration. Then, we determined the optimal DAPT duration which had the highest Youden's index (calculated as sensitivity + specificity − 1)[12]. Cox regression models with test for interaction were used to evaluate the consistency of treatment effects in multiple subgroups. Statistical analysis was performed using IBM SPSS (version 23.0, Chicago, IL, USA) and R software (version 3.5.2; R Project for Statistical Computing, https://www.r-project.org).

Results

Pattern of DAPT duration and baseline characteristics

From July 2006 to August 2017, a total of 1,827 patients with LMCA lesions treated by PCI with second-generation DES and with valid data on DAPT duration were included in the final analytic datasets (Fig. 1). The practice pattern of DAPT duration in these patients is shown in Fig. 2. The median duration on of DAPT was 365 days (interquartile range [IQR], 132.5 days) for the entire population. According to DAPT duration, patients were categorized into four groups: DAPT < 6 months (n = 273), 6–12 months (n = 477), 12–24 months (n = 637), and ≥ 24 months (N = 440). The median DAPT duration were 99 days (IQR, 143 days) in DAPT < 6 months, 365 days (IQR, 24 days) in DAPT 6–12 months, 523 days (IQR, 333 days) in

DAPT 12–24 months, and 1,095 days (IQR, 312 days) in DAPT ≥ 24 months, respectively. The baseline clinical characteristics of the study population are shown in Table 1. The patient clinical characteristics were similar between the four groups, except for dyslipidemia and history of previous PCI. DAPT duration tended to be significantly shorter in patients with stable angina than in those with ACS. The DAPT and procedural characteristics of the study population are shown in Table 2. With regard to P2Y12 inhibitors, most patients used clopidogrel (94.6%), and ticagrelor and prasugrel was used by 4.1% and 1.3% of the patients, respectively. The percentage of multi-vessel disease was the lowest in the DAPT < 6 months group, and the highest in the DAPT ≥ 24 months group. The disease extent of CAD was similar between the four groups. Distal bifurcation involvement was the lowest in the DAPT < 6 months group and the highest in the DAPT ≥ 24 months group. The average stent diameter and post-dilatation balloon diameter were the largest in the DAPT ≥ 24 months group. Post-dilatation balloon pressure was the highest in the DAPT ≥ 24 months group. Patients who have undergone PCI with IVUS were significantly more likely to receive DAPT for ≥ 24 months.

Table 1
Baseline patient characteristics according to DAPT duration

	Total population (N = 1,827)	DAPT < 6 months (N = 273)	DAPT 6–12 months (N = 477)	DAPT 12–24 months (N = 637)	DAPT ≥ 24 months (N = 440)	P value
Age, years	64.3 ± 10.6	65.0 ± 11.3	63.5 ± 10.7	64.8 ± 10.7	64.1 ± 9.7	0.136
Male sex	1,395 (76.4)	205 (75.1)	380 (79.7)	479 (75.2)	331 (75.2)	0.27
Diabetes mellitus	609 (33.3)	87 (31.9)	158 (33.1)	204 (32)	160 (36.4)	0.461
Hypertension	1,146 (62.7)	165 (60.4)	302 (63.3)	401 (63)	278 (63.2)	0.865
Dyslipidemia	1,120 (61.3)	189 (69.2)	292 (61.2)	354 (55.6)	285 (64.8)	< 0.0001
Chronic kidneys disease	137 (7.5)	20 (7.3)	34 (7.1)	53 (8.3)	30 (6.8)	0.796
Smoking	422 (23.1)	57 (20.9)	130 (27.3)	141 (22.1)	94 (21.4)	0.091
Previous PCI	326 (17.8)	45 (16.5)	72 (15.1)	109 (17.1)	100 (22.7)	0.017
Previous CABG	60 (3.3)	6 (2.2)	19 (4)	20 (3.1)	15 (3.4)	0.612
Clinical Indication for PCI						
Stable angina	998 (54.6)	168 (61.5)	295 (61.8)	317 (49.8)	218 (49.5)	< 0.0001
Acute coronary syndrome	747 (40.9)	85 (31.1)	168 (35.2)	301 (47.3)	193 (43.9)	< 0.0001
Unstable angina	670 (36.7)	114 (41.8)	184 (38.6)	225 (35.3)	147 (33.4)	0.098
NSTEMI	222 (12.2)	41 (15)	67 (14)	71 (11.1)	43 (9.8)	0.084
STEMI	96 (5.2)	16 (5.9)	21 (4.4)	38 (6)	20 (4.5)	0.573
Mean ejection fraction, %	59.5 ± 12.5	59.0 ± 13.1	59.8 ± 13.1	59.4 ± 13.3	59.7 ± 10.2	0.871

Values are presented as n (%) or mean ± SD

DAPT = dual antiplatelet therapy; CABG = coronary artery bypass grafting; NSTEMI = non-ST-segment elevation myocardial infarction; PCI = percutaneous coronary intervention; STEMI = ST-segment elevation myocardial infarction

Table 2
DAPT and procedural characteristics according to DAPT duration

	Total population (N = 1,827)	DAPT < 6 months (N = 273)	DAPT 6–12 months (N = 477)	DAPT 12–24 months (N = 637)	DAPT ≥ 24 months (N = 440)	P value
DAPT duration (days)	589.3 ± 443.9	105.1 ± 64.1	336.9 ± 52.7	546.3 ± 145.4	1,225.6 ± 400.2	< 0.0001
DAPT score	0.52 ± 1.30	0.45 ± 1.36	0.74 ± 1.36	0.48 ± 1.27	0.39 ± 1.21	< 0.0001
P2Y12 inhibitor						0.299
Clopidogrel	1,729 (94.6)	255 (93.4)	458 (96)	596 (93.6)	420 (95.5)	
Ticagrelor	75 (4.1)	14 (5.1)	17 (3.6)	31 (4.9)	13 (3)	
Prasugrel	23 (1.3)	4 (1.5)	2 (0.4)	10 (1.6)	7 (1.6)	
Multi-vessel disease	1,281 (70.1)	177 (64.8)	339 (71.1)	447 (70.2)	318 (72.3)	0.186
Disease extent						
Left main only	133 (7.3)	25 (9.3)	34 (7.2)	41 (6.4)	33 (7.5)	0.502
Left main with 1-VD	459 (25.3)	73 (27.2)	114 (24.2)	173 (27.2)	99 (22.5)	0.281
Left main with 2-VD	667 (36.7)	88 (32.8)	184 (39.1)	219 (34.4)	176 (40)	0.094
Left main with 3-VD	557 (30.7)	82 (30.6)	139 (29.5)	204 (32)	132 (30)	0.816
RCA involvement	805 (44.3)	120 (44.8)	202 (42.9)	286 (44.9)	197 (44.8)	0.911
Left main lesion location						
Ostium of shaft	651 (35.8)	111 (41.4)	165 (35)	209 (32.8)	166 (37.7)	0.072
Distal bifurcation	1,244 (68.1)	182 (66.7)	325 (68.1)	435 (68.3)	302 (68.6)	0.955
Stent technique						0.003
1-stent strategy	1,512 (83.3)	216 (80.6)	381 (80.9)	558 (87.7)	357 (81.1)	

Values are presented as n (%) or mean ± SD

DAPT = dual antiplatelet therapy; FKBI = final kissing balloon inflation; IVUS = intravascular ultrasound; MV = main vessel; RCA = right coronary artery; VD = vessel disease

	Total population (N = 1,827)	DAPT < 6 months (N = 273)	DAPT 6–12 months (N = 477)	DAPT 12–24 months (N = 637)	DAPT ≥ 24 months (N = 440)	P value
2-stent strategy	303 (16.7)	52 (19.4)	90 (19.1)	78 (12.3)	83 (18.9)	
Total stent number per patient	2.21 ± 1.22	2.17 ± 1.26	2.19 ± 1.16	2.16 ± 1.23	2.32 ± 1.24	0.156
Average stent diameter in MV (mm)	3.57 ± 0.43	3.51 ± 0.47	3.47 ± 0.47	3.66 ± 0.38	3.63 ± 0.39	< 0.0001
Average stent length in MV (mm)	21.88 ± 7.64	21.85 ± 7.63	21.89 ± 7.83	20.95 ± 7.38	22.92 ± 7.62	0.008
Post-dilatation balloon diameter (mm)	3.71 ± 0.56	3.67 ± 0.56	3.63 ± 0.58	3.71 ± 0.55	3.81 ± 0.54	< 0.0001
Post-dilatation balloon pressure (mmHg)	15.61 ± 4.60	15.13 ± 4.47	15.17 ± 4.12	15.83 ± 4.74	16.09 ± 4.94	0.011
FKBI	848 (46.5%)	164 (60.3%)	213 (44.7%)	250 (39.3%)	221 (50.2%)	< 0.0001
IVUS	1,107 (60.7%)	160 (58.8%)	264 (55.3%)	395 (62.1%)	288 (65.5%)	0.013
Values are presented as n (%) or mean ± SD						
DAPT = dual antiplatelet therapy; FKBI = final kissing balloon inflation; IVUS = intravascular ultrasound; MV = main vessel; RCA = right coronary artery; VD = vessel disease						

Clinical Outcomes according to DAPT duration

The median duration of follow-up among all patients was 47.9 months (IQR, 36.7–60.8 months). First, we fit baseline- and procedural parameters-adjusted Cox proportional-hazards log-linear models with thin-plate spline curves to DAPT duration (Fig. 3). Extended use of DAPT was significantly associated with decreased risk for MACE during follow-up. The receiver operating characteristic curves based on DAPT duration for predicting MACE is shown in **Supplementary Fig. 1**. In this analysis, MACE was significantly reduced in patients who received DAPT > 12.6 months based on the highest Youden's index (**Supplementary Table 1**).

Kaplan-Meier cumulative incidences for clinical outcomes according to the categories of DAPT duration are shown in **Supplementary Table 2**, Fig. 4, and **Supplementary Fig. 2**. The cumulative rates of MACE occurred frequently in the DAPT < 6 months group than in other DAPT groups (lowest for the DAPT ≥ 24 months [1.6%] and highest for the DAPT < 6 months [5.1%]). There was no difference in the cumulative incidence of major bleeding (lowest for the DAPT ≥ 24 months [0.7%] and the highest for the DAPT 6–12 months [1.3%]).

Distributional balance of propensity scores according to DAPT duration before and after weighting is shown in **Supplementary Fig. 3**. The adjusted risks for adverse clinical events according to the different categories of the DAPT duration after application of multiple treatment propensity score weighting are shown in Table 3 **and** Fig. 5. With the DAPT 12–24 months as the reference group, adjusted hazard ratios for MACE were significantly higher for DAPT < 6 months and DAPT 6–12 months than for DAPT 12–24 months (HR, 4.51; 95% CI, 2.96–6.88 and HR 1.92; 95% CI, 1.23–3.00)]. There was no difference in the HRs for the risk of major bleeding between assessed groups.

Table 3
Adjusted HR for clinical outcomes between different pairs of DAPT duration in a multi-group propensity score analysis

	HR (95% CI)	
DAPT duration comparison	**MACE***	**Major bleeding**
DAPT < 6 months vs. DAPT 12–24 months	4.51 (2.96–6.88)	1.08 (0.83–1.68)
P value	< 0.001	0.803
DAPT 6–12 months vs. DAPT 12–24 months	1.92 (1.23–3.00)	0.92 (0.50–1.71)
P value	0.004	0.801
DAPT ≥ 24 months vs. DAPT 12–24 months	0.84 (0.50–1.40)	0.67 (0.34–1.31)
P value	0.494	0.241

CI = confidence interval; DAPT = dual antiplatelet therapy; HR = hazard ratio; *MACE = major adverse cardiovascular event, defined as cardiac death, myocardial infarction, or stent thrombosis

Discussion

In this pooled individual patient-level analysis from two large-sized, contemporary, real-world registries, we observed that DAPT duration was highly variable. As compared with guideline-recommended DAPT duration (at least 1 year), shorter DAPT duration was associated with a significantly increased risk of MACE without benefit of major bleeding.

LMCA lesions are one of the most complex anatomic subsets in real-world clinical settings. Recent clinical studies suggested that PCI with second-generation DES for LMCA disease provided favorable procedural and long-term clinical outcomes[2,3]. However, there have been few studies on long-term duration and effect of DAPT in the contemporary PCI practice with second-generation DES for treatment of LMCA disease. In a recent study, DAPT for > 12 months after an index procedure was associated with a reduced risk of ischemic events among patients with LMCA bifurcation stenting, compared with DAPT for ≤ 12 months[13]. However, this study might have been hampered by the use of first-generation DES, exclusion of LMCA ostial and shaft lesions, and non-assessment of bleeding events. Moreover, since events that occurred within 12 months were excluded, the exact relationship of shorter or longer duration

of DAPT with clinical events could not be assessed. In contrast, in the recent EXCEL trial report, continuation of DAPT beyond 12 months was not found to be associated with a reduced risk of ischemic events (death, MI, or stroke) after PCI with everolimus-eluting stents in patients with LMCA disease[14]. However, this study was a subgroup analysis including a relatively limited number of patients, and bleeding events were also not assessed. In the current study, we investigated the clinical outcomes including ischemic and bleeding events according to different durations of DAPT in patients receiving PCI with contemporary second-generation DES for LMCA disease using two large-scaled real-world registries. Following PCI, most patients (84.8%) maintained DAPT for at least 6 months according to the current guidelines. After multiple treatment propensity score weighting, with the DAPT 12–24 months as the reference group, DAPT for < 6 months was significantly associated with a higher risk of MACE without clinical benefit of major bleeding.

Recently, several RCTs have reported the potential benefit of reduced DAPT duration in patients receiving contemporary second-generation DES[15,16]. Most studies have shown that antiplatelet monotherapy was associated with lower incidence of clinically relevant bleeding compared to DAPT with increasing risk of ischemic events. However, the observed results from several studies with regard to the shortening of DAPT in the complex PCI groups were conflicting and the number of patients with LMCA disease was too small to provide clinically meaningful insights. In the RAIN registry (veRy thin stents for patients with left mAIn or bifurcatioN in real life) subgroup analysis, the incidence of MACE was significantly higher in the ≤ 3 months DAPT group compared to the 3–12 and > 12 months DAPT groups, which was mainly driven by the differences in MI and ST[17]. Theoretically, despite the use of second-generation DES, PCI for LMCA disease is more prone to develop stent malapposition due to large diameter and bifurcation compared to non-LMCA lesions, which might result in insufficient strut coverage and the potential risk of thrombus formation. In previous studies, especially among patients with two-stent strategy implying a high probability of stent malapposition and underexpansion, fatal ischemic events substantially increased when DAPT was discontinued[18]. A similar signal of association between shorter DAPT and higher ischemic events was also observed in our study, which might have a paramount clinical significance with regard to the optimal DAPT duration in patients with complex PCI for LMCA disease. Our findings should be further addressed through adequately powered RCTs involving complex high-risk PCI.

There have been several score systems (e.g. DAPT score, Predicting Bleeding Complications in Patients Undergoing Stent Implantation and Subsequent Dual Antiplatelet Therapy [PRECISE-DAPT score]) and validation studies to determine the optimal duration of DAPT[19,20]. In a previous study, DAPT > 12 months was associated with a lower MACE rate than DAPT ≤ 12 months within a population with DAPT score ≥ 2, but not within a population with DAPT score < 2[13]. In our study, spline analysis showed that maintaining up to 12.6 months of DAPT appears to reduce MACE according to the best cutoff based on the highest Youden's index. This finding may support the current guideline recommendations of at least 12 months DAPT for complex PCI to balance the risks between ischemic and bleeding events. The IDEAL-LM trial (Improved Drug-Eluting stent for All-comers Left Main trial; NCT02303717) will additional information on the optimal duration of DAPT in patients undergoing PCI for LMCA disease.

There are several limitations of our study. First, although multiple propensity score treatment analysis was performed, this study was an observational, nonrandomized study; therefore, it might be vulnerable to the inherent limitations including selection bias and unmeasured confounders. Thus, overall observed findings should be interpretated as provisional and hypothesis-generating only. These findings should be confirmed or refuted through large-sized RCTs. Second, owing to the limited number of clinical events, our study was underpowered to detect clinically relevant difference with regard to hard clinical endpoints including death, ST, or major bleeding. Third, we could not investigate the PRECISE-DAPT score owing to some missing variables. Fourth, we could not systematically measure the detailed information of the atherosclerotic burden and complexity, such as SYNTAX score. Finally, in the current study, potent P2Y12 inhibitors, such as prasugrel and ticagrelor, were less frequently used. In recent study, novel P2Y12 inhibitor monotherapy was shown to reduce major bleeding events without increasing ischemic events in patients with complex PCI[21]. This concept should be further tested in patients with complex PCI including LMCA disease.

In conclusion, in this merged individual patient-level analysis of two large-scaled real-world registries, shorter duration of DAPT was significantly associated with increased risk of MACE without benefit of major bleeding compared to the guideline-directed DAPT duration (at least 1 year) in patients with LMCA disease who have undergone PCI with second-generation DES. Future RCTs to determine the optimal duration of DAPT for patients receiving complex PCI including LMCA disease, are warranted.

Abbrevations

ACS = acute coronary syndrome

CI = confidence interval

DAPT = dual antiplatelet therapy

DES = drug-eluting stent

HR = hazard ratio

IVUS = intravascular ultrasound

LMCA = left main coronary artery

MACE = major adverse cardiovascular events

MI = myocardial infarction

PCI = percutaneous coronary intervention

RCTs = randomized clinical trials

ST = stent thrombosis

Declarations

DATA AVAILABILITY

The datasets used and/or analysed in the current study are available from the corresponding author on reasonable request.

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None

AUTHOR CONTRIBUTIONS

S.C., K.D.Y., K.J.S., and P.D.W. designed the study; K.T.S., A.J.M., L.P.H., K.S.J., L.S.W., K.Y.H., L.C.W., P.S.W., L.S.J., H.S.J., A.C.M., K.B.K., K.Y.G., C.D., J.Y., H.M.K., and P.S.J. assisted with data acquisition and interpretation; S.C., and K.I.S. performed statistical analyses; S.C., K.D.Y., K.J.S., P.D.W., and A.C.M. contributed to the discussion; S.C., and K.J.S. drafted the manuscript; S.C., K.J.S, and P.D.W. revised the manuscript. All authors read and approved the final manuscript.

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COMPETING INTERESTS

The authors declare no competing interests.

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Figures

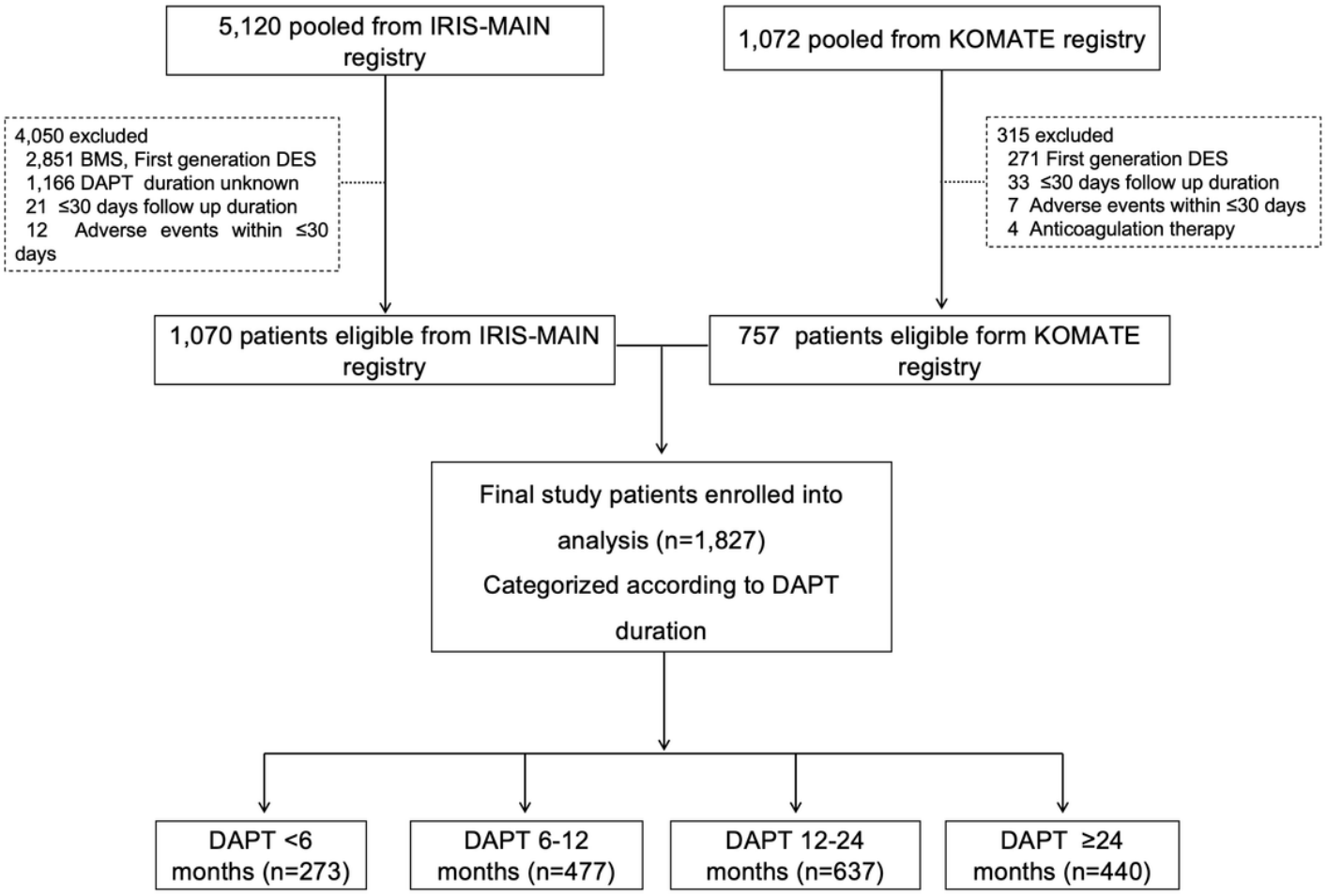

Figure 1

Study Flow Chart

BMS = bare-metal stent; DAPT = dual antiplatelet therapy; DES = drug-eluting stent; IRIS-MAIN = Interventional Cardiology Research Incorporation Society-Left Main Revascularization; KOMATE = Korean Multicenter Angioplasty Team

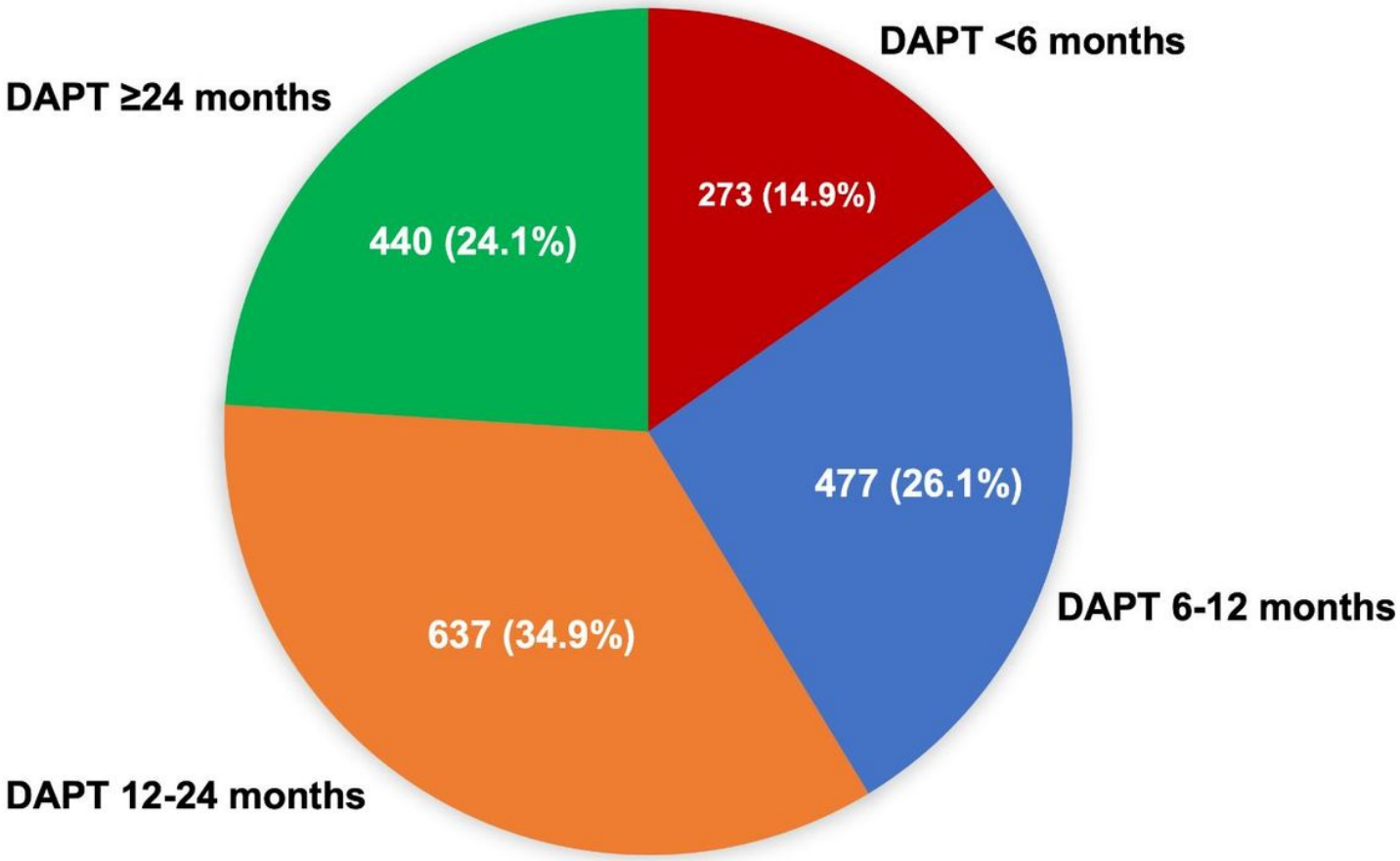

Figure 2

Distribution of Participants According to the DAPT duration

Values are presented as n (%)

DAPT = dual antiplatelet therapy

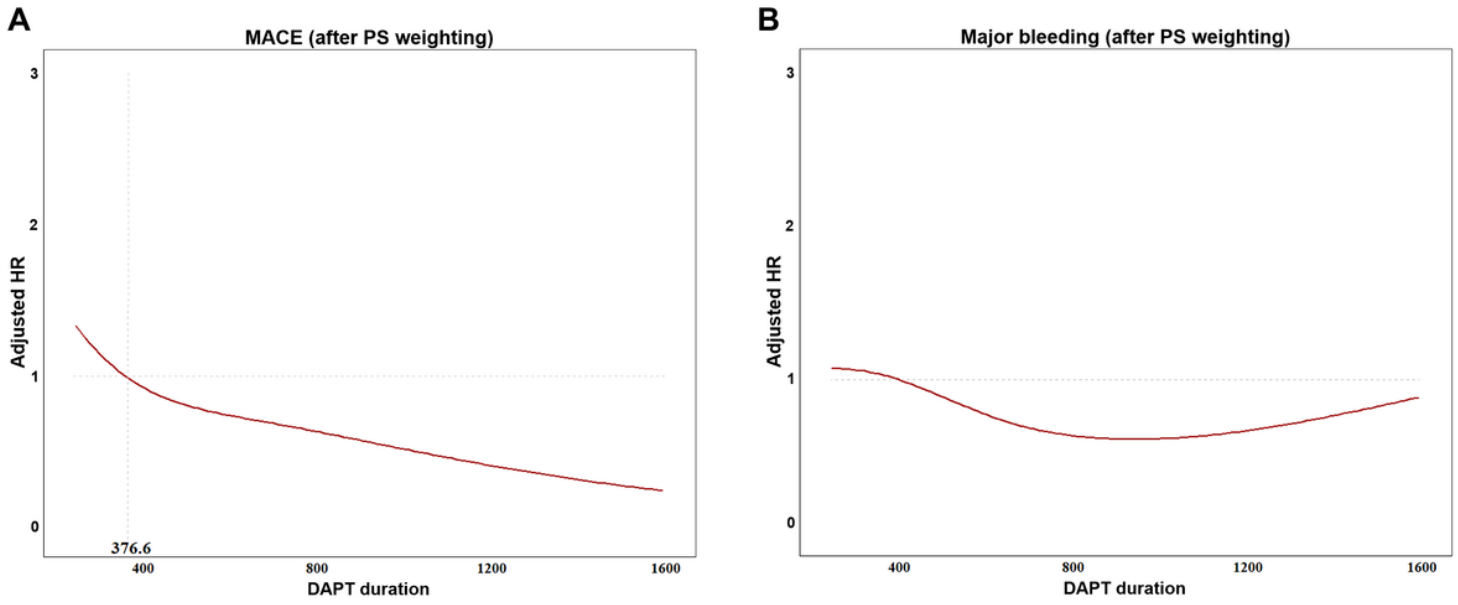

Figure 3

Spline Curves

Duration-responsive relationships between DAPT duration and MACE (A), and between DAPT duration and major bleeding (B) after PS weighting tested by log-linear model with thin-plate spline curves.

DAPT = dual antiplatelet therapy; HR = hazard ratio; MACE = major adverse cardiovascular event; PS = propensity score

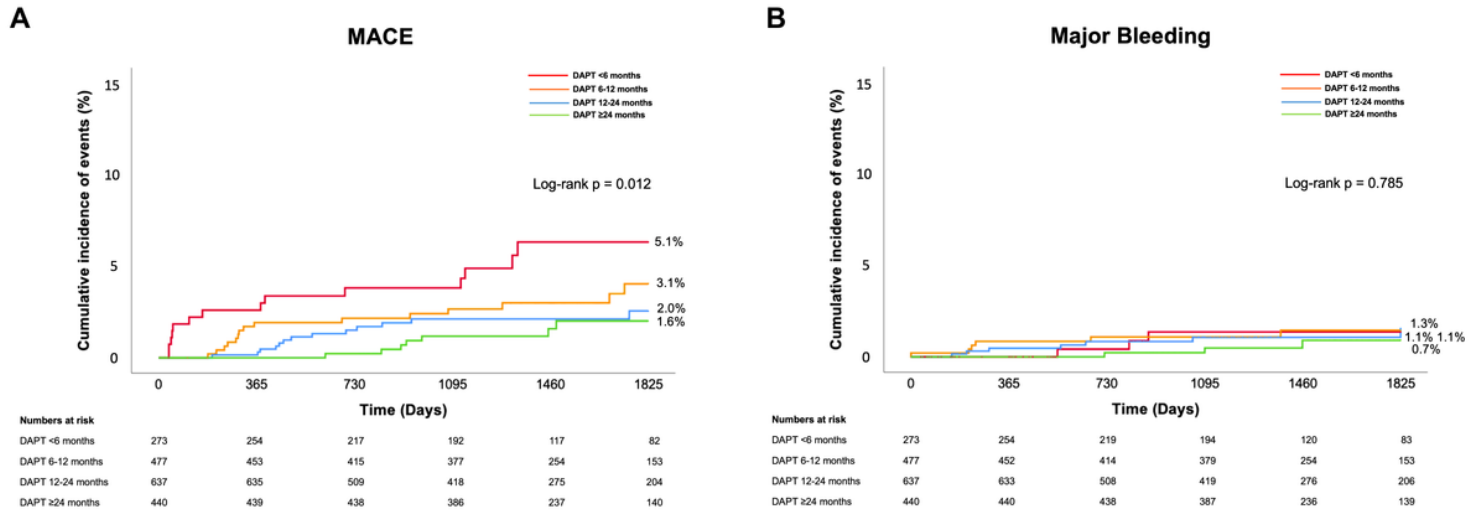

Figure 4

Cumulative Incidence of Clinical Outcomes According to the DAPT duration

Cumulative incidence of MACE (A) and Major bleeding (B)

DAPT = dual antiplatelet therapy; MACE = major adverse cardiovascular events

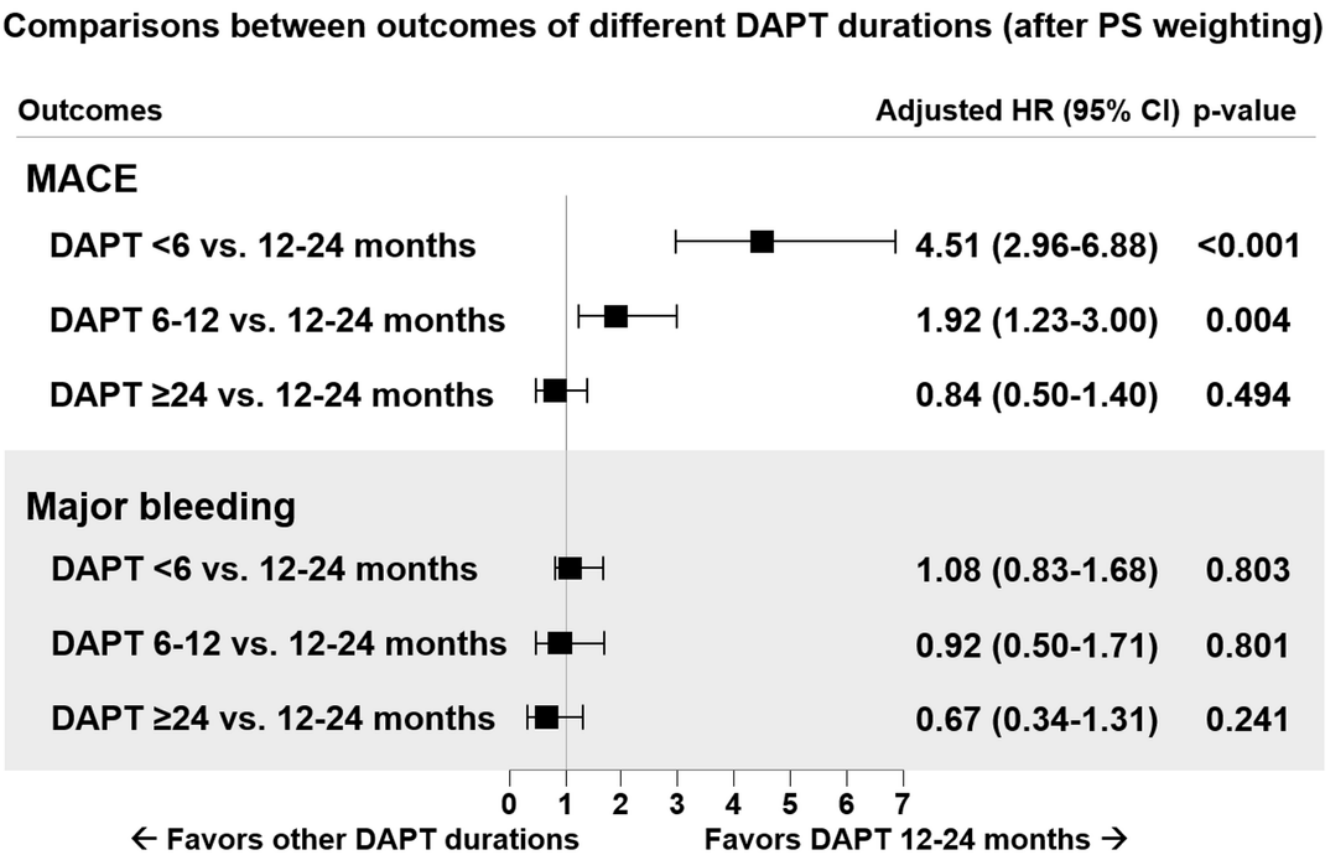

Figure 5

Comparison between Outcomes of Different DAPT Durations in Propensity Score Analyses: Adjusted HR

CI = confidence interval; HR = hazard ratio; MACE = major adverse cardiovascular events; PS = propensity score

Supplementary Files

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- Supplementaryfile.docx