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ORIGINAL ARTICLE

Safe and Efficacious Use of 1-Month Triple Therapy in Patients with Atrial Fibrillation and High Bleeding Risk Undergoing PCI

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Abstract

Background The impact of short or prolonged use of triple therapy (TT) on outcomes in patients with atrial fibrillation (AF) and high risk of bleeding undergoing percutaneous coronary intervention (PCI) is unclear. We compared clinical outcomes according to the duration of TT in patients with AF and HAS-BLED ≥ 3 at 1 year of follow-up.

Methods A prospective observational cohort enrolled 735 patients with AF between 2010 and 2015. Of these, 521 (70.9%) had HAS-BLED ≥ 3 and 380 (72.9%) were discharged on TT. TT was prescribed for 1 month in 233 patients (61.3%). The primary endpoint was the incidence of Bleeding Academic Research Consortium (BARC ≥ 3). The secondary endpoint was the occurrence of ischemic events (cardiac death, MI, stroke, or stent thrombosis).

Results Patients on 1-month TT had a higher median HAS-BLED. Intracraneal hemorrhage was twofold more frequently in patients on > 1-month TT but without statistical significance (0.9% vs 2.1%, p = 0.20). Rates of the *primary endpoint* (bleeding BARC ≥ 3) were 8.2% vs 10.9% and did not differ between groups, while secondary endpoint did not occur more frequently in the 1-month TT group compared with the > 1-month TT group (26.6% vs 23.1%). In adjusted multivariate analyses, patients receiving 1-month TT had a similar risk of the primary endpoint compared to those with > 1-month TT (HR 1.47; 95% CI 0.48–4.47, $p = 0.50$). No difference was found in the secondary ischemic endpoint (HR 1.24; 95% CI 0.77–2.00, $p = 0.38$).

Conclusions In patients with AF undergoing PCI at lower ischemic risk and higher bleeding risk, 1 month of TT seems safe and efficacious. Further studies are warranted in patients at high ischemic risk.

Highlights

- Triple therapy during 1 month is safe and efficacious for patients with AF and high risk of bleeding undergoing PCI.
- Bleeding and ischemic events were similar between patients treated on 1-month TT compared with those treated more than 1 month. However, the incidence of endocraneal hemorrhage was lower in patients on short-term TT.
- Triple therapy during 1 month was preferentially used in those at lower ischemic risk and higher bleeding risk.
- One month of TT should be reasonable as duration of treatment for patients with AF at low ischemic risk and high risk of bleeding undergoing PCI.

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Keywords Anticoagulation · Bleeding · Percutaneous coronary intervention · Atrial fibrillation

Introduction

Approximately 5–10% of patients undergoing percutaneous coronary intervention (PCI) have atrial fibrillation (AF) and concomitant indications for oral anticoagulation [1]. Therefore, a combination of OAC plus dual antiplatelet therapy (DAPT) is plausible among patients with indications for OAC undergoing PCI and is currently recommended in consensus documents [2, 3]. Triple antithrombotic therapy (TAT), the combination of OAC and DAPT, is associated with increased bleeding risk [4, 5] with at least a two- to threefold increase in bleeding complications, but is more effective than DAPT alone for reduction of major adverse cardiovascular events in these patients [4–11]. A comprehensive list of all risk factors that have been associated with greater bleeding risk has been previously published and collected in HAS-BLED score [2, 12].

Furthermore, the benefits of OAC in AF patients at high bleeding risk (HAS-BLED score ≥ 3) undergoing PCI have been reported [1, 2, 12]. The reduction in TT exposure time has been recommended in patients at high bleeding risk by consensus documents in order to lower the incidence of bleeding [2, 3].

However, while these recommendations are based on expert consensus rather than on evidence, balancing the risks of thromboembolism and bleeding in this setting poses a considerable challenge. Recently, the ISAR-TRIPLE trial study and Koskinas et al. reported that 6 weeks of TT yielded similar net clinical outcomes compared with longer TT use in unselected populations of AF patients undergoing PCI, although no analyses were performed in patients at high risk of bleeding [13, 14]. Consequently, the impact of short or prolonged use of TT on outcomes in patients at high risk of bleeding is unclear, particularly in older patients [4–14]. The current study compared clinical outcomes in patients with AF undergoing PCI and with high bleeding risk (HAS-BLED ≥ 3) receiving 1-month TT versus > 1-month TT.

Methods

Population study

A retrospective analysis was made of this prospectively collected cohort designed to assess the outcomes related to different antithrombotic regimes including 735 consecutive patients aged ≥ 18 years between 2010 and 2015, with a pre-existing diagnosis of permanent, persistent, or paroxysmal AF and a firm indication for OAC in those who developed new-onset AF during their index admission and who underwent PCI for stable coronary artery disease (CAD) or acute coronary syndrome (ACS). This cohort comes from a series of 1,328 consecutive patients with indication of OAC for different reasons (Fig. 1). The risk for stroke or systemic embolism and bleeding was calculated in patients included using the CHA_2DS_2-VASc and HAS-BLED scores, respectively [2, 12]. We selected patients with AF, excluding those with OAC for other reasons, in order to use CHA_2DS_2-VASc and HAS-BLED risk scores which had only been established for patients with AF.

Among 735 consecutive patients with AF, 521 (70.9%) of them had a HAS-BLED ≥ 3; of these, 380 (51.7%) were discharged on TT and were included in the analysis. Patients discharged with DAPT alone or clopidogrel plus OAC were excluded. Demographic and clinical characteristics, risk factors for thromboembolism, and the antithrombotic regimen before PCI and at discharge were collected.

Procedures and treatment in the study

Since this was an observational study, PCI and procedural management were performed according to the guidelines recommendations [12]. However, decisions concerning interventional strategy, choice of stent, and duration of the chosen antithrombotic regimen were left to the discretion of the attending cardiologist(s). In general terms, DAPT (aspirin 100 mg once daily, clopidogrel 75 mg once daily) was initiated before PCI, at the time of PCI or immediately after the procedure. Ticagrelor was administered in certain cases of complex anatomy or stent thrombosis [1]. DAPT was recommended for at least 1 month following PCI using bare metal stents (BMS) and 3–12 months following the use of drug-eluting stents (DES) [1, 2, 12]. All patients treated with OAC received vitamin K antagonists or direct anticoagulants plus DAPT. After completing TT, patients on 1-month TT received OAC plus a single antiplatelet agent through 6 months of treatment in case the index procedure was an ACS.

Patients' follow-up

Patients were systematically followed up after discharge as part of routine clinical practice at outpatient hospital for 1 year. Mortality data were based on official mortality registries from

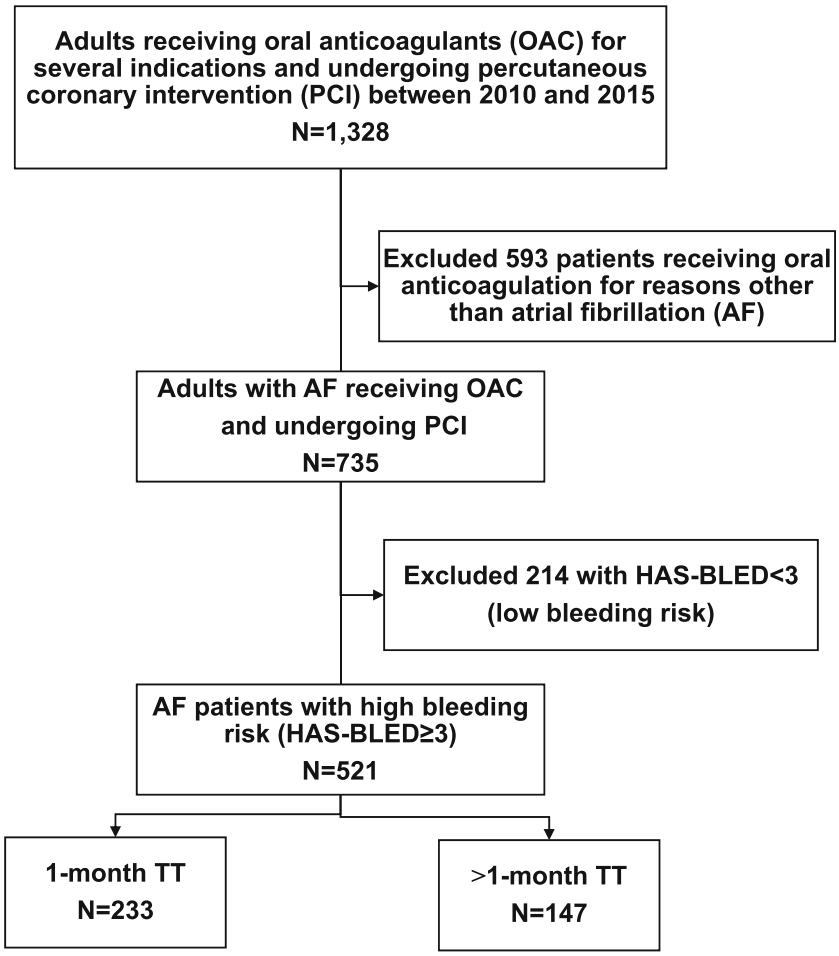


Fig. 1 Flowchart of the cohort

the Spanish government. Furthermore, all outcomes were compared according to the treatment patients were on the time of the event.

All events were collected on specific clinical outpatient forms, using patient records from the hospital or general practitioners. Discharge documents and coronary angiography documentation were systematically reviewed for additional information. Cardiac death was previously defined [6, 11]. Myocardial infarction (MI) was defined according to the criteria of the ESC/ACCF/AHA/WHF [15] and definite stent thrombosis according to the universal definition criteria of The Academic Research Consortium (ARC) [16]. Stroke and systemic embolism were also previously defined [9, 11]. Any degree of bleeding (major and minor) was defined according to the classification scheme of TIMI and Bleeding ARC (BARC) [17].

Clinical endpoint study

The primary endpoint was major bleeding (BARC ≥ 3). Our secondary endpoint was defined as a composite variable of ischemic events: cardiac death, MI, stroke, or definite stent thrombosis. Net clinical benefit was defined as the composite of major bleeding, cardiac death, MI, stroke, or stent thrombosis.

Statistical analysis

Continuous variables were described as mean ± standard deviation (SD) and range and categorical variables were described as number (proportion %). Comparisons of continuous and categorical variables between the two TT groups were made by Student's *t* test and chi-square test, respectively.

Survival analysis were made using a Kaplan–Meier method and survival curves compared using the log-rank test. In addition, multivariate Cox proportional hazard regression analyses were performed for each individual outcome, adjusted for confounding clinical variables. These confounders included age; type of stent (BMS vs DES), for all adjusted models; and other demographic clinical and procedural variables associated with the outcomes with a $p \leq 0.15$ on bivariate analysis. All p values were two-sided and $p < 0.05$ was considered statistically significant. Statistical analysis was performed using the statistical package SPSS 23.0.

Results

Baseline characteristics

Two hundred and thirty-three (61.3%) of 380 patients received TT for 1 month and 147 (38.7%) for > 1 month (median, 6 months; interquartile range [IQR], 3 to 12 months). Baseline clinical characteristics according to the antithrombotic regime are shown in Table 1. Patients on 1-month TT more frequently had a previous stroke or stable coronary artery disease and, less frequently, previous PCI. Distribution of TT prescription was as follows: 233 patients (61.3%) received TT for 1 month, 13 (3.4%) for 3 months, 95 (26.1%) for 6 months, and 39 (10.3%) for 12 months.

The procedural characteristics of patients are shown in Supplementary Table 1. The majority of patients received a BMS (53.2%). DES use among patients with HAS-BLED ≥ 3 was 47.6%. Patients on 1-month TT mostly received a BMS (94.8%). Medical treatments used during the procedure, at discharge and at 1 year, are shown in Table 2. Ticagrelor was used in only 6 patients, all with 1-month TT, and none received prasugrel. Direct oral anticoagulants were used in only 3.1% of patients. Mean of INR as values (interquartile range) were 2.5 (1.7 to 2.9), 2.2 (2.1 to 2.7), and 2.1 (2.0 to 2.4) at 4 weeks, 6 months, and 12 months, respectively, with no differences between the 2 study groups. At 4 weeks, 6 months, and 12 months, INR values were within the therapeutic range (2.0 to 3.0) in 54.7%, 55.9%, and 56.1% of patients, respectively, with no difference between the 2 groups (> 1 month and > 1 month).

Clinical outcomes regarding triple therapy duration

Follow-up was complete for 376 patients (98.9%). Primary and secondary outcomes did not differ significantly between the 1-month and > 1-month TT groups in K-M analyses (Fig. 2a, c). Clinical outcomes at 1-year follow-up are summarized in Table 3 and multivariate models are shown in Supplementary Table 2.

Primary end point rate (bleeding BARC ≥ 3) (8.2% vs 10.9%, adjusted HR 1.47; 95% CI 0.48–4.47, $p = 0.50$) or TIMI major bleeding (adjusted HR, 0.40; 95% CI 0.25–1.30, $p = 0.18$) did not differ either between groups. The peak of major bleeding events occurred at a median of 45 days, 11 bleeding events (31.4%) occurred during the second and third months, 4 (11.4%) between the third and sixth months, and none after the sixth month. Intracraneal hemorrhage occurred more frequently in patients on > 1-month TT, but without significant differences (0.9% vs 2.1%, $p = 0.20$). Nine patients

Table 1 Characteristics of patients with atrial fibrillation and high bleeding risk (HAS-BLED ≥ 3) with ≤ 1 month of TT or > 1 month of TT

	Whole cohort $N = 380$	1-month TT $N = 233$	> 1-month TT $N = 147$	*P* value
Male, *n* (%)	170 (72.9)	107 (73.0)	107 (72.8)	0.53
Age in years, mean ± SD	74.5 ± 6.8	75.2 ± 6.6	73.8 ± 7.4	0.06
Medical history, *n* (%)				
Smoker	191 (50.3)	117 (61.3)	74 (38.7)	0.53
Diabetes	174 (45.8)	102 (43.8)	72 (49.0)	0.54
Hypertension	365 (96.1)	221 (94.8)	144 (98.0)	0.13
Hypercholesterolemia	223 (58.7)	129 (55.4)	94 (63.9)	0.12
Previous heart failure	118 (31.1)	65 (27.9)	53 (36.1)	0.06
Previous stroke	70 (18.4)	51 (21.9)	19 (12.9)	0.02
Renal failure	86 (22.6)	51 (21.9)	35 (23.8)	0.37
Peripheral artery disease	54 (14.2)	33 (14.2)	21 (14.3)	0.54
CHA_2DS_2-Vasc > 2	361 (95.0)	222 (95.3)	139 (94.6)	0.46
Previous MI	128 (33.7)	76 (32.6)	52 (35.4)	0.33
Previous PCI	139 (36.6)	75 (32.2)	64 (43.5)	0.02
Previous CABG	33 (8.7)	21 (9.0)	12 (8.2)	0.46
HAS-BLED	3.5 ± 0.6	3.6 ± 0.7	3.4 ± 0.6	0.001
Indication for PCI, *n* (%)				
ACS	215 (56.6)	67 (45.6)	148 (63.5)	< 0.0001
Stable angina and/or ischemia	165 (43.4)	80 (54.4)	85 (36.5)	

CHA_2DS_2-VASc: heart failure, hypertension, diabetes, vascular disease, age 65 to 74 years and sex (female), all with a score = 1, while age ≥ 75 years and history of previous stroke had a score = 2; *MI*: myocardial infarction; *PCI*: percutaneous coronary intervention; *CABG*: coronary artery bypass graft; *HAS-BLED* :hypertension, abnormal renal/liver function, stroke, bleeding history or predisposition, labile international normalized ratio, elderly (>65 years), drugs/alcohol concomitantly; *ACS*: acute coronary syndrome

Table 2 Treatment after percutaneous coronary intervention, at discharge and at 1 year

	Whole cohort $N = 380$	TT 1 month $N = 233$	TT > 1 month $N = 147$	P value
At discharge				
Aspirin	380 (100)	233 (100)	147 (100)	
Clopidogrel	374 (98.4)	233 (100)	141 (95.9)	0.93
Prasugrel	0	0	0	
Ticagrelor	6 (1.6)	0	6 (4.1)	0.30
Oral anticoagulation	380 (100)	233 (100)	147 (100)	
Vitamin K antagonists	368 (96.8)	231 (99.1)	137 (93.1)	0.02
Novel oral anticoagulants	12 (3.1)	2 (0.8)	10 (6.8)	0.04
At 1 year				
Acetylsalicylic acid	307 (80.7)	198 (85.0)	129 (88.0)	0.82
Clopidogrel	85 (22.3)	49 (21.0)	36 (25.0)	0.76
Prasugrel	0	0	0	
Ticagrelor	0	0	0	
Oral anticoagulation	374 (98.4)	233 (98.7)	141 (95.9)	0.98
Vitamin K antagonists	349 (91.8)	221 (95.0)	128 (87.0)	0.06
Novel oral anticoagulants	25 (6.5)	12 (5.0)	13 (8.8)	0.07

suffered from a bleeding event within 5 days after admission and they received enoxaparin 1 mg/kg/12 h sc +clopidogrel 75 mg/day and AAS 100 m/day. They were bridged to acenocumarol. Mean time for bleeding event was 1.05 ± 05 days within 5 days periprocedural. In other words, the earliest bleeding events occurred within the first 48 h during the admission.

At 1 year, the secondary endpoint did not occur more frequently in the 1-month TT group compared with the > 1-month TT group (26.6% vs 23.1%; adjusted HR, 1.24; 95% CI, 0.77–2.00; $p = 0.38$), neither for any independent ischemic events analyzed. There were no differences between ischemic events in patients with ACS as index events at 1 year of follow-up (12.5% vs 14.6%, $p = 0.73$).

Furthermore, no significant differences were found between groups regarding the net clinical benefit (19.8% vs 15.8%, adjusted HR, 1.24; 95% CI, 0.77–2.00; $p = 0.38$) (Table 3).

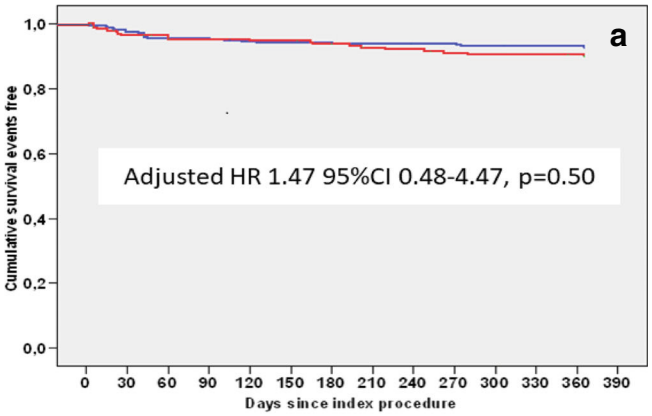
Regarding the occurred adverse events in patients after dropping one antiplatelet, we observed that among patients who only received aspirin combined with OAC therapy after TT, bleeding events occurred in 4% of them in the 1-month group and in 5% of them in the > 1-month group, while ischemic events occurred in 5.2% in the 1-month group and 6.7% in the > 1-month group at 1 year of follow-up. Among patients who only received clopidogrel combined with OAC after TT, bleeding events occurred in 5.2%, in the 1-month group, and in 6.1% in the > 1-month group, while ischemic events occurred in 3.2%, in the 1-month group, and 4.8% in the > 1-month group at 1 year of follow-up.

Discussion

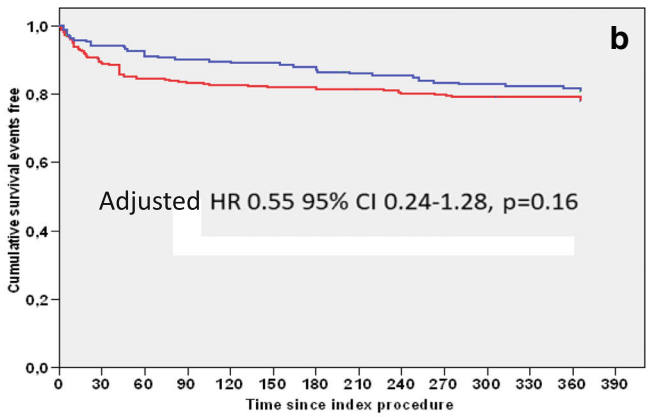
This is the first observational study that analyzes clinical outcomes according to the duration of TT in patients with AF and HAS-BLED ≥ 3 undergoing PCI. The main finding of the current study was that patients receiving 1 month of TT showed similar bleeding complications, ischemic complications, or net clinical benefit over 1 year than those with more prolonged TT treatments. These findings support the guideline recommendations, based on expert consensus, advocating a short period of TT in cases of high risk of bleeding [1–3].

In agreement with previous studies [13, 14], no differences were observed in the major bleeding event rate according to BARC type ≥ 3 or TIMI criteria between patients treated for 1-month or > 1-month TT (8.2% vs. 10.9%, respectively). Furthermore, more than one half of all bleeding events (57.1%) occurred during the 45 days, which is consistent with findings of other authors [7, 10, 13, 14]. The frequency of any bleeding event during the 12-month follow-up in this study was 19.7%, with no significant differences between treatment groups, and similar to those reported in large studies and in selected populations at high risk of bleeding [8, 9, 11].

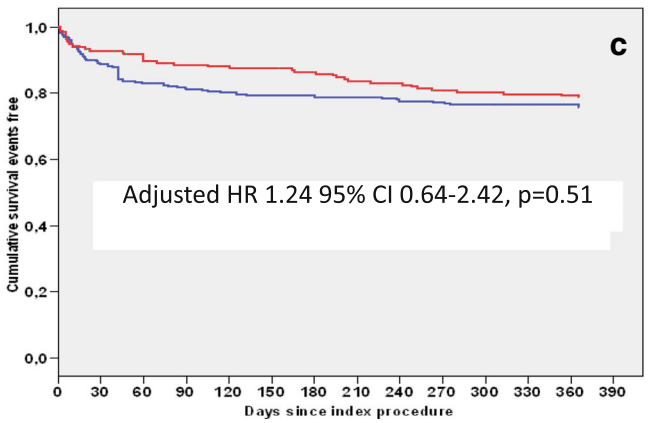
Our results complement previous studies with patients with an increased risk of bleeding and ischemic events. The ISAR-TRIPLE trial demonstrated that 6 weeks of TT was not superior to 6 months with respect to net clinical outcomes in patients on OAC after DES implantation [13]. More recently, Koskinas et al. compared two periods of treatment (1-month vs > 1 month) in a population with an indication for OAC, where 55% (312 patients) had AF and only 58% (181 patients) had HAS-BLED ≥ 3 [13]. In our cohort, we observed a higher



	30	60	90	120	150	180	210	240	270	300	330	360
<1 month	207	192	192	189	186	184	184	188	182	180	180	178
>1 month	139	135	132	128	131	124	125	123	122	121	121	120



	30	60	90	120	150	180	210	240	270	300	330	360
<1 month	203	189	185	185	182	182	181	178	176	175	174	173
>1 month	137	135	131	130	130	127	122	121	118	117	116	114



	30	60	90	120	150	180	210	240	270	300	330	360
<1 month	203	189	189	183	182	181	181	178	177	174	174	173
>1 month	137	134	131	130	130	126	122	121	118	116	116	115

◀ **Fig. 2** **a** Kaplan–Meier survival curve of primary endpoint: major bleeding BARC ≥ 3 in relation to the use of TT for 1 month compared with TT > 1 month in patients at high risk of bleeding. Number of patients followed up: TT 1 month in red: *n* = 233; TT > 1 month in blue: *n* = 147. **b** Kaplan–Meier survival curve of secondary ischemic endpoint in relation to the use of TT for 1 month compared with TT > 1 month in patients at high risk of bleeding. Number of patients followed up: TT for 1 month in red: *n* = 233; TT > 1 month in blue: *n* = 147. **c** Kaplan–Meier survival curve of secondary combined endpoint or net clinical benefit: major bleeding, cardiac death, myocardial infarction, stroke, or stent thrombosis in relation to the use of TT for 1 month compared with TT 1 month in patients at high risk of bleeding. Number of patients followed up: TT 1 month in red: *n* = 233; TT > 1 month in blue: *n* = 147

major bleeding rate in both groups (8.2% vs 10.9%) than Koskinas et al (4.8% vs 5.1%); however, this rate was lower than those observed in ISAR-TRIPLE (11.2% vs 11.9%). Nonetheless, the ischemic rate observed in our study was higher than that in both series (19.8% vs 15.8%), as compared to Koskinas et al (7.8% vs 10.9%) and in ISAR-TRIPLE (4.0% vs 4.3%). Thus, our population was admitted more frequently due to an ACS than those in the ISAR-TRIPLE or Koskinas studies (56.6% vs 32% vs 37.8%, respectively). This factor may explain the higher incidence of ischemic events in our population compared to those studies, as well as in our cohort. Patients with high bleeding risk and thus with higher ischemic risk were included and therefore a higher event rate was actually to be expected.

In agreement with those previous studies [13, 14], we found no differences in ischemic events nor in the incidence of cardiac death, MI, or stroke between treatment durations, or in the incidence of definite stent thrombosis.

Use of DES in patients with AF has been a concern in clinicians because longer duration of dual antiplatelet therapy (DAPT) was believed to be required, to avoid the use of DES in patients on TT, especially those patients at high risk of bleeding [14, 18]. However, the last European guidelines on myocardial revascularization recommend using DES in any PCI, irrespective of concomitant anticoagulant therapy coupled with shorter DAPT duration [19]. Although in our series DES were used in 5.2% of patients with the 1-month and 87.8% treated with > 1-month TT, the results held true after multivariate adjustments including cohort and stent type.

Whether a short period of TT, compared with a longer period in AF patients undergoing PCI, would reduce the incidence of bleeding without being associated with a higher incidence of ischemic events was assessed. However, neither the previously mentioned studies nor our own work showed a reduction in the incidence of bleeding with this approach [13, 14]. Other potential treatment options to reduce the risk of bleeding skipping the aspirin have recently been explored: the WOEST, the PIONEER AF-PCI, the RE-DUAL PCI, and the AUGUSTUS trials. However, these trials have uncertain protection against thromboembolic and ischemic events, since those trials were underpowered for these events [20–23].

Although the combination of OAC and one antiplatelet agent could be an alternative for patients at high risk of bleeding, this option was not evaluated in our study, due to a low use in our series based on the elevated number of patients with ACS as index episode (72.9%), in contrast with those described in randomized trials (WOEST, Pioneer-AF, RE-DUAL, and AUGUSTUS, with proportions of ACS of 26%, 51.5%, 51.9%, and 38%, respectively) [20–23]. These

Table 3 Treatment after percutaneous coronary intervention, at discharge and at 1 year

	Whole cohort *N* = 380	TT 1 month *N* = 233	TT > 1 month *N* = 147	*P* value
At discharge				
Aspirin	380 (100)	233 (100)	147 (100)	
Clopidogrel	374 (98.4)	233 (100)	141 (95.9)	0.93
Prasugrel	0	0	0	
Ticagrelor	6 (1.6)	0	6 (4.1)	0.30
Oral anticoagulation	380 (100)	233 (100)	147 (100)	
Vitamin K antagonists	368 (96.8)	231 (99.1)	137 (93.1)	0.02
Novel oral anticoagulants	12 (3.1)	2 (0.8)	10 (6.8)	0.04
At 1 year				
Acetylsalicylic acid	307 (80.7)	198 (85.0)	129 (88.0)	0.82
Clopidogrel	85 (22.3)	49 (21.0)	36 (25.0)	0.76
Prasugrel	0	0	0	
Ticagrelor	0	0	0	
Oral anticoagulation	374 (98.4)	233 (98.7)	141 (95.9)	0.98
Vitamin K antagonists	349 (91.8)	221 (95.0)	128 (87.0)	0.06
Novel oral anticoagulants	25 (6.5)	12 (5.0)	13 (8.8)	0.07

preferences of cardiologists in our series could be potentially due to their efforts to prevent stent thrombosis more than bleeding events.

Furthermore, after the publication of several randomized trials showed the benefits of longer DAPT [23, 24], the duration of DAPT after DES implantation, even in patients without AF, became controversial. In this way, the results from randomized trials exploring the combination of OAC and a single antiplatelet agent could be in contradiction with those favoring the prolongation of DAPT in patients without AF. That is, if the use of a DOAC could allow skipping the aspirin and shortening the duration of antiplatelet agents in patients with AF needs to be warranted in further randomized trials at long term, especially in patients with ACS. It is important to note that although the use of antithrombotic drugs in clinical practice, in real life, is rapidly changing, recommendations of ESC guidelines on the duration of DAPT in patients with AF undergoing PCI are still class IIb, since there is no evidence which is the safest duration [2]. Our study agrees with these recommendations showing that a short period of TT can be considered in patients with a high bleeding risk. This recommendation comes from additional evidence reinforcing the value of a strategy of combining a DES (to reduce the risk of subsequent repeat revascularization) with a short BMS-like DAPT regimen (to reduce bleeding risk) provided in several recent studies, especially in elderly patients requiring revascularization [25, 26]

Study limitations

The current study had several limitations. First, this was an observational study: the treatment duration of TT was established according to the prescription, because all patients have electronic prescriptions and with an exact period of prescription for each drug. All analyses were done according to "intention to treat," assuming the period of prescription, as also Koskinas et al. did. Second, there was a low number of DES implanted. However, as the rare incidence of stent thrombosis after BMS implantation is accepted, BMS implantation is widely used to treat AF patients in the USA in patients with acute myocardial infarction [27]. However, we accounted for these differences by adjusting for type of stent and other potential confounders in multivariate analyses. Third, our cohort had a relatively small sample size, but similar to those of ISAR-TRIPLE and Koskinas studies [13, 14]. Fourth, we were unable to evaluate the effect of direct OAC (DOACS) vs warfarin as few patients were available for analysis; in this respect, the low use of DOAC in our series could be explained in part by the existence of 22.6% of patients with renal failure. Although other authors have shown that, the use of DOACS is safer than VKA in patients with renal failure, but these have not been tested (at antithrombotic dose) combined with dual antiplatelet treatment (TT) in randomized trials, [28]. Finally, the lack of some of the individual endpoints did not permit us to obtain conclusive effects.

Conclusions

In summary, in our study in AF patients at high risk of bleeding undergoing PCI, 1-month TT was associated with a similar rate of bleeding and ischemic events. Our study suggests to consider a short term of TT in patients at high bleeding risk. Our findings require confirmation by randomized studies testing TT of different durations.

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Compliance with ethical standards

Conflict of interest Dr. Sambola reports grant from Amgen to the institution, fees from lectures, Amgen, Boehringer-Ingelheim, Bristol-Myers, BMS-Pfizer, Astra-Zeneca, Novartis, Novo-nordisk outside the submitted work. Dr. Bueno reports grants from Instituto de Salud Carlos III; personal fees from Bayer; personal fees from Novartis; grants, personal fees, and non-financial support from AstraZeneca; grants and personal fees from BMS-Pfizer; personal fees from Ferrer; personal fees from MEDSCAPE-the Heart-org; and personal fees from Janssen, outside the submitted work. The remaining authors no have disclosures to declare.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study.

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