



Original Article

Clinical Significance of Atrial Fibrillation Status in Patients With Percutaneous Coronary Intervention

Toka Hamaguchi, MD,^{a,‡} Yoshitaka Iwanaga, MD,^{b,‡} Michikazu Nakai, PhD,^b
Yusuke Morita, MD,^a and Moriaki Inoko, MD^a

^a Cardiovascular Center, Tazuke Kofukai Foundation, Medical Research Institute, Kitano Hospital, Osaka, Japan

^b Department of Medical and Health Information Management, National Cerebral and Cardiovascular Center, Suita, Japan

ABSTRACT

Background: Patients undergoing percutaneous coronary intervention (PCI) often develop atrial fibrillation (AF). We investigated the clinical effects of AF status on in-hospital mortality and complications in patients with PCI using a recent large-scale nationwide dataset.

Methods: Using a claims-based dataset from 1022 hospitals in Japan for the time period between 2012 and 2016, patients with PCI were identified and classified into 3 groups according to AF status: no AF, prevalent AF before admission, and incident AF after admission. In-hospital mortality, complications, and medical costs were compared in crude and propensity-matched cohorts.

Results: In 659,525 hospitalized patients undergoing PCI, prevalent AF and incident AF were observed in 6.0% and 1.3% patients, respectively; the AF rates increased over 5 years. A greater proportion of older patients and patients with comorbidities had both of these

RÉSUMÉ

Contexte : Une fibrillation auriculaire (FA) apparaît souvent chez les patients qui subissent une intervention coronarienne percutanée (ICP). Nous avons étudié les effets cliniques de l'état de la FA sur la mortalité à l'hôpital et les complications chez les patients ayant subi une ICP en utilisant un ensemble de données nationales récentes à grande échelle.

Méthodologie : À partir d'un ensemble de données basées sur les demandes de règlement de 1022 hôpitaux au Japon pour la période allant de 2012 à 2016, les patients ayant subi une ICP ont été ciblés et classés en 3 groupes selon l'état de la FA : FA absente, FA présente avant l'admission, et nouvelle FA après l'admission. La mortalité à l'hôpital, les complications et les coûts médicaux ont été comparés dans des cohortes brutes et des cohortes appariées par score de propension.

Atrial fibrillation (AF) is a common arrhythmic disorder with diverse etiology, and its incidence increases with age. The prevalence of AF is approximately 0.56% in Japan, and 0.35% in the US, in the general population,^{1,2} and it is increasing due to the aging of the population.³ The onset of AF is associated with numerous risk factors, such as smoking, alcohol consumption, body mass index, blood pressure, diabetes, and history of heart failure or myocardial infarction,⁴ and it is more frequently complicated in patients with various underlying diseases. Approximately 5%-10% of

patients who underwent percutaneous coronary intervention (PCI) or had acute coronary syndrome (ACS) have concomitant AF.⁵⁻⁸ These patients had higher risk of in-hospital morbidity and mortality, as well as long-term mortality.⁹ AF may have several causes. Concomitant AF is associated not only with hemodynamic compromise, but also other multifactor comorbidities.¹⁰ Moreover, these patients typically require both anticoagulation and antiplatelet therapies.

However, there are limited data that are based on nationally representative cohorts focusing on contemporary trends in prevalence, in-hospital outcomes, and medical costs of patients who undergo PCI. This study aimed to evaluate the current state of clinical practice and the clinical significance of concomitant AF in hospitalized patients who have undergone PCI and to investigate the temporal trends between 2012 and 2016 using a large-scale Japanese nationwide claim-based dataset—the Japanese Registry of All Cardiac and Vascular Diseases-Diagnosis Procedure Combination (JROAD-DPC) database. Concomitant AF was analyzed separately based on its status, prevalent AF before admission, and incident or AF first noted after admission.

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Ethics Statement: The Ethics Committee of Kitano Hospital approved the study protocol. The requirement for individual informed consent was waived by the hospital because no information specifying individuals was included. The original DPC data were anonymized using the code change equations and sent to the Ministry of Health, Labour and Welfare.

[‡]These authors contributed equally to this work.

Corresponding author: Dr Moriaki Inoko, Cardiovascular Center, Tazuke Kofukai Foundation, Medical Research Institute, Kitano Hospital, Osaka, Japan.

E-mail: inoko@kitano-hp.or.jp

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categories of AF; undergoing PCI for acute coronary syndrome was common in incident AF. Both prevalent AF and incident AF were associated with worse crude outcomes and complications during hospitalization. In propensity-matched cohorts, incident AF was associated with a higher in-hospital mortality rate, longer length of stay, higher direct costs, and higher rate of complications, including stroke and acute kidney injury, compared with prevalent AF. These outcomes, except length of in-hospital stay, did not change for either AF status over 5 years.

Conclusions: Prevalent AF and incident AF in patients undergoing PCI were both associated with deteriorating crude outcomes and complications; in particular, incident AF was associated with worse adjusted outcomes and complications. Further efforts are needed to improve patient outcomes in an aging society in which the incidence of AF is increasing.

Methods

Data source

The Japanese Circulation Society has developed the JROAD-DPC database, which is a large-scale nationwide claim-based dataset in Japan. Records include a unique hospital identifier, and information regarding age, sex, main diagnosis, comorbidities, length of stay, in-hospital medications, and discharge status. This dataset extracts only records from the DPC dataset that contain cardiovascular diseases that are in major diagnosis categories.^{11,12} The DPC system was started in 82 Japanese specific-function hospitals, and by 2018, the system had expanded to 1730 hospitals, covering approximately 83% of acute care hospitals in Japan.¹³ In 2016, a total of 812 hospitals submitted their DPC datasets to the JROAD-DPC database, which covered 68% of all hospital beds in DPC hospitals in Japan.

Study population

In this study, the JROAD-DPC data from the time period between April 2012 and March 2017 were analyzed. First, hospitalized patients who underwent PCI were identified by the specific DPC receipt codes for PCI. Identification of diseases in hospitalized patients was based on the International Classification of Diseases (ICD)-10 diagnosis codes. According to AF status, patients who underwent PCI were divided into the following 3 groups: those with no AF, those with prevalent AF (comorbidity), and those with incident AF. Prevalent AF before admission was defined as having an ICD-10 code of I48 in the diagnostic category of comorbidity. Incident AF after admission was defined as having an I48 code in the diagnostic categories of complications, most resource-consuming diagnosis, or second most resource-consuming diagnosis, thereby excluding prevalent AF. The diagnostic

Résultats : Sur 659 525 patients hospitalisés ayant subi une ICP, une FA déjà présente et une nouvelle FA ont été observées chez 6,0 % et 1,3 % des patients, respectivement; les taux de FA ont augmenté sur 5 ans. Une plus grande proportion de patients plus âgés et de patients ayant des comorbidités présentaient ces deux catégories de FA; le fait de subir une ICP pour un syndrome coronarien aigu était fréquent chez les patients présentant une nouvelle FA. La FA déjà présente et la nouvelle FA étaient toutes deux associées à des résultats bruts et à des complications plus graves pendant l'hospitalisation. Dans les cohortes appariées par score de propension, la nouvelle FA était associée à un taux de mortalité à l'hôpital plus élevé, à une durée de séjour plus longue, à des coûts directs plus importants et à un taux plus élevé de complications, notamment d'accidents vasculaires cérébraux et de lésions rénales aiguës, par rapport à la FA déjà présente. Ces résultats, à l'exception de la durée du séjour à l'hôpital, n'ont pas changé pour les deux états de la FA sur 5 ans.

Conclusions : La FA déjà présente et la nouvelle FA chez les patients subissant une ICP étaient toutes deux associées à une détérioration des résultats bruts et à des complications; plus particulièrement, la nouvelle FA était associée à de moins bons résultats ajustés et à de pires complications. Des efforts supplémentaires sont nécessaires pour améliorer les résultats des patients dans une société vieillissante où l'incidence de la FA augmente.

category of complications is defined as conditions that occur during hospitalization and affect the course of hospitalization. Regarding indications for PCI, acute myocardial infarction (AMI) and unstable angina pectoris (UAP) among patients who underwent PCI were identified based on the ICD-10 diagnosis codes. Patients with either an AMI or UAP diagnosis code were grouped as such, and those without an AMI or UAP diagnosis code were grouped into an elective category. To assess the stroke risk of individual patients, the CHA₂DS₂-VASc [Congestive Heart Failure, Hypertension, Age (≥ 75 years), Diabetes, Stroke/Transient Ischemic Attack, Vascular Disease, Age (65-74 years), Sex (Female)] scores were calculated, and patients with a high stroke risk were defined as those with a CHA₂DS₂-VASc score of ≥ 2 .¹⁴ The prescription records of antithrombotic therapies, including aspirin, P2Y₁₂ inhibitors, vitamin K antagonist (VKA), and direct oral anticoagulants (DOACs), were reviewed. Dual antiplatelet therapy (DAPT) and triple therapy were defined as aspirin plus P2Y₁₂ inhibitor, and anticoagulant (VKA or DOAC) plus DAPT, respectively. Seventeen diagnoses were used to calculate the Charlson comorbidity index, which is widely used for risk adjustment in administrative database research studies.¹⁵

The primary outcomes analyzed were as follows: (i) in-hospital mortality; (ii) non-home discharge; (iii) in-hospital cost; (iv) length of stay; and (v) in-hospital morbidity (transient ischemic attack [TIA]/stroke, gastrointestinal [GI] bleeding, blood transfusion, circulatory shock, venous thromboembolism, and acute kidney injury). These outcomes were compared for no AF vs prevalent AF or incident AF in crude and propensity-matched cohorts.

The Ethics Committee of Kitano Hospital approved the study protocol. The requirement for individual informed consent was waived by the hospital because no information specifying individuals was included. The original DPC data

Table 1. Baseline clinical characteristics

Characteristic	No AF	Prevalent AF	Incident AF	<i>P</i>
Number	611,857 (92.8)	39,325 (6.0)	8343 (1.3)	< 0.001
Age (y), mean (SD)	69.56 (11.06)	74.06 (9.34)*	73.20 (10.46)*,†	< 0.001
Men	465,981 (76.2)	29,848 (75.9)	6094 (73.0)*,†	< 0.001
PCI indication				
Elective	356,930 (58.3)	25,175 (64.0)*	3592 (43.1)*,†	< 0.001
AMI/UAP	254,927 (41.7)	14,150 (36.0)*	4751 (56.9)*,†	< 0.001
Comorbidities				
Hypertension	161,018 (33.6)	12,421 (40.0)*	1878 (30.0)*,†	< 0.001
DM	177,197 (29.0)	9890 (25.1)*	2626 (31.5)*,†	< 0.001
Prior stroke	8944 (1.5)	740 (1.9)*	177 (2.1)*	< 0.001
Prior MI	12,446 (2.0)	672 (1.7)*	322 (3.9)*,†	< 0.001
CHF	134,895 (22.0)	10,798 (27.5)*	2848 (34.1)*,†	< 0.001
CPD	14,524 (2.4)	1128 (2.9)*	308 (3.7)*,†	< 0.001
PVD	49,870 (8.2)	2750 (7.0)*	681 (8.2)*,†	< 0.001
CHA ₂ DS ₂ -VAsC, mean (SD)	3.83 (1.20)	4.20 (1.03)*	4.32 (1.08)*,†	< 0.001
Score ≥ 2	97.4	99.4*	99.2*	< 0.001
CCI, mean (SD)	1.60 (1.28)	1.60 (1.20)	2.18 (1.31)*,†	< 0.001
Score 0	120,500 (19.7)	6442 (16.4)	471 (5.6)	< 0.001
Score 1–2	367,596 (60.1)	25,392 (64.6)	5061 (60.6)	
Score ≥ 3	123,761 (20.3)	7491 (19.0)	2811 (33.8)	
Medication				
VKA	22,018 (3.6)	8317 (21.1)*	1774 (21.3)*	< 0.001
DOAC	6253 (1.0)	13,793 (35.1)*	2938 (35.2)*	< 0.001
Aspirin	355,404 (58.1)	25,271 (64.3)*	6657 (79.8)*,†	< 0.001
P2Y ₁₂ inhibitor	387,899 (63.4)	27,341 (69.5)*	6878 (82.4)*,†	< 0.001
DAPT	342,341 (56.0)	23909 (60.8)	6422 (77.0)	< 0.001
Triple therapy	24,137 (3.9)	16,242 (41.3)*	3732 (44.7)*,†	< 0.001
Procedure				
Stent	545,106 (89.1)	34,121 (86.8)*	7262 (87.0)*	< 0.001
DES	503,714 (82.3)	31,401 (79.8)*	6541 (78.4)*,†	< 0.001

Values are n (%), unless otherwise indicated.

AF, atrial fibrillation; AMI, acute myocardial infarction; CCI, Charlson comorbidity index; CHA₂DS₂-VAsC, [Congestive Heart Failure, Hypertension, Age (≥75 years), Diabetes, Stroke/Transient Ischemic Attack, Vascular Disease, Age (65–74 years), Sex (Female)] score; CHF, congestive heart failure; CPD, chronic pulmonary disease; DAPT, dual antiplatelet therapy; DES, drug-eluting stent; DM, diabetes mellitus; DOAC, direct oral anticoagulant; MI, myocardial infarction; PCI, percutaneous coronary intervention; PVD, peripheral vessel disease; SD, standard deviation; UAP, unstable angina pectoris; VKA, vitamin K antagonist

* *P* < 0.01 vs no AF.

† *P* < 0.01 vs prevalent AF.

were anonymized using the code change equations and sent to the Ministry of Health, Labour and Welfare.

Statistical analysis

Data were expressed as mean and standard deviation for normally distributed variables, and median with interquartile range for non-normally distributed data. The Shapiro–Wilk

test was used to examine the normality of distribution. Continuous variables were compared using the Student *t* test or the Mann–Whitney *U* test, as appropriate. Categorical data were expressed as percentages and compared using the χ^2 test or Fisher’s exact test. For yearly-trend analysis, the Cochran–Armitage test was conducted during the study period.

Table 2. In-hospital outcomes and complications

Outcome/complication	No AF	Prevalent AF	Incident AF	<i>P</i>
In-hospital death	13,856 (2.3)	1130 (2.9)*	547 (6.6)*,†	< 0.001
Hospital stay (d), median (IQR)	5.00 (3.00, 12.00)	7.00 (4.00, 17.00)*	15.00 (7.00, 26.00)*,†	< 0.001
Non-home discharge	19,240 (3.2)	2097 (5.5)*	710 (9.1)*,†	< 0.001
Direct cost (\$), median (IQR)	12,170 (9285, 17,547)	13,019* (9528, 19,528)	19,434*,† (13,491, 30,660)	< 0.001
Complications				
TIA/stroke	4198 (0.7)	498 (1.3)*	213 (2.6)*,†	< 0.001
GI bleeding	2769 (0.5)	250 (0.6)*	87 (1.0)*,†	< 0.001
Transfusion	32328 (5.3)	2700 (6.9)*	1436 (17.2)*,†	< 0.001
VTE	1638 (0.3)	137 (0.3)	51 (0.6)*,†	< 0.001
Circulatory shock	20,485 (3.3)	1619 (4.1)*	787 (9.4)*,†	< 0.001
AKI	2923 (0.5)	262 (0.7)*	174 (2.1)*,†	< 0.001

Values are n (%), unless otherwise indicated.

AF, atrial fibrillation; AKI, acute kidney injury; GI, gastrointestinal; IQR, interquartile range; TIA, transit ischemic attack; VTE, venous thromboembolism.

* *P* < 0.01 vs no AF.

† *P* < 0.01 vs prevalent AF.

Table 3. In-hospital outcomes and complications in propensity-matched cohorts for the no AF and prevalent AF groups

Outcome	No AF	Prevalent AF	P
Number	30,951	30,951	
In-hospital death	347 (1.1)	422 (1.4)	0.006
Hospital stay (d), median (IQR)	6.00 (4.00, 14.00)	6.00 (4.00, 15.00)	< 0.001
Non-home discharge	832 (2.7)	1066 (3.5)	< 0.001
Direct cost (\$), median (IQR)	12,547 (9528, 18,208)	12,453 (9361, 18,396)	0.002
Complication			
TIA/stroke	187 (0.6)	284 (0.9)	< 0.001
GI bleeding	172 (0.6)	173 (0.6)	0.96
Transfusion	1848 (6.0)	1714 (5.5)	0.02
VTE	108 (0.3)	102 (0.3)	0.68
Circulatory shock	974 (3.1)	1155 (3.7)	< 0.001
AKI	101 (0.3)	116 (0.4)	0.31

Values are n (%), unless otherwise indicated.

AF, atrial fibrillation; AKI, acute kidney injury; GI, gastrointestinal; IQR, interquartile range; TIA, transient ischemic attack; VTE, venous thromboembolism.

Propensity-score matching using the nearest-neighbor matching method was constructed to evaluate whether the AF status was independently associated with primary outcomes by logistic regression modeling, adjusting for variables including age, sex, PCI indication, comorbidities (hypertension, diabetes, previous stroke, previous myocardial infarction, congestive heart failure, peripheral artery disease, and chronic pulmonary disease), and antiplatelet therapies. Matching was performed in a 1:1 ratio without replacements, with 0.25 multiplied by the standard deviation of the propensity score as a caliper. In-hospital outcomes for propensity-matched cohorts were assessed by using a multilevel mixed effects logistic regression model, using institution as a random intercept to calculate odds ratios (ORs) and 95% confidence intervals (CIs). Additionally, all hospital costs and charges were converted into US dollars according to the current exchange rate (1 US dollar = 106.00 yen). All statistical analyses were conducted using Stata 16.1 (StataCorp, College Station, TX).

Results

From 5,106,151 records of hospitalized patients from April 2012 to March 2017 in the JROAD-DPC data, 4,446,626 records of patients who did not undergo PCI were excluded. Of the 659,525 cases in 921 hospitals included in the study, 163,867 (24.8%) were AMI, 109,961 (16.7%) were UAP, and 385,697 (58.5%) were elective PCI (Supplemental Fig. S1).

A total of 611,857 patients (92.8%) had no AF (no AF group), 39,325 patients (6.0%) had AF before admission as a comorbidity (prevalent AF group), and 8343 patients (1.3%) had AF first noted during admission as a complication (incident AF group). Baseline clinical characteristics are shown in Table 1. Patients in the prevalent AF and incident AF groups were older than those in the no AF group (74.06 ± 9.34 and 73.20 ± 10.46 vs 69.56 ± 11.06 years; $P < 0.001$). In the incident AF group, there were more female patients. The prevalent AF group showed less-urgent indication for PCI (AMI or UAP), and the incident AF group showed more-urgent indication than did the no AF group. The CHA₂DS₂-VASc score was highest in the incident AF group, followed by that in the prevalent AF group. The Charlson comorbidity index score was also highest in the incident AF group. Anticoagulant therapy was administered at a higher rate in the prevalent AF and incident AF groups, as was triple therapy. There was a significant difference in the rate of DAPT among the groups. Stent or drug-eluting stent use was less frequent in the prevalent AF and incident AF groups. Cases requiring assisted circulation (intra-aortic balloon pumping and percutaneous cardiopulmonary support) and mechanical ventilation were most common in the incident AF group.

There were a total of 15,533 deaths (2.4%) during the index admission (Table 2). The in-hospital mortality rate was higher in the prevalent AF and incident AF group than in the no AF group (2.9%, 6.6%, and 2.3%, respectively;

Table 4. In-hospital outcomes and complications in propensity-matched cohorts for the no AF and incident AF groups

Outcome	No AF	Incident AF	P
Number	6225	6225	
In-hospital death	86 (1.4)	184 (3.0)	< 0.001
Hospital stay (d), median (IQR)	9.00 (4.00, 17.00)	14.00 (6.00, 25.00)	< 0.001
Non-home discharge	213 (3.5)	324 (5.4)	< 0.001
Direct cost (\$), median (IQR)	14,340 (10,377, 20,377)	18,491 (12,736, 28,868)	< 0.001
Complications			
TIA/stroke	53 (0.9)	127 (2.0)	< 0.001
GI bleeding	41 (0.7)	55 (0.9)	0.15
Transfusion	426 (6.8)	894 (14.4)	< 0.001
VTE	10 (0.2)	36 (0.6)	< 0.001
Circulatory shock	208 (3.3)	522 (8.4)	< 0.001
AKI	23 (0.4)	77 (1.2)	< 0.001

Values are n (%), unless otherwise indicated.

AF, atrial fibrillation; AKI, acute kidney injury; GI, gastrointestinal; IQR, interquartile range; TIA, transient ischemic attack; VTE, venous thromboembolism.

Adjusted Odds Ratio

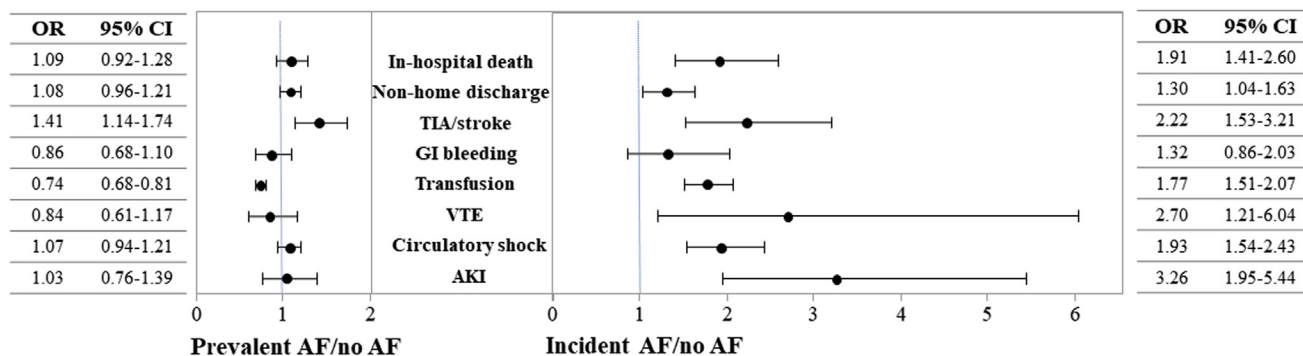


Figure 1. Adjusted odds ratios (ORs) for in-hospital outcomes and complications in propensity-matched patients with percutaneous coronary intervention. ORs and 95% confidence intervals (CIs) are presented for each atrial fibrillation (AF) status. AKI, acute kidney injury; GI, gastrointestinal; TIA, transient ischemic attack; VTE, venous thromboembolism.

$P < 0.001$). Moreover, both AF groups were significantly more likely to have a longer hospital stay, a higher non-home discharge rate, and higher direct cost than the no AF group, and the incident AF group showed the longest hospital stay and highest rates. The complication rate in the groups increased from lowest to highest in the order of no AF, prevalent AF, and incident AF. In the subgroup of patients who had elective PCI, the clinical outcomes, including in-hospital mortality, hospital length of stay, non-home discharge, direct cost, and complication rate increased along with the AF status (Supplemental Table S1).

Propensity-matched cohorts consisted of 30,951 patients and 6225 patients, in the no AF and prevalent AF groups, and the no AF and incident AF groups, respectively (Supplemental Tables S2A and S2B, respectively). In the comparison of in-hospital outcomes and complications in the no AF and prevalent AF groups, deaths were increased, and some complications, such as TIA/stroke and circulatory shock, were frequent (Table 3). In the no AF and incident AF groups, all indexes of in-hospital outcomes and complications, except GI bleeding, were worse in the incident AF group than in the no AF group (Table 4). In multivariate logistic regression analysis for in-hospital outcomes and complications, only TIA/stroke rate was significantly increased in the prevalent AF group (OR, 1.41; 95% CI, 1.14-1.74). and rates of death, non-home discharge, and complications, except for GI bleeding, were increased in the incident AF group compared with the no AF group (Fig. 1).

Yearly-trend analysis for the time period between 2012 and 2016 showed that the prevalence of both prevalent and incident AF cases had increased and that the prevalence of elderly (age ≥ 75 years) and elective PCI cases in both prevalent and incident AF groups had increased (Fig. 2A). Anticoagulant therapy, including DOACs, and triple therapy was increasingly prescribed in both the prevalent AF and incident AF groups (Fig. 2B). Regarding outcomes and complications, although length of hospital stay was shortened, the prevalence of in-hospital mortality and complications had not changed in 5 years in either the prevalent AF or the incident AF group (Fig. 2C).

Discussion

In the present study, 6.0% of patients who underwent PCI reported having a history of AF, and 1.3% of patients developed AF during their hospitalization. Reported prevalence rates of AF in hospitalized patients who have undergone PCI vary, with estimates ranging from 5% to 12%.^{5,7,16,17} Its variation by institution was also reported.⁵ Although rates in our study were slightly lower, they were consistent with data from recent Asian studies. For example, Choi et al. reported that 7% of patients presented with a diagnosis of AF at the index PCI.¹⁸ Several factors, such as differences in the diagnostic method, variations among facilities, and racial and regional differences may be related to whether this diagnosis was made. In all reports, the presence or history of AF was associated with older age and other comorbidities. Consistently, we found that patients with a history of AF and incident AF were older and had more comorbidities. AF is increasing as the society ages³ and is associated with numerous risk factors, such as smoking, alcohol consumption, obesity, hypertension, diabetes, and history of heart failure or myocardial infarction.⁴ Therefore, AF was common in patients who underwent PCI, including those with ACS, who represented a high-risk group.

In the present analysis, we distinguished among concomitant AF based on its status, prevalent AF before admission (comorbidity), and incident or new-onset AF after admission and compared them. Patients with incident AF differed from patients with prevalent AF in not only prevalence and baseline characteristics but also in-hospital outcomes and complications. It is suggested that the underlying pathophysiology of AF differs between these populations. In patients with ACS or AMI, the prognostic impact of preexisting and new-onset AF has been explored, and each prognostic burden has been shown. McManus et al. showed that overall hospital death rates in 59,032 patients with ACS with new-onset or preexisting AF were 14.5% and 8.9%, respectively, compared with 1.2% in those without AF, and that both categories of AF remained associated with an increased risk of important cardiovascular, renal, and hemorrhagic complications.⁶ Lau et al. further showed that new-onset AF in ACS was associated with

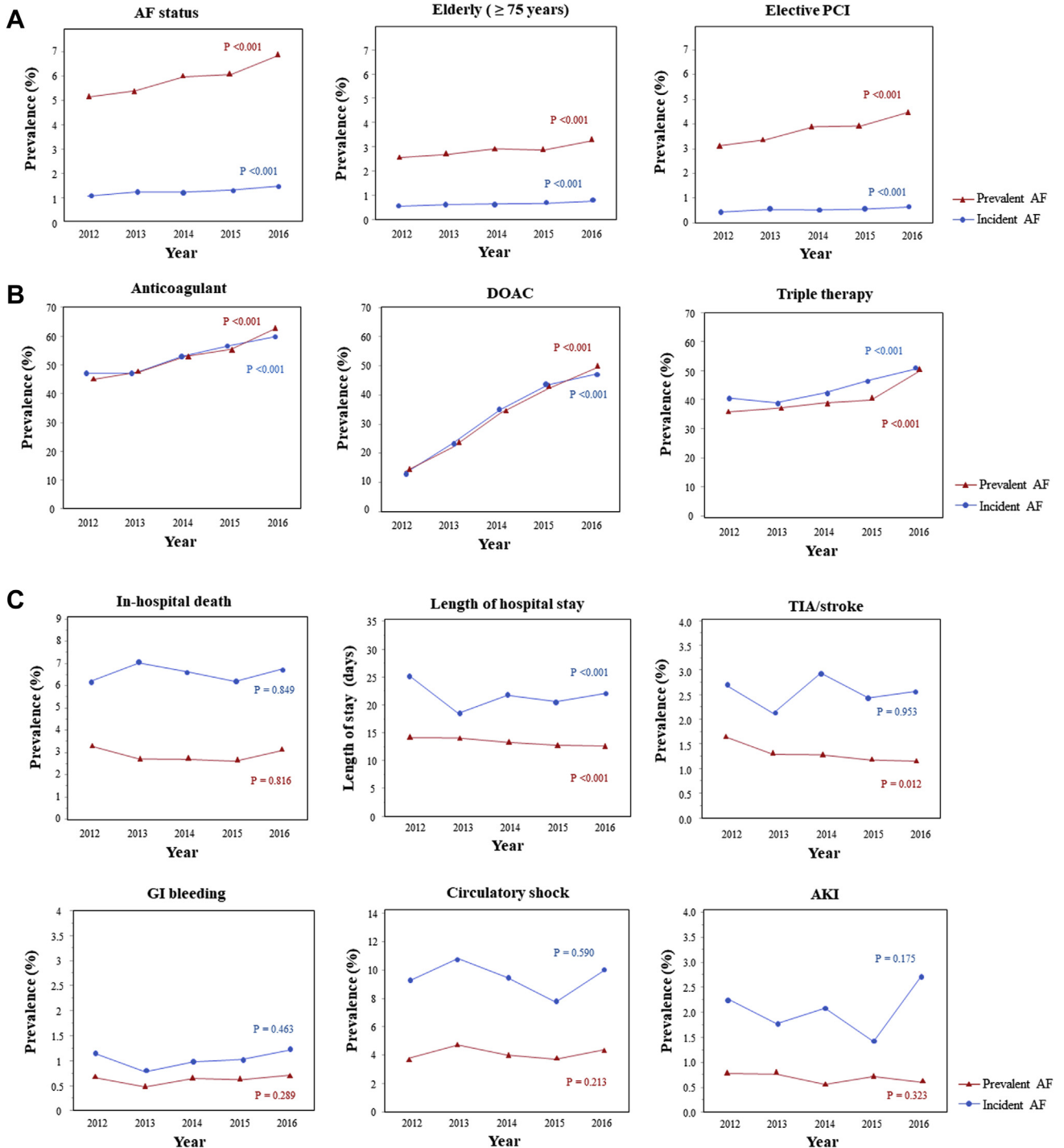


Figure 2. Temporal trends in hospitalized patients with atrial fibrillation (AF) undergoing percutaneous coronary intervention (PCI) from 2012 to 2016. **(A)** The prevalence of AF status among all patients, and that of elderly patients, and PCI indication among all patients in each AF status group. **(B)** The prevalence of patients receiving anticoagulant, direct oral anticoagulant (DOAC), or triple therapy for each AF status group. **(C)** The prevalence or length of in-hospital outcomes or complications among each AF status group. AKI, acute kidney injury; GI, gastrointestinal; TIA, transit ischemic attack.

worse short-term outcomes, and previous AF was associated with a higher mortality rate, even at long-term follow-up.¹⁹ These findings may indicate that a history of AF is a marker that patients are vulnerable to serious outcomes and complications in both the short and long term after PCI. AF occurring in the community is associated with the duration

and severity of exposure to cardiovascular risk factors; thus, the observed relationship between preexisting AF and increased mortality rates likely reflects the more advanced age and greater risk-factor burden of patients with a recent or long-standing history of AF. In incident AF, the reported data, including ours, may be consistent with the theory that

incident AF represents ongoing and underlying myocardial ischemia, dysfunction, hemodynamic alteration, and neurohormonal and autonomic nervous system changes, leading to poor short-term outcomes.²⁰

In the crude cohort, there was a significant difference in GI bleeding for patients with no AF vs those with prevalent or incident AF; however, in the propensity-matched cohort, no such difference was observed. Considering the fact that the difference in DAPT among the crude cohorts disappeared in the propensity-matched cohort after adjusting the variables included in the antiplatelet therapy, GI bleeding in this study may be associated not with anticoagulant use, but with DAPT, as shown in previous studies.^{21,22} Several cohort studies reported that the prescription rates of anticoagulants in patients with AF and PCI were approximately 30%-60% before 2015,^{23,24} which are similar to our findings showing the prevalence of patients on anticoagulants to be 56.2% and 56.5% among those with prevalent and incident AF, respectively. Although a few reports have found a difference in anticoagulant (VKA and DOAC) use among ACS patients with prevalent AF vs incident AF,⁶ our cohort did not show any difference in the rate of anticoagulant prescription for the prevalent AF vs incident AF groups. However, Rivero-Ayerza et al. reported a similar anticoagulant prescription rate for those with previous AF vs new-onset AF (54% and 57%, respectively) among hospitalized patients with heart failure.²⁵ Further exploration of the relationship between antithrombotic therapy and outcomes/complications in a cohort of patients with prevalent AF vs incident AF after PCI will be interesting.

Some investigators showed a decline in the temporal trend of the rates of major in-hospital complications,⁶ and others showed a less favorable (unchanged) trend of mortality, bleeding, and stroke.¹⁷ In the present investigation, in-hospital deaths and complications, such as TIA/stroke, GI bleeding, circulatory shock, and acute kidney injury, have not changed for patients in either AF status group over the study period. Considering that there is a trend toward an increased ratio of elderly patients over time, these findings may reflect the effective enhanced monitoring and treatment of hospitalized patients who have undergone PCI, such as increased antithrombotic medications, in addition to better and timelier treatment of AF. However, continuous efforts are needed to further improve outcomes and manage strategies for patients with AF who are undergoing PCI, and to prevent AF onset in patients with coronary artery disease. Moreover, further study to identify patients at higher risk for complications is critically important to develop preventive strategies to reduce morbidity and mortality levels.⁵ This study has several limitations due to inherent restrictions of DPC dataset analysis on retrospective, observational, and nonrandomized data. First, a misdiagnosis or misclassification of prevalent or incident AF may have occurred, especially in diagnostic categories such as comorbidity and complication. This database has characteristics of high diagnostic specificity and positive predictive value despite the relatively low sensitivity and negative predictive value.^{12,26} The results of the current study must be interpreted in light of this point. Also, preexisting paroxysmal AF is sometimes difficult to diagnose. There might be cases in which it recurred during hospitalization but was classified as a new-onset case (incident AF) because it was missed in the comorbidity

diagnosis (prevalent AF). Second, although comprehensive clinical and procedural data were available, there were inadequate laboratory data as well as cause of in-hospital death and ambulatory data. Particularly, follow-up outcomes after discharge were not available, and these need to be further investigated.^{18,19}

Third, although a comprehensive group of adjustment variables was used, unmeasured variables or variables that were not incorporated into the propensity-matched or multivariate Cox models may have affected the results. Finally, we did not have detailed information regarding AF type (paroxysmal or chronic AF), duration of AF episode, and therapies such as medications, cardioversion, and ablation. This information might be associated with outcomes in the present population.

In this study, the characteristics and clinical effects of AF status on in-hospital mortality and complications were explored in patients who underwent PCI using a current large-scale nationwide claims-based dataset. Both prevalent AF and incident AF were associated with worse crude outcomes and complications during hospitalization. In propensity-matched cohorts, incident AF was associated with higher in-hospital mortality rate, a longer length of stay, higher direct costs, and a higher rate of complications, including stroke and acute kidney injury. Although the prevalence of both categories of AF, the number of elderly patients, and use of antithrombotic medications have all increased, the clinical outcomes and complications, other than length of stay, have not changed for patients with either category of AF in the past 5 years. Further efforts are necessary to improve patient outcomes in an aging society in which the incidence of AF is increasing.

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Disclosures

The authors have no conflicts of interest to disclose.

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Supplementary Material

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