**Current use of direct oral anticoagulants for atrial fibrillation in Japan: Findings from the SAKURA AF Registry**

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**Abstract**

**Background:** Large-scale investigations on the use of oral anticoagulants including direct oral anticoagulants (DOACs) in patients with atrial fibrillation (AF) have not included Japanese patients.

**Methods:** We established the multicenter SAKURA AF Registry to support prospective observational research on the status of anticoagulation treatment, especially with DOAC, for AF in Japan. We enrolled 3266 AF patients treated with warfarin (n = 1577) or any of 4 DOACs (n = 1689) from 63 institutions (2 cardiovascular centers, 13 affiliated hospitals or community hospitals, and 48 private clinics) in the Tokyo area.

**Results:** We conducted our first analysis of the registry data, and although we found equivalent mean age between the DOAC and warfarin users (71.8 ± 9.5 vs. 72.3 ± 9.4 years, p = 0.2117), we found a slightly lower risk of stroke (CHADS2 score of 0 or 1 [46.9% vs. 39.4%, p < 0.0001]) and significantly better creatinine clearance in DOAC users (70.4 ± 27 vs. 65.6 ± 25.7 mL/min, p < 0.0001). Importantly, we documented under-dosing in 32% of warfarin users and inappropriate-low-dosing in 19.7–27.6% of DOAC users.

**Conclusions:** Our initial analysis of the SAKURA AF Registry data clarified the real-world use of anticoagulants, which includes DOACs and warfarin in Japan. The DOAC users were at a lower risk for stroke than the warfarin users. In 20–30% of DOAC users, the dose was inappropriately reduced.

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1. Introduction

Atrial fibrillation (AF), the most common arrhythmia in the elderly, affects approximately 0.6% of the Japanese population, with its prevalence expected to increase to over 1 million persons.
by 2050 [11]. AF is an independent risk factor for stroke and death. Although anticoagulation with warfarin provides effective stroke prophylaxis in patients with AF, its use can be troublesome because of issues such as food-drug interactions, a narrow therapeutic window, and the need for frequent monitoring of the prothrombin-international normalized ratio (PT-INR). To overcome the limitations of warfarin, direct oral anticoagulants (DOACs) have been developed.

The benefits of DOACs over warfarin in reducing the risk of vascular events and bleeding complications in patients with AF have been substantiated in randomized clinical trials (RCTs) [2–5]. Although there have been several “real-world” larger-scale registries in Japan such as the J-RHYTHM Registry [6,7], Fushimi AF Registry [8,9], and SHINKEN database [10], these registries included very few DOAC users. As such, no large-scale studies on the use of DOACs in Japan have been conducted to clarify the clinical characteristics of the AF patients for whom they are prescribed or to confirm the efficacy and safety of these drugs. We therefore established the multicenter SAKURA AF Registry to support prospective observational research on the status of anticoagulation treatment, i.e., treatment with DOACs and warfarin and to clarify the associated long-term outcomes in terms of strokes and bleeding complications in Japanese patients with AF (SAKURA AF Registry: UMIN Clinical Trials Registry: UMIN0000014420). The study described herein stands as the first analysis of the SAKURA AF Registry data and was designed specifically to characterize DOAC and warfarin users separately.

2. Methods

2.1. The SAKURA AF Registry

The SAKURA AF Registry was set up to track the results of the follow-up examinations and clinical events of AF patients for at least 1 year and up to 3 years after their enrollment. Recruitment began in September 2013 and ceased in December 2015. The participating institutions consisted of 2 cardiovascular centers (Nihon University Itabashi Hospital and Nihon University Hospital), 13 affiliated or community hospitals, and 48 private clinics, all located mainly in the capital city of Tokyo or a Tokyo suburb. The analysis of the registry data was approved by our institutional review board (IRB) and individual hospital IRBs. All enrollees provided written informed consent for participation in the registry.

2.2. SAKURA AF Registry population

Patients enrolled in the registry were those aged ≥20 years in whom AF was diagnosed by 12-lead electrocardiograms (ECGs), 24-hour Holter ECGs, or event-activated ECGs, and who had been given warfarin or DOACs as stroke prophylaxis. Patients with rheumatic mitral valve disease, history of prosthetic valve replacements, active infective endocarditis, or who failed to provide written informed consent were not enrolled.

2.3. Data collection

Baseline data collected for the registry included the following: patient clinical characteristics, including the age, sex, body weight, and height; type of AF (paroxysmal AF [AF lasting ≤7 days], persistent AF [AF lasting >7 days and ≤1 year], or long-standing persistent AF [AF lasting >1 year]); current medications used, including antiarrhythmic, anticoagulant, and antiplatelet agents; co-morbidities and/or risk factors including hypertension, diabetes, strokes or transient ischemic attacks, coronary heart disease, and congestive heart failure, and whether the patients smoked or consumed alcohol at the time of enrollment. Any prior major bleeding events were also recorded. The CHADS₂ score [11] and CHA₂DS₂-VASc [12] scores (for stroke risk) and HAS-BLED [13] score (for bleeding risk) were calculated and recorded. If available in the patient clinical records, the N-terminal pro-natriuretic peptide (NT-proBNP) levels were obtained. If available, the BNP score was converted to NT-proBNP (NT-proBNP = BNP⁹/₃₄¹ − 15). The PT-INR was recorded for warfarin users. Hypertension, diabetes, dyslipidemia, and heart failure were diagnosed as previously reported. [9] Creatinine clearance (CrCl) was calculated according to the Cockcroft-Gault formula [14].

2.4. Data management

A website created for the SAKURA AF Registry was used to collect all patient data through a web-based registration system. Each participating investigator was trained on how to use the study website, and received a personal ID and password for access. The patients’ baseline clinical data were entered into online forms and saved to the website. The data entry was checked by clinical research coordinators at the general registry office.

2.5. Study goals and factors analyzed

In addition to ascertaining the characteristics of the total patient population enrolled in the SAKURA AF Registry and then characterizing the warfarin and DOAC users, we explored whether warfarin and DOACs were being appropriately prescribed. In analyzing the warfarin administration, we looked at the PT-INR and accepted 1.6–2.6 as the optimal therapeutic range for those aged ≥70 years and 2.0–3.0 for those aged < 69 years [7]. “Overdosing” was defined as a warfarin-related PT-INR above the therapeutic range, and “under-dosing” as that below the therapeutic range. In analyzing the DOAC administration, “appropriate-standard-dosing” and “appropriate-low-dosing” were defined as an administration according to a standard or low-dose regimen, respectively. The definition of a low-dose regimen for each DOAC is shown in Table 1. Inappropriate-low-dosing was defined as administering low-dose DOACs despite the standard dosage criteria being met. Inappropriate-standard-dosing was defined as administering standard-dose DOACs despite the low-dose regimen criteria being met. Dabigatran was considered to be contraindicated if the patient’s CrCl was < 30 ml/min; the other DOACs were considered to be contraindicated if the patient’s CrCl was < 15 ml/min.

| Table 1 |
| Low-dose regimen for each of the direct oral anticoagulants. |
| Dabigatran 110 mg bid (vs. a standard dosage of 150 mg bid) |
| If CrCl is 30–50 mL/min, or age is ≥70 years, or the patient has a prior bleeding history. |
| Rivaroxaban 10 mg od (vs. a standard dosage of 15 mg od) |
| If CrCl is ≥15–50 mL/min. |
| Apixaban 2.5 mg bid (vs. a standard dosage of 5 mg bid) |
| Two of the following characteristics: ≥80 years, body weight < 60 kg, or serum Cr level > 15 mg/dL. |
| Edoxan 30 mg od (vs. a standard dosage of 60 mg od) |
| If CrCl is 15–50 mL/min or body weight is < 60 kg. |

CrCl, creatinine clearance.
* The use of P-polyprotein inhibitors (verapamil and quinidine or short-term azithromycin, clarithromycin, cyclosporine, or ketoconazole) was not available in this study.
Continuous variables are expressed as the mean ± SD or median value and interquartile range for the warfarin user group and each DOAC user group. Differences in the clinical characteristics between warfarin and DOAC users were analyzed by unpaired Student t-test, Mann–Whitney test, or chi-square test, as appropriate. The results of the 4 types of DOAC users were compared using an analysis of variance (ANOVA) or chi-square test, followed by the Tukey's HSD (honest significant difference) multiple comparison test or a residual analysis. Multiple logistic regression analyses were performed to identify the clinical characteristics associated with DOAC inappropriate-low-dosing, and odds ratios were calculated for the relationship between the identified characteristics and inappropriate-low-dosing. The appropriate standard DOAC doses were used for reference. Between-group differences in the categorical variables were analyzed by chi-square tests. All statistical analyses were performed with JMP software version 11.0.2 (SAS Institute Inc., Cary, NC, USA), with a p < 0.05 considered as statistically significant.

3. Results

3.1. Total enrollment

A total of 3266 patients with AF were enrolled in the registry between September 1, 2013 and December 31, 2015: 1200 (36.7%) from cardiovascular centers, 1310 (40.1%) from affiliated or community hospitals, and 756 (23.1%) from private clinics (see the Appendix). Regionally, 2094 (64.1%) patients were from Tokyo city, 763 (23.4%) from Saitama prefecture, 281 (8.6%) from Kanagawa prefecture, and 47 (1.4%) from other prefectures of Tokyo suburbs. The majority of the patients (1277 [39.1%] patients) were from the northern (referred to as “Johoku”) region of Tokyo city, and in particular, one-third of the registered patients (1051 [32.2%] patients) came from Itabashi-Ku, Kyōtō-ku.

3.2. Characteristics of the SAKURA AF patients

The characteristics of the registry patients are summarized in Table 2. Of the total of 3266 patients, 1577 (48.3%) were on warfarin while 1689 (51.7%) were on a DOAC (dabigatran, n = 456 [14.0%], rivaroxaban, n = 766 [23.5%], apixaban, n = 437 [13.4%], or edoxaban, n = 30 [0.9%]). The total patients’ mean age was 72.0 years, and 840 (25.7%) were women. The mean body weight was 63.8 kg. AF was paroxysmal in 1210 (37.0%) patients, persistent in 723 (22.1%), and long-standing persistent in 1301 (39.8%); the type of AF was not recorded in the remaining 32 patients. Although there was no difference between the warfarin and DOAC groups in the age, body mass index, smoking status, or drinking status, DOAC users were more likely than warfarin users to be female and have paroxysmal AF. Overall, the co-morbidities associated with strokes, such as hypertension and heart failure, tended to be less prevalent among DOAC users than among warfarin users. The average CHADS2 and CHA2DS2-VASc scores were 1.80 and 2.74, respectively. The CHADS2, CHA2DS2-VASc, and HAS-BLED scores were significantly lower among DOAC users than among warfarin users.

3.3. Medications used, laboratory dose testing, and dosing practices in the warfarin and DOAC groups

The medications used by the patients at the time of enrollment are summarized in Table 3. Importantly, only 5.1% of warfarin group patients were new users (oral anticoagulant administered within 3 months before the enrollment date), compared to 33.4%
Table 3
Patient use of medications and laboratory test results upon enrollment in the SAKURA AF Registry.

|                      | Total patients (n = 3266) | DOAC users (n = 1689) | Warfarin users (n = 1577) | P value* |
|----------------------|---------------------------|-----------------------|---------------------------|----------|
| New use              |                           |                       |                           | <.00001  |
| Aspirin              | 645 (19.7)                | 564 (33.4)            | 81 (5.1)                  | <.00001  |
| Ticlopidine          | 513 (15.7)                | 207 (12.3)            | 306 (19.4)                | <.00001  |
| Clopidogrel          | 385 (11.8)                | 151 (8.9)             | 234 (14.8)                | <.00001  |
| Prasugrel            | 8 (0.2)                   | 0 (0.0)               | 8 (0.5)                   | 0.0034   |
| Clopidolol           | 38 (0.6)                  | 10 (0.6)              | 28 (1.8)                  | 0.0001   |
| Other                | 25 (0.8)                  | 16 (1.0)              | 9 (0.6)                   | 0.2172   |
| NSAI D              | 56 (1.7)                  | 34 (2.0)              | 22 (1.4)                  | 0.1740   |
| Rate control drugs   |                           |                       |                           | <.00001  |
| Digitalis           | 436 (13.4)                | 172 (10.2)            | 264 (16.7)                | <.00001  |
| Ca channel blocker  | 436 (13.4)                | 214 (12.7)            | 222 (14.1)                | 0.2374   |
| Beta blocker        | 1450 (44.4)               | 719 (42.6)            | 731 (46.4)                | 0.0296   |
| Rhythm control drugs |                               |                       |                           |          |
| Class I             | 422 (12.9)                | 238 (14.1)            | 184 (11.7)                | 0.0391   |
| Bepridil            | 322 (9.9)                 | 173 (10.3)            | 149 (9.4)                 | 0.4466   |
| Amiodarone          | 30 (0.9)                  | 11 (0.7)              | 19 (1.2)                  | 0.0975   |
| Laboratory test results |                               |                       |                           |          |
| CrCl (mL/min)        | 68.1 ± 26.7               | 70.5 ± 27.4           | 65.6 ± 25.6               | <.00001  |
| > 80                 | 901 (27.6)                | 495 (29.3)            | 406 (25.7)                | <.00001  |
| 50 to 80             | 1535 (47.0)               | 810 (47.8)            | 725 (46.0)                |          |
| > 30                 | 640 (19.6)                | 320 (18.9)            | 320 (20.3)                |          |
| ≤ 30                 | 152 (4.7)                 | 43 (2.5)              | 109 (6.9)                 | <.00001  |
| Not reported         | 38 (1.2)                  | 21 (1.2)              | 17 (1.1)                  |          |
| NT-proBNP (pg/mL)    | 503 (195–474)             | 473 (131–1111)        | 524 (238–1063)            | 0.0121   |
| Not reported         | 834 (25.5)                | 462 (27.3)            | 372 (23.6)                |          |

Values are shown as the mean ± SD, median and interquartile range, or n (%). AST, aspartate aminotransferase; ALT, alanine aminotransferase; BUN, blood urea nitrogen; NT-proBNP, N-terminal pro brain natriuretic peptide; CrCl, creatinine clearance; new use, warfarin or DOAC starting within 3 months after the registration date; Hb, hemoglobin; HDL, high-density lipoprotein; LDL, lactate dehydrogenase; LDI, low-density lipoprotein; NSAID: non-steroidal anti-inflammatory drug; TC, total cholesterol.

* By the Student t-test, Mann–Whitney test, or chi-square test, as appropriate.

of the DOAC group. The use of antiplatelet drugs was relatively low (15.7% of patients) and less common among DOAC users than among warfarin users. The DOAC users were preferentially given rate control rather than rhythm control drugs, whereas warfarin users were preferentially given rate control rather than rhythm control drugs.

The CrCl rate was significantly higher and NT-proBNP level significantly lower in the DOAC group than in the warfarin group. The mean PT-INR in the warfarin group was 1.99 ± 0.56 and did not differ significantly between warfarin users aged < 70 years and those aged ≥ 70 years (2.00 ± 0.55 vs. 1.99 ± 0.57, p = 0.7942). Only 55.1% of warfarin users had a PT-INR within the optimal therapeutic range; 32% had a PT-INR below the therapeutic range and 8.6% above the therapeutic range. Under-dosing of warfarin was more prevalent among patients aged < 70 years than those aged ≥ 70 years (Fig. 1).

3.4. Clinical characteristics of the dabigatran, rivaroxaban, apixaban, and edoxaban users

The characteristics of the DOAC users are shown per subgroup (i.e., according to the specific DOAC they were taking) in Table 4. Patients taking apixaban were significantly older than those taking dabigatran and rivaroxaban. Apixaban users were significantly more likely to be female and have a significantly lower height and weight than dabigatran users. The prevalence of persistent AF and long-lasting AF was significantly lower and higher among rivaroxaban users than among apixaban users, respectively. Patients on dabigatran had a significantly higher CrCl than rivaroxaban and apixaban users. The percentage of patients who were new dabigatran users was significantly lower than the percentage of rivaroxaban users. Although not statistically significant, apixaban users were at relatively higher risk for a stroke.

Low drug doses were prescribed for 72.6% of dabigatran users and 72.4% of the edoxaban users, in contrast to only 42.9% of rivaroxaban users and 40.4% of apixaban users. Notably, an inappropriate dose reduction was observed in 19.7–27.6% of DOAC users. Inappropriate-standard-dosing of DOACs occurred in only 0.7–7.7% (Fig. 2). The characteristics of DOAC patients who were prescribed an appropriate standard dose and those who were prescribed an inappropriate low dose are shown in Table 5. Patients on inappropriately low doses of DOACs were significantly older than those taking appropriately-standard-doses and were also more likely to be female. Inappropriately low-dosed DOAC users also had significantly lower body weight, CHADS2 score, hemoglobin level, and CrCl. Fewer inappropriately low-dosed DOAC users consumed alcohol than appropriately-standard-dosed DOAC users. New use of DOACs was less common among inappropriate low-dosed DOAC users than among appropriately-standard-dosed DOAC users. After multivariate adjustment, age ≥ 75 years, non-drinking status, CrCl ≤ 50 mL/min, and use of dabigatran or edoxaban were strongly associated with inappropriately low-dosed DOAC use (Table 5).

4. Discussion

The SAKURA AF Registry is a large-scale registry designed to gather data that can be used for prospective evaluation of AF patients in Japan who are treated with a DOAC or warfarin. The main findings were as follows: (1) although there was no difference between the warfarin and DOAC groups regarding the age and body mass index, the DOAC users were at significantly lower risk for a stroke than warfarin users; (2) we documented under-dosing in 32% of warfarin users and inappropriately low dosing in 19.7–27.6% of DOAC users; (3) inappropriately low dosing of DOACs was strongly associated with age ≥ 75 years, non-drinking status, CrCl ≤ 50 mL/min, and use of dabigatran or edoxaban. AF patients enrolled in the SAKURA AF Registry were being treated at cardiovascular centers (36.7%), affiliated or community hospitals (40.1%), and general practice clinics (23.2%) in Tokyo or a Tokyo suburb. One-third (1051 patients) of the registry patients were in Itabashi-Ku, which is located in the northern region of Tokyo.
Tokyo city. The population of Itabashi-Ku is approximately 540,000 people. Based on an epidemiological prevalence of AF in the Japanese population of 0.6% [1], the number of AF patients in Itabashi-Ku is estimated to be approximately 3240. This number is 0.6% of the total Japanese population of 540,000 people. Based on an epidemiological prevalence of AF in Tokyo city. The population of Itabashi-Ku is approximately 3240. This number is 0.6% of the total Japanese population of 540,000 people.

Table 4
Clinical characteristics of the dabigatran, rivaroxaban, apixaban, and edoxaban users.

|                  | Dabigatran users (n=456) | Rivaroxaban users (n=766) | Apixaban users (n=437) | Edoxaban users (n=30) | P value |
|------------------|--------------------------|---------------------------|------------------------|-----------------------|---------|
| Age (years)      | 70.9 ± 9.5*              | 71.5 ± 9.1*               | 73.1 ± 10.0            | 74.0 ± 7.8            | 0.0014  |
| Female           | 111 (24.3)*              | 201 (26.2)                | 155 (35.5)             | 10 (33.3)             | 0.0009  |
| Height (cm)      | 163.5 ± 9.0*             | 162.1 ± 9.5               | 160.7 ± 10.2           | 160.6 ± 10.6          | 0.0002  |
| Weight (kg)      | 65.1 ± 13.3*             | 63.7 ± 13.5               | 62.6 ± 13.5            | 58.7 ± 11.6           | 0.0077  |
| BMI (kg/m²)      | 24.2 ± 3.6               | 24.1 ± 4.0                | 24.1 ± 4.0             | 22.6 ± 3.0            | 0.3843  |
| AF type          |                          |                           |                        |                       |         |
| Paroxysmal AF    | 193 (42.3)               | 311 (40.6)                | 199 (45.5)             | 14 (33.3)             | 0.0029  |
| Persistent AF    | 99 (21.7)                | 137 (17.9)*               | 109 (24.9)             | 10 (33.3)             |         |
| LS-AF            | 162 (35.5)               | 308 (40.2)*               | 125 (28.6)             | 7 (23.3)              |         |
| Institution type |                          |                           |                        |                       |         |
| High-volume center | 136 (29.8)*             | 282 (36.8)                | 156 (35.7)             | 17 (36.7)             | <0.0001 |
| Hospital         | 217 (47.6)*              | 267 (34.9)                | 156 (35.7)             | 10 (33.3)             |         |
| Clinic           | 103 (22.6)               | 217 (28.3)                | 125 (28.6)             | 3 (10.0)              |         |
| CHADS2 score     | 1.70 ± 1.7               | 1.67 ± 11.2               | 1.81 ± 1.14            | 1.60 ± 122            | 0.2060  |
| CHA2DS2-VASc score | 2.57 ± 1.37             | 2.61 ± 1.35               | 2.76 ± 1.37            | 2.57 ± 1.36           | 0.1763  |
| New use          | 57 (12.5)*               | 252 (32.9)                | 231 (52.9)             | 24 (80.0)             | <0.0001 |
| PT-INR           | NA                       | 0.84 ± 0.42               | 0.84 ± 0.42            | <0.0001               |         |
| APTT (sec)       | 44.0 ± 9.9               | NA                        | NA                     | NA                    |         |
| CrCl (ml/min)    | 74.6 ± 30.2*             | 70.5 ± 26.1               | 66.5 ± 26.1            | 65.8 ± 24.3           | 0.0001  |

Values are shown as the mean ± SD or n (%). APTT, activated partial thromboplastin time; NA, not applicable; PT-INR, prothrombin time-international normalized ratio. Other abbreviations are as in Tables 2 and 3. P value by an ANOVA or chi-square test, as appropriate.

* P < 0.05 vs. apixaban users.
† P < 0.05 vs. rivaroxaban users.
‡ P < 0.05 vs. edoxaban in the HSD Tukey post-hoc analysis or residual analysis.

Fig. 2. The percentages of DOAC users appropriately dosed, inappropriately-standard-dosed, inappropriately low-dosed, and for whom the drug was contraindicated. Percentages are shown for the 4 different DOACs prescribed. Refer to the text for the definition of each category.

Y. Okumura et al. / Journal of Arrhythmia 33 (2017) 289–296
relatively normal kidney function. Apixaban and edoxaban are thought to be safer than the other DOACs for the elderly and patients with moderate renal impairment [2–5], and, as was expected, our registry data showed a tendency for these DOACs to be prescribed to older patients with moderate renal impairment. We found that 32% of warfarin users were under-dosed. The suboptimal PT-INR was pronounced in patients < 70 years of age; the Japanese guidelines strongly recommend a PT-INR between 2.0 and 3.0 for patients in this age group. The relatively low PT-INR therapeutic ranges aimed at preventing future bleeding episodes are well in line with the J-RHYTHM Registry [6] and FUSHIMI AF Registry [8] data. Most importantly, our registry-based study identified inappropriate-low-dosing in 19.7–27.6% of DOAC users. Inappropriately low-dosed DOAC users were older than appropriately standard-dosed DOAC users; furthermore, they had no history of alcohol abuse and only moderate renal impairment. Age > 75 years and impaired renal function are known risk factors for stroke and bleeding [2–5,14]. Physicians may have reduced the dosages as a precaution against future bleeding events. The low doses were preferentially prescribed to dabigatran and edoxaban users, and inappropriate-low-dosing of these drugs was proportionally greater than appropriate-low-dosing. This trend toward inappropriate-low-dosing may be due to the reported evidence of the effectiveness of these 2 drugs at low doses [2,5]; however, the ROCKET AF and ARISTOTLE trials had too few patients in the low-dose DOAC groups to establish superiority, equivalence, or non-inferiority [3,4].

### 4.1 Study limitations

Our study has several limitations. First, although this was a large-scale prospective observational study, the registry incorporated only selected institutions in a limited geographical area. Therefore, we cannot conclude that the data reflected all of Japan.
Second, the registry did not include patients without anticoagulant drugs. This was because the annual incidence of strokes and bleeding had already been well evaluated in Japanese AF patients without anticoagulants [10]. Third, because edoxaban was approved last in Japan, the enrollment of edoxaban users was small, which may potentially distort the statistical analysis. Nonetheless, this effect was probably negligible, given the small number of edoxaban users in this study. Fourth, we defined “inappropriate-low-dosing” of DOACs according to the low-dose regimen shown in Table 1 to characterize the use of DOACs. However, inappropriate-low-dosing of dabigatran and edoxaban may not have exactly reflected the same meaning as that of rivaroxaban or apixaban, as the effectiveness and safety of low doses of dabigatran and edoxaban are well-established, even in patients that fulfilled those low-dose regimens in the clinical trials [2,5]. Finally, the follow-up data to explore the incidences of strokes and bleeding and the time in therapeutic range (TTR) for warfarin were not available. Analysis of the full registry follow-up data will resolve any remaining questions regarding the clinical efficacy and safety of DOACs and warfarin, as well as its impact on the TTR in Japanese AF patients.

5. Conclusions

The SAKURA AF Registry data characterized Japanese AF patients recently treated with DOACs and warfarin. The DOAC users were at lower risk for strokes than the warfarin users. Twenty to thirty percent of DOACs were inappropriately low-dosed, while 30% of warfarin users were under-dosed.

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Conflict of interest

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Appendix

The key personnel and institutions participating in the registry are as follows:

Chief investigator: Hirayama A (Division of Cardiology, Department of Medicine, Nihon University School of Medicine)
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