Impact of care coordination on oral anticoagulant therapy among patients with atrial fibrillation in routine clinical practice in Japan: a prospective, observational study

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Abstract

Background: Care coordination between general practitioners (GPs) and cardiovascular specialists is expected to play a key role in establishing appropriate oral anticoagulant (OAC) treatment in atrial fibrillation (AF) patients. The aim of this study was to assess the impact of care coordination on oral anticoagulant therapy in the management of AF in Japan.

Methods: This study was a multi-center, single-arm, prospective cohort study with retrospective chart and claims data review for historical controls. The study included three study periods: a 12-month pre-campaign period; a 12-month campaign period for AF screening and care coordination; and a 3-month post-campaign period for follow-up of care coordination. During the campaign period, patients aged ≥65 years who attended participating GP clinics underwent opportunistic AF screening by GPs under the campaign. At the discretion of the GP, newly diagnosed AF patients after the screening were referred to a cardiovascular specialist for care coordination. To assess the impact of care coordination and evaluate the effects of the campaign, implementation of care coordination, antithrombotic therapies, and patient-reported outcomes were compared between patients with and without care coordination, and between patients during the pre-campaign and campaign periods.

Results: There were 86 newly diagnosed AF patients during the pre-campaign period and 90 during the campaign period. The percentage of patients with care coordination increased from 3.5% (3/86) in the pre-campaign period to 14.4% ($n = 13/90$) during the campaign period. The percentage of patients who received OAC therapies, according to the definition from the Japanese AF medication guideline, increased from 55.8% (48/86) to 71.1% (64/90) during the campaign period regardless of care coordination. Younger patients were referred to cardiovascular specialists for care coordination. Implementation of OAC therapy did not differ between patients with and without care coordination. Adherence to OAC therapy was low regardless of care coordination.

Conclusions: This GP-targeted campaign was effective at raising awareness regarding the implementation of care coordination and appropriate OAC therapy at local clinical practices in Japan. Improvement of adherence to OAC therapy in elderly patients is a critical issue, and measures such as education programs targeted to patients and healthcare professionals should be undertaken.

Keywords: Atrial fibrillation, Care coordination, Anticoagulants, Aging society, Regional medical care, Opportunistic screening in primary care

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Ono *et al. BMC Cardiovascular Disorders*   (2019) 19:235

Page 2 of 9

Background

Atrial fibrillation (AF) is a common arrhythmia with a poor prognosis in elderly populations [1, 2], and its prevalence increases with age [3, 4]. Given the continuing growth of the aging population in Japan, an estimated 1 million patients are expected to have AF by 2030 [5]. Patients with AF have a high risk of cardioembolic stroke and thromboembolic complications, up to five times that of a person in sinus rhythm [6–8], and they have a 1.5- to 1.9-fold higher risk of mortality [9]. Moreover, AF is now considered the second most important risk factor for stroke, causing one in five strokes [10, 11], and cardioembolic strokes in patients with AF are more severe than those in patients without AF [7].

In Japanese populations, previous studies have identified AF as an independent and major risk factor for stroke and have found an association between AF and early death in this population [6, 12]. Although appropriate anticoagulant treatment for the prevention of cardioembolic stoke is needed for patients with AF, in particular elderly patients [13, 14], studies of oral anticoagulant (OAC) use in Japan have reported that around half of patients either do not receive OAC treatment or they receive inappropriate OAC treatment [15, 16]. An international systematic review from 2010 also reported that about half of patients requiring OACs were not treated [17]. On the other hand, appropriate OAC treatment in patients with AF has been demonstrated to prevent the risk of stroke and subsequent morbidity and mortality [15, 18, 19].

Care coordination between general practitioners (GPs) and cardiovascular specialists is expected to play a key role in establishing appropriate OAC treatment in patients with AF. The European Society of Cardiology (ESC) guidelines recommend the implementation of integrated AF management, including care coordination, between GPs and cardiovascular specialists for AF patient management [18]. Nonetheless, the effectiveness of care coordination in real-life settings in AF management has not been established; however, it is expected that care coordination will improve outcomes and overcome issues such as underuse of anticoagulants and inconsistent patient management [18, 20, 21].

Therefore, this study aimed to investigate the effectiveness of opportunistic AF screening in patients aged 65 years and older in the primary care setting in Japan. The study also aimed to assess the impact and feasibility of care coordination between GPs and cardiovascular specialists in OAC treatment for AF patients, as well as the adherence to, benefit from, and burden of OAC treatment, and satisfaction with care coordination. This report focuses on the results of implementation of care coordination and its effect on antithrombotic therapy.

Methods

Study design and setting

This study was a multi-center, single-arm, prospective cohort study with retrospective chart and claims data review for historical controls. The campaign in this study was performed at 12 primary care clinics in Daisen and Yokote cities, Akita Prefecture, Japan (Additional file 1).

This study was designed as an awareness campaign targeted at GPs for screening of AF and subsequent implementation of care coordination and optimal anticoagulant therapy. In this study, a patient who received care coordination was defined as one who was referred from a GP to a cardiovascular specialist (that is, a board-certified member of The Japanese Circulation Society) and was then referred back to the GP after consultation by the specialist. In care coordination, cardiovascular specialists performed evaluation of the underlying disease, assessed the risk of stroke (CHADS2 score), and made treatment decisions if necessary. This process is within the routine medical care for AF, and primary care-centric care coordination regarding the management of AF has been introduced in some regions in Japan, in particular for further tests or procedures by cardiovascular specialists [22].

This study included three study periods: a 12-month pre-campaign period (October 19, 2014 to October 18, 2015), a 12-month campaign period (October 19, 2015 to October 18, 2016), and a 3-month post-campaign period for follow-up of referrals from a cardiovascular specialist back to the GP (October 19, 2016 to January 18, 2017). The pre-campaign period was defined as the control period without implementation of the campaign. The 12-month campaign was conducted during the campaign period to renew awareness of care coordination between GPs and cardiovascular specialists for AF management concerning stroke risk assessment and OAC treatment based on the Japanese AF medication guideline [4]. During this period, opportunistic AF screening was performed in patients aged ≥65 years who attended participating GP clinics; the screening performed during this period was more thorough and meticulous than the screening performed during the other periods. The awareness of GPs to implement care coordination during the campaign period was renewed, but they were free to implement it based on their clinical judgment, and they decided to which cardiovascular specialist to refer patients. A list of cardiovascular specialist candidates was prepared in advance to facilitate referrals, but GPs were not restricted to this list. After the assessment of risk for stroke, antithrombotic therapy for stroke prevention such as anticoagulant agents and antiplatelet agents was initiated at the discretion of the cardiovascular specialist, and patients were referred back to the GP for follow-up of ongoing therapy.

Patients

The study population was patients with AF who were seen at one of the participating sites during the 12-month campaign period and the 12-month pre-campaign period, who were identified by claims data in each clinic. This population included outpatients aged ≥65 years who were newly diagnosed with AF during the pre-campaign or campaign periods, and those who had been previously diagnosed with AF at the study clinics prior to the start of the pre-campaign or campaign periods. For identification of patients with AF and to distinguish between newly and previously diagnosed AF patients, the claims data in each clinic were used.

In terms of patient-reported outcomes, AF patients on OAC treatment for at least 4 weeks were asked to fill out the Anti-Clot Treatment Scale (ACTS) [23] and Morisky 8-Item Medication Adherence Scale (MMAS-8) [24–26] questionnaires. Additionally, patients who received care coordination were asked to answer a patient survey on care coordination satisfaction.

Sample size estimation was decided based on feasibility, and no formal statistical sample size estimation was performed for this study. The population of elderly people aged ≥65 years was estimated to be 185,000 and 59,800 in Daisen and Yokote cities, respectively. Therefore, approximately 5000 patients from 12 participating clinics (400 patients per clinic) were expected to undergo screening during the screening period. Of them, newly diagnosed AF patients who were identified as having AF after the opportunistic screening were considered to be enrolled in the target population for the analysis in the current report.

Variables and endpoints

The variables collected for this study included patient background data (demographic and clinical characteristics), AF diagnosis-related data (type of AF, stroke risk score (CHADS$_2$ score)), treatment-related data including care coordination and antithrombotic therapies for stroke prevention (OACs including warfarin and direct OACs [DOACs], antiplatelet agents), and patient-reported data. The following endpoints for this study were descriptively compared between the pre-campaign and the campaign periods: stroke risk score (CHADS$_2$ score), the number and proportion of patients who were referred to cardiovascular specialists and then back to GPs as care coordination, antithrombotic therapies for stroke prevention, antithrombotic therapies according to the definition from the Japanese guideline of AF medication [4], and patient-reported outcomes using ACTS, MMAS-8, and a care coordination satisfaction patient survey. In the current study, the definition from the Japanese guideline of AF medication includes any OAC therapy, including DOACs or warfarin, for patients with a CHADS$_2$ score of 1 point or over or no OAC therapy for those with a CHADS$_2$ score of 0 point. The ACTS burden total score ranges from 12 to 60, and the ACTS benefits total score ranges from 3 to 15 [23].

The above endpoints were also descriptively compared between patients who received and did not receive care coordination, except for the number and proportion of patients who were referred to cardiovascular specialists and then back to GPs as care coordination and the results for care coordination satisfaction on the patient survey.

Data of patients with AF were collected from routine medical practice. GPs entered patient data into an electronic data capture system managed under anonymous conditions. Historical patient data (demographic and clinical characteristics, AF diagnosis, and care coordination records) were collected from the medical records where available. In patients who underwent OAC treatment for at least 4 weeks, the following information was collected by the GP: ACTS, MMAS-8, and patient survey on care coordination satisfaction if they received care coordination.

Ethical

Written, informed consent was obtained from each patient who answered patient-reported outcomes questionnaires. Data were collected from medical charts in routine medical practice and anonymized for subsequent data analysis. The opportunity to opt-out from this study was also provided through posters placed in each clinic.

The study protocol was approved collectively by the Institutional Ethics Committee/Institutional Review Board at the Research Institute for Brain and Blood Vessels-Akita on behalf of all participating clinics (approval number:15–10, approved on October 5, 2015) and the clinical research promotion network, Osaka, Japan (approved on August 27, 2015).

Statistical analyses

In the present study, statistical analyses were of an explorative and descriptive nature. No confirmatory hypothesis testing was performed. To assess the impact of care coordination on AF treatment and the effectiveness of this campaign, implementation of care coordination, antithrombotic therapy patterns, and patient-reported outcomes were numerically compared between patients with and without care coordination, and between patients during the pre-campaign and campaign periods.

Baseline characteristics of AF patients were compared numerically both between those with and without care coordination and between those during the pre-campaign period and the campaign period. Any missing values or unlikely data were queried and validated. For the scoring of ACTS and MMAS-8, appropriate imputation was applied.

Ono *et al. BMC Cardiovascular Disorders*　　(2019) 19:235

Page 4 of 9

All statistical analyses were performed using SAS v9.4 (SAS Institute, Cary, NC, USA).

Results

Characteristics of newly diagnosed AF patients

There were 86 newly diagnosed AF patients during the pre-campaign period and 90 during the campaign period. The median ages of newly diagnosed AF patients during the pre-campaign period and the campaign period were 80.5 years and 82.5 years, respectively, and median $CHADS_2$ scores were 2 and 3, respectively. The percentages of patients with congestive heart failure (40.0% vs. 33.7%), hypertension (75.6% vs. 74.4%), and history of stroke/transient ischemic attack (TIA) (24.4% vs. 18.6%) were higher during the campaign period than the pre-campaign period. The patients' characteristics were comparable between the patients newly diagnosed with AF during the pre-campaign and campaign periods (Table 1).

Implementation of care coordination

As for care coordination, 14 of 90 (15.6%) newly diagnosed AF patients were referred to cardiovascular specialists during the campaign period, and of them, 13 (92.9%) underwent care coordination. Overall, 14.4% (13/90) of the newly diagnosed AF patients received care coordination; for most of these (92.3%, $n = 12/13$), this involved referral to a cardiovascular specialist, whereas one patient was referred for specific treatment.

During the pre-campaign period, 6 of 86 (7.0%) newly diagnosed AF patients were referred to cardiovascular specialists; of them, 3 (50.0%) underwent care coordination. Overall, 3.5% (3 of the 86) of the newly diagnosed AF patients received care coordination.

When comparing the implementation of care coordination between the pre-campaign and campaign periods, the percentage of patients who underwent referral to cardiovascular specialists increased from 7.0 to 15.6% in the campaign period, and the percentage of patients who underwent care coordination increased from 3.5 to 14.4% (Table 2).

Characteristics of patients with and without care coordination

The patient characteristics by group of patients with or without care coordination during the campaign period are shown in Table 3. In the groups of patients with or without care coordination, the median age was 79 years and 83 years, median $CHADS_2$ scores were 2 and 3, the percentages of patients with history of stroke/TIA were 7.7 and 27.3%, the percentages of patients with congestive heart failure were 46.2 and 39.0%, and the percentages of patients with hypertension were 84.6 and 74.0%, respectively.

Antithrombotic therapy

Table 4 shows the comparison of antithrombotic therapy for stroke prevention between patients with and without care coordination during the campaign period. Overall, the status of antithrombotic therapy for stroke prevention in both groups was similar and did not differ according to the presence or absence of care coordination. The overall percentages of patients undergoing antithrombotic therapy were 84.6% vs. 76.6% in the groups with and without care coordination, respectively. The proportions of patients receiving therapy with antiplatelet agents were 15.4% vs. 10.4%, respectively, proportions receiving therapy with OACs were 69.2% vs. 68.8%, respectively, and of patients receiving therapy with OACs, the proportions of those receiving therapy with DOACs were 88.9 and 81.1%, respectively.

The proportions of patients receiving antithrombotic therapy for stroke prevention according to the definition from the Japanese guideline for AF medication [4] did not differ between the groups, being approximately 70% in both.

Table 1 Characteristics of newly diagnosed AF patients

	Pre-campaign period N = 86	Campaign period N = 90
Male	32 (37.2)	40 (44.4)
Age, y		
Median (IQR)	80.5 (75, 87)	82.5 (76, 87)
Mean ± SD	80.8 ± 8.1	81.3 ± 7.2
Risk factors for ischemic stroke		
CHF	29 (33.7)	36 (40.0)
Hypertension	64 (74.4)	68 (75.6)
Age ≥ 75 years	67 (77.9)	72 (80.0)
Diabetes	22 (25.6)	13 (14.4)
History of stroke/TIA	16 (18.6)	22 (24.4)
$CHADS_2$ score		
0	4 (4.7)	6 (6.7)
1	13 (15.1)	10 (11.1)
≥ 2	69 (80.2)	74 (82.2)
Median (IQR)	2 (2, 3)	3 (2, 3)

Data are n (%), unless otherwise stated

Abbreviations: *AF* Atrial fibrillation, *CHF* Congestive heart failure, *IQR* Interquartile range, *SD* Standard deviation, *TIA* Transient ischemic attack

Table 2 Implementation of care coordination

	Pre-campaign period N = 86	Campaign period N = 90
Referral to cardiovascular specialists	6 (7.0)	14 (15.6)
Patients with care coordination	3 (3.5)	13 (14.4)

Data are n (%)

Table 3 Patient characteristics in patients with and without care coordination during the campaign period

Characteristic	With care coordination N = 13	Without care coordination N = 77
Male	5 (38.5)	35 (45.5)
Age, y		
Median (IQR)	79 (76, 86)	83 (76, 87)
Mean ± SD	81.1 ± 7.9	81.4 ± 7.2
Type of AF		
Paroxysmal	4 (30.8)	23 (29.9)
Persistent	5 (38.5)	30 (39.0)
Permanent	3 (23.1)	13 (16.9)
Other/unknown	1 (7.7)	11 (14.3)
Risk factor for ischemic stroke		
CHF	6 (46.2)	30 (39.0)
Hypertension	11 (84.6)	57 (74.0)
Age ≥ 75 y	11 (84.6)	61 (79.2)
Diabetes	0 (0.0)	13 (16.9)
History of stroke/TIA	1 (7.7)	21 (27.3)
$CHADS_2$ score		
0	0 (0.0)	6 (7.8)
1	3 (23.1)	7 (9.1)
≥ 2	10 (76.9)	64 (83.1)
Median (IQR)	2 (2, 3)	3 (2, 3)

Data are n (%), unless otherwise stated

Abbreviations: AF Atrial fibrillation, CHF Congestive heart failure, IQR Interquartile range, SD Standard deviation, TIA Transient ischemic attack

Table 4 Antithrombotic therapy in patients with and without care coordination during the campaign period

	With care coordination N = 13	Without care coordination N = 77
Antithrombotic therapy	11 (84.6)	59 (76.6)
Oral anticoagulant agents	9 (69.2)	53 (68.8)
Warfarin	1 (11.1)	10 (18.9)
DOACs	8 (88.9)	43 (81.1)
Antiplatelet agents	2 (15.4)	8 (10.4)
$CHADS_2$ score low (score: 0)	N = 0	N = 6
Oral anticoagulant agents	0 (0.0)	2 (33.3)
Warfarin	0 (0.0)	0 (0.0)
DOACs	0 (0.0)	2 (100.0)
$CHADS_2$ score intermediate (score: 1)	N = 3	N = 7
Oral anticoagulant agents	2 (66.7)	7 (100.0)
Warfarin	0 (0.0)	3 (42.9)
DOACs	2 (100.0)	4 (57.1)
$CHADS_2$ score high (score: ≥2)	N = 10	N = 64
Oral anticoagulant agents	7 (70.0)	44 (68.8)
Warfarin	1 (14.3)	7 (15.9)
DOACs	6 (85.7)	37 (84.1)
OAC therapy based on JCS 2013 guidelines	9 (69.2)	55 (71.4)

Data are n (%)

Abbreviations: JCS 2013 Japanese guidelines for pharmacotherapy of atrial fibrillation, DOACs Direct oral anticoagulants

The comparison of antithrombotic therapy for stroke prevention between the pre-campaign and campaign periods is shown in Table 5. More patients received antithrombotic therapy (77.8% vs. 69.8%, respectively) and were prescribed anticoagulant agents (68.9% vs. 60.5%, respectively) during the campaign period than during the pre-campaign period. Furthermore, of patients prescribed OACs, the percentage prescribed DOACs increased from 78.8% in the pre-campaign period to 82.3% during the campaign period. Of patients at low risk of stroke, the percentage of patients prescribed OACs decreased from 100% in the pre-campaign period to 33.3% during the campaign period, while among patients at intermediate and high risk of stroke, the percentage increased from 53.8 to 90.0% and from 59.4 to 68.9%, respectively. The percentage of patients who received anticoagulant therapy according to the definition from the Japanese AF medication guideline [9] increased from 55.8% in the pre-campaign period to 71.1% in the campaign period.

Patient-reported outcomes

The MMAS-8 score was similar between patients with and without care coordination. The median total score

for both groups was 1, and the interquartile range (IQR) was 1 to 1.5 in the group with care coordination and 0.75 to 1 in the group without care coordination. Patients in both groups had a low adherence score, regardless of care coordination (Table 6).

As for ACTS, this showed very high satisfaction, with a median burden score of 57.5 (IQR 55, 60) and 59 (IQR 57, 60), respectively, in the groups with and without care coordination. The median benefit score in the group with care coordination was slightly lower, at 10.5 (IQR 9, 12), compared with 12.5 (IQR 11, 15) in the group without care coordination (Table 6). Responses to the survey on overall satisfaction with care coordination were positive in both the pre-campaign and campaign periods (Additional file 2).

Discussion

The present study was a multi-center, single-arm, prospective cohort study with retrospective chart review, which assessed the effectiveness of opportunistic AF screening and the impact of care coordination between GPs and cardiovascular specialists on OAC treatment for AF patients. The current report focuses on the latter objectives.

Table 5 Comparison of antithrombotic therapy between the pre-campaign and campaign periods

	Pre-campaign period $N = 86$	Campaign period $N = 90$
Antithrombotic therapy	60 (69.8)	70 (77.8)
Oral anticoagulant agents	52 (60.5)	62 (68.9)
Warfarin	11 (21.2)	11 (17.7)
DOACs	41 (78.8)	51 (82.3)
Antiplatelet agents	12 (14.0)	10 (11.1)
CHADS$_2$ score low (score, 0)	$N = 4$	$N = 6$
Oral anticoagulant agents	4 (100.0)	2 (33.3)
Warfarin	0 (0.0)	0 (0.0)
DOACs	4 (100.0)	2 (100.0)
CHADS$_2$ score Intermediate (score, 1)	$N = 13$	$N = 10$
Oral anticoagulant agents	7 (53.8)	9 (90.0)
Warfarin	1 (14.3)	3 (33.3)
DOACs	6 (85.7)	6 (66.7)
CHADS$_2$ score high (score, ≥2)	$N = 69$	$N = 74$
Oral anticoagulant agents	41 (59.4)	51 (68.9)
Warfarin	10 (24.4)	8 (15.7)
DOACs	31 (75.6)	43 (84.3)
OAC therapy based on JCS 2013 guidelines	48 (55.8)	64 (71.1)

Data are n (%)

Abbreviations: *JCS 2013* Japanese guidelines for pharmacotherapy of atrial fibrillation, *DOACs* Direct oral anticoagulants

Table 6 Patient-reported outcomes in patients with and without care coordination during the campaign period

	With care coordination	Without care coordination
MMAS-8	$N = 13$	$N = 22$
Total score, median (IQR)	1 (1, 1.5)	1 (0.75, 1)
Adherence level[a], n (%)		
Low	13 (100.0)	22 (100.0)
Medium	0 (0.0)	0 (0.0)
High	0 (0.0)	0 (0.0)
ACTS score	$N = 14$	$N = 22$
Burden		
Burden score, median (IQR)	57.5 (55, 60)	59 (57, 60)
Global question about burdens (Item 13), median (IQR)	1 (1, 2)	1 (1, 1)
Benefit		
Benefit score, median (IQR)	10.5 (9, 12)	12.5 (11, 15)
Global question about benefits (Item 17), median (IQR)	3 (3, 3)	4 (3, 5)

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Abbreviations: *MMAS-8* Morisky 8-Item Medication Adherence Scale, *ACTS* Anti-Clot Treatment Scale, *IQR* Interquartile range

[a]Adherence level: low adherence, total score < 6; medium adherence, total score 6 to < 8; high adherence, total score = 8

Compared with the report of the Fushimi AF Registry, a community-based survey of AF patients whose age distribution is similar to that in Japan [27], the patients in the current study had older mean age (74.2 years in the Fushimi Registry) and higher proportions of females (40.3% in Fushimi Registry) and of CHF and hypertension (27.9 and 60.6%, respectively, in The Fushimi Registry). A previous report from the Fushimi AF Registry showed that the proportions of females and of CHF and hypertension increased with age [28]. Akita prefecture is one of the super-aging regions in Japan; in 2016 [29], individuals aged ≥65 years accounted for approximately 35% of residents, with Yokote and Daisen cities showing similar percentages (36.0, and 35.4%, respectively). In addition, women accounted for 59.1, 58.8, and 59.6% of the population in Akita Prefecture and Yokote and Daisen cities, respectively.

Therefore, the characteristics of the present study's participants reflect the specific demographics of Akita prefecture. However, since Japan is a leading super-aging society, and the percentage of the elderly population (aged ≥65 years) is expected to exceed 30% in 2025, the results of the current study could be helpful for AF management in aging regions in Japan in the future.

The results of this study indicate that this type of awareness campaign, targeted to GPs, has a role in promoting awareness of care coordination among GPs and appropriate anticoagulant therapy according to the definition from the Japanese AF medication guideline [4]. The percentage of patients receiving anticoagulant therapy according to the definition from the Japanese AF medication guideline [4] improved from 55.8% in the pre-campaign period to 71.1% in the campaign period, which was similar to the increase in OAC use (from 68 to 80%) reported in a previous study that evaluated the effectiveness of an educational campaign in patients and providers in several nations [2].

From this perspective, the campaign was successful in enhancing OAC use for stroke prevention. Implementation of care coordination in this study increased from 3.5 to 14.4%, though the percentage of care coordination implementation even after the campaign was much lower than expected. This study showed that > 80% of patients who received oral anticoagulant therapy were prescribed DOACs regardless of care coordination. DOACs, unlike warfarin, do not need INR monitoring and are easy to use in clinics, regardless of the physician's specialty. Therefore, in this study, GPs might have been able to initiate and continue antithrombotic therapy with DOACs for their patients at their clinics and

undertake stroke risk assessment without care coordination. This may have led to the lower implementation of care coordination than expected.

Several studies have evaluated the effectiveness of care coordination or integrative care in reducing hospitalizations, stroke, and death [2, 30–32]. McDonald et al. reported on the role that care coordination may play in implementing and maintaining appropriate OAC therapy in AF patients [33]. However, studies assessing the impact of care coordination in relation to OAC therapy remain limited. In the present study, an increase in OAC therapy with care coordination was not demonstrated, and OAC therapy did not differ between groups with and without care coordination. The patients' characteristics were, in general, comparable between the groups with and without care coordination; however, it was difficult to assess the differences in individual characteristics due to there being relatively few cases of care coordination. The only difference observed between these two groups was a 4-year difference in the median age. Patients receiving care coordination were younger than those who did not receive care coordination.

There are several possible explanations for this lack of difference in prescription of antithrombotic therapies for stroke prevention between the two groups. First, considering the relationship between aging and increased permanent AF, [27] there is a possibility that younger AF patients who have not yet developed permanent AF could be referred to the cardiovascular specialist for ablation, whereas older AF patients with permanent AF likely require OAC therapy that is managed in primary care clinics. In the present study, younger patients were referred to cardiovascular specialists. Second, the lack of difference may be related to the introduction of DOACs regardless of the involvement of cardiovascular specialists. This may have a positive impact on the prescription of OACs and treatment of AF patients by GPs without care coordination, even for older patients with a higher risk of stroke. Additionally, the campaign itself may have increased awareness of and motivation to prescribe OAC therapy based on the Japanese AF medication guideline [4]. Lastly, the participating sites were volunteers; therefore, there is a possibility of bias from participating GPs toward management of AF even without the campaign.

In terms of feasibility and potential of care coordination for AF treatment, this study showed some important and unexpected characteristics of care coordination in AF treatment in Japan: implementation of care coordination seemed to be associated with each patient characteristic; approximately 70% of patients with AF without care coordination received oral anticoagulant therapy; and, of them, approximately 80% were prescribed DOACs at their GPs' clinics. Considering these factors, there is a possibility that use of DOACs could

allow patients to have the option to receive treatment at GPs' clinics; this might decrease the elderly patients' burden of frequent visits to hospitals for prothrombin time-international normalized ratio (PT-INR) monitoring with warfarin therapy, for example. The present findings suggest that care coordination may not be the only solution for appropriate AF treatment in the era of DOACs.

Regarding patient-reported outcomes, the ACTS was used to assess patient satisfaction with anticoagulant treatment by considering the burden and benefits of treatment [23], and adherence was assessed using the MMAS-8. Satisfaction with burden was high in both patient groups, and overall satisfaction with care coordination based on a patient survey showed a positive response. However, adherence measured with the MMAS-8 was remarkably low in both patient groups. A previous study reported that Japanese AF patients in their eighties were less adherent to DOACs prior to their development of acute ischemic stroke than those in their seventies, and it also reported beneficial effects of adequate adherence to DOACs in terms of stroke severity [34]. In this study, which had a median age of approximately 80 years, low adherence was observed for all patients. Considering these results, in aging societies as represented by Akita prefecture, improvement of adherence is a critical issue, and measures such as educational programs targeted to patients and healthcare professionals should be undertaken.

Limitations
This study had several limitations. First, the participating primary care clinics in this study were not selected randomly, and GPs volunteered to participate. This may have introduced a selection bias and may have affected study variables such as treatment patterns, care coordination implementation, and baseline patient characteristics. Second, claims data for AF screening may not accurately match the final diagnosis in medical charts. Third, when judging whether anticoagulant therapy was based on the current guideline, data on PT-INR and creatinine clearance were not included. Fourth, owing to fewer responses to questionnaires and less implementation of care coordination than expected, it was difficult to assess the impact of care coordination. Fifth, the sample size for patient-reported outcomes was small; therefore, these results should be interpreted with caution, and further investigation is needed for more precise clarification. Lastly, this study was not designed to evaluate prognosis after care coordination. Therefore, it is impossible to evaluate the effectiveness of care coordination in terms of improvement of prognosis.

Conclusions
To the best of our knowledge, this study is the first to evaluate the impact of care coordination between GPs

and cardiovascular specialists on AF antithrombotic therapy in Japan. Overall, this study showed the positive impact of the campaign on raising the awareness of GPs regarding care coordination in the study region in Japan, with an increase in the implementation of care coordination and OAC therapy. However, there is still much room for improvement in terms of patient adherence to anticoagulants, particularly among elderly patients. While further verification of this campaign's potential in other areas of Japan is needed, the study results show that it would be meaningful to expand this campaign model of care coordination and appropriate antithrombotic therapy into other regions.

Supplementary information

Supplementary information accompanies this paper at https://doi.org/10.1186/s12872-019-1216-y.

Additional file 1. Primary care clinics and corresponding investigators in Daisen and Yokote, Akita, Japan. A list of the 12 primary care clinics associated with the Akita study group.

Additional file 2. Patients' satisfaction with care coordination during the pre-campaign and campaign period. Table showing the results of the survey assessing patients' satisfaction with care coordination during the pre-campaign and campaign period.

Abbreviations

ACTS: Anti-Clot Treatment Scale; AF: Atrial fibrillation; DOAC: Direct oral anticoagulant; ESC: European Society of Cardiology; GP: General practitioners; IQR: Interquartile range; MMAS-8: Morisky 8-Item Medication Adherence Scale; OAC: Oral anticoagulant; PT-INR: Prothrombin time-international normalized ratio; TIA: Transient ischemic attack

Authors' contributions

AS, YI, AT, HM, and MS designed the study, contributed to interpretation of data, and critically reviewed the draft of the manuscript. TO designed the study, contributed to analysis and interpretation of data, assisted in the preparation of the initial draft of the manuscript, and critically reviewed the draft of the manuscript. SA designed the study, contributed to acquisition, analysis, and interpretation of data, and critically reviewed the draft of the manuscript. NY and FO contributed to acquisition, analysis, and interpretation of data, wrote the initial draft of the manuscript, and critically reviewed the draft of the manuscript. All authors approved the final version of the manuscript and agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Availability of data and materials

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

Ethics approval and consent to participate

This study followed the Ethical Guidelines for Human Clinical Research issued by the Ministry of Education, Culture, Sports, Science and Technology and the Ministry of Health, Labour and Welfare. Documented approval by the Institutional Ethics Committee/Institutional Review Board at the Research Institute for Brain and Blood Vessels-Akita on behalf of all participating clinics was received prior to the start of the study on October 5, 2015 (Approval number:15–10). This study was approved by the clinical research promotion network, Osaka Japan on August 27, 2015.

Patients were required to provide written, informed consent to take part in the surveys if they chose to do so. In terms of data from medical chart review, they were secondary data collected in routine medical practice, and chart review was conducted anonymously; therefore, individual informed consent for data use was not required.

Consent for publication

Not Applicable.

Competing interests

A Suzuki has received a consultation fee from Bayer Yakuhin, Ltd. and an honorarium for a scientific meeting from Pfizer Japan Inc. Y Ikeda has received a consultation fee from Bayer Yakuhin, Ltd. and an honorarium for a scientific lecture from Daiichi Sankyo Co., Ltd. M Sasaki has received a consultation fee from Bayer Yakuhin, Ltd. H Matsuoka has received a consultation fee and a technical guidance fee from Bayer Yakuhin, Ltd., an honorarium for a scientific lecture from Bristol-Myers Squibb K.K., and an honorarium for a manuscript and a scientific lecture from Daiichi Sankyo Co., Ltd. A Takahashi has received a consultation fee and an honorarium for his participation as a general practitioner in this study from Bayer Yakuhin, Ltd. T Okamura has received a consultation fee and honoraria for scientific lectures from Bayer Yakuhin, Ltd., an honorarium for an annual scientific meeting from Daiichi Sankyo Co., Ltd., and a grant from the Japan Agency for Medical Research and Development. S Akiyama, F Ono and N Yoshihara are employees of Bayer Yakuhin, Ltd.

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Ono *et al. BMC Cardiovascular Disorders*   (2019) 19:235

Page 9 of 9

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