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CLINICAL RESEARCH

Smartphone electrocardiogram for detecting atrial fibrillation after a cerebral ischaemic event: a multicentre randomized controlled trial

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Aims Atrial fibrillation (AF) is a preventable cause of ischaemic stroke but it is often undiagnosed and undertreated. The utility of smartphone electrocardiogram (ECG) for the detection of AF after ischaemic stroke is unknown. The aim of this study is to determine the diagnostic yield of 30-day smartphone ECG recording compared with 24-h Holter monitoring for detecting AF ≥30 s.

Methods and results In this multicentre, open-label study, we randomly assigned 203 participants to undergo one additional 24-h Holter monitoring (control group, $n = 98$) vs. 30-day smartphone ECG monitoring (intervention group, $n = 105$) using KardiaMobile (AliveCor®, Mountain View, CA, USA). Major inclusion criteria included age ≥55 years old, without known AF, and ischaemic stroke or transient ischaemic attack (TIA) within the preceding 12 months. Baseline characteristics were similar between the two groups. The index event was ischaemic stroke in 88.5% in the intervention group and 88.8% in the control group ($P = 0.852$). AF lasting ≥30 s was detected in 10 of 105 patients in the intervention group and 2 of 98 patients in the control group (9.5% vs. 2.0%; absolute difference 7.5%; $P = 0.024$). The number needed to screen to detect one AF was 13. After the 30-day smartphone monitoring, there was a significantly higher proportion of patients on oral anticoagulation therapy at 3 months compared with baseline in the intervention group (9.5% vs. 0%, $P = 0.002$).

Conclusions Among patients ≥55 years of age with a recent cryptogenic stroke or TIA, 30-day smartphone ECG recording significantly improved the detection of AF when compared with the standard repeat 24-h Holter monitoring.

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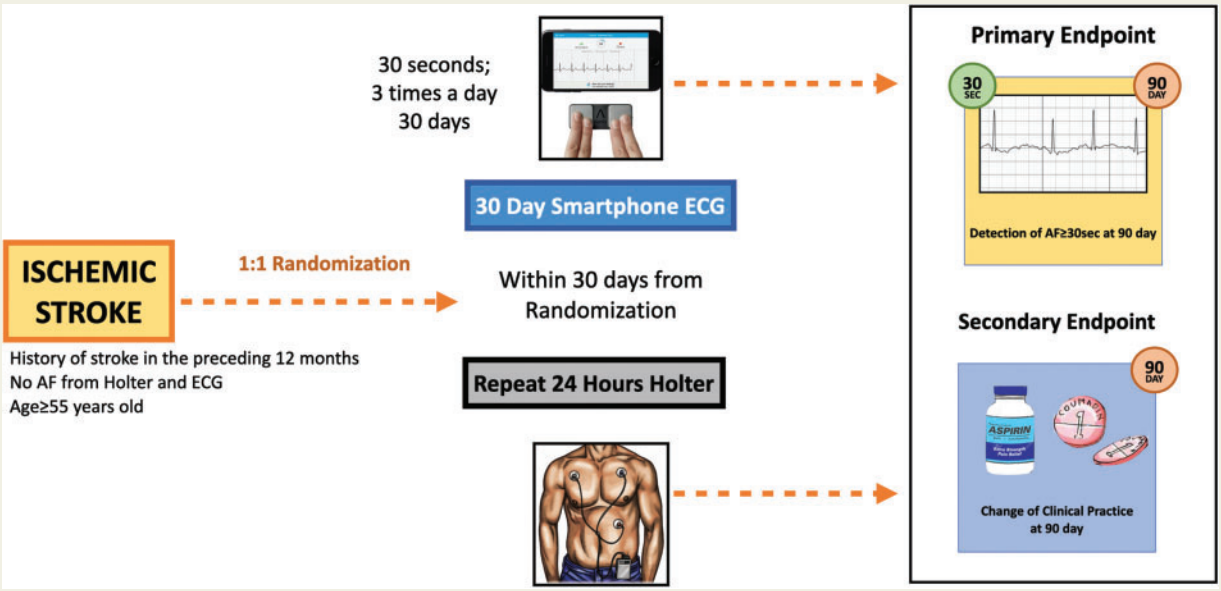
Graphical Abstract



Keywords Atrial fibrillation • Cryptogenic stroke • Smartphone electrocardiogram • Digital health • Anticoagulation

What's new?

- Among patients ≥55 years of age with a recent cryptogenic stroke or transient ischaemic attack, a 30-day smartphone electrocardiogram recording significantly improved the detection of atrial fibrillation compared with the standard repeat 24-h Holter monitoring.
- There was a significantly higher proportion of patients prescribed with oral anticoagulation therapy after the 30-day smartphone monitoring.

Introduction

The estimated number of individuals with atrial fibrillation (AF) globally in 2010 was 33.5 million (20.9 million men and 12.6 million women).[1] It is estimated that by 2060, the prevalence of AF in adults >55 years old in the European Union will be double to >60 million.[2] In Malaysia, the prevalence of AF in patients admitted to the hospital was 2.8%, with many remained undiagnosed and undertreated.[3]

Stroke due to AF is common (20–30% of strokes) and frequently devastating, with a higher risk of death, disability, and haemorrhagic complications.[4] Stroke or transient ischaemic attack (TIA) secondary to AF face a higher risk of recurrent stroke. Nevertheless, stroke due to AF is preventable with anticoagulants. In the absence of AF, the standard treatment for secondary prevention of stroke is antiplatelet therapy; however, in the presence of AF, antiplatelet therapy becomes a Class IIIA recommendation.[5] About 25% of ischaemic strokes and 50% of TIA have no cause identified after the standard diagnostic workout and are labelled as cryptogenic stroke or Embolic Stroke of Undetermined Source (ESUS).[6] Undiagnosed AF is often suspected as the cause of many cryptogenic strokes, but oral anticoagulant (OAC) is not recommended unless AF is documented. Two randomized studies were done to look at post-stroke cardiac rhythm monitoring strategies for cryptogenic stroke. In the CRYSTAL-AF trial, insertable cardiac monitor (ICM) for 12 months detected an additional 12.4% of AF; in the EMBRACE trial, 30-day event-triggered loop recorder detected an additional 16.1% of AF.[7,8] Current guidelines recommend short-term electrocardiogram (ECG) monitoring followed by continuous ECG monitoring for at least 72 h (Class IB recommendation).[5]

KardiaMobile (AliveCor®, Mountain View, CA, USA) is a pocket-sized ECG recorder that is used with a mobile device application. Studies have reported a sensitivity of 98.5% and a specificity of 91.4% for the KardiaMobile in detecting AF.[9,10] Community screening of AF with KardiaMobile is feasible and diagnosed a significant proportion of the population with AF.[10,11] However, the feasibility of KardiaMobile in post-stroke and post-TIA cardiac rhythm monitoring is unknown.[5] we hypothesize that the use of KardiaMobile for 30 days, compare with another round of conventional 24-h Holter monitoring, will enhance the detection and treatment of AF in post-stroke patients who can benefit from anticoagulation therapy.

Methods

Study population

Patients were eligible for enrolment if they were 55 years of age or older, did not known to have AF, and had an ischaemic stroke or TIA of undetermined cause within the previous 12 months. Standard workup, including 12-lead ECG, 24-h ambulatory Holter monitoring, inpatient telemetry ECG monitoring, brain and neurovascular imaging, and transthoracic echocardiography were carried out. Patients were excluded if the most likely etiologic diagnosis had already been determined (mitral stenosis, left ventricular clot, large-vessel or small-vessel disease, or other known cause). Patients were also excluded from the study if they were deemed unable to use KardiaMobile smartphone ECG recording upon enrolment into the study, the refusal for informed consent, or if the life expectancy was <1 year.

Study design

In this investigator-initiated, open-label, multicentre study, we randomly assigned participants in a 1:1 ratio to undergo ambulatory ECG monitoring with a 30-day KardiaMobile recording (intervention group) or one additional round of 24-h Holter monitoring (control group). The patients were called for the installation for the 24-h ambulatory Holter monitoring (control group) or the KardiaMobile (Intervention group) within 6 weeks from the randomization. Randomization was performed with the use of computer-generated simple randomization and was carried out by a contract research organization. Patients were enrolled by neurologists and physicians at four participating centres within the Ministry of Health, Malaysia. The study protocol was approved by the National Medical Research Register and Medical Research and Ethical Committee (NMRR-17-1342-36303). The study is registered on the ClinicalTrials.gov (NCT04332718) on 3 April 2020 to help the editors and others to understand the context of the study results. The first author wrote the first and subsequent study drafts of the manuscript. All the authors vouch for the accuracy of the data and confirm that the contents of this article adhere to the specifications in the protocol.

The KardiaMobile and 1 unit of Holter analysis system were purchased for the study. The source of the funding was from the Medical Research Grant, Ministry of Health, Malaysia (NMRR-17-1342-36303). The device manufacturers had no role in the study design, data accrual, or data analysis and had no access to the study data.

Electrocardiogram monitoring

KardiaMobile (AliveCor®, Mountain View, CA, USA) was used with a compatible smartphone to record the ECG. The training was provided to the patients upon installation of the AliveCor® KardiaMobile application on the smartphone. The patients in the intervention group were instructed to use the monitor 3 times a day for 30 days. Patients were instructed to record their ECG on three sessions in a day: morning (0400-1059), afternoon (1100-1759), and evening (1800-0359) or whenever they felt palpitations. Patients in the intervention group were instructed to keep a diary of their ECG recordings and symptoms of palpitation. The diary was reviewed at the end of the 30 days of monitoring. Adherence to the ECG monitoring was defined as recorded ECG per session per day. Recorded ECG data were transmitted wirelessly to the web-based archive. All ECGs were adjudicated by an electrophysiologist who was unaware of the patient's demographic and clinical characteristics. The results were sent to the study sites, and decision regarding anticoagulation therapy was made at the discretion of the treating physicians.

The patients in the control group were assigned to one additional round of conventional 24-h ambulatory ECG monitoring with a Holter monitor from the local hospital. All the reports were reviewed by the treating physician at the respective hospital.

Outcomes

The primary outcome was the detection of one or more episodes of ECG-documented AF lasting 30 s or longer within 3 months after randomization. The primary outcome was determined at 3 months after the randomization to allow variation in duration from randomization to initiation of ECG monitoring. Detection of AF outside the monitoring period but within 3 months from randomization was also included. Secondary outcomes included the usage of anticoagulation therapy at 3 months and the performance of KardiaMobile.

Statistical analysis

Statistical analysis was done using IBM SPSS Statistics version 16 (IBM Corp., Armonk, NJ, USA). Descriptive data were reported as the number with percentage or mean with standard deviation, whichever appropriate. Categorical variables were analysed using the χ^2 test or Fisher's exact test. Continuous variables were analysed using the independent Student's *t*-test. The analysis compared the proportion of patients in each group who had the primary outcome and was performed with the use of Pearson's χ^2 test in the intention-to-monitor population. Kaplan–Meier curve for the primary outcome was plotted up to 3 months from randomization to capture AF detected outside the monitoring period of the devices.

Sample size calculation

Based on our preliminary results, the study showed detection of 15.8% of AF in the intervention arm vs. 0% in the control arm.[12] The estimated proportion of AF in the intervention arm was 10.5% and in the control arm was 1.0%. Therefore, a sample size of 186 patients, with 93 patients in each group, will be able to detect a 9.5% difference with a two-sided alpha of 5% and 80% power. Estimating a loss to follow-up of 10%, a sample size of 203 is sufficient to give an alpha of 0.5 and a statistical power of 0.8.

Results

Characteristics of the patients

From September 2017 to March 2020, 236 patients were enrolled and randomized for the study, but only 203 patients were included for data analysis: 105 patients in the intervention group and 98 patients in the control group (*Figure 1*). The mean (±SD) age of the patients was 65.3 (±7.4) and 65.8 (±8.2) years old, respectively ($P = 0.156$) (*Table 1*). The mean (±SD) duration from the index event to randomization was 87.1 ± 70.1 days. The baseline characteristics were similar except for a higher proportion of patients in the control group with no formal education (11.4% vs. 22.6%, $P = 0.017$). The majority of the patients (88.5 vs. 88.8%, $P = 0.799$) had an ischaemic stroke as the index event. The modified Rankin Scale score was ≤2 in the majority of the patients (58.2% vs. 70.5%, $P = 0.067$). The median (±IQR) CHA_2DS_2VASc was 4 (±2). The medications before discharged were similar between the two groups.

Detection of atrial fibrillation

The 30-day KardiaMobile strategy was superior to 24-h ECG monitoring for the detection of at least one episode of AF lasting 30 s or longer (the primary outcome, *Figure 2*). AF was detected in 10 of 105

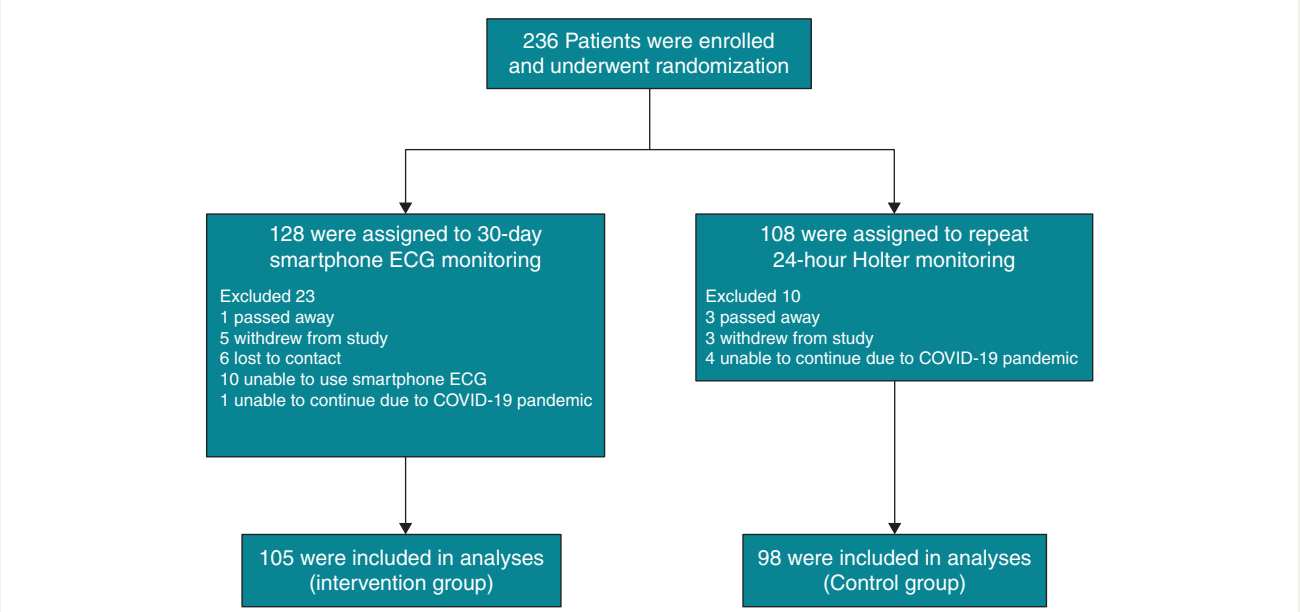


Figure 1 Enrolment and randomization of the study participants and follow-up through 3 months. ECG, electrocardiogram.

patients (9.5%) in the intervention group, when compared with 2 of 98 (2.0%) in the control group, for an absolute difference of 7.5% points ($P = 0.024$, the number needed to screen, 13). The median (IQR) duration from randomization to the detection of AF was 27 (22.5–41.5) days. The median (IQR) duration from initiation of KardiaMobile to the detection of AF in the intervention group was 10 (3.5–20.5) days. No AF episode was detected clinically other than during the study monitoring period.

Effect on treatment

There was a significantly higher proportion of patients on OAC therapy at 3 months compared to baseline in the intervention group (9.5% vs. 0%, $P = 0.002$). The proportion of patients on OAC therapy at 3 months compared with baseline in the control group was not statistically significantly different (4.1% vs. 1.0%, $P = 0.250$) (*Table 2*). However, the proportion of patients on OAC therapy at 3 months were not statistically significantly different when compared between the intervention group and the control group (9.5% vs. 4.1%, $P = 0.126$). Three patients were prescribed with OAC therapy despite no AF of ≥30 s were detected. The reason for prescribing OAC therapy was due to the high index of suspicion of cardioembolic stroke based on the assessment by the treating physicians. One patient was not prescribed with OAC despite the detection of AF ≥30 s. The reason for not prescribing OAC therapy was due to the high risk of bleeding.

Performance of KardiaMobile

A total of 6778 ECGs were analysed from the 30-day KardiaMobile. From the algorithm of the KardiaMobile, 5673 (83.7%) of the ECGs were reported as normal, 887 (13.1%) were reported as unclassified and 218 (3.2%) were reported as possible AF (*Figure 3A*). The unclassified ECGs were mainly due to signal artefacts and the short duration of ECG recording (<30 s). On average, 51 patients of the 105 patients (48.6%) in the intervention group received at least one notification for possible AF. From further verification of the ECGs that were reported as possible AF by the algorithm, 164 (75.2%) were determined to be false positive for AF, and 54 (24.8%) were determined to be true positive for AF (*Figure 3B*). Of the 5673 ECGs that was reported as normal, 1 was subsequently determined to be AF. The most common cause of false-positive reporting of AF by KardiaMobile was due to signal artefacts. Other possible causes of false-positive reporting included sinus arrhythmia, atrial ectopy, premature ventricular ectopy, and supraventricular tachycardia.

The majority of the patients in the intervention group (100 of 105, 95.2%) was able to complete 1 or more weeks of monitoring. Median (IQR) adherence to smartphone ECG recording of 3 times a day for 30 days was 63.3 (40.0–87.8)%. The adherence to 30-day KardiaMobile showed a significant decline over the monitoring period, from 79.2 (52.1–91.67)% in Week 1 to 52.3 (28.9–87.5)% in Week 4 ($P < 0.001$) (*Figure 3C*). The percentage of non-interpretable ECG remained the same across the monitoring period (*Figure 3D*).

In 7 of 10 (70%) patients with AF, the first AF episode was detected in the 1st 2 weeks of the monitoring period. Of the 10 patients detected with AF using KardiaMobile, 9 were asymptomatic for AF. Detection of AF was not associated with a higher number of smartphone ECG recording (65.8 ± 32.5 vs. 67.1 ± 33.1, $P = 0.909$) nor adherence to smartphone ECG (81.1%, IQR 48.9–94.4 vs. 63.3%, IQR 38.9–87.7, $P = 0.323$).

Discussion

This study is the first randomized controlled trial to explore outpatient 30-day smartphone ECG monitoring in patients with cryptogenic stroke. Our study showed that a 30-day smartphone ECG

Table 1 Baseline characteristics of the patients[a]

	Control group (*N* = 98)	Intervention group (*n* = 105)	*P*-value
Age (years), mean (SD)	65.8 (8.2)	65.3 (7.4)	0.623
Male gender, *n* (%)	72 (73.5)	80 (76.2)	0.655
Education, *n* (%)			0.017
No formal education	21 (22.6)	12 (11.4)	
Primary school	36 (38.7)	40 (38.1)	
Secondary school	35 (37.6)	43 (41.0)	
University	1 (1.1)	10 (9.5)	
Smoker, *n* (%)			0.304
Never	46 (47.4)	61 (58.1)	
Former	35 (36.1)	29 (27.6)	
Current	16 (16.5)	15 (14.3)	
Diabetes mellitus, *n* (%)	35 (36.1)	43 (41.3)	0.444
Dyslipidaemia, *n* (%)	68 (69.4)	85 (81.0)	0.056
Hypertension, *n* (%)	78 (79.6)	89 (84.8)	0.335
Heart failure, *n* (%)	4 (4.1)	4 (3.8)	0.909
History of myocardial infarction, *n* (%)	0 0	2 (1.9)	0.498
Previous stroke, *n* (%)	19 (19.6)	19 (18.3)	0.811
No. of stroke, *n* (%)			0.411
1	13 (13.4)	17 (16.3)	
2	5 (5.2)	2 (1.9)	
3	1 (1.0)	0 0	
Previous TIA, *n* (%)	7 (7.2)	2 (1.9)	0.091
Height (m), mean (SD)	158.9 (8.1)	160.6 (10.1)	0.226
Weight (kg), mean (SD)	62.5 (11.0)	65.6 (14.6)	0.103
BMI (kg/m^2), mean (SD)	24.7 (4.0)	25.4 (5.0)	0.318
Serum creatinine (μmol/L), mean (SD)	104.6 (75.6)	97.9 (32.2)	0.411
Total cholesterol (mmol/L), mean (SD)	4.42 (1.29)	4.50 (1.60)	0.697
Triglycerides (mmol/L), mean (SD)	1.58 (0.73)	1.73 (1.73)	0.248
LDL (mmol/L), mean (SD)	2.38 (1.16)	2.44 (1.28)	0.731
HDL (mmol/L), mean (SD)	1.18 (0.42)	1.17 (0.30)	0.802
FBS (mmol/L), mean (SD)	7.09 (3.11)	6.63 (3.10)	0.335
LVEF (%), mean (SD)	61.83 (10.74)	62.97 (12.64)	0.543
Left atrial diameter (mm), mean (SD)	26.75 (14.40)	29.48 (14.74)	0.269
Type of index event, *n* (%)			0.799
Ischaemic stroke	87 (88.8)	92 (88.5)	
TIA	11 (11.5)	13 (12.4)	
Modified Rankin scale score ≤2, *n* (%)[b]	57 (58.2)	74 (70.5)	0.067
CHA_2DS_2VASc score, median (IQR)[c]	4 (2)	4 (2)	0.999
No. of days from index event to randomization, mean (SD)	78.5 (63.7)	95.1 (75.0)	0.090
Aspirin, *n* (%)	79 (80.6)	94 (89.5)	0.074
Clopidogrel, *n* (%)	35 (35.7)	25 (23.8)	0.063
Statin, *n* (%)			0.841
Atorvastatin	85 (86.7)	90 (85.7)	
Simvastatin	10 (10.2)	12 (11.4)	
Rosuvastatin	2 (2.0)	1 (1.0)	
Lovastatin	0 0	1 (1.0)	
No	1 (1.0)	1 (1.0)	
β-Blockers, *n* (%)	15 (15.3)	18 (17.1)	0.723
ACE inhibitors, *n* (%)	33 (33.7)	31 (29.5)	0.525
ARB, *n* (%)	5 (5.1)	7 (6.7)	0.637
Spironolactone, *n* (%)	1 (1.0)	4 (2.9)	0.347

ACE, angiotensin-converting enzymes; ARB, angiotensin II receptor blockers; BMI, body mass index; IQR, inter-quartile range; LVEF, left ventricular ejection fraction; TIA, transient ischaemic attack.

[a]*P*-values were calculated with the use of Student's *t*-test, Pearson χ^2 test, or Fisher's exact test, as appropriate.

[b]Scores on the modified Rankin scale range from 0 to 6, with 0 indicating no symptoms and 6 indicating death; a score of ≤2 indicates that the patient is ambulatory and independent in activities of daily living.

[c]Scores on the CHA_2DS_2VASc risk assessment range from 0 to 6, with higher scores indicating a greater risk of stroke.

monitoring was feasible to implement as part of routine stroke care, resulting in the detection of AF in every 10.5 patients screened, when compared with 50 in the repeat 24-h Holter monitoring. The primary outcome showed congruent results with the EMBRACE and CRYSTAL AF study, with the detection of AF ranging from 12% to 16% in the intervention group, and a very low detection rate in the repeat Holter monitoring.[7,8] The numerically lower detection of AF in the intervention group may be due to the method of intermittent ECG recording when compared with continuous ECG monitoring, as well as the shorter duration of ECG monitoring. Nevertheless, our study concurred on the concept that the longer the ECG monitoring, the higher the yield for the detection of AF.[13]

Although it may seem logical that any type of extended period of rhythm monitoring predictably increases the detection of AF in patients with cryptogenic stroke, it was not known if wearable technology with remote monitoring was applicable in post-stroke patients. Before drafting the protocol, the authors were doubtful of the feasibility of the 30-day KardiaMobile strategy in post-stroke patients, because it required post-stroke patients with a neurological disability to place two fingers from each hand on the electrodes for 30 s to record the ECG. Despite a large proportion of our patients had a Modified Rankin Scale score of 2 or more, all except five patients in the intervention group were able to perform the recording of ECG 3 times a day for 30 days. On the other hand, there were 10 of 128 patients in the intervention group who were not able to continue with the study due to the inability to consistently use the smartphone ECG. The reason for this was due to the unavailability of a suitable smartphone compatible with KardiaMobile rather than the inability to learn how to record ECG using KardiaMobile. Even though there was a significant difference in the baseline formal educational level amongst our subjects, we think that it was due to the social-economic background of the patients rather than the inability to learn how to record ECG using KardiaMobile. The Median adherence to mobile ECG monitoring was 63.3%, which was however not associated with a higher yield of AF detection. On the other hand, we think that the adherence to mobile ECG monitoring could be improved by the more user-friendly smartwatch ECG, such as the KardiaBand (AliveCor®, Mountain View, CA, USA) and other validated commercial smartwatch ECG. Mobile ECG monitoring smartwatches with continuous background photoplethysmographic detection algorithm and reminder for intermittent ECG monitoring could potentially enhance the detection of silent AF.[14] Furthermore, almost half (48.6%) of the patients received at least one notification for possible AF, but only a quarter (24.8%) of the possible AF notifications were true positive for AF. We think that this is an important finding in which all the notifications for possible AF require further verification.

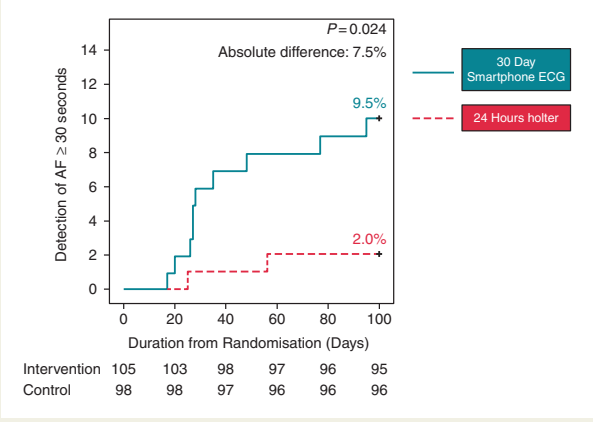


Figure 2 Primary outcome: detection of atrial fibrillation ≥30 s at 3 months. ECG, electrocardiogram.

Besides, the detection of AF in 9.5% of the intervention group was likely to be a conservative estimate for several reasons. First, patients with severe strokes, in which cardioembolism was likely to be most prevalent, were underrepresented. However, they were not the target of this study, which focused on stroke survivors who were still able to use a 30-day KardiaMobile with >1 year of life expectancy. Secondly, we know that the yield of monitoring increases well beyond 30 days, as well as with increasing frequency of recording. From our study, 9 of 10 patients had 'silent' AF and was detected from the instructed recording of ECG 3 times a day. The yield for smartphone ECG recording to detect AF might increase, should the patients were to monitor the smartphone ECG more frequently and in a longer duration beyond 30 days. Thirdly, the recruitment for our study was within 12 months from the indexed event, compared to 90 days for the CRYSTAL AF and 6 months for the EMBRACE study. Knowing that the higher incidence of AF is often observed in the initial period of monitoring following a stroke, therefore the primary outcome may be higher than the actual result if patients were recruited immediately after the indexed event. Lastly, because cryptogenic stroke is a heterogeneous entity, and not all of our patients underwent intracranial vascular imaging, the study probably enrolled patients with other causes of stroke, thus reducing the proportion with AF.

Our study is not the only study to explore the feasibility of digital health technology for the detection of AF on an outpatient basis.

Table 2 Secondary outcome: number of patients on anticoagulation 3 months after randomization

	Baseline	After 3 months	*P*-value
Control group, *n* (%)	1 (1.0)	4 (4.1)	0.250
Intervention group, *n* (%)	0 0	10 (9.5)	0.002
Patient on anticoagulation therapy but no AF of ≥30 s detected	1	3	NA
Patient not on anticoagulation therapy but AF of ≥30 s detected	0	1	NA

AF, atrial fibrillation; NA, not applicable.

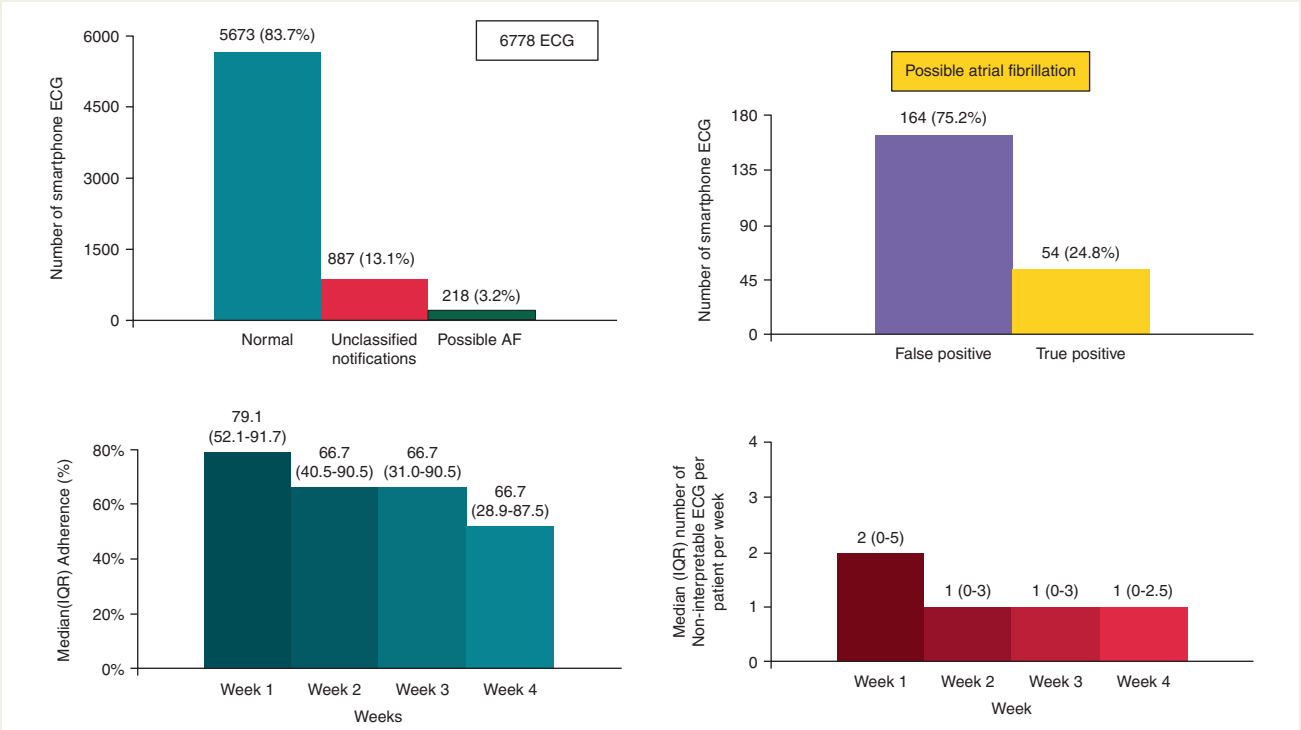


Figure 3 Performance of KardiaMobile. (*A*) Notifications by the algorithm of the KardiaMobile. (*B*) Verification of possible atrial fibrillation ECG by the algorithm. (*C*) Adherence to KardiaMobile. (*D*) Percentage of non-interpretable ECG in the 30-day monitoring period. ECG, electrocardiogram.

The Apple Heart Study, explored the feasibility of a commercial smartwatch to detect AF in the normal population, utilized the photoplethysmography in Apple Watch to intermittently measure blood flow activity and detect subtle changes that might indicate irregular heartbeat.[15] Of the 2161 participants who received irregular pulse notification, AF was identified in 153 out of the 450 participants (34%) who received a notification and wore an ECG patch for up to 7 days. Our study design was different from Apple Heart Study in which we embarked on screening high-risk patients with cryptogenic stroke who can potentially benefit from future stroke prevention with anticoagulation therapy. Furthermore, our study utilized KardiaMobile smartphone ECG monitoring rather than heart rate irregularity from photoplethysmography, which gives a more definitive diagnosis of AF.

Limitations

Nevertheless, this study has several limitations. First, our study only utilized a single-lead ECG to monitor for AF rather than multiple leads. At the time of designing and conducting the study, multiple leads smartphone ECG monitoring device, such as the KardiaMobile 6L was not yet available. We think that multiple leads smartphone ECG could improve the accuracy of ECG interpretation, but the detection rate for AF would be similar. Secondly, even though the secondary outcome showed a significantly higher number of patients prescribed anticoagulation therapy in the intervention group, the proportion of patients on anticoagulation therapy was not statistically significantly different at 3 months when compared between the two groups. We attributed this to the behavioural bias of the physicians and patients to the use of anticoagulation in response to the detection of AF. Three patients were prescribed anticoagulation despite no AF of ≥ 30 s were detected and 1 patient was not prescribed anticoagulation despite the detection of AF ≥ 30 s (*Table 2*). The former was due to off-label prescription of anticoagulation (recurrent stroke, evidence of cardioembolic stroke based on neurovascular imaging, and presentation of stroke), and the latter was due to refusal of the patient on anticoagulation. Lastly, we did not include cost-effectiveness analysis in our study. At the time of writing this manuscript, the cost of one 24-h Holter was USD3500 vs. USD99 for KardiaMobile in our country (One Holter is 35 times the price of KardiaMobile). The number needed to screen to detect one AF was 13 patients based on the primary outcome. We will include the cost-effectiveness analysis in a separate manuscript.

Conclusion

Among patients ≥55 years of age with a recent cryptogenic stroke or TIA, a 30-day smartphone ECG recording significantly improved the detection of AF compared with the standard repeat 24-h Holter monitoring. There was a significantly higher proportion of patients prescribed oral anticoagulation therapy after the 30-day smartphone monitoring.

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Conflict of interest: none declared.

Data availability

All data are incorporated into the article.

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