Ahmet Anıl Başkurt[1], Ferhat S. Yurdam[1], Sevinj Namazova[2],
Eren Ozan Bakır[1], Yusuf Demir[1], Ayşe Ceren Öztürk[2], Yeliz Çiftçi[2], Oktay Şenöz[1]
[1] Department of Cardiology, Bakırçay University Çiğli Training and Research Hospital, Izmir, Turkey
[2] Department of Neurology, Bakırçay University Çiğli Training and Research Hospital, Izmir, Turkey

Screening for Paroxysmal Atrial Fibrillation with Smart Devices in Hospitalized Patients with Stroke or Transient Ischemic Event

Background	Cardioembolism in stroke and transient ischemic attack (TIA) patients is highly influenced by atrial fibrillation (AF). The best timing, duration, location (outpatient or inpatient), and procedure for diagnosing paroxysmal atrial fibrillation (PAF) after stroke/TIA are unknown. We investigated the use of smart devices in the detection of PAF during the index event hospitalization.
Material and methods	Stroke and TIA patients hospitalized in the neurology service were evaluated. Patients with AF detected on the ECG at emergency department admission and patients with known AF were excluded from the study. Smartphone-based apps were given to 342 other patients to utilize the mobile app on smart devices during follow-up. Three cardiologists reviewed all smart device rhythm electrographs and identified patients with AF. On the basis of concurrent 24–72 h Holter rhythm monitoring, the patients were separated into those who had PAF (n=85; group 1) and those who did not have PAF (n=245; group 2).
Results	Left atrium size (LA), arterial hypertension, lowest and highest heart rate on the smart device and episodes of AF on the smart device differed between patients with and without PAFas noted on the 24–72 h Holter rhythm recordings. Detection of AF on the smart device was found to be an independent predictor of PAF as observed on the Holter rhythm recording (p=0.017). An AF episode identified on the smart device predicted the detection of PAF on the Holter 24–72 h rhythm recording with 58% sensitivity and 87% specificity. (AUC=0.723, 95% CI=0.569–0.876, p=0.007)
Conclusion	The detection of PAF following acute ischemic stroke or TIA may be significantly improved during hospitalization by continuously monitoring cardiac rhythm with smart devices.

Keywords	Atrial fibrillation; smart device; stroke; transient ischemic attack
For citations	Ahmet Anıl Başkurt, Ferhat S. Yurdam, Sevinj Namazova, Eren Ozan Bakır, Yusuf Demir, Ayşe Ceren Öztürk et al. Screening for Paroxysmal Atrial Fibrillation with Smart Devices in Hospitalized Patients with Stroke or Transient Ischemic Event. Kardiologiia. 2025;65(11):94–100. [Russian: Ахмет Анил Башкурт, Ферхат С. Юрдам, Севиндж Намазова, Эрен Озан Бакыр, Юсуф Демир, Айше Серен Озтюрк и др. Скрининг пароксизмальной фибрилляции предсердий с помощью интеллектуальных устройств во время госпитализации пациентов с инсультом или транзиторной ишемической атакой. Кардиология. 2025;65(11):94–100].

Corresponding author	Ahmet Anıl Başkurt. E-mail: a.baskurt@windowslive.com

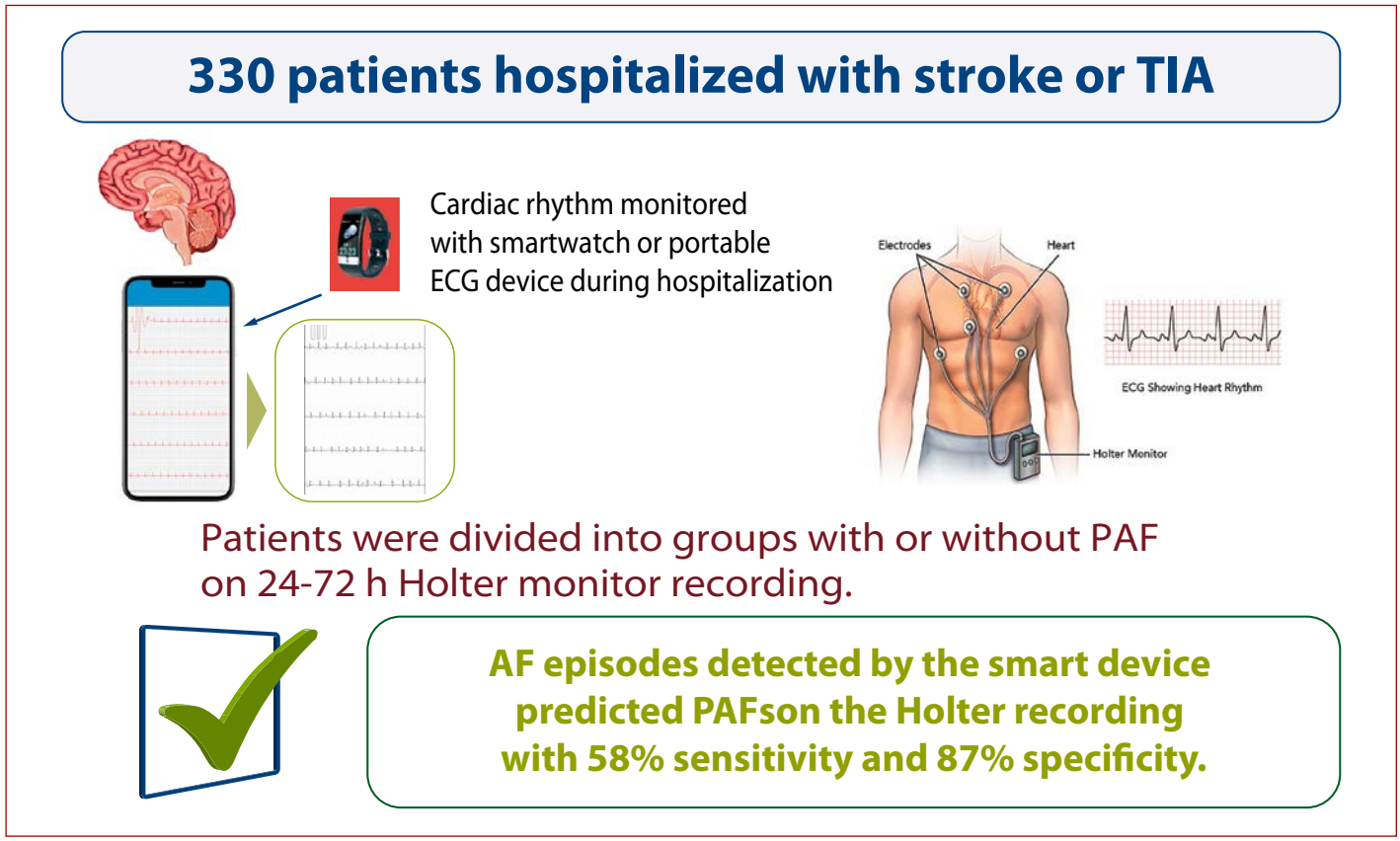
Introduction

Stroke and transient ischemic attack (TIA) remain significant global health concerns, contributing substantially to morbidity and mortality worldwide [1]. TIA, often referred to as a "mini-stroke" is characterized by brief episodes of neurological dysfunction that typically resolve within 24 h. Despite its transient nature, TIA is increasingly recognized as a critical warning sign, often preceding more severe cerebrovascular events [2, 3]. The etiology of stroke and TIA is diverse, encompassing a spectrum of vascular, cardiac, and hematologic disorders. However, cardioembolic events stand out as a particularly significant cause, accounting for approximately 20–30% of all ischemic strokes. Among the various cardiac sources of embolism, atrial fibrillation (AF) is the most common and clinically relevant [1, 4].

AF is a cardiac arrhythmia characterized by rapid and irregular atrial activation, leading to ineffective atrial contraction and increased risk of thrombus formation, particularly in the left atrial (LA) appendage. The relationship between AF and stroke is well-established, with AF-associated strokes typically being more severe and associated with higher mortality rates compared to non-AF-associated strokes [5]. Patients with AF have a five-fold increased risk of stroke compared to those without AF. Moreover, AF-related strokes tend to be more severe, with larger infarct sizes and poorer functional outcomes. This heightened risk underscores the critical need for early detection and appropriate management of AF in both primary and secondary stroke prevention strategies [2, 5]. The detection of AF in stroke and TIA patients is of paramount importance for several reasons. Firstly, the identification of AF as the underlying cause of a cerebrovascular event significantly in-

ISSN 0022-9040. Кардиология. 2025;65(11). DOI: 10.18087/cardio.2025.11.n2946

Central illustration. Screening for paroxysmal atrial fibrillation with smart devices during hospitalization in stroke and transient ischemic event patients



fluences treatment decisions, particularly regarding anticoagulation therapy [6, 7]. Secondly, AF detection helps in risk stratification and prognosis. Early identification of AF allows for more aggressive risk factor management and closer monitoring, potentially improving long-term outcome [1, 5].

Despite its importance, the detection of paroxysmalAF (PAF) in stroke and TIA patients presents significant challenges. The paroxysmal nature of AF means that it may not be present during routine electrocardiographic (ECG) assessment. This has led to the development and implementation of various monitoring strategies to enhance AF detection in this high-risk population [3, 4]. PAF is difficult to document because it occurs in short episodes. If patients are symptomatic during an episode of PAF, the PAFmay be detected only after presentation to the emergency department or by screening methods. However, it is difficult to detect these episodes of PAF in asymptomatic patients. While it may be easier to detect AF in older people with known structural heart disease and high pulse rate, it is still challenging to detectAF without many comorbidities [8, 9].

The advent of smartphone-based ECG monitoring has opened new possibilities for AF detection. Recent studies have shown promising results in using smartphone-based ECG monitors for AF detection in both the general population and in post-stroke patients [10, 11]. The ongoing REMOTE trial by Wouters et al. (2022) is investigating the potential of mobile health and insertable cardiac monitors in AF detection in cryptogenic stroke patients [12]. Early detection of AF and initiation of appropriate anticoagulant therapy may reduce recurrent cerebrovascular events.

Current guidelines reflect the growing recognition of the importance of AF detection in stroke and TIA patients. The European Stroke Organization (ESO) guidelines recommend at least 24 h of ECG monitoring for all patients with no AF detected on their ECG with acute ischemic stroke or TIA. For patients with embolic stroke of undetermined source (ESUS), more prolonged monitoring is advised [6]. Similarly, the American Heart Association/American Stroke Association guidelines suggest at least 24 h of cardiac monitoring for hospitalized stroke and TIA patients, with consideration of more prolonged monitoring of select patients [13, 14].

Despite these recommendations, the optimal duration and the method of cardiac monitoring for AF detection remain subjects of debate. In this study, we investigated whether AF screening with a smart device during hospitalization detects AFas well as standard Holtermonitoring of the ECG.

Material and methods

Thiswas a prospective, observational study. Patients who presented to the Bakırçay Universty Çiğli Research and Training Hospital Emergency Department between September 7,

2023 and July 1, 2024 and were diagnosed with a TIA or cerebrovascular eventwere included in the study. The patients were hospitalized in the Stroke Unit after the decision for hospitalization due to stroke orTIA was made in the Emergency Department. Patients in the Stroke Unit are monitored, and the average length of stay in the study was 2.2 days. After follow-up in the Stroke Unit, patients with stable vital signs were transferred to the Inpatient Ward and fitted with smart devices.

Patients who did not require hospitalization, had a known diagnosis of PAF, were diagnosed with AF in the Emergency Department, or were already diagnosed with AF or PAF during continuous monitoring in the Stroke Unit were excluded from the study. In addition, patients whose mental abilities were so weakened that they couldn't use the mobile app and patients didn't have smartphone were also excluded.

Patients stayed in the Inpatient Ward for an average of 5 days. Etiologic tests, including carotid CT angiography and echocardiography, were performed during this follow-up period after the initial diagnosis. Transesophageal echocardiography (TEE) was performed on patients with high Risk of Paradoxical Embolism scoresor on young patients to identify etiological factors such as patent foramen ovale (PFO), atrial septal defect (ASD), and possible thrombus in the LA appendage (LAA). During inpatient ward follow-up, smart devices were fitted to patients. Recorded data was periodically transferred to a central database wirelessly or via manual download during clinic visits.

All of the rhythm electrographs that were collected by the smart device were analyzed by three cardiologists who specialized in this area of expertise, and the patients who were found to have AF by all three cardiologists were identified. The three cardiologists reviewed the device records separately and made a consensus decision when there was an initial disagreement. Attacks lasting more than 30 sec were accepted as AF. Patients whose follow-up procedures had been finished were scheduled to have an elective 24–72 hr Holter rhythm recording. This 24–72 hr Holter recording was decided by the neurologist by evaluating factors such as the presence of cryptogenic stroke and dilated left atrium.

The data obtained from the smart device were evaluated in a similar period to the data obtained from the Holterrhythm monitor and were analyzed blindly by different cardiologists. Within the scope of the research project, a total of 342 patients were equipped with smart devices; however, 12 patients could not be evaluated because their device records were not appropriate ("interference electrocardiograms").

Wearable Technologies and Their Application

The software and devices used in the study were the Rehealth Remote Patient Monitoring System. The software allowed us to monitor and observe all patient health data, including both ECG on a single platform.

Two devices integrated into the Rehealth platform were selected for use in the study. The first device was a smartwatch featuring a medically certified chip. This smartwatch was capable of measuring ECG, heart rate. The second device was the DuoEK Professional ECG Monitor, a single-channel ECG device with a heart rate sensor, capable of real-time ECG tracking with recordings lasting from 30 sec to 15 min. Additionally, two mobile applications (Emoda app) were utilized to enable physicians to analyze the data collected from the wearable devices.

Statistical analysis

Data were analyzed with the SPSS 22.0 program (IBM Corporation, Armonk, NY, USA). The variables included age, gender, comorbidities, electrocardiographic measurements, echocardiographic data, laboratory data, and data obtained from the smart device. The normal distribution of variables was evaluated with the Kolmogorov–Smirnov test, and the homogeneity of variance was evaluated with the Levene test. All continuous variables were found to have normal distributions. Data determined by measurementsare presentedas mean and standard deviation (SD). Theunpaired t-test was used toanalyze these data. Categorical data were shown as absolute and relative frequencies. The χ^2 test or the Fisher's exact test was used as appropriate.

Variablesare stated with a 95% confidence interval, and $p<0.05$ was considered as statistically significant. Univariate logistic regression was performed to identify significant independent predictors of AF, as detected by standard Holter ECG. Parameters with a p value below 0.1 were considered risky in terms of the independent predictor and were included in the multivariate logistic regression. In the results of multivariate logistic regression, $p<0.05$ were considered significant.

Receiver operating characteristic (ROC) analysis was used for area under the curve (AUC) calculations.

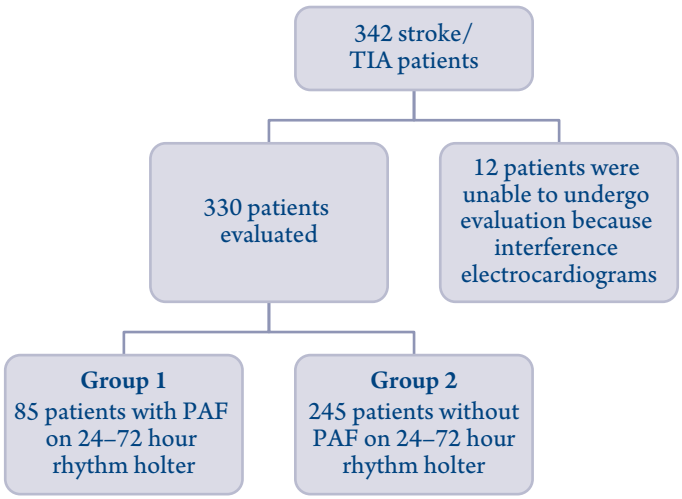
Results

Data of 330 patients were evaluated. Patients presenting to the Emergency Department with neurological symptoms underwent brain CT and brain diffusion MRI. 184 (56%) of the patients had anterior cerebral infarction (middle cerebral artery oranterior cerebral artery (ACA) obstruction), 102 (31%) had posterior cerebral infarction (posterior cerebral artery or vertebral artery obstruction), 44 had both anterior and posterior infarctions or TIA. The mean Modified Rankin Scalescore of the patients was 2.59. On the basis of the 24–72 h Holter monitor recordingthe, patients were separated into those who had PAF (n=85, group 1) and those who did not have PAF (n=245, group 2) (Figure 1). The comorbidities, laboratory results, and routine examinations of these individuals were analyzed, and results of the two groups were compared.

Mean age of the patients was 63.32±13.20 yr; 130 of 330 patients were female. Mean left ventricular ejection frac-

ISSN 0022-9040. Кардиология. 2025;65(11). DOI: 10.18087/cardio.2025.11.n2946

Figure 1. Diagram of thestudy protocol



tion (LVEF) was 58.5±6.2% and mean left atrium (LA) diameter was 36.55±3.63 mm. 50 patients had AF episodes that were recorded on 24–72 h Holter record. Premature beats were observed in 141 of 330 patients undergoing Holter monitoring.

Patients with and without PAF in the Holter monitor record were compared. There were no statistically significant differences between the two groups in terms of age, gender, coronary artery disease, diabetes mellitus and chronic kidney disease. A total of 29 patients had recurrent cerebrovascular events and there was no difference between the two groups in this respect. Again, there was no statistically significant difference between the two groups in terms of carotid artery stenosis detected by CT angiography. There was a statistically significant difference the groups in the number of AF episodesand the highest and lowest pulse rates according to smart device data (Table 1).

All patients underwent echocardiographic evaluation and there was no statistically significant difference between the two groups in LVEF, LA and other data associated with AF. TEE was performed on 46 of the 330 patients, and eight of these patients were found to have a risky PFO and had an ASD. If no other cause for stroke was found in these patients, percutaneous closure was performed.

The highest rate on the smart device gives the highest pulse rate measured on the patient during the time it wasworn by the patient. Thelowest rate on the smart device gives the lowest pulse rate measured on the patient during the time it was worn by the patient.

Following the analyses performed with chi-square and t-tests, regression analyses were performed for the parameters with p-values below 0.1. Comparing patients with and without PAFon the 24–72 h Holter monitor rhythm recordings revealed that there were differences between the two groups in terms of the LA diamrter, the existence of arterial hypertension, the lowest and maximum heart rates on the smart device, and the number of episodes of AF recorded on the smart device. Using these parameters, both univariate and multivariate logistic regression were performed (Tables 2 and 3). These analyses found that the detection of AF on the smart device was an independent predictor of PAFas recorded on the Holter rhythm monitor (p=0.017).

Table 1. Patient data grouped according to presence or absence of PAF in the 24–72 h Holter monitor recording

Variable	Patients with PAF in the 24–72 h Holter monitor record (n=85)	Patients withno PAF in the 24–72 h Holter monitor record (n=245)	p value
Age (yr)	67.82±9.99	61.75±13.89	0.103
Gender, male	55 (64.7)	145 (59.2)	0.688
Coronary artery disease	15 (17.6)	32 (13.1)	0.576
Arterial hypertension	49 (57.6)	82 (33.5)	0.057
Diabetes mellitus	21 (24.7)	41 (16.7)	0.507
Chronic kidney disease	5 (5.8)	10 (4.1)	1.000
COPD	5 (5.8)	11 (4.5)	0.613
Recurrent stroke or TIA	14 (16.4)	15 (6.1)	0.172
Carotid artery stenosis	9 (10.5)	15 (6.1)	0.597
Episode in smart device	50 (58.8)	35 (14.2)	0.001
Highest rate on smart device	94.88±16.79	75.714±36.10	0.039
Lowest rate on smart device	66.65±7.48	57.27±26.41	0.029
LDL-cholesterol (mg/dl)	127.5±27.1	119.4±24.4	0.188
TSH (mUI/ml)	2.72±0.61	3.08 ±0.63	0.103
BNP (pg/m)	319.00 ±112.18	351.50 ±211.48	0.702
LVEF (%)	59.71%±1.21	58.06%±7.13	0.127
LAD (mm)	37.88±3.69	36.08±3.54	0.078
LAV (ml)	38.6±10.6	42.3±11.1	0.061
LVEDD (mm)	49.14±0.81	47.4±0.70	0.191
LVESD (mm)	33.21±0.91	33.79±0.92	0.316

Data are mean±SD or n (%). n – number; % – percent of group; LVEF – left ventricular ejection fraction; LAD – left atrium diameter; mm – millimeter; LVEDD – left ventricular end diastolic diameter; LVESD – left ventricular end systolic diameter; TIA – transient ischemic attack; COPD – chronic obstructive pulmonary disease; TSH – thyroid stimulating hormone; BNP – brain natriuretic peptide; LAV – left atrial volume.

AF episodes recorded on smart device record predicted the detection of PAF on 24–72 h Holter rhythm monitor with 58% sensitivity and 87% specificity (AUC = 0.723, 95% CI = 0.569–0.876, p=0.007; Figure 2)

Discussion

This study of patients hospitalized for acute ischemic stroke or TIA revealed the potential value of smart devices for detecting PAF. These findings align with recent studies employing extended monitoring techniques [10, 11]. For instance, the Cryptogenic Stroke and Underlying Atrial Fibrillation (CRYSTAL-AF) study by Sanna et al. found that an implanted heart monitor was able to identify AF in 30% of patients with cryptogenic stroke after three years follow up [15].

Table 2. Univariate logistic regression analysis of risk factors determining the presence of PAF on the 24–72 hour Holter rhythm monitor recording

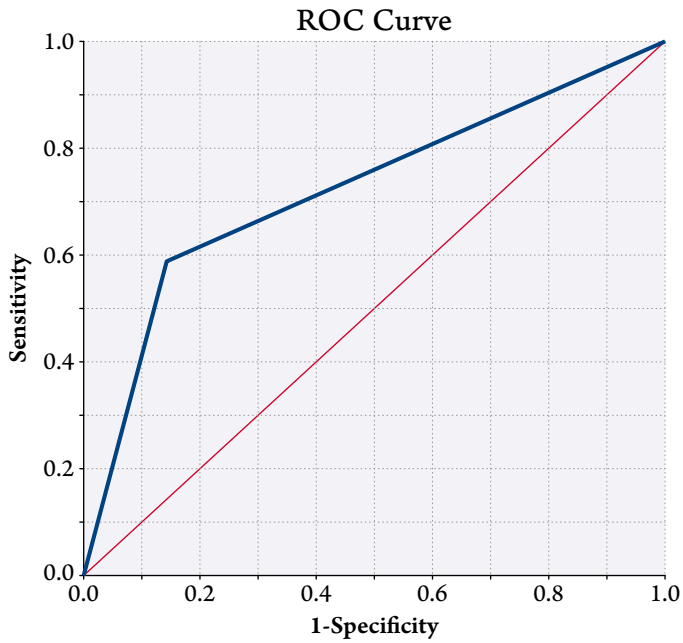
Variable	OR (95% CI)	p value
Arterial hypertension	2.946 (0.947–9.172)	0.062
LAdiameter (mm)	1.141 (0.982–1.327)	0.086
Highest rate on smart device	1.028 (0.999–1.058)	0.058
Lowest rate on smart device	1.025 (0.988–1.063)	0.082
AF episode in smart device	0.117 (0.033–0.409)	0.001

OR – odds ratio. CI – confidence interval.

Table 3. Multivariate logistic regression of risk factors determining the presence of PAF on 24–72 hour Holter rhythm monitor recording

Variable	OR (95% CI)	p value
Arterial hypertension	0.385 (0.094–1.571)	0.183
Left atrium diameter (millimeter)	1.087 (0.911–1.296)	0.355
Highest rate on smart device	1.039 (0.993–1.088)	0.101
Lowest rate on smart device	0.963 (0.895–1.037)	0.322
AF episode in smart device	0.157 (0.041–597)	0.017

Figure 2. ROC curve analysis for AF episode on smart device to predict PAF on 24–72 h Holter rhythm monitor record



Diagonal segments are produced by ties.

A key finding of the current study is that smart device detection of AF episodes was an independent predictor of PAF as identified on the Holter monitoring (OR 0.157, 95% CI 0.041–597, p=0.017). This result aligns with recent research on smartphone-based and wearable electrocardiographic monitoring in acute stroke and TIA patients. For example, Tu et al. demonstrated the feasibility of using smartphone-based monitoring for AF detection in this population, although their study focused on outpatient monitoring rather than inpatient use [10].

The potential of smart devices in AF detection is further supported by recent studies [11, 16]. Han et al. (2023) designed a smartwatch system for continuous AF monitoring in older adults after stroke or TIA, highlighting the growing interest in this technology for post-stroke care [17]. This is one of the first studies to provide a detailed design for a smartphone-smartwatch dyad for ambulatory AF monitoring. In our study, we applied it to high-risk patients. Additionally, Weichert (2019) reported a case where a smart device alarm led to the diagnosis of asymptomatic AF with fast ventricular response in a patient with recent TIA, demonstrating the potential real-world impact of these devices [18].

Grond et al. (2013) found that 72-h Holter ECG significantly improved the detection of silent AF in patients with ischemic stroke compared to 24-h monitoring [19]. Similarly, Rizos et al. (2012) demonstrated that continuous stroke unit ECG monitoring was superior to 24-h Holter ECG monitoring for detecting PAF after stroke [20].Our study has shown that monitoring with smart devices can be used in the inpatient ward after the stroke unit. Prolonged supraventricular ectopy, frequent atrial premature beats (APC), and atrial high-rate episodes are increasingly recognized as surrogate markers for PAF. Studies have demonstrated that parameters such as the APC burden, short atrial runs (>5 beats), and variability in heart rate may predict subsequent AF detection on prolonged monitoring [21]. Including these data could enhance risk stratification and justify more aggressive rhythm surveillance or anticoagulation in selected patients, especially those with ESUS [22].

AF was seen more frequently in men and the elderly in our study, as in the literature [23, 24]. Since the population in the current study was relatively middle-aged, there was no statistically significant difference in age between patients with and without AF. Our study identified several factors associated with PAF detection, including LA diameter, presence of arterial hypertension, and highest and lowest heart rates recorded on the smart device. These findings are consistent with previous studies that have identified similar risk factors for AF in stroke patients [1, 2].

The association between arterial hypertension and PAF (57.6% in PAF group vs. 33.5% in non-PAF group, p=0.057) underscores the importance of blood pressure control in stroke prevention and management. Studies have shown that hypertension is frequently observed in stroke patients with atrial fibrillation [25]. LA diameter as a predictor of PAF is consistent with the findings of Alhadramy et al., who identified LA enlargement as an independent predictor of PAF in stroke patients [5]. This emphasizes the importance of echocardiographic assessment in stroke patients for risk stratification.

The use of smart devices for continuous monitoring during hospitalization offers several advantages over traditional monitoring methods:

1. Less intrusive and more comfortable for the patients.
2. Provides real-time data.

ISSN 0022-9040. Кардиология. 2025;65(11). DOI: 10.18087/cardio.2025.11.n2946

3. Ability to capture brief or asymptomatic AF episodes that might be missed by intermittent monitoring.

These advantages are particularly relevant in light of the findings by Edwards et al., that significant underutilization of ambulatory ECG monitoring after stroke and TIA resulted in missed opportunities for AF detection [26]. Smart device-based monitoring could help address this gap.

The high detection rate of PAF by smart device has significant implications for clinical practice. The meta-analysis of Kishore et al. confirmed that newly detected AF after stroke or TIA was associated with a high risk of recurrent stroke [27]. Therefore, early detection of PAF using smart devices could lead to timely initiation of anticoagulation therapy, potentially reducing the risk of recurrent stroke. Moreover, our findings support the concept of more intensive monitoring in the acute phase of stroke, as suggested by D'Anna et al., who found that automated continuous ECG monitoring accelerated AF detection in a hyper-acute stroke unit [28]. The integration of smartwatch technology into stroke units could further enhance this approach.

Although the sensitivity of the smart devices for detecting PAF wasis low (58%), the most important limitation of this study is that AF was paroxysmal. Even in patients known to have PAF, both the smart device and Holterrhythm monitoring mayfail to detect the arrhythmia. The current study was conducted to demonstrate that smart devices can also be used during hospitalization for AF screening.

In a study using devices similar to those in the current study, sensitivity and specificity for the detection of AF was 85% and 75% for the Apple Watch 6, 85% and 75% for the Samsung Galaxy Watch 3, 58% and 75% for the Withings Scan watch, 66% and 79% for the Fitbit Sense, and 79% and 69% for the AliveCor KardiaMobile, respectively [29]. These devices achieved such favorable results with continuous use.

The current findings could have significant implications for the management of stroke and TIA patients. Early detection of PAF could lead to the initiation of appropriate anticoagulation therapy and potentially reduce the risk of recurrent stroke. Additionally, smart device-based monitoring may offer advantages in terms of patient comfort and cost-effectiveness. Early detection of AF in these patients is important in terms of controlling secondary triggers of AF such as smoking and alcohol use, heavy sports and arterial hypertension, and hyperthyroidism bymore strictly making lifestyle changes after discharge [30, 31].

Limitation

This study has several limitations that should be addressed in future research:

1) The study was a single-center design, which may limit generalizability;
2) There was the potential for selection bias since only patients who could use the mobile application and the smart devicewere included;
3) There was alack of long-term follow-up to assess the impact of early PAF detection on clinical outcomes;
4) All smart devices may produce false negativity by failing to capture short-term attacks, and it is not clear how successful smart devices are in differentiating AF from other rhythm disorders.

Thus, smart devices may not be sufficient in the differential diagnosis of AF from atrial tachycardia or supraventricular tachycardia or ventricular tachycardia with aberrant conduction.

Additionally, even in patients known to have PAF, neither the smart device and the Holterrhythm monitor mayalways detect the arrhythmia. This study was conducted to show that smart devices can be used during hospitalization for AF screening. Another limitation is that not all independent risk factors used in PAF screening were evaluated, nor was advanced imaging of the left atrium.

Conclusion

This study shows that the use of smart devices for continuous monitoring during hospitalization for acute ischemic stroke or TIA can predict PAF as detected by conventional Holter monitoring. This approach may enable earlier initiation of appropriate anticoagulation therapy and potentially reduce the risk of recurrent stroke. Further research is needed to evaluate the long-term clinical outcomes and cost-effectiveness of this strategy, as well as to optimize its implementation in various clinical settings.

Consent to participate

Verbal and written informed consent was obtained from all patients.

No conflicts of interest are reported.

The article was received on 04/05/2025

REFERENCES

1. Khoo CW, Lip GY. Clinical outcomes of acute stroke patients with atrial fibrillation. Expert Review of Cardiovascular Therapy. 2009;7(4):371–4. DOI: 10.1586/erc.09.11
2. Healey JS, Connolly SJ, Gold MR, Israel CW, Van Gelder IC, Capucci A et al. Subclinical atrial fibrillation and the risk of stroke. The New England Journal of Medicine. 2012;366(2):120–9. DOI: 10.1056/NEJMoa1105575
3. Lazzaro MA, Krishnan K, Prabhakaran S. Detection of Atrial Fibrillation With Concurrent Holter Monitoring and Continuous Cardiac Telemetry Following Ischemic Stroke and Transient Ischemic Attack. Journal of Stroke and Cerebrovascular Diseases. 2012;21(2):89–93. DOI: 10.1016/j.jstrokecerebrovasdis.2010.05.006
4. Shafqat S, Kelly PJ, Furie KL. Holter monitoring in the diagnosis of stroke mechanism. Internal Medicine Journal. 2004;34(6):305–9. DOI: 10.1111/j.1444-0903.2004.00589.x
5. Alhadramy O, Jeerakathil TJ, Majumdar SR, Najjar E, Choy J, Saqqur M. Prevalence and Predictors of Paroxysmal Atrial Fibrilla-

tion on Holter Monitor in Patients With Stroke or Transient Ischemic Attack. Stroke. 2010;41(11):2596–600. DOI: 10.1161/STROKEAHA.109.570382
6. Fonseca AC, Merwick Á, Dennis M, Ferrari J, Ferro JM, Kelly P et al. European Stroke Organisation (ESO) guidelines on management of transient ischaemic attack. European Stroke Journal. 2021;6(2):V. DOI: 10.1177/23969873211027003
7. Kleindorfer DO, Towfighi A, Chaturvedi S, Cockroft KM, Gutierrez J, Lombardi-Hill D et al. 2021 Guideline for the Prevention of Stroke in Patients With Stroke and Transient Ischemic Attack: A Guideline From the American Heart Association/American Stroke Association. Stroke. 2021;52(7):e364–467. DOI: 10.1161/STR.0000000000000375
8. Mariani MV, Pierucci N, Piro A, Trivigno S, Chimenti C, Galardo G et al. Incidence and Determinants of Spontaneous Cardioversion of Early Onset Symptomatic Atrial Fibrillation. Medicina. 2022;58(11):1513. DOI: 10.3390/medicina58111513
9. Cochet H, Mouries A, Nivet H, Sacher F, Derval N, Denis A et al. Age, Atrial Fibrillation, and Structural Heart Disease Are the Main Determinants of Left Atrial Fibrosis Detected by Delayed-Enhanced Magnetic Resonance Imaging in a General Cardiology Population. Journal of Cardiovascular Electrophysiology. 2015;26(5):484–92. DOI: 10.1111/jce.12651
10. Tu HT, Chen Z, Swift C, Churilov L, Guo R, Liu X et al. Smartphone electrographic monitoring for atrial fibrillation in acute ischemic stroke and transient ischemic attack. International Journal of Stroke. 2017;12(7):786–9. DOI: 10.1177/1747493017696097
11. Reichl JJ, Hamid KA, Burkard T, Vischer AS, Guzman C, Dudek D et al. PPG-based smartphone application vs usual care for atrial fibrillation screening: A European multicenter randomized trial. Heart Rhythm. 2025;S1547-5271(25)02741-9. DOI: 10.1016/j.hrthm.2025.07.060
12. Wouters F, Gruwez H, Vranken J, Vanhaen D, Daelman B, Ernon L et al. The Potential and Limitations of Mobile Health and Insertable Cardiac Monitors in the Detection of Atrial Fibrillation in Cryptogenic Stroke Patients: Preliminary Results From the REMOTE Trial. Frontiers in Cardiovascular Medicine. 2022;9:848914. DOI: 10.3389/fcvm.2022.848914
13. Jauch EC, Saver JL, Adams HP, Bruno A, Connors JJ (Buddy), Demaerschalk BM et al. Guidelines for the Early Management of Patients With Acute Ischemic Stroke: A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association. Stroke. 2013;44(3):870–947. DOI: 10.1161/STR.0b013e318284056a
14. Kernan WN, Ovbiagele B, Black HR, Bravata DM, Chimowitz MI, Ezekowitz MD et al. Guidelines for the Prevention of Stroke in Patients With Stroke and Transient Ischemic Attack: A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association. Stroke. 2014;45(7):2160–236. DOI: 10.1161/STR.0000000000000024
15. Sanna T, Diener H-C, Passman RS, Di Lazzaro V, Bernstein RA, Morillo CA et al. Cryptogenic Stroke and Underlying Atrial Fibrillation. New England Journal of Medicine. 2014;370(26):2478–86. DOI: 10.1056/NEJMoa1313600
16. Gognieva D, Vishnyakova N, Mitina Y, Chomakhidze P, Mesitskaya D, Kuznetsova N et al. Remote Screening for Atrial Fibrillation by a Federal Cardiac Monitoring System in Primary Care Patients in Russia: Results from the Prospective Interventional Multicenter FECAS-AFS Study. Global Heart. 2022;17(1):4. DOI: 10.5334/gh.1057
17. Han D, Ding EY, Cho C, Jung H, Dickson EL, Mohagheghian F et al. A Smartwatch System for Continuous Monitoring of Atrial Fibrillation in Older Adults After Stroke or Transient Ischemic Attack: Application Design Study. JMIR Cardio. 2023;7:e41691. DOI: 10.2196/41691
18. Weichert I. 'My watch kept on alarming all night about my heart rate': diagnosis of asymptomatic atrial fibrillation with fast ventricular response in a patient with a recent TIA as the result of a smartwatch alarm. Oxford Medical Case Reports. 2019;2019(3):omz014. DOI: 10.1093/omcr/omz014
19. Grond M, Jauss M, Hamann G, Stark E, Veltkamp R, Nabavi D et al. Improved Detection of Silent Atrial Fibrillation Using 72-Hour Holter ECG in Patients With Ischemic Stroke: A Prospective Multicenter Cohort Study. Stroke. 2013;44(12):3357–64. DOI: 10.1161/STROKEAHA.113.001884
20. Rizos T, Güntner J, Jenetzky E, Marquardt L, Reichardt C, Becker R et al. Continuous Stroke Unit Electrocardiographic Monitoring Versus 24-Hour Holter Electrocardiography for Detection of Paroxysmal Atrial Fibrillation After Stroke. Stroke. 2012;43(10):2689–94. DOI: 10.1161/STROKEAHA.112.654954
21. Larsen BS, Aplin M, Nielsen OW, Dominguez Vall-Lamora MH, Høst NB, Kristiansen OP et al. Excessive supraventricular ectopic activity and risk of incident atrial fibrillation in a consecutive population referred to ambulatory cardiac monitoring. Heart Rhythm O2. 2021;2(3):231–8. DOI: 10.1016/j.hroo.2021.04.002
22. Germanova O.A., Reshetnikova Yu.B., Syunyakov T.S., Germanov A.V. Prediction of paroxysmal atrial fibrillation based on 24-hour Holter electrocardiographic monitoring. Kazan medical journal. 2025;106(2):298–307. [Russian: Германова О.А., Решетникова Ю.Б., Сюняков Т.С., Германов А.В. Прогнозирование пароксизмальной фибрилляции предсердий на основании данных суточного мониторирования электрокардиограммы по холтер. Казанский медицинский журнал. 2025;106(2):298-307]. DOI: 10.17816/KMJ631754
23. Shapkina M, Ryabikov A, Mazdorova E, Titarenko A, Avdeeva E, Mazurenko E et al. The Determinants of the 13-Year Risk of Incident Atrial Fibrillation in a Russian Population Cohort of Middle and Elderly Age. Journal of Personalized Medicine. 2022;12(1):122. DOI: 10.3390/jpm12010122
24. Shkolnikova MA, Jdanov DA, Ildarova RA, Shcherbakova NV, Polyakova EB, Mikhaylov EN et al. Atrial fibrillation among Russian men and women aged 55 years and older: prevalence, mortality, and associations with biomarkers in a population-based study. Journal of geriatric cardiology. 2020;17(2):74–84. DOI: 10.11909/j.issn.1671-5411.2020.02.002
25. Mehrabanfar AA, Adel SM. Atrial fibrillation among patients with stroke. Neurosciences Journal. 2008;13(2):196–8. [Av. at: https://nsj.org.sa/content/13/2/196]
26. Edwards JD, Kapral MK, Fang J, Saposnik G, Gladstone DJ. Underutilization of Ambulatory ECG Monitoring After Stroke and Transient Ischemic Attack: Missed Opportunities for Atrial Fibrillation Detection. Stroke. 2016;47(8):1982–9. DOI: 10.1161/STROKEAHA.115.012195
27. Kishore A, Vail A, Majid A, Dawson J, Lees KR, Tyrrell PJ et al. Detection of Atrial Fibrillation After Ischemic Stroke or Transient Ischemic Attack: A Systematic Review and Meta-Analysis. Stroke. 2014;45(2):520–6. DOI: 10.1161/STROKEAHA.113.003433
28. D'Anna L, Kar A, Brown Z, Harvey K, Banerjee S, Korompoki E et al. Automated Continuous Electrocardiogram Monitoring Accelerates the Detection of Atrial Fibrillation after Ischemic Stroke or Transient Ischemic Attack on a Hyper Acute Stroke Unit. Journal of Stroke and Cerebrovascular Diseases. 2020;29(4):104669. DOI: 10.1016/j.jstrokecerebrovasdis.2020.104669
29. Mannhart D, Lischer M, Knecht S, Du Fay De Lavallaz J, Strebel I, Serban T et al. Clinical Validation of 5 Direct-to-Consumer Wearable Smart Devices to Detect Atrial Fibrillation: BASEL Wearable Study. JACC: Clinical Electrophysiology. 2023;9(2):232–42. DOI: 10.1016/j.jacep.2022.09.011
30. Frost L, Vestergaard P, Mosekilde L. Hyperthyroidism and Risk of Atrial Fibrillation or Flutter: A Population-Based Study. Archives of Internal Medicine. 2004;164(15):1675–8. DOI: 10.1001/archinte.164.15.1675
31. Mont L, Elosua R, Brugada J. Endurance sport practice as a risk factor for atrial fibrillation and atrial flutter. Europace. 2008;11(1):11–7. DOI: 10.1093/europace/eun289

ISSN 0022-9040. Кардиология. 2025;65(11). DOI: 10.18087/cardio.2025.11.n2946