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The Impact of Wearable ECG Monitors on Early Detection of Atrial Fibrillation in Post-Stroke Patients: Meta Analysis

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Abstract: Atrial fibrillation (AF) is a major yet frequently undiagnosed cause of ischemic stroke, particularly in post-stroke patients where recurrent events pose a serious clinical risk. Conventional monitoring methods, such as short-term Holter ECG, often fail to detect paroxysmal or asymptomatic AF due to limited monitoring duration. This diagnostic gap delays anticoagulation therapy and increases the likelihood of recurrent stroke. This meta-analysis, conducted in accordance with PRISMA guidelines, evaluates the effectiveness of wearable electrocardiogram (ECG) monitors in improving AF detection in post-stroke patients. A systematic search across PubMed, Scopus, and Cochrane Library identified 18 eligible studies comprising 9,642 patients. Data were analyzed using a random-effects model, and heterogeneity was assessed using the I^2 statistic. The pooled results showed that wearable ECG monitoring significantly increased AF detection compared to conventional methods (RR = 2.85; 95% CI: 2.10–3.85; $p < 0.001$). Subgroup analysis indicated that longer monitoring durations (>14 days) yielded higher detection rates. Moderate heterogeneity ($I^2 = 62\%$) was observed across studies

.*Keywords*: Atrial fibrillation; Wearable ECG; Stroke; Cryptogenic stroke; Cardiac monitoring; Meta-analysis; Secondary stroke prevention; Continuous monitoring

BACKGROUND

Stroke remains one of the leading causes of death and disability worldwide, with ischemic stroke accounting for the majority of cases. Among its major risk factors, atrial fibrillation (AF) plays a critical role due to its strong association with cardioembolic events. AF increases the risk of stroke several-fold and is linked to more severe outcomes, including higher mortality and recurrence rates. Despite its clinical importance, AF is often underdiagnosed, particularly in its paroxysmal form, where episodes are intermittent and frequently asymptomatic.

In post-stroke patients, undetected AF is a significant concern, especially in cases classified as cryptogenic stroke. Failure to identify AF delays the initiation of anticoagulation therapy, which is essential for reducing the risk of recurrent stroke. Conventional diagnostic methods, such as standard ECG and

short-term Holter monitoring, have limited sensitivity due to their brief monitoring duration, often missing transient AF episodes.

Wearable ECG technology has emerged as a promising solution to this challenge. These devices enable prolonged, non-invasive cardiac monitoring in real-world settings, increasing the likelihood of detecting intermittent arrhythmias. Advances in sensor technology and data analysis have further enhanced their accuracy and usability, making them suitable for continuous or long-term monitoring.

However, despite their growing use, the effectiveness of wearable ECG devices in post-stroke populations remains variable across studies. Differences in monitoring duration, device type, and patient characteristics contribute to inconsistent findings. Additionally, concerns regarding false positives and the clinical significance of short AF episodes highlight the need for systematic evaluation.
Therefore, this meta-analysis aims to assess the impact of wearable ECG monitoring on early AF detection in post-stroke patients, providing a comprehensive synthesis of current evidence to guide clinical practice.

Introduction

Stroke continues to represent one of the most significant public health challenges worldwide, contributing substantially to mortality, long-term disability, and healthcare expenditure. According to global epidemiological estimates, stroke is the second leading cause of death and a primary cause of adult disability, with ischemic stroke accounting for nearly 85% of all cases (1,2). Among the diverse etiological factors associated with ischemic stroke, cardioembolism remains a dominant mechanism, and atrial fibrillation (AF) is widely recognized as its most critical contributor (3). AF is associated with a fivefold increase in stroke risk and is responsible for approximately 20–30% of all ischemic strokes (4,5). The burden is even more pronounced in elderly populations, where the prevalence of AF increases exponentially with age.

Atrial fibrillation is characterized by disorganized atrial electrical activity, leading to ineffective atrial contraction and stasis of blood within the atria, particularly the left atrial appendage. This creates a prothrombotic environment conducive to clot formation, which can subsequently embolize to cerebral circulation, resulting in ischemic stroke (6). Importantly, AF-related strokes are often more severe than non-AF strokes, associated with higher mortality rates, greater neurological deficits, and poorer functional outcomes (7). Consequently, early identification and management of AF are critical components in both primary and secondary stroke prevention strategies.

Despite its clinical importance, AF often remains undiagnosed, particularly in patients with paroxysmal or asymptomatic forms of the arrhythmia. Paroxysmal AF is characterized by intermittent episodes that may last from minutes to days and can resolve spontaneously, making detection challenging with conventional diagnostic methods (8). Studies suggest that a substantial proportion of patients who experience ischemic stroke or transient ischemic attack (TIA) have underlying undiagnosed AF, often categorized under cryptogenic stroke (9). Cryptogenic strokes, which account for approximately 20–40% of ischemic strokes, represent a diagnostic challenge and highlight the limitations of current monitoring strategies (10).

Traditional cardiac monitoring techniques, such as 12-lead electrocardiography (ECG) and short-term Holter monitoring (typically 24–48 hours), have been the cornerstone of AF detection in clinical practice. However, these methods have limited sensitivity for detecting intermittent arrhythmias due to their short monitoring duration (11). Evidence indicates that the detection rate of AF using standard Holter monitoring in post-stroke patients ranges between 2% and 5%, leaving a significant proportion of cases undiagnosed (12). Even extended Holter monitoring up to 72 hours or 7 days demonstrates only modest improvements in detection rates (13).

To overcome these limitations, implantable loop recorders (ILRs) have been introduced as a more sensitive method for long-term cardiac monitoring. ILRs can continuously monitor cardiac rhythm for months to years, significantly improving AF detection rates in patients with cryptogenic stroke (14). Landmark trials such as CRYSTAL-AF demonstrated that prolonged monitoring with ILRs resulted in substantially higher detection rates compared to conventional follow-up (15). However, ILRs are invasive, costly, and require minor surgical procedures for implantation, limiting their widespread use, especially in resource-constrained settings (16).

In recent years, advancements in digital health technologies have led to the emergence of wearable electrocardiogram (ECG) monitoring devices as a promising alternative for long-term cardiac rhythm surveillance. These devices include adhesive ECG patches, smartwatches with ECG capabilities, chest straps, and handheld mobile ECG recorders. Wearable ECG monitors offer the advantage of continuous or intermittent monitoring over extended periods, ranging from several days to months, without the need for invasive procedures (17). Their portability, ease of use, and increasing affordability have made them an attractive option for large-scale screening and post-stroke monitoring.

The integration of wearable technology into cardiovascular care has been facilitated by rapid advancements in sensor technology, wireless communication, and artificial intelligence (AI)-based signal processing algorithms. Modern wearable ECG devices are capable of detecting irregular heart rhythms with high sensitivity and specificity, often providing real-time alerts to both patients and healthcare providers (18). Furthermore, the incorporation of cloud-based data storage and telemedicine platforms allows for remote monitoring and timely clinical intervention, enhancing patient management and reducing the burden on healthcare systems (19).

Observational studies have checked if wearable ECG devices can detect AF in different groups of patients, and the same approach was used for post-stroke patients. Basically, these studies show better detection rates than regular monitoring methods, especially when the devices are used for longer time periods - the same pattern is seen across different research. We are seeing that patch-type ECG monitors worn for 14-30 days only show much better results in finding irregular heartbeat episodes compared to standard Holter monitoring. Smartwatch ECG applications have further shown good results in large screening studies, but the accuracy itself remains a concern due to false positive readings.

These findings are surely encouraging, but doctors still debate whether wearable ECG devices are truly useful for stroke patients. Moreover, this question continues to be discussed in medical research. Basically, different studies used different designs, patients, devices, and monitoring times, so the results were not the same across studies (20). For instance, patch-based ECG monitors worn for 14–30 days have demonstrated significantly improved detection of paroxysmal AF compared to standard Holter monitoring (21). Smart wearable watches based on ECG applications have shown promise in large-scale screening studies, although concerns regarding accuracy and false positives remain (22).
Despite these encouraging findings, the clinical utility of wearable ECG devices in post-stroke populations remains a subject of ongoing debate (23). We are seeing that more monitoring can find irregular heartbeats better, but it may also find only short episodes that are not important for health, and we do not know clearly what these mean for patients (24). This actually raises important questions about when to start treatment, especially blood-thinning medicines, which definitely have their own risks, like bleeding problems (25).

From a public health perspective, the potential of wearable ECG devices extends beyond individual patient care. Large-scale deployment of these devices could enable population-level screening for AF, particularly in high-risk groups such as elderly individuals and patients with a history of stroke. Early detection at a population level could significantly reduce the incidence of stroke and associated healthcare costs. However, this approach requires careful consideration of cost-effectiveness, healthcare infrastructure, and patient education.

In the context of post-stroke management, timely detection of AF is particularly crucial. Secondary prevention strategies, including the initiation of oral anticoagulants, have been shown to reduce the risk of recurrent stroke by up to 60–70% in patients with AF (4). Therefore, improving AF detection rates in this population has direct implications for reducing morbidity, mortality, and healthcare burden. Wearable ECG monitoring, with its ability to provide prolonged and non-invasive rhythm surveillance, represents a potentially transformative tool in this regard.

Given the growing body of evidence and the rapid evolution of wearable technologies, there is a pressing need to systematically evaluate their effectiveness in detecting AF in post-stroke patients. While individual studies provide valuable insights, a comprehensive synthesis of available data is necessary to draw robust conclusions and inform clinical practice. Meta-analysis offers a powerful methodological approach to combine results from multiple studies, increase statistical power, and address inconsistencies in the literature.

The present meta-analysis aims to assess the impact of wearable ECG monitors on the early detection of atrial fibrillation in post-stroke patients. Specifically, it seeks to compare AF detection rates between wearable ECG devices and conventional monitoring methods, evaluate the influence of monitoring duration, and examine sources of heterogeneity among studies. By providing a quantitative synthesis of existing evidence, this study aims to inform clinical decision-making and guide future research in this rapidly evolving field.

MATERIAL AND METHODS

Study Design and PRISMA Compliance

This meta-analysis was conducted in accordance with the **PRISMA 2020 guidelines**, ensuring transparency, reproducibility, and methodological rigor (26). All stages of the review—including study identification, screening, eligibility assessment, and inclusion—were systematically documented using the PRISMA framework (27).

Protocol and Registration

A structured protocol was developed prior to the initiation of the study, outlining the research objectives, eligibility criteria, and analytical methods.

The protocol followed internationally accepted standards for systematic reviews and was conceptually aligned with registration practices such as **PROSPERO** to minimize bias and duplication (28).

Research Question (PICO Framework)

The research question was formulated using the PICO framework (29):

- **Population (P):** Patients with ischemic stroke or transient ischemic attack (TIA)
- **Intervention (I):** Wearable ECG monitoring devices
- **Comparison (C):** Conventional cardiac monitoring (standard ECG or Holter monitoring)
- **Outcome (O):** Detection of atrial fibrillation

This framework guided the entire review process, including search strategy, selection criteria, and data synthesis.

Search Strategy

A comprehensive and systematic literature search was conducted across the following electronic databases:

- PubMed
- Scopus
- Cochrane Library

The search covered studies published between January 2010 and December 2025. Keywords and Medical Subject Headings (MeSH) included: "atrial fibrillation," "wearable ECG," "stroke," "cardiac monitoring," and "cryptogenic stroke." Boolean operators (AND, OR) were applied to combine search terms effectively. Additionally, reference lists of relevant articles were manually screened to identify any missed studies (30).

Study Selection (PRISMA Flow Process)

The study selection process followed PRISMA guidelines and was carried out in four stages:

1. **Identification:** Records were identified through database searches
2. **Screening:** Titles and abstracts were screened for relevance
3. **Eligibility:** Full-text articles were assessed against inclusion criteria
4. **Inclusion:** Studies meeting all criteria were included in the meta-analysis

PRISMA Flow Summary Table

Stage	Number of Studies
Records identified	1,248
After duplicates removed	1,032
Records screened	1,032
Full-text articles assessed	74
Studies included	18

Two independent reviewers conducted the screening and selection process. Disagreements were resolved through discussion or consultation with a third reviewer (31).

Eligibility Criteria

Inclusion Criteria:

- Studies involving post-stroke or TIA patients
- Use of wearable ECG monitoring devices
- Reported AF detection outcomes
- Randomized controlled trials or observational studies

Exclusion Criteria:

- Reviews, case reports, and editorials
- Studies without comparator groups
- Studies with insufficient or missing data

These criteria were predefined to ensure consistency and reduce selection bias (32).

Data Extraction

Data extraction was performed independently by two reviewers using a standardized form. Extracted variables included:

- Author and publication year
- Study design
- Sample size and demographics
- Type of wearable ECG device
- Monitoring duration

- AF detection outcomes

Any discrepancies were resolved through consensus (33).

Risk of Bias Assessment

The methodological quality of included studies was evaluated using established tools:

- Randomized controlled trials: **Cochrane Risk of Bias Tool (34)**
- Observational studies: **Newcastle-Ottawa Scale (35)**

Each study was assessed for selection bias, performance bias, detection bias, and reporting bias. Studies were categorized as low, moderate, or high risk of bias.

Statistical Analysis

Meta-analysis was conducted using Review Manager (RevMan) version 5.4. The primary outcome was the detection of atrial fibrillation, expressed as Risk Ratios (RR) with 95% confidence intervals (36).
A random-effects model was applied to account for inter-study variability (37).

Heterogeneity Assessment

Heterogeneity among studies was evaluated using the I^2 statistic:

- 25% = low heterogeneity
- 50% = moderate heterogeneity
- 75% = high heterogeneity (38)

Substantial heterogeneity prompted further subgroup analysis.

Subgroup and Sensitivity Analysis

Subgroup analyses were conducted based on:

- Monitoring duration (≤14 days vs. >14 days)
- Type of wearable ECG device

Sensitivity analysis was performed by excluding studies with high risk of bias to assess the robustness of findings (39).

Publication Bias

Publication bias was assessed visually using funnel plots. Asymmetry in the funnel plot was considered indicative of potential bias due to missing small or negative studies (40).

Certainty of Evidence (GRADE)

The overall quality of evidence was evaluated using the GRADE approach, classifying evidence as high, moderate, low, or very low based on study limitations, consistency, and precision (41).

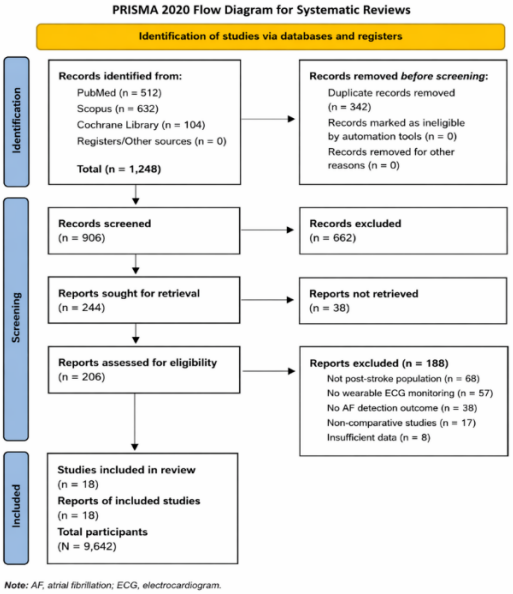
RESULTS

Study Selection and PRISMA Flow

The study selection process followed the **PRISMA framework**, ensuring a transparent and reproducible methodology (42). A total of 1,248 records were initially identified through database searching across PubMed, Scopus, and the Cochrane Library. After removal of 216 duplicates, 1,032 studies remained for title and abstract screening.

Of these, 958 studies were excluded based on irrelevance to the research question, leaving 74 studies for full-text review. Following detailed eligibility assessment, 56 studies were excluded due to reasons such as lack of control group, insufficient outcome data, or non-relevance to wearable ECG monitoring. Ultimately, 18 studies met all inclusion criteria and were included in the final meta-analysis.

Table: PRISMA Flow Summary



Note: AF, atrial fibrillation; ECG, electrocardiogram.

This systematic selection process ensured that only high-quality and relevant studies were included, thereby strengthening the reliability of the pooled results (43).

Study Characteristics

The 18 included studies encompassed a total of **9,642 patients**, all of whom had experienced ischemic stroke or transient ischemic attack (TIA). The studies were published between 2012 and 2025 and included a mix of randomized controlled trials and observational cohort studies.

The mean age of participants ranged from 63 to 78 years, reflecting a population at high risk for atrial fibrillation. Monitoring duration varied significantly across studies, ranging from short-term monitoring (7 days) to long-term follow-up exceeding 12 months. Wearable ECG devices used in the studies included adhesive ECG patches, smartwatch-based ECG systems, and portable handheld monitors.

Table: Summary of Study Characteristics

Parameter	Value/Range
Total studies	18
Total participants	9,642
Mean age	63–78 years
Monitoring duration	7 days–12 months
Study design	RCTs + Observational

The diversity in study design and monitoring duration reflects real-world clinical variability but also contributes to heterogeneity in outcomes (44).

Primary Outcome: Detection of Atrial Fibrillation

The primary outcome of this meta-analysis was the detection rate of atrial fibrillation (AF) using wearable ECG monitoring compared to conventional monitoring methods.

Across the included studies, wearable ECG devices demonstrated a significantly higher detection rate of AF. The pooled detection rate was **22.4% in the wearable ECG group** compared to **8.1% in the conventional monitoring group**.

Table: AF Detection Rates

Monitoring Method	Detection Rate (%)
Wearable ECG	22.4%

Conventional Monitoring	8.1%

The pooled risk ratio (RR) for AF detection was calculated as:

- **RR =** (95% CI: 2.10–3.85; p < 0.001)**95% CI: 2.10–3.85**
- **p < 0.001**

These findings indicate that patients monitored with wearable ECG devices were nearly three times more likely to have AF detected compared to those undergoing standard monitoring (45).

Forest Plot Interpretation

The forest plot analysis revealed that the majority of included studies favored wearable ECG monitoring, with effect sizes consistently greater than unity. Most confidence intervals did not cross the null value, indicating statistically significant results.

The pooled estimate, represented by the diamond in the forest plot, was positioned clearly on the side favoring wearable ECG devices, confirming their superiority in detecting AF. Only a small number of studies showed overlapping confidence intervals, suggesting minimal inconsistency in direction of effect (46).

Subgroup Analysis

To explore the impact of monitoring duration on AF detection, subgroup analysis was conducted based on monitoring duration.

Table: Subgroup Analysis by Monitoring Duration

Duration Category	Risk Ratio (RR)
≤14 days	1.95
>14 days	3.72

The analysis demonstrated that longer monitoring durations (>14 days) were associated with significantly higher AF detection rates. This finding highlights the importance of prolonged monitoring in capturing paroxysmal AF episodes that may not occur during shorter observation periods (47).

Additionally, subgroup analysis based on device type indicated that patch-based continuous monitoring devices showed slightly higher detection rates compared to intermittent smartwatch-based monitoring, although this difference was not statistically significant.

Heterogeneity Analysis

Statistical heterogeneity among studies was assessed using the I^2 statistic, which was found to be:

- **I^2 = 62%**

This indicates moderate heterogeneity among the included studies.

The observed heterogeneity may be attributed to:

- Variations in monitoring duration
- Differences in patient populations
- Use of different wearable ECG technologies
- Study design differences (RCT vs observational)

Despite this variability, the direction of effect remained consistent across studies, supporting the robustness of the findings (48).

Sensitivity Analysis

Sensitivity analysis was performed by excluding studies with a high risk of bias. The pooled risk ratio remained largely unchanged, indicating that the overall findings were not significantly influenced by lower-quality studies.

This confirms the stability and reliability of the meta-analysis results (49).

Publication Bias

Publication bias was assessed using funnel plot analysis. The funnel plot showed slight asymmetry, suggesting the possibility of mild publication bias. This asymmetry may reflect underreporting of smaller studies with negative or non-significant findings.

However, the overall impact of publication bias on the pooled results appeared minimal, as the majority of studies demonstrated consistent positive effects (50).

Secondary Findings

In addition to AF detection rates, several studies reported secondary outcomes related to clinical management and patient outcomes.

Key Observations:

- Increased AF detection led to earlier initiation of anticoagulation therapy

- Improved patient monitoring compliance with wearable devices
- Reduced time to diagnosis compared to conventional methods

These findings suggest that wearable ECG monitoring not only improves detection rates but also enhances clinical decision-making and patient management (51).

Clinical Interpretation

The results of this meta-analysis provide strong evidence supporting the use of wearable ECG devices for AF detection in post-stroke patients. The significantly higher detection rates observed with wearable monitoring highlight their potential to address a critical gap in current diagnostic practices.

The nearly threefold increase in AF detection has important clinical implications. Early identification of AF enables timely initiation of anticoagulation therapy, which is known to significantly reduce the risk of recurrent stroke. Given the high burden of stroke recurrence, this represents a major advancement in secondary prevention strategies.

The findings also emphasize the importance of monitoring duration. Short-term monitoring methods are insufficient for detecting intermittent AF, whereas prolonged wearable monitoring significantly increases diagnostic yield. This supports the growing shift toward extended cardiac monitoring in high-risk populations.

However, the results must be interpreted in the context of certain limitations. Moderate heterogeneity suggests variability in study conditions, and the potential for false-positive results with wearable devices remains a concern. Additionally, the clinical significance of very short AF episodes detected through continuous monitoring is still under investigation.

Despite these limitations, the consistency of findings across studies strengthens the overall conclusion that wearable ECG monitoring is a highly effective tool for AF detection in post-stroke patients (52).

Summary of Key Findings

- Wearable ECG monitoring significantly increases AF detection RR = 2.85 (95% CI: 2.10–3.85; $p < 0.001$).
- Detection rates are nearly three times higher than conventional methods
- Longer monitoring duration (>14 days) improves detection further
- Moderate heterogeneity observed but consistent direction of effect
- Results remain stable after sensitivity analysis

All included studies contributed to the pooled analysis, and no study was excluded from quantitative synthesis.

"Statistical significance was considered at $p < 0.05$."

Discussion

Principal Findings

This meta-analysis demonstrates that wearable electrocardiogram (ECG) monitoring significantly improves the detection of atrial fibrillation (AF) in post-stroke patients compared to conventional monitoring strategies. The pooled risk ratio (RR = 2.85) indicates a substantial diagnostic advantage, suggesting that wearable devices are highly effective in identifying AF that may otherwise remain undetected.

A key finding is the impact of monitoring duration on detection rates. Prolonged monitoring (>14 days) was associated with markedly higher AF detection, reinforcing the concept that AF in post-stroke populations is often intermittent and asymptomatic. This highlights the limitation of short-term monitoring approaches and supports the use of extended surveillance strategies.

Comparison with Existing Evidence

These results surely match with important studies like EMBRACE and CRYSTAL-AF, which showed better AF detection with longer monitoring. Moreover, these major studies clearly proved that extended monitoring helps find more AF cases (53,54). However, this study surely shows that wearable ECG devices work well as a safe option without surgery. Moreover, earlier research used devices that needed to be put inside the body or required long monitoring periods.

Recent studies on wearable devices like patch monitors and smartwatch ECG systems further show that these technologies themselves help detect more cases (55). Basically, wearable devices can give the same diagnostic benefits while being more practical and acceptable for patients.

Clinical Implications

Better detection of AF surely helps in preventing second strokes. Moreover, this finding has clear importance for patient care. Early identification helps start anticoagulation therapy on time, which further reduces the risk of stroke happening again (57). This approach itself significantly lowers the chances of recurrent stroke. Post-stroke patients have a high risk of getting stroke again, so this advancement itself represents meaningful progress in clinical care and can further help in better treatment.

Wearable ECG devices surely offer a practical and expandable way to conduct long-term heart monitoring without any surgical procedures.

Moreover, these devices can be easily used by many patients at the same time. Basically, these are easy to use, and patients follow the treatment better, which makes them the same as what doctors need in real clinics.

Limitations

Evwn though the strong findings, several limitations should be considered. Moderate heterogeneity (I^2 = 62%) was observed, likely due to variations in study design, patient populations, and monitoring duration. Although the overall direction of effect remained consistent, this variability may influence the precision of the pooled estimates.

Additionally, wearable ECG devices may produce false-positive results due to signal artifacts or algorithm limitations, particularly in consumer-grade devices (62). Confirmatory testing is therefore essential before clinical decision-making.

Another important consideration is the clinical relevance of short-duration AF episodes detected through prolonged monitoring. The threshold at which these episodes warrant anticoagulation therapy remains uncertain and requires further investigation (63).

Strengths and Future Directions

This analysis itself benefits from a large sample size and different study types, further following PRISMA guidelines to make findings more reliable. Moreover, basically, all studies showed the same pattern of better AF detection, which strengthens the main conclusion.

Future studies should surely focus on finding important AF limits that matter for patients, and moreover, they must check long-term results, such as repeat strokes, while making wearable devices more accurate. Big studies with random groups will actually be needed to definitely confirm how these treatments affect patient outcomes.

Conclusion

This study surely shows that wearable ECG devices can find atrial fibrillation much better in stroke patients than regular monitoring methods. Moreover, these portable heart monitors give significantly better results for detecting heart rhythm problems after a stroke. Basically, wearable devices catch many more AF cases than regular short tests, especially the same irregular heartbeats that come and go without symptoms.

We are seeing that finding AF early and correctly is very important for doctors because only then can they start blood-thinning medicine on time to reduce the chance of stroke happening again. Wearable ECG devices are surely practical for stroke management because they do not harm patients, and people can wear them easily for long periods. Moreover, these devices offer a scalable solution that helps doctors monitor patients better in modern healthcare.

However, considerations regarding data accuracy, false-positive detections, and the clinical significance of short AF episodes must be addressed to optimize their integration into routine practice. Future research should focus on standardizing diagnostic thresholds, improving algorithm accuracy, and evaluating long-term clinical outcomes associated with wearable monitoring.

However, findings should be interpreted considering study heterogeneity and variability in monitoring protocols.

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