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Ischemic Stroke in Atrial Fibrillation: Detection by ECG at Admission versus Prolonged Monitoring

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Abstract

Introduction: Atrial fibrillation (AF) is a major risk factor for ischemic stroke (IS). Its diagnosis can be challenging, particularly for paroxysmal forms. This study aims to compare the clinical and prognostic characteristics of IS due to AF detected by an admission ECG versus those detected by prolonged ECG monitoring (Holter ECG). **Methods:** A retrospective observational study was conducted at CHU Ibn Rochd in Casablanca between January 2023 and May 2024. We included cardioembolic IS with newly diagnosed AF, divided into two groups: AF detected by ECG at admission (Group A) and AF detected by 24 h - 72 h Holter ECG (Group B). Demographic, clinical, and radiological data were collected and analyzed. **Results:** Among 66 patients with cardioembolic IS, 50 (75.8%) had AF. The mean age was 68.5 years. AF was detected by standard ECG in 76% of cases and by Holter ECG in 24%. Paroxysmal AF accounted for 84% of cases. The median NIHSS score at admission was 7.5. In 69.7% of cases, the stroke involved the carotid territory. There was no significant difference in stroke severity or functional outcome between Groups A and B. The stroke recurrence rate was 2.9%. **Conclusion:** The high prevalence of newly diagnosed AF (75.8%) highlights the importance of systematic screening. The absence of a significant difference between Groups A and B in terms of severity and functional outcomes is intriguing and warrants further long-term follow-up studies.

Keywords

Ischemic Stroke, Atrial Fibrillation, Electrocardiogram, Holter ECG, Monitoring, Prognosis

1. Introduction

Atrial fibrillation (AF) is the most common cardiac arrhythmia, affecting approx-

imately 1% - 2% of the general population, with an increasing prevalence with age [1]. AF is a risk factor which is known to increase the incidence of ischemic stroke (IS) fivefold [2]. Diagnosing AF can be challenging, particularly in its paroxysmal form. Standard electrocardiogram (ECG) at admission is a first-line diagnostic tool that is widely available and cost-effective. However, its sensitivity for detecting AF is limited, especially in non-permanent AF, necessitating prolonged ECG monitoring methods such as continuous cardiac monitoring during hospitalization, 24 - 72-hour Holter ECG, or implantable event recorders [3]-[5]. Many studies illustrated that these tools can significantly increase AF detection rates, especially for initiating anticoagulation therapy [6].

The purpose of this study is to compare the clinical features and results of IS linked to AF identified by ECG at admission with those identified by long-term monitoring. We speculate that patients whose AF is discovered through extended monitoring might have different clinical and prognostic characteristics from those whose AF is identified right away at admission, which could have an impact on risk assessment and treatment choices.

2. Materials and Methods

2.1. Study Population

The Neurology Department at CHU IBN ROCHD in Casablanca was the site of this retrospective observational study. It included patients who had a cardioembolic IS with newly diagnosed AF at admission or during follow-up and were monitored in post-stroke consultations from January 2023 to May 2024. If an AF diagnosis was made using either standard ECG monitoring or prolonged ECG monitoring at the time of the cerebrovascular event, the patient was included. Cases with missing clinical or radiological data, AF unrelated to a cerebrovascular event, and unknown AF detection techniques were among the exclusion criteria.

2.2. Study Protocol

Patients were divided into two groups: Group A (AF diagnosed by ECG at admission) and Group B (AF diagnosed by prolonged ECG monitoring). For Group B, prolonged monitoring was performed using a 24 - 72-hour Holter ECG within 30 days of admission.

The following data were collected for each patient:

- Demographics: Age, sex.
- Cardiovascular risk factors: Hypertension, diabetes, dyslipidemia, obstructive sleep apnea syndrome, smoking, etc.
- Stroke severity and outcome: NIH Stroke Scale (NIHSS) at admission, affected vascular territory (determined by imaging), short-term complications (hemorrhagic transformation), modified Rankin Scale (mRS) at 1 and 3 months, and stroke recurrence.

2.3. Statistical Analysis

Statistical analysis was performed using Jamovi 2.3.21 software. Continuous vari-

ables were expressed as medians (minimum and maximum), while categorical variables were expressed as frequencies and percentages. Comparisons between the two groups were made using the chi-square test or Fisher's exact test for categorical variables.

3. Results

Among 66 patients with cardioembolic IS, 50 (75.8%) had newly diagnosed AF, while 16 (24.4%) had other cardiac causes such as a patent foramen ovale. The mean age was 68.5 years (range: 28 - 90), with a slight female predominance (60%, sex ratio: 0.93).

AF was detected via standard ECG in 76% of cases and via Holter ECG in 24% (Figure 1). Demographics, cardiovascular risk factors, and medical history are detailed in Table 1.

The median NIHSS score at admission was 7.5 (range: 0 - 24), with 53% of strokes classified as severe (NIHSS > 15) (Figure 2). The most frequently reported symptoms were headaches (35.4%), palpitations (18.2%), and altered consciousness (9.2%). Notably, 92% of patients were autonomous with normal cognitive function before the stroke.

Table 1. Demographic characteristics and medical history.

		All Patients	ECG-Detected AF	Holter-Detected AF
		(N = 50)	(N = 38)	(N = 12)
Age, median (min: max)		68.5 (37:90)	70 (37:90)	75 (65:90)
Sex (n, %)	F	30 (60%)	20 (40%)	10 (20%)
	M	20 (40%)	18 (36%)	2 (4%)
Hypertension		35 (70%)	27 (54%)	8 (16%)
Diabetes		15 (30%)	9 (18%)	6 (12%)
Dyslipidemia		11 (22%)	5 (10%)	6 (12%)
obstructive sleep apnea syndrome		15 (20%)	10 (20%)	5 (10%)
Smoking		7 (12%)	6 (12%)	1 (2%)
Alcohol		3 (6%)	3 (6%)	0 (0%)
Sédentarité		7 (14%)	5 (10%)	2 (4%)
Menopause		22 (44%)	14 (28%)	8 (16%)
Migraine		1 (2%)	1 (2%)	0 (0%)
Anterior TIA and IS		12 (24%)	9 (18%)	3 (6%)
thrombo-embolic events		5 (6%)	4 (4%)	1 (2%)

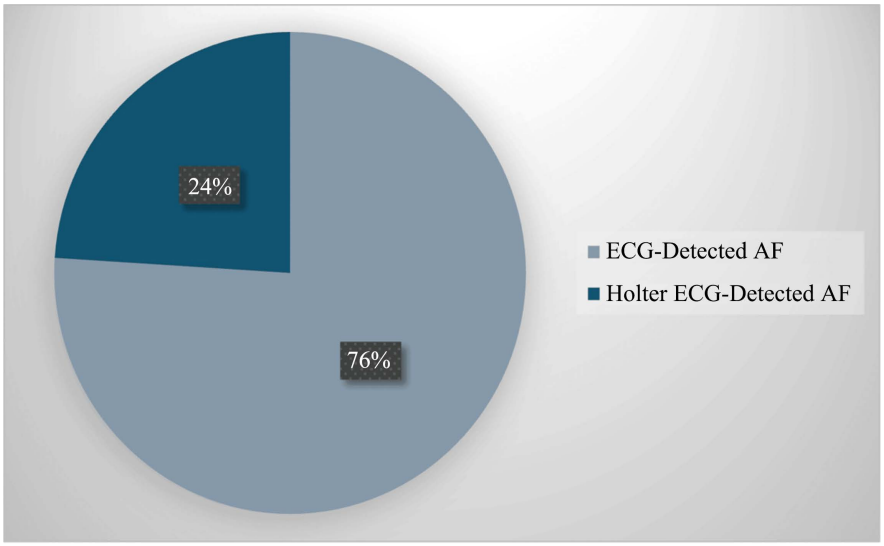

Figure 1. Distribution of patients based on AF detection method.

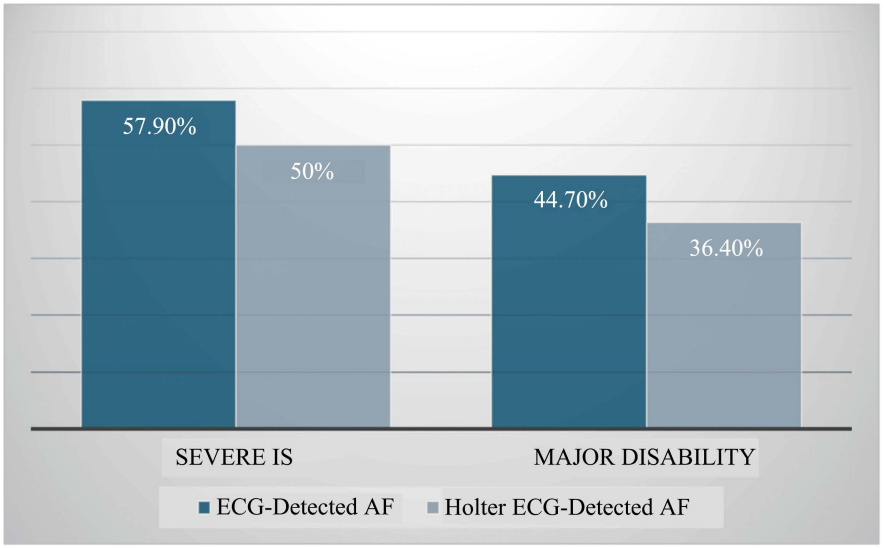

Figure 2. Clinical and functional severity between the two study groups.

Stroke predominantly affected the carotid territory (69.7%), particularly the middle cerebral artery (MCA): superficial (42.4%), deep (9.1%), and total (16.7%). Vertebrobasilar territory strokes accounted for 16.7% of cases, and 16.6% of patients had multi-territorial involvement. Hemorrhagic transformation occurred in 22.7% of cases, and a proximal thrombus was detected in 28.8% of patients.

Regarding AF characteristics, 84% were paroxysmal and 14% were permanent. Among evaluated cases, 66.7% had valvular AF, and 96.2% had atrial cardiomyopathy. A quarter of patients received intravenous thrombolysis, and 77.3% were placed on anticoagulation therapy.

At one month, 60% of patients had an mRS score ≥ 3, and 24% achieved good functional recovery at six months (mRS 0 - 2). The overall stroke recurrence rate was 2.9% (**Figure 2**).

No significant differences were observed between groups in terms of stroke severity (57.9% in the ECG group vs. 50% in the Holter group; p = 0.631) or functional outcomes (mRS > 3 at one month: 44.7% in the ECG group vs. 36.4% in the Holter group; p = 0.882).

4. Discussion

In one hand, the high prevalence of newly diagnosed AF (75.8%) in our study is striking. This rate is higher than that reported by Sposato *et al.* (23.7%), likely due to systematic screening and the use of prolonged monitoring [6].

In the other hand, the high proportion of paroxysmal AF (84%) aligns with previous literature. Sanna *et al.* demonstrated that implantable cardiac monitors increased AF detection after cryptogenic stroke (30% vs. 3%) [7]. Our findings reinforce the need for extended cardiac monitoring beyond the acute stroke phase, particularly in patients with suggestive radiological patterns and advanced age.

Interestingly, the absence of significant differences in stroke severity or functional outcomes between groups suggests that the timing of AF detection may not directly influence immediate prognosis. However, prior studies indicate that AF diagnosed post-stroke may be associated with better long-term outcomes compared to known AF or AF detected on standard ECG, which is often linked to significant cardiovascular complications [8] [9].

The hemorrhagic transformation rate (22.7%) highlights the challenges of anticoagulation management in this population. This rate is slightly higher than that reported by Paciaroni *et al.* (19.5%) [10], possibly due to differences in anticoagulation protocols or patient characteristics, emphasizing the need for individualized anticoagulation strategies considering hemorrhagic risk.

Moreover, the stroke recurrence rate of 2.9% in our study, although relatively low, aligns with the findings of Friedman *et al.* [11], who demonstrated that the risk of stroke recurrence in patients with AF detected after a stroke appears to be 26% lower compared to those with previously known AF. This underscores the importance of adequate secondary prevention, particularly through effective anticoagulation and regular follow-up to prevent recurrences. Additionally, optimizing secondary prevention strategies-potentially by combining anticoagulation with other approaches, such as strict control of cardiovascular risk factors known to be associated with AF-remains crucial [9] [12].

Finally, our study has several limitations that should be acknowledged. First, the relatively small sample size may reduce the statistical power to detect certain differences between groups. Second, the follow-up period was relatively short, which could underestimate the actual stroke recurrence rate and limit our ability to assess long-term effects.

5. Conclusion

This study highlights the importance of systematic and prolonged AF screening in patients with ischemic stroke. While no significant differences were observed

in short-term outcomes between patients diagnosed via standard ECG versus Holter ECG, our findings underscore the complexity of AF-related stroke and the need for further studies to elucidate its impact on functional and survival prognosis.

Human Subjects

All authors have confirmed that this study did not involve human participants or tissue.

Animal Subjects

All authors have confirmed that this study did not involve animal subjects or tissue.

Financial Relationships

All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work.

Other Relationships

All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

Conflicts of Interest

In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work.

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