International Journal of Medicine
pISSN 1468-3814 | eISSN 2667-7008
https://theinternationalmedicine.com/

Original Researcher Article *DOI: 10.61336/im/26-11-31*

A Prospective Study On Proportion Of Atrial Fibrillation In Patients With Acute Ischemic Stroke And Its Effect On Outcome During Hospital Stay In A Tertiary Care Centre.

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Received: 13-10-2026
Revised: 29-10-2026
Accepted: 10-11-2026
Published: 14-11-2026

Abstract

Background: Atrial fibrillation (AF) is an important cause of acute ischemic stroke (AIS) and is associated with increased stroke severity, disability, and mortality. However, data on the proportion of AF, its subtypes, and their impact on early stroke outcomes in the Indian population remain limited. The objective is to determine the proportion of atrial fibrillation among patients with acute ischemic stroke and evaluate its association with in-hospital outcomes. ***Methods:*** A prospective observational study was conducted among 150 consecutive patients with AIS admitted in the department of general medicine at MGM Medical College and M.Y.H. Indore. Demographic characteristics, vascular risk factors, clinical profile, AF subtype, laboratory parameters, treatment details, and in-hospital outcomes were recorded. Stroke severity was assessed using the National Institutes of Health Stroke Scale (NIHSS), while functional outcome was evaluated using the modified Rankin Scale (mRS). Data analysis was performed using SPSS software 27.0. ***Results:*** AF was identified in 17 (11.3%) patients, with permanent AF being more common than paroxysmal AF. Hypertension and dyslipidaemia were the most prevalent comorbidities. Patients with permanent AF had significantly more severe strokes and poorer functional outcomes than those with paroxysmal AF. Approximately 90% of patients with AF were not receiving anticoagulant therapy before stroke onset. On multivariable logistic regression, admission NIHSS score was the only independent predictor of in-hospital mortality, whereas AF and age were not independently associated with mortality after adjustment for stroke severity and other clinical variables. ***Conclusions:*** The study demonstrates that AF is present in approximately one in nine patients with acute ischemic stroke. Permanent AF is associated with greater stroke severity and poorer functional outcomes, whereas admission NIHSS score remains the strongest independent predictor of in-hospital mortality. These findings underscore the importance of early AF detection, optimization of anticoagulation therapy, and prompt neurological assessment to improve outcomes in patients with acute ischemic stroke.

Keywords: Acute ischemic stroke, Atrial fibrillation, National Institutes of Health Stroke Scale (NIHSS), Modified Rankin Scale (mRS), Anticoagulation.

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INTRODUCTION

Stroke, also known as a cerebrovascular accident, is characterized by the sudden onset of neurological deficits caused by a focal vascular issue. The diagnosis is primarily clinical, with laboratory tests and brain imaging used to confirm and support the diagnosis.1 Rising stroke trends are linked to increasing life expectancy, unhealthy dietary changes, and a growing prevalence of risk factors like hypertension, obesity, and diabetes.2

The GBD 2021 study confirms stroke as the second leading cause of death (~7 million deaths) and third leading cause of death/disability combined (>160 million DALYs) globally. From 1990–2021, incident strokes rose 70%, deaths 44%, and DALYs 32%. In 2021, there were 93.8 million prevalent and 11.9 million incident strokes. Ischemic stroke (IS) accounted for 65.3% of incident strokes.3 In India, data from the GBD study (1990–2021) shows that stroke remains a leading cause of death and disability. The overall incidence rate rose from 76 to 88 per 100,000 between 1990 and 2021, driven by aging, better detection, and other factors. Similarly, the overall death rate increased from 44 to 55 per 100,000 during the same period, again with the youngest age group (15–49) remaining stable and the older groups (50–69 and 70+) showing notable decreases (207→152 and 806→674). The overall rise in death rates may reflect increasing risk factors or an aging population.4

Stroke is categorized into two main types: ischemic stroke (80%) and hemorrhagic stroke (20%). Ischemic stroke results from atherothrombosis of cranial or extracranial vessels or embolism originating from the heart or major neck vessels.5 Atrial fibrillation (AF) is the most common sustained arrhythmia and is strongly associated with an increased risk of acute ischemic stroke (AIS).6 AF is a heterogeneous arrhythmia that occurs in various clinical settings. Its development and persistence are influenced not only by local triggers but also by atrial remodelling, which involves electrophysiological and structural abnormalities in the heart.7

AF-related ischemic strokes are typically more severe, have higher fatality rates, and recur more often than non-AF strokes. Oral anticoagulation (OAC) - including vitamin K antagonists (VKAs, e.g., warfarin) and non-vitamin K antagonist oral anticoagulants (NOACs, e.g., dabigatran, rivaroxaban, apixaban, edoxaban) is the cornerstone treatment, significantly reducing the risk of stroke, systemic embolism, and mortality in AF patients.8,9 Accurately distinguishing the cause of stroke particularly AF-related versus non-AF etiologies is critical, as it directly impacts prognosis and guides treatment (e.g., anticoagulation for AF). Comparing mortality and morbidity rates helps clinicians optimize interventions. This study aims to determine the proportion of AF in patients with acute ischemic stroke at a tertiary care centre and assess its impact on clinical outcomes (e.g., stroke severity, mortality, disability, or complications) during hospitalization.

METHODOLOGY

This was a prospective study conducted in the department of general medicine at MGM Medical College and M.Y.H. and Associated Hospitals, Indore for a period of 1 year. on 150 patients. Sample size was calculated using Cochran's formula (n=Z^2 PQ/e^2), where Z is the standard normal deviate corresponding to a 95% confidence level (1.96), P is the estimated proportion (0.10), Q is 1-P(0.90), and e is the allowable margin of error (5%, 0.05). Based on these assumptions, the calculated sample size was 138.3, which was rounded up to 139 participants. To account for potential missing or incomplete data and to ensure adequate study power, a minimum sample size of 150 patients with acute ischemic stroke was planned for inclusion in the study.

The study enrolled patients over 18 years of age who presented with acute ischemic stroke or transient ischemic attacks (TIAs) as defined by American Stroke Association (ASA) criteria, provided that they or their legally accepted representatives had provided voluntary written informed consent for participation. Patients were excluded if they had hemorrhagic stroke, documented significant carotid artery stenosis, a history suggestive of stroke mimics (such as hypoglycemia, head injury, dyselectrolytemia, or meningoencephalitis), or the presence of a space-occupying brain lesion.

Method of data collection:

All enrolled patients underwent a comprehensive evaluation. Baseline clinical assessment was performed using the National Institutes of Health Stroke Scale (NIHSS) for stroke severity, the modified Rankin Scale (mRS) for functional status, and standard anthropometric measurements. Neuroimaging included CT head as the initial investigation to exclude hemorrhage, with MRI brain employed for greater sensitivity in detecting early ischemic changes. CT/MR angiography (head and neck) was performed to evaluate intracranial and extracranial vessels for stenosis, occlusion, or other vascular abnormalities. Laboratory investigations included complete blood count, renal and liver function tests, erythrocyte sedimentation rate, urine microscopy, fasting and postprandial blood sugar, glycated hemoglobin, serum electrolytes (including calcium and magnesium), lipid profile, and thyroid profile.

Cardiac rhythm evaluation was systematically performed using serial 12-lead ECGs for initial detection of rhythm abnormalities, 2D echocardiography to assess cardiac structure and function and identify potential embolic sources, and Holter monitoring for prolonged rhythm surveillance to detect intermittent arrhythmias not captured on routine ECG. All patients were followed during their hospital stay to determine the proportion with atrial fibrillation and assess its effect on in-hospital outcomes, including stroke severity, functional disability, and mortality.

Statistical analysis:

Data were analyzed using IBM SPSS software, version 27.0. Normality of the data was assessed using the Kolmogorov–Smirnov test, along with skewness and kurtosis values. Categorical variables were expressed as frequencies (n) and percentages (%), while continuous variables were expressed as mean ± standard deviation (SD). The Chi-square test was employed to compare categorical variables between groups, and the independent t-test was used to compare continuous variables. Logistic regression analysis was performed to identify predictor variables. A total of 150 patients were included in the study, and a *p*-value <0.05 was considered statistically significant.

RESULTS

A total of 150 patients with acute ischemic stroke were included in the study. The mean age was 60.5 ± 15.3 years (range: 19–90 years). Males constituted 64.7% (n = 97) of the study population. Most participants belonged to the middle

socioeconomic class (Class III, 42.7%), followed by Class IV (30.0%). Hypertension and dyslipidaemia were the most common comorbidities, each present in 76.0% of patients, followed by diabetes mellitus (38.7%), smoking (34.7%), alcohol use (33.3%), and previous stroke/TIA (24.7%) (Table 1).

Table 1. Baseline Demographic and Clinical Characteristics of the Study Population (N = 150)

Variable	Category	Value
Age (years), Mean ± SD		**60.5 ± 15.3**
Gender	Male	97 (64.7)
	Female	53 (35.3)
Socioeconomic status	Class II	21 (14.0)
	Class III	64 (42.7)
	Class IV	45 (30.0)
	Class V	20 (13.3)
Comorbidities	Hypertension	114 (76.0)
	Diabetes mellitus	58 (38.7)
	Dyslipidaemia	114 (76.0)
	Smoking	52 (34.7)
	Alcohol use	50 (33.3)
	Previous Stroke/TIA	37 (24.7)
	Coronary artery disease	20 (13.3)
	Heart failure	11 (7.3)
	Thyroid disease	8 (5.3)

The median time from symptom onset to hospital admission was 9 hours (IQR: 6–72 hours). The median NIHSS score improved from 9 (IQR: 6–14) at admission to 8.5 (IQR: 5–11) at discharge. The median modified Rankin Scale (mRS) score at discharge was 3 (IQR: 3–4), and the median duration of hospital stay was 4 days (IQR: 3–6). The mean systolic and diastolic blood pressures were 150.5 ± 31.9 mmHg and 88.7 ± 14.7 mmHg, respectively. Valvular heart disease was identified in 8.7% of patients, while intravenous thrombolysis was performed in 4.7% of patients (Table 2).

Table 2. Clinical Characteristics, Cardiac Findings and In-Hospital Management (N = 150)

Variable	Value
Clinical variables	
Time to admission (hours), Median (IQR)	9 (6–72)
NIHSS at admission, Median (IQR)	9 (6–14)
NIHSS at discharge, Median (IQR)	8.5 (5–11)
mRS at discharge, Median (IQR)	3 (3–4)
Length of stay (days), Median (IQR)	4 (3–6)
SBP (mmHg), Mean ± SD	150.5 ±31.9
DBP (mmHg), Mean ± SD	88.7 ±14.7
Fasting glucose (mg/dL), Median (IQR)	116 (103–136)
HbA1c (%), Median (IQR)	6.2 (5.8–7.1)
Waist circumference (cm), Mean ± SD	69.9 ±14.1
Valvular heart disease	
No valvular disease	137 (91.3)
Any valvular disease	13 (8.7)
Thrombolysis	
Yes	7 (4.7)
No	143 (95.3)

In-Hospital Complications among Acute Ischemic Stroke Patients: Chest infection or pneumonia was the most frequent in-hospital complication, occurring in 16.7% of patients, followed by seizures (13.3%) and hemorrhagic transformation (7.3%). No patient developed deep vein thrombosis or pulmonary embolism during hospitalization

Characteristics of Atrial Fibrillation: Atrial fibrillation was identified in 17 of 150 patients, yielding a proportion of 11.3%. Among patients with atrial fibrillation, permanent AF was more common than paroxysmal AF (70.6% vs. 29.4%). Female sex was significantly associated with the presence of atrial fibrillation (58.8% vs. 32.3%; $\chi^2 = 4.63$, $p = 0.031$). No

significant associations were observed between atrial fibrillation and hypertension, diabetes mellitus, dyslipidaemia, smoking, alcohol use, previous stroke/TIA, coronary artery disease, or heart failure (Table 3a).

Among the continuous variables, waist circumference was significantly lower in patients with atrial fibrillation than in those without atrial fibrillation (61.3 ± 15.6 cm vs. 70.9 ± 13.6 cm; $p = 0.007$). No statistically significant differences were observed in age, admission or discharge NIHSS scores, time to hospital admission, duration of hospital stay, blood pressure, fasting glucose, or HbA1c levels between the two groups (Table 3b).

Table 3a. Comparison of Demographic Characteristics and Risk Factors Between Patients With and Without Atrial Fibrillation

Variable	No AF (n = 133)	AF (n = 17)	χ^2	*p* value
Sex				
Male	90 (67.7)	7 (41.2)	4.63	0.031
Female	43 (32.3)	10 (58.8)		
Hypertension				
Yes	101 (75.9)	13 (76.5)	0.002	0.962
No	32 (24.1)	4 (23.5)		
Diabetes mellitus				
Yes	51 (38.3)	7 (41.2)	0.17	0.919
No	82 (61.7)	10 (58.8)		
Dyslipidaemia				
Yes	102 (76.7)	12 (70.6)	0.31	0.579
No	31 (23.3)	5 (29.4)		
Smoking				
Yes	47 (35.3)	5 (29.4)	0.33	0.849
No	86 (64.7)	12 (70.6)		
Alcohol use				
Yes	46 (34.6)	4 (23.5)	0.89	0.639
No	87 (65.4)	13 (76.5)		
Previous stroke/TIA				
Yes	30 (22.6)	7 (41.2)	2.81	0.094
No	103 (77.4)	10 (58.8)		
Coronary artery disease				
Yes	18 (13.5)	2 (11.8)	0.04	0.840
No	115 (86.5)	15 (88.2)		
Heart failure				
Yes	9 (6.8)	2 (11.8)	0.55	0.457
No	124 (93.2)	15 (88.2)		

Table 3b. Comparison of Continuous Clinical Variables Between Patients With and Without Atrial Fibrillation

Variable	No AF (n = 133)	AF (n = 17)	*t* value	*p* value
Age (years)	60.2 ± 14.7	62.8 ± 19.6	−0.66	0.510
NIHSS at admission	12.6 ± 7.6	13.4 ± 11.8	−0.38	0.700
Time from symptom onset to admission (hours)	25.4 ± 31.2	21.9 ± 28.8	0.44	0.660
NIHSS at discharge	9.5 ± 5.3	6.5 ± 5.8	1.88	0.063
Modified Rankin Scale at discharge	3.77 ± 1.22	3.18 ± 1.94	1.74	0.085
Length of hospital stay (days)	5.09 ± 3.16	4.82 ± 3.28	0.33	0.750
Systolic blood pressure (mmHg)	150.9 ± 32.7	146.9 ± 25.6	0.48	0.630
Diastolic blood pressure (mmHg)	88.7 ± 15.3	88.5 ± 8.9	0.07	0.950
Fasting glucose (mg/dL)	140.6 ± 71.7	135.1 ± 37.5	0.31	0.760
HbA1c (%)	6.68 ± 1.71	6.79 ± 1.28	−0.26	0.790
Waist circumference (cm)	70.9 ± 13.6	61.3 ± 15.6	2.72	0.007

The type of atrial fibrillation was significantly associated with both stroke severity ($\chi^2 = 24.49$, $p < 0.001$) and functional outcome at discharge ($\chi^2 = 14.21$, $p = 0.001$). Patients with paroxysmal atrial fibrillation more frequently had mild stroke severity and good functional outcomes, whereas permanent atrial fibrillation was associated with a higher proportion of severe stroke and poor functional outcome (Table 4).

Table 4. Association Between Atrial Fibrillation Subtype and Stroke Severity and Functional Outcome (N = 150)

Variable	No AF (n = 133)	Paroxysmal AF (n = 5)	Permanent AF (n = 12)	Statistical analysis
Stroke severity (NIHSS)				$\chi^2 = 24.49$, $p < 0.001$
Mild	13 (9.8)	4 (80.0)	1 (8.3)	
Moderate	85 (63.9)	0 (0.0)	6 (50.0)	
Severe	35 (26.3)	1 (20.0)	5 (41.7)	
Modified Rankin Scale				$\chi^2 = 14.21$, $p = 0.001$
Good outcome (mRS <3)	20 (15.0)	4 (80.0)	3 (25.0)	
Poor outcome (mRS ≥3)	113 (85.0)	1 (20.0)	9 (75.0)	

Clinical Profile of Patients with Atrial Fibrillation:
Among the 17 patients with atrial fibrillation, only two (11.8%) were receiving anticoagulation before admission, and none underwent intravenous thrombolysis. Good functional outcome at discharge was observed in 41.2% of patients, while 58.8% had poor functional outcome. Four patients (23.5%) died during hospitalization.

Table 5. Multivariable Logistic Regression for Predictors of In-Hospital Mortality

Variable	Adjusted OR	95% CI	p value
Atrial fibrillation	0.65	0.02–22.23	0.808
Age	1.05	0.99–1.11	0.072
NIHSS at admission	1.51	1.23–1.84	<0.001
Heart failure	0.04	0.00–5.17	0.190
Small infarct	0.10	0.01–1.29	0.078

Multivariable logistic regression demonstrated that the model was statistically significant ($\chi^2 = 65.85$, $p < 0.001$) with good calibration (Hosmer–Lemeshow test, $p = 0.844$) and a Nagelkerke R^2 of 0.701. NIHSS score at admission was the only independent predictor of in-hospital mortality (adjusted OR 1.51, 95% CI: 1.23–1.84; $p < 0.001$). Atrial fibrillation, age, heart failure, and infarct size were not independently associated with in-hospital mortality after adjustment (Table 5).

DISCUSSION

The present prospective study evaluated the proportion of atrial fibrillation (AF) among patients with acute ischemic stroke (AIS) and examined its association with clinical characteristics and in-hospital outcomes. AF was identified in 11.3% of patients, with permanent AF accounting for approximately two-thirds of cases. Although AF was associated with differences in stroke severity and functional outcome according to AF subtype, admission NIHSS score emerged as the only independent predictor of in-hospital mortality after adjustment for potential confounders. These findings highlight the prognostic importance of neurological deficit at presentation while emphasizing the heterogeneity of AF-related stroke.

The demographic profile of our study population was comparable to that reported in previous studies. The mean age of 60.5 years and predominance of older adults are consistent with reports by Molla et al.,10 Goel et al.,11 and Nathan et al.,12 who similarly observed that ischemic stroke predominantly affects elderly individuals. Increasing age is a well-established risk factor for both ischemic stroke and atrial fibrillation because of progressive vascular changes, atrial remodeling, and accumulation of cardiovascular comorbidities. Male predominance observed in our cohort is also consistent with most epidemiological studies describing higher stroke incidence among men.

The proportion of AF in our cohort (11.3%) is comparable with previous hospital-based studies from Asia and other developing countries, although reported prevalence varies widely depending on study design, patient characteristics, and methods used for AF detection. Permanent AF was considerably more frequent than paroxysmal AF, suggesting that sustained arrhythmia represents the predominant pattern among stroke patients in our setting. Since paroxysmal AF is frequently asymptomatic and may remain undetected without prolonged cardiac rhythm monitoring, its true prevalence may have been underestimated in the present study.

Among the conventional cardiovascular risk factors evaluated, female sex was the only variable significantly associated with the presence of AF. Similar observations have been reported by Addisu et al.13 and Pinzon et al.,14 who demonstrated a relatively higher proportion of women among stroke patients with AF despite an overall male predominance in ischemic stroke. This finding may be explained by the increasing prevalence of AF among elderly women, particularly after menopause, as well as their longer life expectancy. In contrast, hypertension, diabetes mellitus, dyslipidaemia, smoking, alcohol consumption, coronary artery disease, and heart failure were not significantly associated with AF in our study. Although these factors are recognized contributors to AF development, their uniformly high prevalence in the present cohort may have reduced the ability to demonstrate statistically significant differences between groups. Furthermore, the relatively small number of AF patients likely limited statistical power to detect moderate associations.

Interestingly, prior stroke or transient ischemic attack was more common among patients with AF, although the association did not reach statistical significance. This observation is consistent with the findings of Pinzon et al.,14 who reported a significantly higher prevalence of previous stroke among patients with AF, reflecting the well-established risk of recurrent cardioembolic events in this population. Similarly, Goel et al.11 demonstrated that AF was associated with recurrent ischemic stroke and poorer clinical outcomes. The absence of statistical significance in the present study is likely attributable to the relatively small number of patients with AF, resulting in limited statistical power.

Comparison of continuous clinical variables showed that most baseline characteristics were comparable between patients with and without AF. Age, admission NIHSS score, time from symptom onset to hospital presentation, blood pressure, glycemic indices, and duration of hospitalization did not differ significantly between the two groups. Similar findings have been reported by Nathan et al.,12 who observed no significant differences in several baseline clinical characteristics between AF and non-AF stroke patients. In contrast, Goel et al.,11 Otite et al.,15 and Xie et al.16 reported significantly higher admission NIHSS scores among patients with AF, suggesting more severe neurological deficits at presentation. The only significant difference in our study was a lower waist circumference among patients with AF. Although obesity is an established risk factor for AF, previous studies have described an "obesity paradox," in which lower body weight or central adiposity may be associated with poorer outcomes in patients with established cardiovascular disease. Whether this observation reflects frailty, sarcopenia, nutritional status, or other underlying mechanisms requires further investigation.

One of the important findings of the present study was the differential impact of AF subtype on stroke severity and functional outcome. Patients with permanent AF experienced significantly more severe strokes and poorer functional outcomes than those with paroxysmal AF, whereas most patients with paroxysmal AF presented with mild neurological deficits and achieved favourable functional recovery. Most previous studies, including those by Goel et al.,11 Pinzon et al.,14 Otite et al.,15 Addisu et al.,13 and Nathan et al.,12 evaluated AF as a single clinical entity without distinguishing between permanent and paroxysmal AF. Consequently, direct comparison with our subtype analysis is limited. Nevertheless, these studies consistently reported poorer functional outcomes and greater stroke severity among patients with AF overall, which is in agreement with our findings for patients with permanent AF. The better outcomes observed in patients with paroxysmal AF in our cohort suggest that AF subtype may have important prognostic implications and merits further evaluation in larger prospective studies.

An important observation in our cohort was the extremely low use of anticoagulant therapy before stroke onset. Nearly 90% of patients with AF were not receiving anticoagulation despite established evidence demonstrating its effectiveness in preventing cardioembolic stroke. Similar treatment gaps have been reported from several low- and middle-income countries. Inadequate detection of AF, poor access to anticoagulants, financial constraints, and concerns regarding bleeding risk may all contribute to underutilization of anticoagulation. Improving early identification of AF and ensuring appropriate thrombo prophylaxis remain essential strategies for reducing stroke burden.13,14,17

Multivariable logistic regression identified admission NIHSS score as the only independent predictor of in-hospital mortality. Each one-point increase in NIHSS significantly increased the odds of death, emphasizing that neurological deficit at presentation remains the strongest determinant of short-term outcome. Neither AF nor age independently predicted mortality after adjustment for stroke severity and other clinical variables. Similar observations have been reported in several studies where the adverse effect of AF on mortality was largely mediated through its association with more severe strokes rather than through an independent effect.11,14,15 These findings reinforce the importance of rapid neurological assessment and aggressive management of patients presenting with severe stroke.

The present findings have several important clinical implications. First, routine screening for AF should be considered in all patients presenting with acute ischemic stroke, particularly among older adults. Second, differentiating permanent from paroxysmal AF may provide additional prognostic information regarding stroke severity and functional recovery. Third, the substantial underuse of anticoagulant therapy observed in our cohort highlights the need for improved community-based detection of AF and adherence to evidence-based thromboprophylaxis guidelines. Finally, early assessment using the NIHSS remains crucial for risk stratification and identifying patients at increased risk of adverse in-hospital outcomes.

The strengths of this study include its prospective design, standardized assessment of stroke severity and functional outcome using validated scales, comprehensive evaluation of cardiovascular risk factors, and separate analysis of permanent and paroxysmal AF. The use of multivariable logistic regression further strengthened the identification of independent predictors of mortality.

The study has several limitations. It was conducted at a single tertiary care centre, which may limit the generalizability of the findings. The relatively small number of patients with AF reduced statistical power for subgroup analyses and may

have contributed to the absence of significant associations for several established cardiovascular risk factors. Continuous rhythm monitoring beyond routine in-hospital evaluation was not performed; therefore, some cases of paroxysmal AF may have remained undetected. In addition, outcomes were limited to the in-hospital period, and longer-term functional recovery and recurrent vascular events were not assessed.

CONCLUSION

This study demonstrates that the prognostic impact of atrial fibrillation (AF) in acute ischemic stroke is largely mediated by stroke severity and varies significantly by AF subtype. Permanent AF is independently associated with worse in-hospital outcomes compared to paroxysmal AF or no AF. The high prevalence of hypertension and dyslipidemia across both groups underscores the critical need for aggressive vascular risk-factor modification. Notably, the exceptionally low rate of pre-stroke anticoagulation represents a substantial missed preventive opportunity. Collectively, these findings highlight the urgent necessity for enhanced community-wide AF screening, stricter adherence to anticoagulation guidelines, and the development of targeted acute management protocols, particularly for patients with permanent AF who remain at the highest risk for severe stroke and poor functional recovery.

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