Short-Term Outcome of Ischemic Stroke Patients with and without Atrial Fibrillation

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Abstract

Introduction: Atrial fibrillation (AF) is a significant risk factor for ischemic stroke, associated with increased stroke severity and poorer outcomes. However, limited data exist from developing countries regarding the impact of AF on stroke outcomes. Hence, this study aimed to investigate the short-term outcomes of ischemic stroke patients with and without atrial fibrillation in a tertiary care hospital in Bangladesh.

Methods: This cross-sectional comparative study was conducted at Rajshahi Medical College Hospital over six months, enrolling 60 ischemic stroke patients (30 with AF, 30 without AF). Outcomes were assessed using the modified Rankin Scale (mRS) at one- and three months post-stroke. Data analysis included chi-square tests, t-tests, and multivariable logistic regression.

Results: AF-associated strokes occurred more frequently in females (53.33% vs 26.67%, p=0.035) and showed significantly higher mRS scores at one month (3.60 vs 1.73, p=0.001) and three months (3.47 vs 1.40, p=0.001). Three-month mortality was significantly higher in the AF group (46.7% vs 12.3%, p=0.005). After adjustment for confounders, AF was associated with significantly higher odds of poor functional outcome at one month (AOR: 5.49, 95% CI: 1.4-21.20).

Conclusion: Ischemic stroke patients with AF experience significantly worse short-term outcomes compared to those without AF. These findings emphasize the need for enhanced AF screening and prevention strategies in Bangladesh, particularly among high-risk populations.

[Shaheed Syed Nazrul Islam Med Col J 2026, July; 11 (2):212-219]
DOI: https://www.doi.org/10.69699/ssnimcj.2026.11.2.14

Keywords: Atrial Fibrillation, Ischemic Stroke, Bangladesh, Outcome

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Introduction

Stroke remains a significant global health challenge, ranking as the third most common cause of mortality and the fourth leading cause of disease burden worldwide.[1,2] The World Health Organization defines acute stroke as rapidly developing clinical signs of focal or global cerebral dysfunction, with symptoms persisting for 24 hours or longer, or leading to death, with no apparent cause other than vascular origin.[3] Among the various risk factors associated with ischemic stroke, atrial fibrillation (AF) stands out as a particularly significant contributor. AF, the most common sustained cardiac arrhythmia, affects approximately 1% of adults aged 60-64 years, with prevalence increasing dramatically to 9% in those over 80 years.[4] The condition carries substantial clinical significance, as individuals with AF face a fivefold increased risk of stroke compared to those without the condition.[5]

The relationship between AF and stroke outcomes is particularly concerning. Strokes associated with AF tend to be more severe, disabling, and fatal compared to those without AF. This increased severity may be attributed to several pathophysiological mechanisms. One hypothesis suggests that the higher prevalence of ischemic heart disease and congestive heart failure in AF patients contributes to reduced cerebral blood flow, particularly when cerebral autoregulatory mechanisms are compromised in ischemic regions. Additionally, the sudden interruption of blood flow caused by AF-related emboli may result in less developed collateral circulation compared to strokes resulting from chronic arterial atherosclerotic disease.[5,6]

The global burden of stroke is expected to shift dramatically toward developing regions, with projections suggesting that by 2050, 80% of stroke events will occur in these areas.[7] In Bangladesh, stroke incidence is increasing compared to developed countries, with a prevalence of 370 per 100,000 in individuals above 40 years of age.[8] Notably, while stroke is typically considered a disease of the elderly, in Bangladesh, it commonly affects individuals in their fifth and sixth decades of life. While ischemic infarctions constitute 85-90% of strokes in Western countries, hemorrhagic strokes represent a larger percentage in Asian populations.[9] Among ischemic strokes, approximately 20% are due to cardiac embolism, with AF being a vital risk factor.[4] The prevention and management of AF-related strokes have become increasingly important, particularly as appropriate antithrombotic therapy can prevent many of these events.[10]

Despite the known association between AF and poor stroke outcomes, limited research has been conducted in developing countries to quantify this relationship and understand its local implications. Understanding the impact of AF on stroke outcomes is crucial for several reasons: it can help identify high-risk patients, guide appropriate preventive strategies, and inform acute management decisions. Furthermore, this knowledge is essential for healthcare resource allocation and the development of targeted interventions in resource-limited settings. This study aimed to investigate the short-term outcomes of ischemic stroke in patients with and without atrial fibrillation, with particular attention to the challenges and implications in a developing country context. The findings may contribute to better risk stratification and management strategies for stroke patients, potentially leading to improved outcomes in this vulnerable population.

Methods

This cross-sectional comparative study was conducted in the inpatient departments of Medicine and Neurology at Rajshahi Medical College Hospital (RMCH), Bangladesh, over

a six-month period between January 2016 to July 2016. The study included adult patients (≥18 years) with ischemic stroke using convenient sampling. The sample size was calculated using the formula for cross-sectional comparative study. After accounting for a 5% dropout rate, 60 patients with ischemic stroke (30 with AF and 30 without AF) were enrolled. Inclusion criteria encompassed patients of any age and gender presenting with first-time ischemic stroke, confirmed by clinical and neuroimaging features, who received standard rehabilitative treatment. Cases were defined as ischemic stroke patients who developed atrial fibrillation (AF) within the first three days of admission, while comparators were those who survived three days post-admission without developing AF. Patients or their relatives provided informed consent. Exclusion criteria included recurrent stroke, severely ill patients, and those refusing to participate in the study. All patients received standardized stroke management, including physiotherapy and two-hourly posture changes, with support from the physiotherapy and rehabilitation unit. To ensure homogeneity, patients with multiple comorbid conditions beyond diabetes mellitus and hypertension were excluded. Detailed drug histories were recorded to account for factors that might influence disease progression and outcomes, including anti-lipid therapy, anti-platelet drugs, anticoagulation therapy, and thrombolytic therapy. Both groups were assessed using the Modified Rankin Score (mRS) on day 30 and day 90. For discharged patients, follow-up assessments were conducted via telephone.

Stroke was defined according to WHO criteria; ischemic stroke was confirmed by CT scan; AF was diagnosed through ECG showing normal but irregular QRS complexes and absence of P waves with irregular fibrillation waves. Additional definitions included criteria for diabetes mellitus (fasting plasma glucose ≥7mmol/L or random/2-hour post-glucose load ≥11.1mmol/L), and hypertension (BP ≥140/90 mmHg or on antihypertensive medication).

The study protocol was approved by the Ethical Review Committee of RMCH and conducted in accordance with the Declaration of Helsinki. Written informed consent was obtained from all participants, and confidentiality was maintained throughout the study. Data analysis was performed using SPSS version 20.0. Descriptive statistics were computed to confirm homogeneity between groups. Quantitative data were expressed as mean ± standard deviation (SD). Chi-square tests, Fisher's exact test, and Independent samples t-test were employed for comparisons, with statistical significance set at $p<0.05$. Multiple logistic regression was used to analyze the effect of atrial fibrillation on the outcome of stroke after controlling for age, smoking status, alcohol intake, hypertension, diabetes, and lipid parameters. Poor outcome was defined as mRS >1, and if death occurred one or three months after discharge. Results of logistic regression analysis were expressed with 95% confidence intervals.

Results

A total of 60 patients with ischemic stroke were studied, equally divided between those with atrial fibrillation (AF) and those without. The mean age of patients with AF was slightly higher (61.13 ± 11.73 years) compared to those without AF (55.73 ± 12.61 years), though this difference was not statistically significant ($p=0.091$). In the AF group, most patients (53.33%) were in the 61-70 years age bracket, while in the non-AF group, the majority (46.67%) were in the 51-60 years category. Significant demographic differences were observed in gender distribution and educational qualification. The AF group had a higher proportion of females (53.33%) compared to the non-AF group

(26.67%) (p=0.035). Regarding education, 73.33% of AF patients had only primary education, while educational attainment was more evenly distributed in the non-AF group (p=0.044). Monthly family income showed no significant difference between the groups (p=0.111) (Table I).

Analysis of risk factors revealed several notable differences. Smoking was significantly more prevalent in the non-AF group (60%) compared to the AF group (26.67%) (p=0.009). Diabetes mellitus was also more common in the non-AF group (40% vs 13.33%, p=0.020). However, other risk factors including family history of stroke (p=0.779), alcohol consumption (p=0.694), hypertension (p=0.542), elevated cholesterol (p=0.243), and high LDL levels (p=0.573) showed no significant differences between the groups (Table II).

Short-term outcomes demonstrated significant differences between the groups. The mean modified Rankin Scale (mRS) scores were consistently higher in the AF group both at one month (3.60 ± 2.12 vs 1.73 ± 1.91, p=0.001) and three months (3.47 ± 2.56 vs 1.40 ± 2.02, p=0.001) post-stroke. Mortality rates were also higher in the AF group, with a particularly significant difference at three months (46.7% vs 12.3%, p=0.005).

Multivariable logistic regression analysis, adjusted for age, smoking history, hypertension, and diabetes, revealed that AF was associated with significantly higher odds of poor functional outcome (mRS > 1) at one month (AOR: 5.49, 95% CI: 1.4-21.20). While the association remained positive at three months, it did not reach statistical significance (AOR: 2.85, 95% CI: 0.79-10.19). Similarly, AF showed a trend toward increased mortality at both one month (AOR: 2.92, 95% CI: 0.65-12.93) and three months (AOR: 3.62, 95% CI: 0.87-14.97), though these associations did not reach statistical significance in the adjusted analysis.

Table I: Sociodemographic profile of patients

Variable	Stroke with AF	Stroke without AF	P-value
	n (%)	n (%)	
Age (years), mean ±SD	61.13(±11.73)	55.73(±12.61)	0.091*
Age groups (years)			
31-40	4 (13.33)	6 (20)	0.110**
41-50	2 (6.67)	2 (6.67)	
51-60	6 (20)	14 (46.67)	
61-70	16 (53.33)	8 (26.67)	
71-80	2 (6.67)	0 (0)	
Sex			
Male	14 (46.67)	22 (73.33)	0.035***
Female	16 (53.33)	8 (26.67)	
Educational Qualification			
Primary	22 (73.33)	12 (40)	0.044**
SSC	0 (0)	6 (20)	
HSC	6 (20)	6 (20)	
Graduation and above	2 (6.67)	6 (20)	
Monthly Family Income			
<3000	4 (13.33)	0 (0)	0.111**
3000 - <6000	8 (26.67)	12 (40)	
6000 - 10000	10 (33.33)	6 (20)	
>10000	8 (26.67)	12 (40)	

p-values were determined by independent samples t-test*, Fisher's exact test** and Chi-square test***

Table II: Family history of stroke and comorbidities among patients

Variable	Stroke with AF	Stroke without AF	p-value
	n (%)	n (%)	
Family history of stroke			
Present	10 (33.3)	8 (26.7)	0.779*
Absent	20 (66.7)	22 (73.3)	
Smoking habit			
Present	8 (26.67)	18 (60)	0.009*
Absent	22 (73.33)	12 (40)	
Alcohol drinking habit			
Present	2 (6.67)	2 (6.67)	0.694**
Absent	28 (93.33)	28 (93.33)	
Hypertension			
Yes	24 (80)	22 (73.33)	0.542*
No	6 (20)	8 (26.67)	
Diabetes Mellitus			
Yes	4 (13.33)	12 (40)	0.020*
No	26 (86.67)	18 (60)	
Fasting cholesterol >200mg/dl			
Yes	6 (37.5)	10 (62.5)	0.243*
No	24 (54.5)	20 (45.5)	
Fasting LDL >130mg/dl			
Yes	10 (55.6)	8 (44.4)	0.573*
No	20 (47.6)	22 (52.4)	

p-values were determined by Chi-squared test* and Fisher's exact test**

Table III: Short term outcome assessed by modified Rankin Scale (mRS) of ischemic stroke patients

Outcome	Stroke with AF	Stroke without AF	p-value
	Mean ±SD or n (%)	Mean ±SD or n (%)	
mRS score			
One month after the stroke	3.60 (±2.12)	1.73 (±1.91)	0.001*
Three months after the stroke	3.47 (±2.56)	1.40 (± 2.02)	0.001*
Death			
One month after the stroke	10 (33.3)	4 (12.3)	0.063**
Three months after the stroke	14 (46.7)	4 (12.3)	0.005**

p-values were determined by independent samples t-test* and Chi-square test**

Table IV: Strength of association of atrial fibrillation with outcome of stroke determined by multivariable logistic regression analysis

Outcome	One month after the stroke		Three months after the stroke	
	COR (95%CI)	AOR* (95%CI)	COR (95%CI)	AOR* (95%CI)
mRS > 1	7.91 (2.26-27.65)	5.49 (1.4-21.20)*	5.44 (1.69-17.53)	2.85 (0.79-10.19)
Death	3.56 (0.99-12.85)	2.92 (0.65-12.93)	6.27 (1.78-22.13)	3.62 (0.87-14.97)

*Adjusted for age, h/o smoking, hypertension and diabetes; AOR: Adjusted Odds Ratio; COR: Crude Odds Ratio

Discussion

This study demonstrated significant differences in both the demographic profile and clinical outcomes of ischemic stroke patients with and without atrial fibrillation (AF) in a Bangladeshi population. The demographic analysis revealed that AF-associated stroke occurred in relatively older patients (mean age 61.13 years) compared to non-AF stroke (55.73 years), although this difference did not reach statistical significance. This age distribution aligns with previous studies showing AF prevalence increases with age, though our cohort's mean age was notably lower than reported in Western populations[11]. This finding reinforces existing observations that stroke occurs at a younger age in Bangladesh compared to developed countries,[12,13] possibly due to different risk factor profiles and earlier onset of cardiovascular disease in South Asian populations.[14]

A striking finding was the higher proportion of females in the AF stroke group (53.33% vs 26.67%, p=0.035), similar to other studies.[11] This gender disparity might be attributed to several factors, including the higher prevalence of rheumatic heart disease in females in developing countries,[15] which predisposes to AF. Additionally, the lower educational attainment in the AF group (73.33% with only primary education) may suggest that they are less aware and concerned about the seriousness of their condition, resulting in inadequate management of AF and consequent stroke. However, in the absence of treatment and treatment compliance-related data, this should be read with caution. Future studies could explore the pathways through which lower education influences AF associated stroke.

The risk factor profile showed interesting patterns. The significantly lower prevalence of smoking (26.67% vs 60%, p=0.009) and diabetes mellitus (13.33% vs 40%, p=0.020) in the AF group suggests that AF itself might be a more potent risk factor for stroke, potentially overshadowing these traditional risk factors.[16] The high prevalence of hypertension in both groups (80% vs 73.33%) underscores its importance as a universal risk factor for stroke, regardless of AF status.

The most clinically significant findings relate to short-term outcomes. AF-associated strokes demonstrated consistently poorer functional outcomes, with significantly higher mRS scores at both one month (3.60 vs 1.73, p=0.001) and three months (3.47 vs 1.40, p=0.001). This marked difference in functional outcomes suggests that AF-related strokes result in more severe neurological deficits, possibly due to the larger infarct sizes typically associated with cardioembolic strokes.[17,18] The mortality rate was particularly concerning, with AF patients showing significantly higher three-month mortality (46.7% vs 12.3%, p=0.005).

The multivariate analysis further strengthens these findings. After adjusting for confounding factors, AF was associated with significantly higher odds of poor functional outcome (mRS >1) at one month (AOR: 5.49, 95% CI: 1.4-21.20). While this association weakened at three months, the trend toward poorer outcomes persisted. The increased mortality risk, though not reaching statistical significance in the adjusted analysis, remained clinically relevant and corroborated findings from previous study.[19]

These findings have important clinical implications. First, they emphasize the need for enhanced screening and prevention strategies for AF in the Bangladeshi population, particularly among older females and those with lower socioeconomic status. Second, the markedly worse outcomes in AF-related strokes suggest that these patients may

benefit from more intensive acute management and rehabilitation protocols. Finally, the high mortality rate underscores the importance of primary prevention through appropriate anticoagulation in AF patients.

Our study has several limitations. The single-center design and relatively small sample size may limit generalizability. The short follow-up period of three months may not capture the full spectrum of stroke outcomes. Additionally, we were unable to assess the adequacy of anticoagulation in AF patients prior to their stroke, which could have provided valuable insights into preventive strategies.

Future research should focus on larger, multicenter studies with longer follow-up periods to better understand the long-term outcomes of AF-related strokes in developing countries. Studies investigating the barriers to AF detection and appropriate anticoagulation in this population would also be valuable for improving preventive strategies.

Conclusion

Ischemic stroke patients with atrial fibrillation showed significantly worse outcomes than non-AF patients, with higher three-month mRS scores and mortality rates. AF-related strokes predominantly affected older females and those with lower education. These findings highlight the urgent need for improved AF screening and prevention in Bangladesh, particularly in high-risk groups. Appropriate anticoagulation therapy and targeted interventions could improve outcomes in this vulnerable population.

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