RECURRENT STROKE IN OLDER ADULTS: SITUATION AND ASSOCIATED FACTORS AT THE EMERGENCY AND STROKE DEPARTMENT, NATIONAL GERIATRIC HOSPITAL

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ABSTRACT

Background: Stroke recurrence is a significant concern in elderly patients due to its impact on morbidity and mortality. Identifying associated factors can help improve secondary prevention strategies. **Objectives:** To describe the clinical and epidemiological characteristics of patients with acute ischemic stroke and identify factors associated with stroke recurrence. **Methods:** A cross-sectional study was conducted on 146 patients with ischemic stroke. Data on demographics, medical history, behavioral risk factors, and treatment adherence were collected. Stroke recurrence was defined as ≥2 episodes. Associations between risk factors and recurrence were analyzed using odds ratios (OR) with 95% confidence intervals (CI). **Results:** The mean age was 79.1 ± 10.7 years; 56.2% were male. Hypertension was present in 68.8%, diabetes and dyslipidemia each in 31.2%, and coronary artery disease in 13.9% of patients. Treatment adherence was high (94.7%). Stroke recurrence occurred in 41.8% of patients. Hypertension (OR = 2.58; 95% CI: 0.86–7.79) and coronary artery disease (OR = 2.37; 95% CI: 0.59–9.52) tended to increase recurrence risk. Other factors such as diabetes, atrial fibrillation, male sex, low education, and rural residence were more common among patients with recurrent stroke. **Conclusions:** Stroke recurrence is common among elderly patients, particularly those with hypertension and coronary artery disease. High treatment adherence is encouraging, but continued management of modifiable risk factors is necessary to reduce recurrence risk.

Keywords: *ischemic stroke, stroke recurrence, hypertension, coronary artery disease, elderly*

I. INTRODUCTION

Stroke is one of the leading causes of death and disability among adults worldwide, and its impact is particularly severe in the elderly population. Aging is associated with a progressive decline in physiological reserves and the accumulation of vascular and metabolic insults, which significantly increase the risk of both first-ever and recurrent stroke events(1). Recurrent stroke represents a major clinical challenge, as it often results in more severe neurological deficits, longer hospital stays, increased dependence, and higher mortality rates. Moreover, recurrent strokes contribute substantially to the global burden of disease and healthcare costs, particularly in aging societies such as Vietnam(2).

Several factors are associated with stroke recurrence, including hypertension, diabetes, dyslipidemia, atrial fibrillation, coronary artery disease, and treatment adherence(2). However, the impact of each factor may vary depending on population characteristics, socioeconomic conditions, and local disease patterns.

In Vietnam, the number of stroke patients is increasing, especially among older adults. Despite improvements in acute management and secondary prevention, recurrence rates remain high, while data on patient characteristics and associated factors in elderly stroke patients are still limited(3). Accurate identification of risk factors in this population is crucial to optimize secondary prevention strategies, reduce disease burden, and improve quality of life.

Based on this context, we conducted the study "Recurrent Stroke in Older Adults: Situation and Associated Factors at the Emergency and Stroke Department, National Geriatric Hospital" to assess the current situation and associated factors of stroke recurrence in elderly patients, providing a foundation for more effective prevention and management strategies..

II. METHODS

2.1. Study Population

Elderly patients (≥60 years) diagnosed with first-ever or recurrent ischemic stroke, treated at the Emergency and Stroke Department, National Geriatric Hospital in 2025.

Inclusion criteria:

- Age ≥60 years.

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Date of receipt: 6.1.2026
Date of scientific judgment: 10.2.2026
Reviewed date: 7.4.2026

- Diagnosed ischemic stroke based on clinical evaluation and imaging (CT or MRI).
- At least one prior stroke episode (for recurrent group) or first-ever stroke (comparison group).
- Complete medical records including medical history, risk factors, and treatment outcomes.

Exclusion criteria:

- Hemorrhagic stroke or other non-ischemic stroke types.
- History of traumatic brain injury or other neurological diseases affecting the study.
- Malignant or end-stage chronic diseases affecting outcomes.
- Incomplete data or lack of cooperation.
- Participation in other clinical studies that could confound results.

2.2. Study Design

Cross-sectional study with prospective and retrospective data collection.

Sample size calculation:

$$n = \frac{Z^2 . p. (1 - p)}{d^2}$$

Where:

- Z=1,96 for 95% confidence
- p=0,751 (based on An Giang Central General Hospital study, 2024)(3).
- Desired precision d=0,08

Minimum sample size: 113 patients; actual sample: 146 patients.

2.3. Data Collection

- Demographics: age, sex, education.

- Stroke recurrence: ≥1 prior stroke episode separated by ≥28 days.

- Risk factors: hypertension, diabetes, dyslipidemia, atrial fibrillation, smoking, alcohol use.

+ Hypertension, defined as a chronic elevation of arterial blood pressure, is one of the most significant modifiable risk factors for stroke. It contributes to cerebrovascular disease through multiple mechanisms, including structural and functional alterations of cerebral vessels, endothelial dysfunction, oxidative stress, inflammation, and promotion of atherosclerosis, which together increase susceptibility to both initial and recurrent ischemic events. Hypertension was assessed using standardized blood pressure measurements obtained with a calibrated sphygmomanometer or automated device, following international guidelines. Systolic and diastolic pressures were recorded, and hypertension was defined as a systolic blood pressure equal to or greater than 140 mmHg, a diastolic pressure equal to or greater than 90 mmHg, or ongoing use of antihypertensive medication. For the purpose of this study, the presence of physician-diagnosed hypertension or use of antihypertensive therapy was considered indicative of the condition.

+ Diabetes mellitus, another important modifiable risk factor, is characterized by chronic hyperglycemia resulting from impaired insulin secretion, insulin resistance, or both. In the elderly population, diabetes accelerates atherosclerosis, contributes to endothelial injury, promotes platelet aggregation, and enhances inflammatory responses, all of which increase the likelihood of recurrent cerebrovascular events. Assessment of diabetes was based on multiple parameters, including fasting plasma glucose levels, glycated hemoglobin (HbA1c), oral glucose tolerance testing, and a documented history of physician-diagnosed diabetes or current use of anti-diabetic medication. A fasting plasma glucose level equal to or greater than 126 mg/dL (7.0 mmol/L) or HbA1c equal to or greater than 6.5% was considered diagnostic of diabetes, while the use of glucose-lowering therapy indicated the presence of the disease for research purposes.

+ Dyslipidemia, defined as abnormal circulating lipid levels, is a critical contributor to systemic atherosclerosis and cerebrovascular risk. Dyslipidemia encompasses elevated total cholesterol, low-density lipoprotein cholesterol (LDL-C), and triglycerides, or reduced high-density lipoprotein cholesterol (HDL-C). In this study, lipid profiles were obtained from fasting blood samples and analyzed according to established clinical thresholds. Patients were considered to have dyslipidemia if total cholesterol exceeded 200 mg/dL, LDL-C exceeded 130 mg/dL, triglycerides exceeded 150 mg/dL, or HDL-C was below 40 mg/dL for men and below 50 mg/dL for women. Additionally, documented use of lipid-lowering medications was considered indicative of dyslipidemia. By measuring these parameters, the study aimed to capture both overt clinical dyslipidemia and subclinical alterations that may influence vascular health.

+ Atrial fibrillation, a common cardiac arrhythmia characterized by irregular atrial

contractions, represents a potent risk factor for cardioembolic stroke. AF promotes thrombus formation in the atria, which can embolize to cerebral vessels, thereby increasing the risk of recurrent ischemic stroke, particularly in elderly patients. Detection of AF was performed using 12-lead electrocardiography (ECG) and, when necessary, 24–48 hour Holter monitoring to identify paroxysmal arrhythmias. Patients with a documented history of atrial fibrillation or current use of anticoagulant therapy were classified as having AF for the purpose of this analysis.

+ Smoking, a well-established behavioral risk factor, accelerates atherosclerosis and vascular injury through exposure to nicotine and other toxic chemicals, promoting endothelial dysfunction, oxidative stress, and inflammation. In this study, smoking behavior was assessed using self-reported information on current and past tobacco use, including the number of cigarettes smoked per day, duration of smoking in years, and time to first cigarette upon waking, as quantified by the Fagerström Test for Nicotine Dependence. The intensity of smoking was also calculated using pack-years, allowing for a more precise evaluation of cumulative exposure.

+ Alcohol consumption, although potentially protective at low levels, becomes a significant risk factor when intake is excessive. Excessive alcohol intake can lead to hypertension, atrial fibrillation, cardiomyopathy, and direct neurovascular injury, thereby increasing the risk of stroke recurrence. Alcohol use was assessed based on self-reported daily or weekly intake, quantified in standard drinks, and categorized according to international guidelines. The study considered both average daily intake and patterns of heavy or binge drinking, as these have been shown to differentially impact cerebrovascular risk. The Alcohol Use Disorders Identification Test – Consumption (AUDIT-C) questionnaire was also employed to provide a standardized assessment of hazardous drinking behaviors.

- Treatment information: duration, medications, adherence.

- Imaging: CT/MRI to determine stroke type and location.

- Clinical assessment: heart rate, blood pressure, consciousness (GCS/NIHSS).

- Laboratory tests: lipid profile, carotid Doppler, transcranial Doppler.

2.4. Study Procedure

+ Identify patients ≥60 years with ischemic stroke during the study period.

+ Screen based on inclusion/exclusion criteria.

+ Explain study and obtain informed consent.

+ Collect standardized data until the required sample size is reached.

2.5. Data Management and Analysis

- Descriptive statistics: qualitative variables as frequency (%), quantitative variables as mean ± SD or median.

- Inferential statistics: Chi-square for categorical variables, t-test or Mann–Whitney U for continuous variables, multivariable logistic regression to identify independent predictors of recurrence.

- Model evaluation: Hosmer–Lemeshow test; ORs with 95% CI.2.6.

2.6. Ethical Considerations

The study was conducted in accordance with the Declaration of Helsinki and the ethical guidelines for biomedical research in Vietnam. Patients or their legal representatives were fully informed about the study and provided written consent. Personal information was anonymized and securely stored, and the study did not interfere with routine medical care or treatment decisions.

III. RESULTS

Table 3.1. Demographic characteristics (N = 146)

Variable	Group	n	%
Age (mean ± SD)		79,1 ± 10,7	
Sex	Male	82	56,2
	Female	63	43,2
Education	No school/Primary incomplete	25	17,1
	Primary	32	21,9
	Secondary	71	48,6
	College/University	18	12,4
Occupation	Officer/Staff	21	14,4
	Farmer	39	26,7
	Others (housework, military, self-employed)	86	58,9
Residence	Rural	47	32,4
	Urban	98	67,6

*: $p < 0.05$ was considered statistically significant.

A total of 146 elderly patients with acute ischemic stroke were included in the study. The mean age was 79.1 ± 10.7 years, ranging from 60 to 98 years. Males accounted for 56.2% (n = 82), while females accounted for 43.2% (n = 63). Regarding education, 17.1% (n = 25) had never attended school or had not completed primary education, 21.9% (n = 32) completed primary school, 48.6% (n = 71) completed secondary school, and 12.4% (n = 18) had a college or university degree. Occupational distribution showed that 14.4% (n = 21) were government staff or office workers, 26.7% (n = 39) were farmers, and 58.9% (n = 86) had other occupations, including homemakers, military personnel, and informal labor. Most patients resided in urban areas (67.6%), whereas 32.4% lived in rural areas.

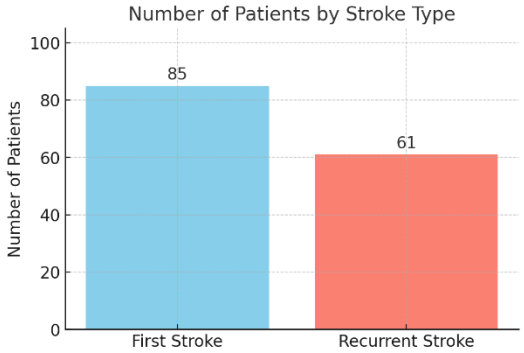

Figure 3.1. Stroke recurrence rate

The proportion of patients with recurrent stroke was 41.8%.

Table 3.2. Medical history, risk behaviors, and adherence to treatment (N = 146)

Feature	Group	n	%
Hypertension	Yes	99	68,8
	No	45	31,2
Atrial fibrillation	Yes	15	10,6
	No	127	89,4
Diabetes mellitus	Yes	45	31,2
	No	99	68,8
Dyslipidemia	Yes	45	31.2
	No	99	68.8
Coronary artery disease	Yes	20	13,9
	No	124	86,1
Adherence to treatment	Yes	125	94,7
	No	7	5,3
Alcohol consumption (drinks/day)	0–2 drinks	77	74,0
	≥3 drinks	27	26,0
Smoking (FTND – time to first cigarette)	>60 minutes	46	76,7
	31–60 minutes	2	3,3
	6–30 minutes	4	6,7
	Within first 5 minutes	8	13,3

Regarding medical history, 68.8% of patients had hypertension, 31.2% had diabetes mellitus, 31.2% had dyslipidemia, 13.9% had coronary artery disease, and 10.6% had atrial fibrillation. The rate of adherence to treatment for underlying conditions was 94.7%. Concerning risk behaviors, 74.0% of patients consumed 0–2 alcoholic drinks per day, while 26.0% consumed ≥3 drinks per day. Among smokers, 76.7% smoked their first cigarette more than 60 minutes after waking; higher dependence levels included smoking within 31–60 minutes (3.3%), 6–30 minutes (6.7%), and within the first 5 minutes (13.3%).

Table 3.3. Factors associated with recurrent stroke (≥2 and 1 occurrence)

Factor	OR	KTC 95%	p-value
Hypertension	2.58	0.86 – 7.79	0.092
Diabetes mellitus	1.81	0.75 – 4.37	0.190
Coronary artery disease	2.37	0.59 – 9.52	0.225
Rural residence	0.60	0.23 – 1.52	0.278
Male sex	0.69	0.29 – 1.64	0.402
Farmer occupation	1.15	0.43 – 3.05	0.776
Atrial fibrillation	1.21	0.32 – 4.67	0.778
Education ≤ Secondary	0.91	0.27 – 3.07	0.885

Analysis of factors associated with recurrent stroke showed odds ratios as follows: hypertension (OR = 2.58), diabetes mellitus (OR = 1.81), coronary artery disease (OR = 2.37), atrial fibrillation (OR = 1.21), and farmer occupation (OR = 1.15). Other factors included rural residence (OR = 0.60), male sex (OR = 0.69), and education ≤ secondary school (OR = 0.91).

IV. DISCUSSION

This study was conducted at the National Geriatric Hospital on 146 patients aged 60 years and above, recording a recurrent stroke rate of 41.8%. This rate is relatively high compared with both domestic and international data, reflecting the characteristics of a very elderly population (mean age 79.1 ± 10.7 years) with multiple chronic diseases and cumulative vascular

damage over time(2, 3). The aging process weakens oxygen and glucose delivery to active brain regions, disrupts endothelial transport mechanisms essential for cerebral blood flow, impairs protein homeostasis by reducing the clearance of potentially toxic proteins, diminishes immune surveillance and privilege, and deprives the brain of crucial growth factors necessary for repair and regeneration, leading to cardiovascular–neurological system deterioration(4). These mechanisms collectively contribute to an increased risk of stroke recurrence in this age group.

Compared with a study conducted at An Giang Hospital (2024), where the rate of second stroke recurrence was 24.9% with a mean age of only 69 years, our study shows a considerably higher recurrence rate. Internationally, recurrent stroke rates range from 5.7% to 51.3%(2), placing our cohort in the high-risk category(3). his discrepancy is mainly attributable to the large proportion of patients aged ≥75, who are naturally at higher risk due to widespread atherosclerosis, a higher prevalence of comorbidities, and reduced physiological reserve. Additionally, as a tertiary geriatric hospital, our center admits more severe, complex cases or patients previously treated in other facilities, further contributing to the elevated recurrence rate(5).

Regarding comorbidities, hypertension was the most common, affecting 68.8% of patients. Regression analysis indicated that hypertension tended to increase recurrence risk (OR = 2.58), consistent with the study by Wang et al. in China involving 11,560 participants, which demonstrated significantly higher recurrence rates among hypertensive patients compared with non-hypertensive individuals(6). Increasing evidence supports hypertension as the most important modifiable risk factor for stroke. Hypertension not only alters the structure and function of cerebral vessels through hemodynamic effects but also contributes to endothelial dysfunction, oxidative stress, and inflammation. Diabetes mellitus was present in 31.2% of patients-a substantial proportion in the elderly population. A Korean study involving 9,687 participants also confirmed diabetes as a risk factor for recurrent stroke. Dyslipidemia was observed in approximately one-third of patients, consistent with findings by Nawar et al. in 2022(7).

Coronary artery disease was observed in 13.9% of patients, serving as a marker of systemic atherosclerosis and showing a relatively high OR (2.37). Although not statistically significant, this aligns with the pathophysiology of diffuse atherosclerosis, particularly as age is a strong promoting factor. Atrial fibrillation, present in 10.6% of patients, also had an OR greater than 1 (1.21), consistent with a study of 6,052 participants in the United Kingdom, which identified coronary artery disease and atrial fibrillation as independent risk factors for recurrent ischemic stroke(8).

The treatment adherence rate was 94.7%, reflecting the context of a specialized geriatric hospital, where patients often have caregiver support for medication use. High adherence may partly explain why classic risk factors did not reach statistical significance. Nevertheless, the recurrence rate remains high, indicating that even good adherence cannot fully compensate for cumulative vascular injury and comorbidity burden in the very elderly.

This study has several strengths. Conducted in a leading geriatric hospital, it accurately reflects the real-world characteristics of elderly patients with multimorbidity, advanced age, and severe vascular lesions. However, its cross-sectional design limits the ability to evaluate long-term recurrence risk and establish causal relationships. Some factors, such as medication adherence, may also be subject to self-report bias. Additionally, lifestyle factors and socioeconomic determinants, which may influence stroke recurrence, were not fully captured in this study and warrant further investigation.

The findings emphasize that stroke recurrence risk in older adults is predominantly driven by cumulative vascular aging and comorbidity burden rather than individual risk factors alone. Consequently, secondary prevention strategies should adopt a multimodal approach, including intensive blood pressure control, early detection and management of atrial fibrillation, glucose and lipid regulation, optimization of medication adherence, caregiver education, and enhanced post-discharge monitoring. Implementation of continuous care models, comprehensive management of

multimorbidity, and coordinated multidisciplinary interventions within geriatric hospitals may play a critical role in reducing recurrence rates in this very high-risk population. Furthermore, public health initiatives focusing on vascular health promotion and early intervention in midlife could contribute to lowering long-term recurrence in the aging population.

V. CONCLUSION

In this study of 146 patients aged ≥60 years at the National Geriatric Hospital, the recurrent stroke rate was 41.8%. The study population was characterized by an advanced mean age (79.1 ± 10.7 years) and a high prevalence of chronic conditions such as hypertension, diabetes mellitus, and dyslipidemia. Certain factors, including hypertension, diabetes mellitus, atrial fibrillation, and coronary artery disease, tended to increase the risk of recurrence. Despite a high rate of treatment adherence, stroke recurrence remained common, highlighting the need for strengthened secondary prevention management in elderly patients.

VI. RECOMMENDATIONS

It is recommended to strengthen the control of chronic risk factors and provide regular monitoring for elderly stroke patients, while promoting health education and maintaining adherence to medication to reduce the risk of recurrence. In addition, conducting studies with larger sample sizes and longitudinal designs is necessary to more clearly identify independent risk factors for recurrent stroke. Implementing integrated, multidisciplinary care models in geriatric hospitals, with emphasis on continuous care, comorbidity management, and post-discharge follow-up, can help reduce recurrence in very high-risk older adults. Early preventive strategies for vascular health at the population level, targeting modifiable risk factors from midlife, should also be encouraged to mitigate long-term stroke recurrence.

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