Research Square

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Prognostic factors for outcomes in young and middle-aged stroke patients with atrial fibrillation: a hospital-based cohort study in China

Liu Yang
Tangshan Gongren Hospital
Xin Li
Tangshan Gongren Hospital
Xiaofang Gu
Tangshan Fengrun District People's Hospital
Lili Bian
Tangshan Fengrun District People's Hospital
Haijun Zhao
navyzhao424@126.com
Tangshan Gongren Hospital

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Abstract

Objective: Atrial fibrillation (AF) is a well-established risk factor for ischemic stroke and is associated with substantial mortality and disease burden. This study aimed to evaluate the 3- and 12-month prognosis after stroke in Chinese patients aged < 65 years with AF.

Methods: We conducted a hospital-based cohort study and enrolled 230 stroke patients with AF.

Clinical characteristics and outcomes at 3 and 12 months after stroke were assessed.

Results: The mortality, recurrence, and dependency rates at 3 months after stroke were 13.3%,

5.1%, and 23.1%, respectively, and at 12 months were 17.2%, 19.0%, and 36.8%, respectively. At 3 months, compared with POCI, PACI was associated with 4.79-fold and 2.27-fold increases in the risks of mortality and dependency, respectively. Obesity and current smoking were associated with 3.71-fold and 6.87-fold increases in recurrence risk, respectively (all $P < 0.05$). At 12 months, compared with POCI, PACI remained associated with 3.10-fold and 3.73-fold increases in mortality and dependency risks, respectively (all $P < 0.05$). Hypertension was not associated with increased stroke mortality in these young and middle-aged patients with AF ($P = 0.122$).

Conclusions: This study demonstrates that mortality and dependency rates among post-stroke patients increase over time, and that specific stroke subtypes and modifiable risk factors substantially elevate health risks. These findings underscore the need to optimize blood pressure management, prioritize influential risk factors, and develop targeted strategies for the prevention, treatment, and rehabilitation of stroke and atrial fibrillation.

Background

Stroke is the second leading cause of death worldwide and has led to a growing number of deaths and hospitalizations over the past two decades [1–4]. In China, stroke was the leading cause of death, years of life lost, and disability-adjusted life-years in 2017 [5]. An estimated 13 million individuals in China have experienced a stroke, and the associated increase in hospitalization costs has outpaced the growth rate of the gross domestic product [6]. National data indicate that between 2005 and 2016 the proportion of stroke patients under 70 years of age in China continued to rise, while the age at first stroke gradually declined. Consequently, the stroke burden among younger people in China is increasing, constituting a major public health problem.

Atrial fibrillation (AF) is an independent risk factor for ischemic stroke and is associated with high mortality and substantial disease burden [7–10]. AF increases stroke risk approximately fivefold and has been reported in population-based studies to account for 13–31% of incident ischemic strokes [11–13]. Moreover, AF-associated strokes are more likely to be fatal or disabling than non-AF strokes, and the stroke risk attributable to AF exceeds that of other risk factors for ischemic stroke [9, 14–18]. Among patients with AF-related stroke, previous studies have shown that older patients are more likely than

younger patients to experience poor outcomes, including higher rates of mortality, dependency, and recurrence [19, 20]. However, China's large population of patients with AF-associated stroke has not translated into sufficient attention to this important subtype. Therefore, we conducted this study to evaluate the outcomes and associated determinants of AF-related stroke in young and middle-aged adults in China.

Methods

Patient selection

We consecutively recruited patients with acute ischemic stroke admitted to the stroke unit between January 2015 and December 2018, excluding those aged ≥ 65 years and those who had experienced a transient ischemic attack. Patients who received thrombolysis or endovascular reperfusion were also excluded. All patients were diagnosed according to World Health Organization criteria, and the diagnoses were confirmed by brain computed tomography or magnetic resonance imaging.

Trained neurologists collected detailed information for each patient with acute ischemic stroke, including stroke subtype, stroke severity, previous medical history, lifestyle factors, and outcomes at 3 and 12 months after stroke. AF was defined as a documented history of AF or new-onset AF detected upon admission.

Stroke subtype

At admission, strokes were classified according to the Oxfordshire Community Stroke Project (OCSP) criteria as total anterior circulation infarcts (TACIs), partial anterior circulation infarcts (PACIs), lacunar infarcts (LACIs), or posterior circulation infarcts (POCIs) [21].

Clinical features

Stroke severity was categorized using the National Institutes of Health Stroke Scale (NIHSS) as mild (NIHSS ≤ 7), moderate (NIHSS 8–16), or severe (NIHSS ≥ 17) [22]. The Barthel Index (BI) and modified Rankin Scale (mRS) score at admission were also recorded.

Assessed stroke risk factors included hypertension, diabetes mellitus, dyslipidemia, stenosis of the brain-supplying arteries, myocardial infarction (MI), venous thromboembolism (VTE), and obesity (body mass index [BMI] ≥ 30 kg/m²). Lifestyle factors included current smoking (≥ 1 cigarette per day for ≥ 1 year) and alcohol consumption (drinking alcohol at least once per week for 1 year).

Outcome definitions and follow-up process

Outcome definitions and follow-up process

The post-stroke outcomes assessed were mortality, recurrence, and dependency at 3 and 12 months. These were evaluated through both face-to-face and telephone follow-up interviews. Mortality comprised all-cause death occurring within the follow-up period, with death data obtained from family-member reports during follow-up interviews. Recurrence was defined as any new vascular event, including stroke, myocardial infarction, and venous thrombosis, occurring within 30 days after the index stroke; the diagnosis and classification of recurrent events were retrieved from the patients' medical records. Dependency was defined as an mRS score > 2 [15].

Trained neurologists followed up all discharged stroke patients at 3, 6, 9, and 12 months after the index stroke. Information on outcomes, medication use, control of primary risk factors, and mRS scores was recorded during face-to-face or telephone interviews.

Statistical analysis

All enrolled patients were classified into AF and non-AF groups for analysis. Continuous variables, including NIHSS score, BI, mRS, and age, are presented as median (interquartile range); between-group comparisons were performed using Student's t-test or the Mann–Whitney U-test. Categorical variables, including OCSP classification, stroke severity, conventional risk factors, and outcomes at different post-stroke time points, are presented as numbers (percentages); between-group comparisons were performed using Kaplan–Meier survival curves. Logistic regression analysis was used to identify outcome-associated risk factors in patients with AF at 3 and 12 months after stroke, with results expressed as relative risks (RRs) and 95% confidence intervals (CIs). Multivariate analysis included covariates that were statistically significant in the univariate analysis and is presented as adjusted odds ratios (ORs) with 95% CIs. Patients lost to follow-up were excluded from the analyses.

All statistical analyses were performed using SPSS version 25.0 (SPSS Inc., Chicago, IL, USA), with a two-tailed $P < 0.05$ considered statistically significant.

Results

Participants

We consecutively recruited all patients with acute ischemic stroke admitted to the stroke unit in Tangshan, China, between January 2015 and December 2018, excluding those aged ≥ 65 years and those who had experienced a transient ischemic attack.

Patients treated with thrombolysis or endovascular reperfusion were not included.

Ultimately, data from 230 patients with AF were included in the analysis. Among the 230 patients, 151 (65.7%) were male and 79 (34.3%) were female. PACI was the most common OCSP subtype (60.3%). A higher proportion of men had mild stroke severity (47.0%), whereas a higher proportion of women had severe stroke (40.5%). The NIHSS score was significantly higher in women than in men (median 13 vs. 8;

P = 0.001), and the BI score was significantly lower in women than in men (median 20 vs. 55; P = 0.002). Rates of smoking and drinking were also significantly higher in men than in women (all P < 0.001) (Table 1).

Influencing factors related to stroke prognosis in univariate analysis At 3 months after stroke, the mortality and dependency rates were significantly higher in the TACI, severe-stroke, and obesity groups (all P < 0.05). Mortality was also significantly higher in the VTE group (P = 0.006). The recurrence rate was higher among obese than non-obese patients (16.0% vs. 3.5%, P = 0.008) and higher among current smokers than never-smokers (11.8% vs. 1.6%, P = 0.002) (Table 2).

At 12 months, higher mortality and dependency rates were observed in the TACI and severe-stroke groups (all P < 0.001). Mortality was higher among patients with hypertension (22.0% vs. 10.5%, P = 0.030), diabetes (26.4% vs. 14.1%, P = 0.040), and VTE (100% vs. 16.4%, P = 0.002). Dependency was also higher among obese patients (58.6% vs. 33.3%, P = 0.009). By contrast, mortality was lower among current smokers than never-smokers (9.2% vs. 20.8%, P = 0.040), and dependency was lower among current drinkers than non-drinkers (14.7% vs. 41.1%, P = 0.003) (Table 3).

Determining factors related to stroke prognosis in multivariate analysis At 3 months after stroke, compared with POCI, PACI was associated with a 4.79-fold increase in mortality risk (95% CI 2.02–16.61; P = 0.001) and a 2.27-fold increase in dependency risk (95% CI 1.44–7.46; P = 0.005). Obesity (reference: non-obesity) and current smoking (reference: never smoking) were associated with 3.71-fold and 6.87-fold increases in recurrence risk, respectively (all P < 0.05) (Table 4). At 12 months, compared with POCI, PACI remained associated with 3.10-fold and 3.73-fold increases in mortality and dependency risks, respectively (all P < 0.05). Compared with mild stroke, severe stroke was associated with a 2.71-fold increase in mortality risk at 12 months (95% CI 1.11–12.43; P = 0.034), and moderate and severe stroke were associated with 1.86-fold and 2.20-fold increases in dependency risk, respectively, compared with POCI (all P < 0.05). Conversely, compared with non-drinkers, current drinkers had an 81% lower risk of dependency (95% CI 0.06–0.58; P = 0.004) (Table 5).

Discussion

This hospital-based study identified determinants of stroke outcomes at 3 and 12 months among young and middle-aged patients with AF in China. The mortality, recurrence, and dependency rates at 3 months were 13.3%, 5.1%, and 23.1%, respectively, and at 12 months were 17.2%, 19.0%, and 36.8%, respectively. In our cohort, stroke severity was lower in men than in women with AF. At 3 months, PACI was associated with increased risks of mortality and dependency, whereas obesity, smoking, and VTE were associated with higher recurrence risk. At 12 months, mortality and dependency risks were increased among patients with PACI and severe stroke. By contrast, alcohol consumption was associated with a reduced risk of stroke disability at 12 months.

A cohort study involving 11 stroke centers in Ontario, Canada, reported a 12-month case fatality of 23.6% [14]. The multinational European Community Stroke Project hospital-based registry reported a 3-month

post-stroke mortality of 32.8% [23]. The North Dublin Population Stroke Study reported a 5-year post-stroke mortality as high as 60.8% among patients with AF [20]. In the present study, the overall mortality rates at 3 and 12 months were 13.3% and 17.2%, respectively, which are lower than those reported in previous AF-related stroke studies. Several factors may explain this difference. First, the follow-up period in our study was limited to 1 year, and our population was younger than those in the above studies. Second, the study was conducted in Tangshan, China, where the overall standard of medical care is relatively high, which may have contributed to the lower mortality. Therefore, longer follow-up and multicenter studies are needed to validate our findings.

The obesity paradox is well recognized in many chronic diseases among older patients [24, 25]. A Danish cohort study showed that, compared with normal-weight individuals, overweight was associated with a significantly higher risk of ischemic stroke [26]. A previous study reported that among patients with AF aged > 70 years, obesity increased the risk of stroke but did not affect post-stroke mortality [27].

Moreover, a systematic review found an obesity paradox in patients with AF, particularly for all-cause and cardiovascular mortality [28]. In the present study, obesity was a risk factor for recurrence at 3 months after stroke among patients with AF. This may be attributable to the obesity paradox, which predominantly occurs in older populations, whereas our study population comprised young and middle-aged adults under 65 years of age.

Some studies have shown that heavy alcohol consumption increases stroke mortality [29, 30]. Another study found no strong association between alcohol consumption and functional outcome after stroke among patients with AF [31]. A report from the China Atrial Fibrillation Registry Study indicated that drinkers had a lower risk of poor prognosis at 2.5 years after stroke, although this was not statistically significant [32]. In the present study, however, current drinking was protective against dependency at 12 months after stroke among patients with AF. This may be related to the amount and type of alcohol consumed.

In this study, smoking, VTE, and severe stroke were risk factors for poor prognosis after stroke, consistent with previous findings. Multiple studies have reported that smoking increases the risk of mortality and recurrence of stroke among patients with AF [9, 32]. Severe stroke is a known predictor of poor prognosis [13, 22].

Furthermore, VTE is a major cause of morbidity and mortality in patients with stroke [33, 34]. Our results are in line with these previous studies.

This study has several limitations. First, all patients were recruited from a single city, which may limit the generalizability of the findings to China as a whole. Second, pre-stroke information on anticoagulation use was lacking for both groups, which may have affected outcome evaluation; however, the impact is likely minor given the low proportion of anticoagulant use in China. Finally, we did not perform a quantitative analysis of alcohol consumption, and future follow-up should capture more detailed drinking-related information.

Conclusion

In this large, hospital-based stroke registry, we assessed differences in clinical features, risk factors, and outcomes at 3 and 12 months after stroke among young and middle-aged patients with AF. Severe stroke, obesity, and smoking were associated with poor prognosis at 3 months, whereas alcohol consumption was associated with a reduced dependency rate at 12 months. Hypertension was not a contributing factor to stroke recurrence in these young and middle-aged patients with AF. Although the underlying mechanisms require further basic research, these findings provide guidance for predicting stroke prognosis in young and middle-aged patients with AF.

Abbreviations

AF
Atrial fibrillation
CT
computed tomography
MRI
magnetic resonance imaging
OCSP
Oxfordshire Community Stroke Project
TACI
total anterior circulation infarct
PACI
partial anterior circulation infarct
LACI
lacunar infarct
POCI
posterior circulation infarct
NIHSS
National Institutes of Health Stroke Scale
BI
Barthel Index
BMI
body mass index
TC
total cholesterol
TG
triglycerides
HDL-C
high-density lipoprotein cholesterol
LDL-C

low-density lipoprotein cholesterol
FG
fasting glucose
HbA1c
glycosylated hemoglobin
HR
hazard ratio
CI
confidence interval
OR
odds ratio
VISTA
Virtual International Stroke Trials

Declarations

Ethics approval and consent to participate:

The study was reviewed and approved by the Ethics Committee of Tangshan Gongren Hospital (approval No. 2024-Lunshenyanlin-054), in accordance with the principles of the Declaration of Helsinki. Written informed consent was obtained from each patient for the publication of any potentially identifiable images or data included in this article.

Clinical trial number: not applicable.

Consent for publication

Consent for publication is not applicable.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors’ contributions

L.Y. and H.Z. contributed to the conception and design of the study and provided critical revision of the manuscript. X.L. performed the data analysis and drafted the manuscript. L.B. and X.G. were responsible for data collection, case diagnosis, and confirmation. L.Y. reviewed, verified, and refined the statistical methods during the revision phase. All authors read and approved the final manuscript.

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Tables

Tables 1 to 5 are available in the Supplementary Files section.

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