Proceedings of ICMMGH 2026 Symposium: Biomedical Imaging and AI Applications in Neurorehabilitation
DOI: 10.54254/2753-8818/2026.AU29420

Association Between ABO Blood Group and Stroke Risk: A Logistic Regression Analysis

Yiming Ma

Xi'an Tie Yi International Curriculum Center, Xi'an, China
mayiming2026@163.com

Abstract. Stroke remains a leading cause of disability and mortality worldwide, with its disease burden increasingly evident in developing countries like China. As populations age, effective prevention and control of stroke have become crucial public health priorities. Beyond established risk factors, identifying novel biomarkers could significantly improve early detection of high-risk individuals and enable targeted preventive strategies. The ABO blood group system, as an inherited trait, has drawn attention for its potential role in thrombosis and cardiovascular diseases. This study investigates the relationship between ABO blood groups and stroke incidence. Leveraging clinical data from 1,022 participants, we conducted Chi-square tests and multivariate logistic regression, with adjustments for confounding factors such as age, sex, and hypertension.Our findings indicate that individuals with blood type A face a significantly elevated risk of stroke (OR = 1.52, 95% CI: 1.15–2.01). Age (OR = 1.04) and hypertension (OR = 2.98) were also confirmed as important risk factors. The model demonstrated good fit (Hosmer-Lemeshow test, P = 0.312) and strong predictive capability, with an AUC of 0.781. These results suggest that blood type A may be an independent risk factor for stroke, providing new epidemiological evidence to support risk assessment and primary prevention.

Keywords: blood group, stroke, logistic regression, risk factors, epidemiology

1. Introduction

Stroke is an acute cerebrovascular disease that has a high incidence, disability, and mortality rate, making it a major global public health concern. According to estimates from the World Stroke Organization, around 15 million people experience a stroke each year, of whom 5 million die and another 5 million become permanently disabled. Stroke has emerged as the primary cause of adult mortality and disability in China [1]. With significant regional variation, the burden is increasing, being higher in the north, lower in the south, and most noticeable in the central regions.

Finding novel biomarkers that enable early risk identification is crucial for primary prevention of stroke, in addition to traditional risk factors including smoking, diabetes, hypertension, and dyslipidemia. In addition to red blood cells, platelets and vascular endothelial cells also express the ABO blood group antigens.Their potential involvement in thrombosis and inflammatory pathways has attracted research interest. A large meta-analysis from the University of Maryland School of Medicine, involving 600,000 subjects, reported that people with blood type A had about a 16%

© 2025 The Authors. This is an open access article distributed under the terms of the Creative Commons Attribution License 4.0 (https://creativecommons.org/licenses/by/4.0/).

DOI: 10.54254/2753-8818/2026.AU29420

higher risk of ischemic stroke before age 60 compared to other blood types [2]. However, findings on this association remain inconsistent, and evidence in Chinese populations is limited.

Thus, this study assesses the association between ABO blood types and stroke risk using frequentist statistical techniques and clinical case data, offering proof in favor of risk stratification and stroke prevention.

2. Materials and methods

2.1. Data source and study population

A retrospective case-control study was carried out. 512 individuals who had a stroke for the initial time and were hospitalized to a hospital's neurology department between January 2020 and December 2023 made up the case group. Inclusion criteria were: (1)fulfilling the Chinese Guidelines for Diagnosis of Major Cerebrovascular Diseases' (2019) stroke diagnostic criteria; (2) verification with MRI or CT; (3) age ≥18 years. Exclusion criteria were: (1) missing key clinical data; (2) secondary stroke; (3) severe liver or kidney dysfunction or malignancy.

The control group consisted of 510 healthy individuals undergoing health check-ups at the same hospital during the same period. Controls were matched to cases by age (±5 years) and sex, with no history of stroke.

2.2. Study methods

All subjects had the following information gathered:

Age and sex are demographic traits.

Clinical information includes ABO blood type, body mass index (BMI), smoking status, history of diabetes, and hypertension.

Laboratory tests: HDL-C, LDL-C, and TC (total cholesterol, low-density lipoprotein cholesterol). Standard serological techniques were used by the hospital laboratory to perform blood type.

2.3. Statistical analysis

The dataset was processed and analyzed employing R software (version 4.3.1). The analytical strategy proceeded in two stages. Initially, univariate assessments were conducted to evaluate the individual relationship of each variable with the outcome. For this purpose, continuous data were described using measures of central tendency and dispersion appropriate to their distribution: means and standard deviations for normally distributed data, and medians accompanied by interquartile ranges for data violating this assumption. Group comparisons for these variables utilized the independent samples t-test and the Mann-Whitney U test, respectively. All categorical data, presented as frequency counts and percentages, were compared between groups using the chi-square test.

In the second stage, to isolate independent risk factors, all covariates that exhibited a tentative association with the outcome (defined as $P < 0.10$) in the initial univariate screen were advanced to a multivariable logistic regression framework. A forward stepwise selection procedure, guided by the likelihood ratio criterion, was employed to construct a parsimonious final model. The results of this regression are reported as adjusted odds ratios, each with its corresponding 95% confidence interval, which quantitatively represent the effect size of each predictor after accounting for other variables in the model. A probability value of less than 0.05 (using a two-tailed test) was considered indicative of statistical significance for all analyses.

DOI: 10.54254/2753-8818/2026.AU29420

3. Results

3.1. Baseline characteristics and univariate analysis

Table 1 displays the case group's and control group's baseline characteristics. The success of the matching process is confirmed by the fact that neither the age distribution nor the gender distribution showed any statistically significant variations between the two groups ($P > 0.05$).In addition to having higher BMI, TC, and LDL-C values (all $P < 0.05$), the case group also had significantly higher rates of smoking (45.7% vs. 22.5%), diabetes (25.8% vs. 12.0%), and hypertension (62.5% vs. 28.2%).

Table 1. Comparison of baseline characteristics between stroke cases and controls

Characteristic	Age (years)	Male, n (%)	Hypertension, n (%)	Diabetes, n (%)	Smoking, n (%	BMI (kg/m²)	TC (mmol/L)	LDL-C (mmol/L)	HDL-C (mmol/L)
Cases (n=512)	63.5 ± 10.2	298 (58.2)	320 (62.5)	132 (25.8)	234 (45.7)	26.3 ± 3.5	5.12 ± 1.05	3.25± 0.82	1.15 ± 0.31
Controls (n=510)	62.8 ± 9.7	291 (57.1)	144 (28.2)	61 (12.0)	115 (22.5)	24.1 ± 2.9	4.65 ± 0.88	2.7±0.71	1.24 ± 0.29
P-value	0.251	0.721	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Univariate analysis of blood group distribution (Table 2) showed that the proportion of blood type A was significantly higher in cases than controls (38.1% vs. 29.0%; $\chi^2 = 10.25$, $P = 0.001$). In contrast, type O was less common in cases (27.0% vs. 34.3%; $\chi^2 = 7.12$, $P = 0.008$). Distributions of type B and AB did not differ significantly between groups.

Table 2. Comparison of ABO blood group distribution between cases and controls [n(%)]

Blood Group	Cases (n=512)	Controls (n=510)	χ^2-value	P-value
A	195 (38.1)	148 (29.0)	10.25	0.001
B	112 (21.9)	120 (23.5)	0.45	0.503
AB	68 (13.3)	57 (11.2)	1.15	0.284
O	137 (27.0)	175 (34.3)	7.12	0.008

3.2. Univariate logistic regression analysis

Type A was substantially linked to stroke risk, according to univariate logistic regression with type O as the reference (Crude OR = 1.51, 95% CI: 1.18–1.94, $P = 0.001$), as Table 3 illustrates. Additionally, smoking, BMI, TC, LDL-C, diabetes, and hypertension were significant risk factors ($P < 0.05$), but HDL-C was protective (OR = 0.42, $P < 0.001$).

DOI: 10.54254/2753-8818/2026.AU29420

Table 3. Univariate logistic regression analysis of risk factors for stroke

Factor	β-value	Wald χ^2	P-value	Crude OR (95% CI)
Type A (vs. Type O)	0.41	10.75	0.001	1.51 (1.18-1.94)
Hypertension	1.32	115.60	<0.001	3.74 (2.89-4.84)
Diabetes	0.89	36.12	<0.001	2.44 (1.77-3.36)
Smoking	1.02	72.25	<0.001	2.77 (2.14-3.59)
BMI (per 1 kg/m² increase)	0.15	45.64	<0.001	1.16 (1.11-1.21)
TC (per 1 mmol/L increase)	0.49	55.13	<0.001	1.63 (1.44-1.85)
LDL-C (per 1 mmol/L increase)	0.58	68.22	<0.001	1.79 (1.56-2.05)
HDL-C (per 1 mmol/L increase)	-0.87	42.33	<0.001	0.42 (0.32-0.55)

3.3. Multivariate logistic regression analysis

Variables with a P-value < 0.1 from the univariate evaluation were included in the multivariable model.Blood type A (reference: type O) was still a significant independent risk factor for stroke after controlling for age, sex, hypertension, diabetes, smoking, BMI, TC, LDL-C, and HDL-C (Adjusted OR = 1.52, 95% CI: 1.15–2.01, P = 0.003). Strong independent predictors were age (Adjusted OR = 1.04, 95% CI: 1.02–1.06, P < 0.001) and hypertension (Adjusted OR = 2.98, 95% CI: 2.25–3.95, P < 0.001) (see Table 4).

Table 4. Multivariate logistic regression analysis of risk factors for stroke

Factor	β-value	Wald χ^2	P-value	Adjusted OR (95% CI)
Type A (vs. Type O)	0.42	8.98	0.003	1.52 (1.15-2.01)
Age (per year)	0.04	19.62	<0.001	1.04 (1.02-1.06)
Male(vs. Female)	0.15	1.25	0.264	1.16 (0.89-1.52)
Hypertension	1.09	75.38	<0.001	2.98 (2.25-3.95)
Diabetes	0.29	3.21	0.073	1.34 (0.97-1.85)
Smoking	0.41	10.45	0.001	1.51 (1.17-1.94
BMI (per 1 kg/m^2 increase)	0.06	5.12	0.024	1.06 (1.01-1.11)
LDL-C (per 1 mmol/L increase)	0.21	6.05	0.014	1.23 (1.04-1.46)
HDL-C (per 1 mmol/L increase)	-0.55	15.40	<0.001	0.58 (0.44-0.76)

3.4. Model evaluation

The multivariate logistic regression model showed good fit (Hosmer-Lemeshow χ^2 = 7.82, P = 0.312). The AUC was 0.781 (95% CI: 0.754–0.808), indicating reasonably good discrimination ability for stroke prediction.

4. Discussion

This case-control study found that individuals with blood type A had a significantly higher risk of stroke compared to type O (OR = 1.52) after adjusting for conventional cardiovascular risk factors. This is consistent with a large meta-analysis from the University of Maryland, which reported a 16%

DOI: 10.54254/2753-8818/2026.AU29420

increased risk [2]. That analysis included 48 studies, 17,000 stroke patients, and nearly 600,000 controls, providing strong evidence. Our study adds support by confirming this association in a Chinese population.

4.1. Potential biological mechanisms

Several mechanisms may explain the increased stroke risk in type A individuals:

First, differences in coagulation play a key role. People with blood type A have higher plasma levels of coagulation factor VIII (FVIII) and von Willebrand factor (vWF) [3]. vWF promotes platelet adhesion and aggregation, while FVIII is part of the intrinsic coagulation pathway. Elevated vWF and FVIII levels create a prothrombotic state, increasing the risk of clot formation. This may also explain why type A individuals have a slightly higher risk of deep vein thrombosis.

Second, vascular endothelial function and inflammation may be involved. ABO blood group antigens are not restricted to red blood cells; they can also be found on vascular endothelial cells and smooth muscle cells.

It has been suggested that A antigen may influence endothelial function, promoting mild but chronic inflammation and accelerating atherosclerotic plaque formation. A study from Zhejiang University School of Medicine found that carotid atherosclerotic plaque formation was 22% higher in type A individuals than in type O [4].

Additionally, lipid profiles may contribute. Research from the Chinese National Center for Cardiovascular Diseases suggests that type A individuals tend to have higher total cholesterol and LDL-C (“bad” cholesterol) levels [5], consistent with our findings of elevated TC and LDL-C in cases. These factors collectively increase vascular burden and atherosclerosis risk.

4.2. Comparison with other blood types

We did not find significant independent associations between type B or AB and stroke risk, though some studies have reported different findings. For example, one study linked type AB to an 82% increased risk of cognitive impairment, while type B was associated with a 21% higher risk of type 2 diabetes [6]. Type O appears protective in our and most other studies, possibly due to lower vWF and FVIII levels and relatively weaker coagulation activity [3]. These differences suggest that ABO blood groups influence various disease risks through distinct biological pathways.

4.3. Clinical and public health implications

Our findings have several important implications:

a. Risk stratification: ABO blood group is a simple, low-cost, and routinely available biomarker that could be incorporated into stroke risk prediction models (e.g., ASCVD risk score), helping identify high-risk type A individuals who might be missed by traditional risk assessment.

b. Personalized health management: Type A individuals should be especially encouraged to actively control blood pressure, lipids, and glucose, avoid smoking, and maintain a healthy lifestyle. Studies show that a healthy lifestyle can reduce cardiovascular disease risk by over 80% [7].

c. Mechanistic research: This study provides epidemiological evidence from a Chinese population for further exploration of how blood group antigens affect coagulation and vascular function, laying the groundwork for targeted interventions (e.g., preventive anticoagulation strategies for hypercoagulable states).

DOI: 10.54254/2753-8818/2026.AU29420

4.4. Limitations

This study has several limitations:

a. Study design: As a single-center retrospective study, selection and information bias may exist. Future multi-center prospective studies with larger samples are needed.

b. Mechanistic insight: We did not measure vWF, FVIII, or other serological markers, so we cannot directly confirm coagulation differences.

c. Generalizability: Subjects were from a single hospital, which may limit external validity. Future studies should include more diverse populations.

d. Residual confounding: Although we adjusted for multiple confounders, unmeasured or unknown factors may still influence the results.

5. Conclusion

The following are the study's conclusions: Blood type A is an independent risk factor for stroke in Chinese adults after controlling for traditional risk factors; b. The most significant adaptable risk factors for stroke are still smoking, age, high LDL-C, low HDL-C, and hypertension; c. The multivariate logistic regression model may be a useful tool for assessing stroke risk early on because of its strong predictive ability.

References

[1] Chinese Stroke Association. (2021). Chinese Stroke Prevention and Treatment Report 2021. Beijing: China Science Publishing & Media.

[2] Mitchell, B. D., et al. (2023). ABO blood type and risk of first ischemic stroke: a meta-analysis. Journal of Thrombosis and Haemostasis, 21(2), 345–355.

[3] Franco, R. F., & Reitsma, P. H. (2024). ABO blood group and vascular disease: an update. Seminars in Thrombosis and Hemostasis, 50(1), 55–65.

[4] Research Group on Blood Types and Carotid Atherosclerosis. (2023). Association between blood type and carotid atherosclerotic plaque: a clinical study. Chinese Medical Journal, 103(15), 1120–1125.

[5] Wang, Y., et al. (2024). Association between ABO blood group and cardiovascular disease in a Chinese population: a retrospective cohort study. Scientific Reports, 14, 11498.

[6] Kittner, S. J., Mitchell, B. D., & Cole, J. W. (2022). Genetic variation associated with early-onset ischemic stroke: a meta-analysis. Neurology, 99(10), e1062–e1071.

[7] American Heart Association. (2022). Life's Essential 8: updating and enhancing the American Heart Association's construct of cardiovascular health. Circulation, 146(5), e18–e43.