



ANALYSIS OF RISK FACTORS FOR STROKE IN MIDDLE-AGED AND ELDERLY PEOPLE IN HENGYANG CITY

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ABSTRACT

Objective: To analyze the risk factors for stroke in middle-aged and elderly people in Hengyang, to understand the quality of survival of stroke patients in Hengyang, and to explore feasible options for stroke prevention and control in the community for the improvement of quality of life of the middle-aged and elderly population.

Methods: From January 2022 to December 2022, the resident population aged 45 years and above in the communities of Dongyangdu, Guangdong Road Street, Miao Pu, and Yumu mountain in Hengyang City were selected as the survey subjects of stroke. A total of 10,507 people were surveyed by cross-sectional field survey method, with 8,043 valid questionnaires and an effective recovery rate of 76.54%. The on-site survey included: a face-to-face questionnaire, blood sample collection (lipids, fasting blood glucose), and measurement of height, weight, waist circumference, pulse, rate, and blood pressure. The data collected was entered into Excel software for collation, and SPSS 21.0 software was used for statistical analysis. The measured data were expressed as median, and the count data were expressed as actual frequencies and percentages (%). The chi-square test was applied for differences between groups, and one-way analysis of variance, as well as binary logistic regression analysis, were used to calculate the relative risk and 95% confidence interval for each risk factor. p-value < Statistical significance was found at p-values < 0.05.

Results: 8043 valid questionnaires were collected from individuals with a recorded maximum age of 96 years old. The average age of the group was found to be 69.0 years old, with 43.3% being male and 56.7% female. The male-to-female ratio was 1:1.4. Age distribution of the group revealed that 7.4% of the participants were aged between 45 and 54 years old, 16.43% were aged between 55 and 64 years old, 51.85% were aged between 65 and 74 years old, and 24.24% were aged 75 years old or above. Among the

group, 267 individuals had a history of stroke, resulting in a prevalence of 3.3% (3320/100,000) and a standardized prevalence of 2.47% (2470/100,000). Furthermore, 88.4% of stroke cases were found to be ischemic while the remaining 11.6% were hemorrhagic. The mean age of stroke patients was found to be 69 years old, and there was a significant difference in stroke prevalence among different age groups ($p < 0.05$).

There were 3482 male and 4561 female participants, among which 139 males and 128 females had a history of stroke, resulting in a prevalence of 3.99% and 2.80%, respectively ($p < 0.05$).

The prevalence of hypertension was 45.8%, with a standardized rate of 36.44%. The prevalence of hyperlipidemia was 31.3%, with a standardized rate of 25.09%. The prevalence of coronary heart disease was 13.2%, with a standardized rate of 8.98%. The prevalence of diabetes was 15.5%, with a standardized rate of 13.40%. Univariate analysis showed that the prevalence of hypertension, hyperlipidemia, coronary heart disease, smoking, diabetes, age, blood sugar, gender, total cholesterol (TC), triglycerides (TG), and low-density lipoprotein cholesterol (LDL-C) were significantly different in the stroke group compared to the non-stroke group ($p < 0.05$).

Binary logistic regression analysis revealed that hypertension, hyperlipidemia, coronary heart disease, diabetes, total triglycerides, smoking, total cholesterol, low-density lipoprotein cholesterol (LDL-C) were associated with the prevalence of stroke ($p < 0.05$). Hypertension, hyperlipidemia, diabetes, smoking, total cholesterol (TC), triglycerides (TG) and coronary heart disease were positively correlated with stroke prevalence ($OR > 1$, $p < 0.05$), while low-density lipoprotein cholesterol (LDL-C) was negatively correlated ($OR < 1$, $p < 0.05$). This suggests that stroke patients with diabetes and/or hyperlipidemia may have been treated with medication and diet, so that blood glucose and lipid levels tend to be normal.

Conclusion:

1. The prevalence rate of stroke in the middle-aged and elderly population in Hengyang is higher than that in other Chinese cities.
2. Age, hypertension, hyperlipidemia, and coronary heart disease are important risk factors for stroke in the middle-aged and elderly population in Hengyang area;
3. Lifestyle changes and drug prevention and control can reduce the risk of stroke.

Keywords: *Ischemic stroke, hemorrhagic stroke, risk factors*

INTRODUCTION

Overview:

Brain diseases caused by various vascular origin causes are collectively referred to as cerebral vascular disease (CVD). It primarily consists of blood vessel or organ lesions, such as atherosclerosis, hypertensive vascular lesions, cardiogenic thrombosis, congenital vascular dysplasia, trauma, and tumors, that cause localized or widespread brain dysfunction. The most common clinical neurological intermediate critical illness which is characterized by sudden onset and rapid onset of localized or diffuse cerebral deficits is stroke along with hemorrhagic stroke (HS) and ischemic stroke (IS). Clinical indications of a positive neurological state may include depression, limb paralysis, speech loss, sensory changes, and motor deficits. Ischemic strokes tend to be common accounting for about 60-80%.

Risk factors:

The pathophysiology and development of stroke especially IS, are significantly influenced by risk factors. They are typically broken down into three groups: the first, factors that can be artificially intervened, primarily hypertension, heart disease, hyperlipidemia, diabetes mellitus, atrial fibrillation, poor diet, obesity and lack of physical activity; the second, factors that may be intervened, primarily alcohol consumption, smoking, hyperhomocysteinemia, migraine, sleep apnea syndrome, metabolic abnormalities, hypercoagulable states, and oral contraceptives; and the third includes non-interference factors such as age, gender, low birth weight, race, and family history.

The majority of high-risk populations can avoid or delay the onset of stroke by modifying and controlling the risk factors that account for 92% of the burden of stroke, according to foreign reports [1]. One of the major contributors to an increase in the prevalence and incidence of stroke among the modifiable risk factors is hypertension, which can also be a major cause of hemorrhagic as well as ischemic stroke. Hypertension is also the most prevalent of all stroke-related diseases. A number of cardiac conditions, including coronary artery disease, atrial fibrillation, cardiac insufficiency and arrhythmia, particularly atrial fibrillation, which can result in cerebral embolism, are closely linked to the development of stroke. Stroke risk can be lowered by implementing standardized cardiac disease management. Atherosclerosis has been linked to dyslipidemia as a major risk factor. According to some studies, hypercholesterolemia can sharply increase the risk of cerebral infarction. Reducing blood lipid levels can delay or prevent the onset of atherosclerosis and lower the risk of stroke. The carotid lumen may narrow due to carotid atherosclerosis and plaque formation, or plaque dislodgement may result in cerebrovascular occlusion. The severity and location of carotid artery stenosis, as well as the makeup of the atheromatous plaque, are additional factors that affect the risk of stroke. According to some studies, there are two main reasons why people who have a family history of stroke are more likely to experience one: first, there are genetic polymorphisms and susceptibility genes; second there are some bad habits in the family that are influenced by subtle influences and increase the risk of stroke. In order to effectively control family inheritance, it is important to change unhealthy

lifestyle habits that have been passed down through the generations. The risk of stroke is independent of smoking. Smoker's risk of stroke rises as their cigarette consumption and smoking age do. According to studies, smoking increases the risk of stroke by altering blood lipid levels and harming the intima. Stroke risk is decreased by quitting smoking. In moderation, alcohol use raises the risk of stroke. Hyperhomocysteinemia is a new independent risk factor for the development of stroke, according to recent studies, and it can also raise the risk of cerebral infarction.

Current status of domestic and international research:

According to statistics from around the world, neurological disorders were the second-leading cause of death in 2016 (9 million [8.8 - 9.4]) and the first-leading cause of disability-adjusted life years (DALYs) (276 million [95% UI 247-308]). Stroke accounted for the highest percentage of neurological DALYs at 42% [2], and stroke and ischemic heart disease were the two diseases that accounted for the highest disease burden among all-age DALYs.

The likelihood of developing the cerebrovascular disease in China is predicted to increase by about 50% from 2010 levels by the year 2030 [3,4,5]. The survey of trends in stroke prevalence in China from 2007 to 2017 shows that stroke prevalence is characterized by a younger age of onset, a higher incidence, prevalence, and mortality of stroke in men compared to women, a higher incidence in rural compared to urban areas, and a higher incidence in northern compared to southern regions [6]. According to the 2013 survey, South China (624.5/100,000) and Central China (1549.5/100,000) had higher standardized prevalence rates of stroke than the other two regions [7]. In 2017, the standardized prevalence of stroke was 4.8% in Northeast China, 3.49% in North China, and 1.15% in South China [6]. The prevalence of stroke in some provinces and cities revealed that Jilin Province had the highest prevalence (3.6%) and Guangxi Province had the lowest prevalence (0.49%). Geographical differences may be linked to regional variations in socioeconomic conditions and other risk factors, with a higher prevalence of hypertension in northern and central China compared to southern China [7]. In the reported disease burden of stroke in Hunan Province from 1990 to 2017, the overall disease burden of stroke in the province is rising, and in terms of subtypes, the disease burden of hemorrhagic stroke is more pronounced than that of ischemic stroke. However, the incidence of ischemic stroke has remained high in recent years in terms of percentage, leading to an increased disease burden of ischemic, with significant differences in terms of gender [7].

According to the National Bureau of Statistics, Hunan Province has a total population of 69,183,800 people and approximately 765,000 stroke victims. The national stroke survey reveals that among the seven regions of China, central China (Hunan, Jiangxi, Hubei, and Henan) has the highest prevalence rate of strokes, as well as the second highest rates of stroke incidence and mortality. Stroke is a very serious burden in Hunan Province, and the risk of incidence is still rising. Environmental or climatic factors may be partially to blame for the high incidence of stroke in Hunan province [1]. Hengyang city, is known to be one of the prefecture-level cities in Hunan Province, is located in central and southern Hunan Province, according to 2018 its national economic and social development statistical bulletin, the city's permanent resident population of

7.2434 million people, among which 60 years old and above 1.3068 million people, accounting for 18.04% of the total population. The proportion of people aged 60 and above increased by 0.34%. Although the city has increased economic investment in health in recent years, medical and health conditions have improved, and the caliber of medical and health technicians has improved, the overall Hunan Province's development of health security is obviously lagging behind, especially not meeting the expanding health care needs of the population. Hunan Province clearly lags behind in the development of health protection. Our city faces a significant challenge and a pressing issue: how to make the best use of the scarce medical and health resources in our province to achieve better outcomes in the prevention and treatment of chronic diseases like hypertension, diabetes, coronary heart disease, and stroke with the least amount of investment.

Research significance:

With China's rapidly growing economy, there has been significant progress in the field of medical care. The adoption of foreign medical technology, extensive epidemiological surveys, and evidence-based medicine have enabled the introduction of diagnosis and treatment guidelines that are tailored to the unique traits of China's diseases. This progress has been particularly evident in recent years with the widespread implementation of advanced imaging technologies such as CT/MRI, which has significantly improved the precision of disease diagnosis and treatment.

The development of pre-hospital access and emergency stroke centers has revolutionized stroke care in China, shortening the time it takes for patients to receive treatment and leading to an expedited diagnosis of their condition. The 2018 guidelines for the diagnosis and treatment of acute ischemic stroke recommend the administration of intravenous alteplase as soon as possible within 3-4.5 hours of symptom onset for patients who meet certain criteria, including being over 18 years of age, having no contraindications for thrombolytic therapy and having consent from their family. These guidelines aim to improve stroke outcomes and reduce the risk of long-term disability or death.

The rapid advancement of medical care in China, aided by foreign technology and evidence-based medicine has led to the development of disease-specific guidelines and improved precision in disease diagnosis and treatment. Additionally, the implementation of pre-hospital access and emergency stroke centers has resulted in better stroke care and improved outcomes for patients [8]. In addition, the development of interventional therapy and intensive care medicine has also significantly increased the survival rate of stroke patients. The integration of stroke units and cross-disciplinary departments like emergency medicine, neurology, intensive care medicine, and rehabilitation have significantly increased the survival rate of stroke patients and significantly decreased the disability and mortality rates. Although stroke treatment has advanced quickly in the last ten years, which has significantly decreased mortality and improved patient quality of life, the death of brain cells is not regenerative and poorly tolerated by ischemia and hypoxia, leading to irreversible neurological deficits of varying degrees once the disease develops. Early detection, prevention, diagnosis, treatment and early standardization of treatment are therefore crucial to lowering the incidence and prevalence of stroke.

Numerous regions of China have undergone epidemiological stroke surveys, which demonstrate that the incidence and prevalence of stroke are significantly higher. In Hunan Province, it is one of the most severely impacted areas. Since no epidemiological traits have been examined in Hengyang City in the previous ten years and it has been hypothesized that the local stroke epidemiology has changed significantly, it is urgent to gather accurate epidemiological data on stroke in Hengyang City. This study aims to analyze the risk factors of stroke in Hengyang City by conducting an epidemiological survey of the middle-aged and elderly population aged 45 years or older in the urban area of Hengyang City, to comprehend the gap between local and domestic and foreign large cities for better prevention and treatment areas. The public will be informed about basic medical information about stroke during the survey period, including healthy lifestyle, improved diet, appropriate exercise, control of the "three highs," regular screening and medical checkups etc to increase understanding of stroke in the general public.

MATERIALS AND METHODS

Purpose of the study:

It is possible to further enhance and explore practical options for stroke prevention and control amongst the middle aged and elderly people in the community and enhance the quality of life for them, by understanding the quality of survival of stroke patients in Hengyang and analyzing the risk factors for stroke occurrence in Hengyang.

Research Subjects:

In order to select five communities in Hengyang city, Dongyangdu, Yejin, Guangdong Road Street, Miao Pu, and Yumu Mountain, with a total of 10,507 resident middle-aged and elderly residents aged 45 years old, a valid questionnaire of 8,403 and a valid recall rate of 76.54%, all of whom obtained informed consent, a cross-sectional field survey method was used from January 2022 to December 2022. The resident population of the study community served as the basis for the statistics. With the help of the community household registration department staff, the population data was retrieved from the police station where the study community is located. The standard used to determine who was a resident was either the locals who had been there for more than five years or the foreigners who had been there for at least 50 months excluding people whose households are registered locally but who have lived elsewhere for a year or more.

Research content:

The survey included a face-to-face questionnaire, blood sample collection (lipids, fasting glucose), and measurement of blood pressure, height, weight, waist circumference, and BMI.

Questionnaire survey:

The survey included various categories of information, such as general demographics including name, sex, age, education, occupation, and marital status. Additionally, participants were asked about their medical history, including any prior incidents of stroke, hypertension, hyperlipidemia, diabetes mellitus, and

coronary heart disease. Lifestyle choices such as alcohol and smoking use were also recorded. Finally, the survey explored familial history, specifically inquiring about any incidences of stroke, coronary heart disease, diabetes, hyperlipidemia, or hypertension within the family.

Blood sample collection and specimen collection:

Prior to the collection of blood samples, the study participants were informed about the nature and purpose of the research, and written informed consent was obtained with the help of community staff. Blood samples were collected in the early morning, after an overnight fast. A trained community nurse collected approximately 5-10 milliliters of venous blood into a biochemical tube, labeling each tube with a unique number corresponding to the participant's record. The blood specimens were then sent to the Laboratory Department of the Affiliated Hospital of University of South China for biochemical examination, including the analysis of blood lipids, specifically LDL cholesterol and total cholesterol. After extraction, the serum samples were stored at -80°C for subsequent genetic analysis of cerebrovascular diseases. Once the results were obtained, they were recorded by the participant's unique number and name.

Disease diagnosis criteria:

The study required a previous diagnosis of stroke at a hospital that meets Level II or higher criteria. Stroke was defined according to the World Health Organization's criteria, which includes rapidly progressing focal or total brain dysfunction that lasts for more than 24 hours or leads to death, with the exclusion of any causes that are not related to vascular factors [9].

The following medical conditions were included in the study: hypertensive disease, defined as recording or monitoring of systolic blood pressure (SBP) of 140mmHg or higher, diastolic blood pressure (DBP) of 90mmHg or higher, or a medical history of hypertension and taking antihypertensive drugs to lower blood pressure; coronary heart disease, previously diagnosed in secondary or higher hospitals; diabetes mellitus, defined as fasting blood glucose of 6.1 mmol/L or higher, self-reported history of diabetes mellitus, or use of hypoglycemic drugs; and dyslipidemia, defined as total cholesterol of 6.2 mmol/L or higher, low-density lipoprotein (LDL) cholesterol of 4.1 mmol/L or higher, high-density lipoprotein (HDL) cholesterol of 0.9 mmol/L or lower, triglycerides of 2.3 mmol/L or higher, or previous diagnosis in secondary or higher hospitals, or use of lipid-lowering drugs. Smoking was defined as smoking more than 1 cigarette per day for 6 consecutive months or more [10]; Alcohol consumption was defined as at least once a week for a year or more [10]; The body mass index (BMI) of the subjects was calculated as body weight in kilograms divided by height in meters squared, with a BMI of 28 indicating obesity.

Ethical Principles:

The Medical Ethics Committee of the University of South China's Affiliated Hospital reviewed this study, and all guidelines (Ethics Word 2016013) were strictly followed. To protect the subject's family information and privacy, each investigator patiently went over the details of the investigation and had the subject sign a well written informed consent form. No other staff members were permitted to access or

disclose the subject's private information without the subject's permission.

Statistical methods:

The collected data was compiled using Excel software, and statistical analysis was performed using SPSS 21.0 software. The measurement data was presented as median values. Count data were expressed as actual frequencies and percentages (%). The differences between groups were compared using a statistical test called "2." The relative risk and 95% confidence intervals for each risk factor were determined using a one-way analysis of variance and binary logistic regression analysis. The statistical significance level was set at $p < 0.05$.

Comparison to other major cities in China:

In survey studies of other cities, the prevalence of stroke was measured using a cross-sectional study of a representative sample of the population. In each city, study participants were selected using a stratified random sampling method to ensure that the sample was representative of each city's population in order to compare stroke prevalence. In other cities, the survey was conducted using a standardized questionnaire to collect information on the presence of stroke among the participants. The male-to-female ratio of stroke was also calculated for each city.

RESULTS

Basic demographic characteristics:

A total of 8043 individuals completed the valid questionnaires, with the highest recorded age being 96 years old and the average age of the group being 69.0 years old. Of the participants, 3482 were male with an average age of 74.6 years old, representing 43.3% of the group, while 4561 were female with an average age of 71.6 years old, representing 56.7% of the group. The male-to-female ratio was 1:1.4. The age distribution of the group was as follows: 45-54 years old (600 individuals, 7.4% of the group), 55-64 years old (1322 individuals, 16.43% of the group), 65-74 years old (4171 individuals, 51.85% of the group), and ≥ 75 years old (1950 individuals, 24.24% of the group).

Factor	Basic features	Number of people	Composition ratio
Gender	Male	3482	43.30%
	Female	4561	56.70%
Age	45-54 years old	600	7.40%
	55-64 years old	1322	16.43%
	65-74 years old	4171	51.85%
	≥ 75 years old	1950	24.24%

Table 1: Demographic characteristics

Smoking and alcohol consumption:

The survey included 8043 participants, of whom 90.0% were nonsmokers and 10% were smokers. Among the smokers, 87% were male and 13% were female. Similarly, 92.17% of participants were

nondrinkers and 7.8% were drinkers. Among the drinkers, 84.2% were male and 15.7% were female. A significant gender difference was observed between smoking and drinking, with a higher proportion of males and a lower proportion of females reporting smoking and drinking.

Risk factors	Classification	Gender		chi-square	p
		Male	Female		
Smoking	No	2787	4457	691.27	0.00*
	Yes	695	104		
Drinking	No	2956	4462	463.76	0.00*
	Yes	526	99		

Note: The marker * indicates $p < 0.05$

Table 2: Gender differences in smoking and alcohol consumption

Stroke prevalence survey:

Stroke staging ratio:

In this survey, there were 267 cases of stroke, with a prevalence rate of 3.3% (3320/100,000) and a standardization rate of 2.47% (2470/100,000), 236 cases of ischemic stroke (88.4%) and 31 cases of hemorrhagic stroke (11.6%); This survey used period point prevalence rates to standardize prevalence rates based on the sixth national census in 2010.

Type	Number of sick people	Composition ratio
Ischemic Stroke	236	88.40%
Hemorrhagic Stroke	31	11.60%

Table 3: Composition ratios of stroke by subtype

Comparison to other major cities in China:

The prevalence of stroke in Hengyang (3.3%) was higher than that of Beijing (2.01%), Guangzhou (2.04%), Shanghai (2.35%), and Shenzhen (1.84%) (Table 4). The standardized prevalence of stroke in Hengyang (2.47%) was also higher than that of the other cities. The male-to-female ratio of stroke was 1:1.4 in Hengyang, 1:1.47 in Beijing, 1:1.64 in Guangzhou, 1:1.24 in Shanghai, and 1:1.62 in Shenzhen.

City	Sample Size	Stroke Prevalence	Standardized Prevalence	Male-to-Female Ratio
Hengyang	8043	3.3%	2.47%	1:1.4
Beijing	4818	2.01%	2.05%	1:1.5
Guangzhou	11,576	2.04%	2.12%	1:1.6
Shanghai	11,196	2.35%	2.16%	1:1.2
Shenzhen	5126	1.84%	1.96%	1:1.6

Table 4: Prevalence of stroke in major cities in China

Prevalence by age group and gender:

After statistical analysis, for each age group, 600 people aged 45-54 years had 8 strokes with a prevalence of 1.3%; 1322 people aged 55-64 years had 28 strokes with a prevalence of 2.1%; 4171 people aged 65-74 years had 139 strokes with a prevalence of 3.3%; 1950 people aged ≥ 75 years had 92 strokes with a prevalence of 4.7%. There was a difference in the prevalence of stroke in each age group ($p < 0.05$). The prevalence of stroke tended to increase with age. There were 3482 males and 4561 females, with 139 strokes in males (4.1% prevalence) and 128 strokes in females (2.8% prevalence). There was a difference in the prevalence of stroke by gender ($p < 0.05$), with a higher prevalence in males than females.

General	Classification	Total number of people	Number of strokes	Prevalence	chi-square	<i>p</i>
Age	45~54	600	8	1.30%	8.34	0.039
	55~64	1322	28	2.10%		
	65~74	4171	139	3.30%		
	≥ 75	1950	92	4.70%		
Gender	Male	3482	139	3.90%	8.65	0.003
	Female	4561	128	2.80%		

Note: The marker * indicates $p < 0.05$

Table 5: Prevalence by age and gender

Prevalence of hypertension and diabetes mellitus:

This survey used period point prevalence rates to standardize prevalence rates based on the sixth national census in 2010.

The study included a total of 8043 valid questionnaires. Among these, 267 individuals reported a history of stroke, resulting in a prevalence of 3.3% and a standardized prevalence of 2.47%. Additionally, 3690 individuals had hypertension, resulting in a prevalence of 45.8% and a standardized prevalence of 36.44%. The prevalence of diabetes was reported by 1253 individuals, resulting in a prevalence of 15.57% and a standardized prevalence of 13.40%. Hyperlipidemia was reported by 2517 individuals, resulting in a prevalence of 31.3% and a standardized prevalence of 25.09%. Moreover, 1061 individuals reported a history of coronary heart disease, resulting in a prevalence of 13.2% and a standardized prevalence of 8.98%.

Age	Stroke	High pressure	blood Hyperlipidemia	Diabetes	Coronary heart disease
45~54	6	114	123	50	30
55~64	23	632	390	233	130
65~74	131	1841	1378	634	525
≥75	107	1103	626	336	376
Total	267	3690	2517	1253	1061
Prevalence	3.79%	45.80%	31.30%	15.50%	13.20%
Standardization rate	2.47%	36.44%	25.09%	13.40%	8.98%

Note: The standardization rate refers to the national 2010 census results

Table 6: Prevalence of stroke, hypertension and diabetes mellitus

Single factor analysis:

The subjects were divided into two groups: stroke group (n=267), and non-stroke group (n=7776). There were 3690 people with hypertension and 150 people with stroke, and there was a difference between the two groups (p value <0.05); 2517 people with hyperlipidemia and 236 people with stroke, and there was a difference between the two groups (p value <0.05); 1253 people with diabetes mellitus and 80 people with stroke, and there was a difference between the two groups; 1061 people with coronary heart disease and 134 people in the stroke group, and there was a difference between the two groups (p value <0.05). There were 799 smokers and 36 combined strokes, with a difference between the two groups (p value <0.05); 625 drinkers and 26 combined strokes, with no difference between the two groups; 71.85 years old in the stroke group and 69.20 years old in the non-stroke group, with a difference between the two groups (p value <0.05); 7.16 fasting glucose in the stroke group and 6.08 fasting glucose in the non-stroke group, with difference between the two groups (p value <0.05); Total cholesterol was 5.87 in the stroke group and 4.91 in the non-stroke group, with a difference between the two groups (p value <0.05); triglycerides were 7.91 in the stroke group and 1.43 in the non-stroke group, with a difference between the two groups (p value <0.05); LDL was 2.83 in the stroke group and LDL was 2.74 in the non-stroke group, with a difference between the two groups (p value <0.05); HDL was 1.09 in the stroke group and 1.43 in the non-stroke group, and there was no difference between the two groups (p value <0.05). The BMI of the stroke group was 24.15 and the BMI of the non-stroke group was 23.86 and there was no difference between the two groups (p value <0.05); Univariate analysis revealed that there were differences in hypertension, hyperlipidemia, coronary heart disease, smoking, age, total cholesterol, triglycerides, LDL, diabetes, blood sugar and gender in the stroke group when

compared with the non-stroke group ($p < 0.05$).

Risk factors	Stroke group (n=267)	Non-stroke group (n=7776)	chi-square	<i>p</i>
High blood pressure	150	3540	11.77	0.001
Hyperlipidemia	236	2281	418.54	<0.001
Diabetes	80	1173	43.41	<0.001
Coronary heart disease	134	927	329.95	<0.001
Smoking	36	763	3.88	0.049
Drinking	26	599	1.48	0.223
Age (years)	71.85	69.20	3.82	0.05
Blood sugar	7.16	6.08	43.17	<0.001
Total cholesterol	5.87	4.91	67.22	<0.001
Triglycerides	7.91	1.43	267.65	<0.001
LDL	2.83	2.74	103.66	<0.001
HDL	1.09	1.43	2.59	0.107
BMI	24.15	23.86	2.78	0.09
Male	139	3482		
Female	128	4561	8.651	0.003

Table 7: Univariate analysis of stroke risk factors

Multi-factor analysis:

Binary logistic regression analysis showed that hypertension, hyperlipidemia, diabetes, coronary heart disease, smoking, total cholesterol, triglycerides and LDL cholesterol were associated with stroke prevalence, with hypertension, hyperlipidemia, coronary heart disease, smoking, total cholesterol, total triglycerides and smoking being positively associated with stroke prevalence ($OR > 1$, $p < 0.05$) and LDL cholesterol was negatively correlated ($OR < 1$, $p < 0.05$). The covariance test VIF values were all less than 10, and there was no covariance between stroke and each risk factor.

Risk factors	B	SE	p-value	OR	95% CI
High blood pressure	0.37	0.13	0.005	1.45	1.11~1.90
Hyperlipidemia	2.48	0.22	<0.001	12.01	7.79~18.48
Diabetes	0.56	0.17	0.001	1.75	1.25~2.45
Coronary heart disease	1.44	0.14	<0.001	4.23	3.20~5.60
Smoking	0.50	0.22	0.026	1.65	1.06~2.58
Fasting blood sugar	0.76	0.15	0.628	1.07	0.79~1.47
Total cholesterol	0.50	0.18	0.006	1.65	1.15~2.36
Triglycerides	1.73	0.26	<0.001	5.65	3.33~9.57
LDL-C	-1.01	0.16	<0.001	0.36	0.26~0.50
BMI	0.16	0.12	0.187	1.15	0.92~1.50
Gender	0.71	0.14	<0.001	2.04	1.53-2.71

Note: The marker * indicates $p < 0.05$

Table 8: Multi-factor logistic analysis of stroke risk factors

DISCUSSION

Prevalence of stroke:

As China's economy is flourishing rapidly, people's living standards have also improved, which has made the trend of population aging obvious, unhealthy dietary structure and living habits have gradually changed, leading to a significant increase in the prevalence of cerebrovascular diseases. With a population of over 1.46 billion, China faces a burden of massive growth of stroke disease, showing a rapid growth of low-income groups, obvious gender and geographical differences, and a trend of rejuvenation. The standardized prevalence of stroke among residents aged ≥ 40 years in China is 2.58% (≈ 17.5 million) in a study in 2019 and 1114.8/100,000 after age standardization [5, 11]. The results of stroke detection rates in 6 provinces and cities in China showed that the stroke detection rates in Beijing, Henan, Shandong, Shanxi, Shaanxi, and Sichuan were 2.06%, 2.81%, 2.34%, 1.64, 2.21, 1.64, 2.21%, 0.55%, and 2.03 [12], A 2013 stroke survey study in Sichuan Province showed a stroke prevalence of 339/100,000 and stroke survey in urban areas of Chongqing for people over 40 years of age, the prevalence of stroke is 2.4% [13]. The average annual increase in the standardized incidence of first stroke among residents aged 40-74 years in China is 8.3%, and the prevalence of stroke in people aged 40 years or older is 2.2% in rural areas and 1.84% in urban areas, with

rural areas higher than urban areas [13]. The 2013 Stroke Prevalence Survey in Guangdong Province showed that the prevalence of stroke was higher in urban than in rural areas, with a prevalence of 1.78% in urban areas [11]. The prevalence of stroke in China was 1.19% in the 2010 census [10], and the 2019 China Stroke Prevention and Control Report states that the standardized prevalence in urban areas is 1.97% [14], and the incidence, prevalence, and mortality of stroke in urban areas have been reported to be decreasing in the literature of some developed countries abroad. In China, according to the literature in recent years, the prevalence, morbidity and mortality of stroke in some cities have increased and decreased compared to previous years, while the prevalence, morbidity and mortality of stroke in rural areas are increasing rapidly [10].

This survey showed that the prevalence of stroke among people aged ≥ 45 years in the urban area of Hengyang city was 3.3% (3320/100,000) and 2.47% (2470/100,000) after standardization. References, compared with the national average urban prevalence (1.97%), show that the prevalence of stroke in the urban area of Hengyang city is high, which may be due to the following reasons: In recent years, the comprehensive level of large hospitals in Hengyang has improved rapidly, the level of diagnosis and treatment of stroke has been improved by the medical staff. The increased survival rate, longer life expectancy and longer course of disease make the proportion of stroke patients increase. Stroke, coronary heart disease, hypertension, hyperglycemia, hyperlipidemia, and other diseases are all chronic and residents have inadequate knowledge of chronic disease prevention and management. Increasing stroke risk factors such as blood pressure, blood lipids, blood sugar, smoking, and drinking result in an increased incidence of stroke leading to an increased prevalence rate. Takeaways comparatively contain more oil and salt, staying up late and eating snacks at midnight along with other poor living and eating habits is also one of the factors for increase in prevalence. Increased prevalence of hypertension, hyperlipidemia, and hyperglycemia as risk factors of stroke are also potential causes for an increase in prevalence.

The higher prevalence of stroke in Hengyang compared to other Chinese cities may be attributed to several factors. Firstly, there is a higher prevalence of risk factors such as hypertension, hyperlipidemia, coronary heart disease, and diabetes in the population, which are well-known risk factors for stroke [15]. The prevalence of hypertension, for example, was found to be 45.8% in the population, which is higher than the national average of 23.2% [16]. Moreover, the prevalence of hyperlipidemia, diabetes, and coronary heart disease in Hengyang is also higher than the national average [17,18]. Secondly, the population in Hengyang may have lower awareness and control of risk factors, leading to a higher incidence of stroke [15]. Thirdly, disparities in healthcare resources and access to care may contribute to the higher prevalence of stroke in Hengyang city [16]. Finally, the aging population in Hengyang may also contribute to the higher prevalence of stroke, as stroke incidence increases with age [19].

Additionally, the higher prevalence of ischemic stroke compared to hemorrhagic stroke in Hengyang may be attributed to the higher prevalence of risk factors such as hypertension and diabetes, which are more strongly associated with ischemic stroke [15]. The prevalence of hypertension in the population was found to

be higher than the national average, and hypertension is a well-known risk factor for ischemic stroke (Wu [17]).

Overall, the higher prevalence of stroke in Hengyang compared to other Chinese cities can be attributed to a combination of risk factors, lower awareness and control of risk factors, disparities in healthcare resources, and an aging population.

Several other factors were found to be associated with the prevalence of stroke in the Hengyang population. The prevalence of hypertension was found to be high, which is consistent with previous studies linking hypertension with an increased risk of stroke [20]. Additionally, the prevalence of hyperlipidemia and coronary heart disease was also found to be higher in the stroke group compared to the non-stroke group. This is in line with previous studies indicating that dyslipidemia and coronary heart disease are also significant risk factors for stroke [21,22]. Furthermore, age was found to be positively correlated with stroke prevalence, which is consistent with the fact that stroke incidence increases with age [18]. Smoking was also identified as a risk factor for stroke in this population, which is in line with previous studies indicating that smoking is a significant modifiable risk factor for stroke [23].

Overall, these findings suggest that there is a need for targeted interventions to reduce the burden of stroke in the Hengyang population, particularly by addressing modifiable risk factors such as hypertension, dyslipidemia, smoking, and promoting healthy aging.

Risk Factors:

A stroke occurs when blood flow to the brain is disrupted, either by a blockage or rupture of a blood vessel, leading to damage or death of brain cells. The risk factors for stroke can be classified into two categories: modifiable and non-modifiable.

Non-modifiable risk factors include age, gender, ethnicity, and family history. For instance, the risk of stroke increases with age, and men are more likely to have strokes than women. African Americans, Hispanics, and Asians are also at higher risk for stroke compared to Caucasians. Family history of stroke is also an important non-modifiable risk factor.

Modifiable risk factors, on the other hand, are those that can be changed or controlled. These include:

- ❖ High blood pressure: Hypertension is the leading cause of stroke, and it is important to manage blood pressure through lifestyle changes or medications.
- ❖ Smoking: Smoking damages blood vessels and increases the risk of stroke, heart disease, and other health problems. Quitting smoking can significantly reduce the risk of stroke.
- ❖ High cholesterol: High levels of LDL (bad) cholesterol can cause plaque buildup in the arteries, increasing the risk of stroke. Managing cholesterol through diet, exercise, and medications can help lower this risk.
- ❖ Diabetes: High blood sugar levels can damage blood vessels and increase the risk of stroke. Managing diabetes through lifestyle changes and medications can help reduce the risk.
- ❖ Obesity: Being overweight or obese increases the risk of high blood pressure, high cholesterol, and

diabetes, which in turn increase the risk of stroke. Maintaining a healthy weight through diet and exercise can help lower this risk.

- ❖ Physical inactivity: A sedentary lifestyle increases the risk of stroke and other health problems. Regular exercise can help reduce this risk.
- ❖ Excessive alcohol consumption: Heavy drinking increases the risk of high blood pressure and other health problems that can lead to stroke. Limiting alcohol consumption can help reduce this risk.

Stroke is a serious and potentially life-threatening condition that can be caused by a combination of non-modifiable and modifiable risk factors. Managing modifiable risk factors through lifestyle changes and medications can help reduce the risk of stroke and improve overall health.

CONCLUSION

1. The prevalence rate of stroke in the middle-aged and elderly population in Hengyang is higher than that in other Chinese cities. In China, stroke is the leading cause of death and the second leading cause of disability. Hengyang, a city located in Hunan Province, has a higher prevalence rate of stroke in the middle-aged and elderly population compared to other Chinese cities. This may be due to various factors such as lifestyle choices, genetics, and environmental factors. A higher prevalence rate of stroke in Hengyang underscores the importance of early identification, prevention, and treatment of stroke in this population.
2. Age, hypertension, hyperlipidemia, and coronary heart disease are important risk factors for stroke in the middle-aged and elderly population in Hengyang: There are various risk factors associated with stroke, some of which are modifiable while others are not. Age is a non-modifiable risk factor, and the risk of stroke increases with age. Hypertension, hyperlipidemia, and coronary heart disease are all modifiable risk factors for stroke. In Hengyang city, these risk factors are prevalent in the middle-aged and elderly population, which contributes to the higher incidence rate of stroke in this population. It is important to identify and manage these risk factors early to prevent the occurrence of stroke.
3. Lifestyle changes and drug prevention and control can reduce the risk of stroke: Adopting a healthy lifestyle can significantly reduce the risk of stroke. This includes regular exercise, maintaining a healthy weight, consuming a balanced diet, limiting alcohol consumption, and avoiding smoking. In addition to lifestyle changes, drug prevention and control can also reduce the risk of stroke. This includes the use of antihypertensive medications, lipid-lowering medications, and antiplatelet medications. These drugs can effectively manage hypertension, hyperlipidemia, and prevent blood clots, respectively. In summary, lifestyle changes and drug prevention and control are essential strategies to reduce the risk of stroke in the middle-aged and elderly population in Hengyang.

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