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ORIGINAL ARTICLE

Risk factors of acute cerebral infarction in patients with primary hypertension

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Abstract

Objective To explore the risk factors of acute cerebral infarction (ACI) in patients with primary hypertension.

Methods Patients diagnosed with primary hypertension and ACI and confirmed by MRI, who were admitted to Honghuagang District people's Hospital, Zunyi City, from January 2020 to December 2020, were selected. Concurrent patients with primary hypertension were selected as the control group. The risk factor including sex, age, smoking, drinking, laboratory examination, and other complications was analyzed.

Results Three hundred patients with hypertensive ACI and 117 cases with hypertension were included. The laboratory examination comparison between the two groups showed that patients in the ACI group had higher glycosylated hemoglobin, D-dimer and FDPs then patients of the control group ($P < 0.05$). There was significant association between diabetes mellitus and acute cerebral infarction in patients with primary hypertension ($OR = 1.452$, $P = 0.004$).

Conclusion Poor control of blood glucose in pre-morbid diabetes mellitus may be related to the occurrence of ACI. Diabetes mellitus is an independent risk factor in ACI patients with primary hypertension.

Keywords Acute cerebral infarction · Diabetes mellitus · Hypertension · Risk factors

Introduction

Hypertension is a complex disease that can be caused by many factors such as heredity, environment, and society [1–4], which is the main risk factor for cardiovascular disease, stroke, disability, and death [5, 6]. Acute cerebral infarction (ACI) is one of the most dangerous ischemic cerebrovascular diseases, and its prevalence is increasing year by year [7]. According to a global disease study in 2010, ACI has become the second-largest cause of death in the world [8], which is the leading cause of death in China [9].

There are many risk factors for ACI, but hypertension is considered as one of the most important risk factors. However, not all patients with hypertension develop ACI. As a result, it is particularly important to explore the potential risk factors of ACI in patients with hypertension. Recent studies have shown that dyslipidemia, D-dimer, and FDPs are of great significance with close correlation to the occurrence of ACI [10, 11], but there are few studies on the occurrence of ACI in patients with high blood pressure. Ischemic stroke was associated with small and large artery disease [12]. Therefore, this study is mainly for the clinical characteristics and risk factors of ACI in patients with hypertension.

Methods

Patients

Patients diagnosed with primary hypertension and ACI and confirmed by MRI, who were admitted to Honghuagang District people's Hospital, Zunyi City, from January 2020 to December 2020, were selected. Concurrent patients with primary hypertension were selected as the control group.

The inclusion criteria were (1) patients diagnosed with high blood pressure according to the International Society of Hypertension (ISH) 2020 International Hypertension Practice Guide [13], (2) patients diagnosed with ACI according to 2018 guidelines for the early management of

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Table 1 Comparison of basic characteristics

	ACI	Control	$X^{2/z}$	*P*
Sex (M)	143(47.7)	51(43.6)	0.562	0.512
Age/Years	70(63,77)	70(63,76)	1.237	0.216
Smoking	78(26.0)	23.(19.7)	1.844	0.204
Drinking	36(12.0)	7(6.0)	3.295	0.075

patients with acute ischemic stroke [14], and (3) patients who can complete the relevant examinations in accordance with the doctor's advice. The exclusion criteria were (1) patients with first aid and (2) patients with mental disorders. This study has been approved by the ethics committee of Honghuagang District people's hospital. The study was performed in accordance with the 1964 Helsinki declaration on ethical standards. All participants and their families have agreed to use the information required for this study for scientific research and signed informed consent.

Observation index

The general data including sex, age, smoking, and drinking were collected. The results of the brain MRI examination were recorded. Laboratory tests including blood glucose, glycosylated hemoglobin, coagulation function, and blood lipids. The complication of dyslipidemia and type 2 diabetes mellitus (T2DM) was evaluated. The diagnosis of dyslipidemia was according to 2019 ESC/EAS guidelines [15]. The T2DM was diagnosed according to 2020 ADA guidelines [16].

Statistical analysis

All the data were processed and analyzed using SPSS 19.0. Qualitative data were reported as frequency and percentage, χ^2 or Fisher accurate inspection was used for comparison. Univariate logistic regression was used to evaluate the risk factor related with hypertensive ACI. Measurement of non-normal distribution was reported as median and interquartile spacing. Kruskal–Wallis test was used for intergroup comparisons, with the level of $\alpha = 0.05$.

Results

Basic characteristics

Three hundred patients with hypertensive ACI and 117 cases with hypertension were included.

The age of the ACI group was 70 (range 63–77) years old, while it was 70 (range 63–76) years old in the control group. There were 143 males in the ACI group and 51 males in the control group. There were no significant differences of sex, age, and smoking status between the two groups ($P > 0.05$). The proportion of drinking patients in the ACI group was significantly higher than that in the control group ($P = 0.075$) (Table 1).

Comparison of laboratory examination

There were no significant differences of blood glucose, CT, Triglyceride, C-LDL, and C-HDL between the two groups ($P > 0.05$). The level of glycosylated hemoglobin, D-dimer, and FDPs was significantly higher in the ACI group compared with that in the control group ($P < 0.05$) (Table 2).

Analysis on risk factors

There were 90 patients with T2DM in the ACI group, while there were 19 patients in the control group. In the comparison of risk factors between the ACI group and control group, it was found that T2DM was associated with ACI ($OR = 1.452$, $P = 0.004$) (Table 3).

Table 2 Laboratory examination

	ACI	Control	*z*	*P*
Blood glucose	.775(5.13,6.93)	.20.165(6,7.70)	1.818	0.178
Glycosylated hemoglobin	6.27(5.6,7.3)	5.30(5.70,6.15)	25.921	0.000
CT	4.64(3.71,5.47)	4.57(3.61,5.28)	1.076	0.300
Triglyceride	1.45(0.98,2.12)	1.33(0.91,1.94)	1.823	0.177
C-LDL	2.39(1.73,3.14)	2.42(1.68,2.88)	0.924	0.336
C-HDL	1.62(1.39,1.87)	1.59(1.37,1.87)	0.136	0.713
D-dimer	0.6(0.27,1.06)	0.43(0.23,0.79)	5.663	0.017
FDPs	2.12(1.21,3.63)	1.41(0.98,2.25)	10.884	0.001

CT clotting time, *C-LDL* low density lipoprotein cholesterol, *C-HDL* high density lipoprotein cholesterol, *FDPs* fibrinogen degradation products

Table 3 Analysis on risk factors

	ACI	Control	$X^{2/z}$	*P*	OR	95%CI
Sex(M)	143(47.7)	51(43.6)	0.562	0.512	1.179	0.767-1.812
Age/ Years	70(63,77)	70(63,76)	1.237	0.216	1.002	0.999-1.004
Smoking	78(26.0)	23(19.7)	1.844	0.204	0.696	0.412-1.176
Drinking	36(12.0)	7(6.0)	3.295	0.075	0.467	0.202-1.081
Dyslipidemia	167(55.7)	73(62.4)	1.559	0.226	0.927	0.600-1.432
T2DM	90(30.0)	19(16.2)	8.256	0.004	1.452	1.261-1.784

Discussion

The prevalence of hypertension in China is still increasing yearly [17]. In was considered that the risk factors of hypertension included genetic factors, age, and multiple unhealthy lifestyles [17]. With the continuous development of the economy, smoking, drinking, and high-fat diet have gradually become unhealthy lifestyle in more and more populations, which are also considered as "traditional risk factors." Many diseases have been caused by these risk factors and hypertension is one of the most common diseases.

It was reported that hypertension is closely related to ACI, and nearly 60% of stroke is attributed to hypertension [18]. Hypertension can increase the risk of hemorrhagic stroke by about 10 times, and the risk of ischemic stroke by about 4 times, which is significantly higher than that of other diseases [19]. At the same time, hypertensive patients with other risk factors will aggravate the occurrence of stroke. According to the National Stroke Epidemiology Survey (NESS-China), the incidence of stroke in China in 2016 was 403.09/100000 [20, 21]. Therefore, in addition to focusing on hypertension as an important risk factor, effective prevention, and control of risk factors which were synergistic with hypertension can reduce the incidence of stroke.

Diabetes mellitus is one of the most important risk factors for the occurrence and recurrence of ACI in patients with hypertension [22, 23]. Diabetes mellitus is an important risk factor for cardiovascular disease, while more than half of patients with diabetics died from cardiovascular disease [24, 25]. The incidence of diabetes mellitus has been increasing in recent years [26], which also significantly increases the risk of cardiovascular disease. In the current study, T2DM was an independent risk factor for ACI in patients with hypertension. In addition, although there is no significant difference of blood glucose between the ACI group and the control group, there is a significant difference of glycosylated hemoglobin between the two groups, indicating that compared with the control group, the ACI group had poor control on blood glucose in the nearly 2–3 months of onset, which is similar to the conclusion of previous study [27]. It showed that the risk of cerebral infarction in patients with diabetes mellitus increased by 2–3 times, and hypertensive patients with diabetes mellitus also had greatly increased prevalence of cerebral infarction [28]. However, the effect of diabetes mellitus on blood vessels in the brain remains controversial. Chen et al. [26] believed that diabetes mellitus mainly affected cerebral small blood vessels, but some studies had suggested that diabetes mellitus was only related to the occurrence of stroke in the aorta, not to arteriolar stroke or cardiogenic stroke [28–30]. Therefore, more studies are needed on the effects of diabetes mellitus on cerebral vessels.

D-dimer and FDPs in plasma can reflect fibrinolysis, which are important markers for evaluating thrombosis or dissolution [31]. Thrombosis and fibrinolysis that occurred during ACI and D-dimer were significantly increased [32]. The results of our study also showed that D-dimer and FDPs in ACI group were higher than those in the control group, which was in accordance with the previous study.

However, there was some limit in this study. The different ischemic stroke subtypes in the study population would be studied in the future. Patients with cerebral ischemia and diabetes mellitus have a higher risk of stroke recurrence and the female sex is a demographic factor associated with a worse prognostic outcome [33]. Which will be added in the future.

In conclusion, diabetes mellitus is an independent risk factor for the ACI in patients with hypertension, which is a risk important factor for the high prevalence of cerebrovascular diseases. Furthermore, high-glycemic hemoglobin may also be associated with ACI in hypertensive patients. Therefore, patients with high blood pressure should pay attention to the blood glucose control and glycosylated hemoglobin to prevent the concurrent ACI.

Author contribution Guarantor of integrity of the entire study: Zheng Deliang, study concepts: Li Xinmiao, study design: Li Xinmiao, definition of intellectual content: Zheng Deliang, literature research: Li Xinmiao, clinical studies: Li Xinmiao, experimental studies: Li Xinmiao, data acquisition: Li Xinmiao, data analysis: Li Xinmiao, statistical analysis: Li Xinmiao, manuscript preparation: Li Xinmiao, manuscript editing: Li Xinmiao, Zheng Deliang, Fu Yongping, and manuscript review: Li Xinmiao, Zheng Deliang, Fu Yongping.

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Availability of data and material The datasets used or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate This study has been approved by the ethics committee of Honghuagang District people's hospital. The study was performed in accordance with the 1964 Helsinki declaration on ethical standards. All participants and their families have agreed to use the information required for this study for scientific research and signed informed consent.

Consent for publication Informed consent was obtained from all individual participants included in the study.

Conflict of interest The authors declare no competing of interests.

References

1. Grassi G, Calhoun DA, Mancia G, Carey RM (2019) Resistant hypertension management: comparison of the 2017 American and 2018 European High Blood Pressure Guidelines. Curr Hypertens Rep 21:67
2. Zhou Y, Jia L, Lu B et al (2019) Updated hypertension prevalence, awareness, and control rates based on the 2017ACC/AHA high blood pressure guideline. J Clin Hypertens (Greenwich) 21:758–765
3. Ge WQ, Chen J, Pan H et al (2018) Analysis of risk factors increased hemorrhagic transformation after acute ischemic stroke. J Stroke Cerebrovasc Dis 27:3587–3590
4. Li F, Yang L, Yang R et al (2017) Ischemic stroke in young adults of Northern China: characteristics and risk factors for recurrence. Eur Neurol 77:115–122
5. Yang K, Zhu X, Feng Y et al (2020) Abnormal blood pressure circadian rhythms are relevant to cerebral infarction and leukoaraiosis in hypertensive patients. BMC Neurol 20:36
6. Carey RM, Whelton PK (2018) Prevention, detection, evaluation, and management of high blood pressure in adults: synopsis of the 2017 American College of Cardiology/American Heart Association Hypertension Guideline. Ann Intern Med 168:351–358
7. Romano JG, Sacco RL (2015) Decade in review-stroke: progress in acute ischaemic stroke treatment and prevention. Nat Rev Neurol 11:619–621
8. Feigin VL, Forouzanfar MH, Krishnamurthi R et al (2014) Global and regional burden of stroke during 1990–2010: findings from the global burden of disease study 2010. Lancet 383:245–254
9. Chen S, Guo L, Wang Z et al (2019) Current situation and progress toward the 2030 health-related sustainable development goals in China: a systematic analysis. PLoS Med 16:e1002975
10. Hirano K, Takashima S, Dougu N et al (2012) Study of hemostatic biomarkers in acute ischemic stroke by clinical subtype. J Stroke Cerebrovasc Dis 21:404–410
11. Ohta Y, Takao Y, Harada K et al (2012) Metabolic syndrome is a risk factor for acute cerebral infarction in a younger elderly Kurashiki population. J Stroke Cerebrovasc Dis 21:231–239
12. Arboix A, Roig H, Rossich R et al (2004) Differences between hypertensive and non-hypertensive ischemic stroke. Eur J Neurol 11:687–692
13. Unger T, Borghi C, Charchar F et al (2020) 2020 International society of hypertension global hypertension practice guidelines. Hypertension 75:1334–1357
14. Powers WJ, Rabinstein AA, Ackerson T et al (2018) 2018 Guidelines for the early management of patients with acute ischemic stroke: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke 49:e46–e110
15. Authors/Task Force Members; ESC Committee for Practice Guidelines (CPG); ESC National Cardiac Societies (2019) 2019 ESC/EAS guidelines for the management of dyslipidaemias: lipid modification to reduce cardiovascular risk. Atherosclerosis 290:140–205
16. American Diabetes Association (2020) Classification and diagnosis of diabetes: standards of medical care in diabetes-2020. Diabetes Care 43:S14–S31
17. Committee of Cardio-Cerebro-Vascular Diseases of Gerontological Society of China; Chinese College of Cardiovascular Physicians of Chinese Medical Doctor Association (2017) Chinese expert consensus on the diagnosis and treatment of hypertension in the elderly. Zhonghua Nei Ke Za Zhi 56:885–893
18. Zhang XF, Attia J, D'Este C, Ma XY (2006) The relationship between higher blood pressure and ischaemic, haemorrhagic stroke among Chinese and Caucasians: meta-analysis. Eur J Cardiovasc Prev Rehabil 13:429–437
19. Arima H, Murakami Y, Lam TH et al (2012) Effects of prehypertension and hypertension subtype on cardiovascular disease in the Asia-Pacific region. Hypertension 59:1118–1123
20. Wang W, Jiang B, Sun H et al (2017) Prevalence, incidence, and mortality of stroke in China: results from a nationwide population-based survey of 480 687 adults. Circulation 135:759–771
21. Chao BH, Yan F, Hua Y et al (2021) Stroke prevention and control system in China: CSPPC-stroke program. Int J Stroke 16:265–272
22. Li W, Jin C, Vaidya A et al (2017) Blood pressure trajectories and the risk of intracerebral hemorrhage and cerebral infarction: a prospective study. Hypertension 70:508–514
23. Rawshani A, Rawshani A, Franzén S et al (2018) Risk factors, mortality, and cardiovascular outcomes in patients with type 2 diabetes. N Engl J Med 379:633–644
24. Espeland MA, Probstfield J, Hire D et al (2015) Systolic blood pressure control among individuals with type 2 diabetes: a comparative effectiveness analysis of three interventions. Am J Hypertens 28:995–1009
25. Li YR, Tsai SS, Chen DY et al (2018) Linagliptin and cardiovascular outcomes in type 2 diabetes after acute coronary syndrome or acute ischemic stroke. Cardiovasc Diabetol 17:2
26. Chen R, Ovbiagele B, Feng W (2016) Diabetes and stroke: epidemiology, pathophysiology, pharmaceuticals and outcomes. Am J Med Sci 351:380–386
27. Zinman B, Inzucchi SE, Lachin JM et al (2017) Empagliflozin and cerebrovascular events in patients with type 2 diabetes mellitus at high cardiovascular risk. Stroke 48:1218–1225
28. Chi Y, Lu ZN (2017) Association between patency of the circle of Willis and diabetes mellitus in patients with cerebral ischaemic stroke. J Int Med Res 45:723–732
29. Larsson SC, Scott RA, Traylor M et al (2017) Type 2 diabetes, glucose, insulin, BMI, and ischemic stroke subtypes: Mendelian randomization study. Neurology 89:454–460
30. Sun B, Li X, Liu X et al (2017) Association between carotid plaque characteristics and acute cerebral infarction determined by MRI in patients with type 2 diabetes mellitus. Cardiovasc Diabetol 16:111
31. Shi D, Xia T, Feng H, Cheng Q (2014) Evaluating the diagnostic value of vWF:Ag, D-D and FDP in patients with acute cerebral infarction using ROC curves. Exp Ther Med 7:1573–1577
32. Wang R, Wei Y, Teng J (2018) Levels of plasma N-terminal pro-brain natriuretic peptide and D-dimer on the prognosis of patients with acute cerebral infarction. Pak J Med Sci 34:855–858

33. Arboix A, Milian M, Oliveres M et al (2006) Impact of female gender on prognosis in type 2 diabetic patients with ischemic stroke. Eur Neurol 56(1):6–12

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原创文章

原发性高血压患者急性脑梗死的危险因素分析

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摘要

目的探讨原发性高血压患者发生急性脑梗死(ACI)的危险因素。

**方法选择2020年1月~
2020年12月在遵义市红花岗区人民医院就诊，经MRI确诊为原发性高血压和ACI的患者。**同期合并原发性高血压患者作为对照组。分析其危险因素包括性别、年龄、吸烟、饮酒、实验室检查及其他并发症。

结果高血压ACI患者300例，高血压患者117例。两组间实验室检查比较，ACI组糖化血红蛋白、d - 二聚体和FDPs均高于对照组(P < 0.05)。原发性高血压患者糖尿病与急性脑梗死之间存在显著相关性(OR = 1.452, P = 0.004)。

结论糖尿病前期血糖控制不良可能与急性脑梗死的发生有关。糖尿病是ACI合并原发性高血压患者的独立危险因素。

关键词急性脑梗死 • 糖尿病 • 高血压 • 危险因素

简介

高血压是一种由遗传、环境、社会等多种因素引起的复杂疾病[1-4]，是心血管疾病、中风、残疾、死亡的主要危险因素[5,6]。急性脑梗死(ACI)是最危险的缺血性脑血管疾病之一，其发病率逐年上升。根据2010年的一项全球疾病研究，ACI已成为世界第二大死亡原因[8]，这是中国的主要死亡原因[9]。

ACI的危险因素有很多，但高血压被认为是其中最重要的危险因素之一。然而，并不是所有的高血压患者都会发生ACI。因此，探讨高血压患者ACI的潜在危险因素尤为重要。

近期研究表明血脂异常、d - 二聚体、FDPs具有重要意义，且与ACI的发生密切相关[10,11]，但对高血压患者ACI发生的研究较少。缺血性卒中与大、小动脉疾病[12]相关。因此，本研究主要针对高血压患者ACI的临床特点及危险因素进行研究。

方法

病人

选择2020年1月至2020年12月在遵义市红花岗区人民医院就诊，经MRI确诊为原发性高血压和ACI的患者。同期合并原发性高血压患者作为对照组。纳入标准为(1)根据国际高血压学会(ISH)
2020年国际高血压实践指南[13]诊断为高血压的患者，(2)根据2018年早期管理指南诊断为ACI的患者

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表1基本特征比较

	酸	控制	*X2/z*	*p*
性别(M)	143(47.7)	51(43.6)	0.562	0.512
年龄/年龄	70(63,77)	70(63,76)	1.237	0.216
吸烟	78(26.0)	23.(19.7)	1.844	0.204
饮酒	36(12.0)	7(6.0)	3.295	0.075

急性缺血性脑卒中[14]患者;(3)能够按照医嘱完成相关检查的患者。排除标准为(1)急救患者和(2)精神障碍患者。本研究经红花岗区人民医院伦理委员会批准。这项研究是根据1964年关于道德标准的赫尔辛基宣言进行的。所有参与者及其家属均同意将本研究所需信息用于科学研究，并签署知情同意书。

观察指数

一般资料包括性别、年龄、吸烟和饮酒情况。记录脑MRI检查结果。实验室检查包括血糖、糖化血红蛋白、凝血功能和血脂。评估血脂异常和2型糖尿病的并发症。血脂异常的诊断依据2019年ESC/EAS指南[15]。2型糖尿病是根据2020年ADA指南[16]诊断的。

统计分析

所有数据采用SPSS 19.0进行处理和分析。定性资料以频数、百分数、 χ^2表示 或Fisher精确检验进行比较。采用单因素logistic回归分析评价高血压ACI的相关危险因素。非正态分布的测量报告为中位数和四分位数间距。组间比较采用Kruskal-Wallis检验， α 水平= 0.05。

结果

基本特征

其中高血压ACI患者300例，高血压患者117例。

ACI组年龄70岁(63-77岁)，对照组年龄70岁(63-76岁)。ACI组男性143例，对照组男性51例。两组患者性别、年龄、吸烟情况比较，差异均无统计学意义(P < 0.05)。ACI组饮酒患者比例显著高于对照组(P = 0.075)(表1)。

实验室检查比较

两组间血糖、CT、甘油三酯、C-LDL、C-HDL比较，差异均无统计学意义(P > .05)。ACI组糖化血红蛋白、d - 二聚体、FDPs水平明显高于对照组(P < 0.05)(表2)。

风险因素分析

ACI组T2DM患者90例，对照组19例。ACI组与对照组危险因素比较发现，T2DM与ACI相关(OR = 1.452, P = 0.004)(表3)。

表2实验室检查

	酸	控制	*z*	*p*
血糖	.775(5.13,6.93)	.20.165(6,7.70)	1.818	0.178
糖化血红蛋白	6.27(5.6、7.3)	5.30(5.70,6.15)	25.921	0.000
ct	4.64(3.71,5.47)	4.57(3.61,5.28)	1.076	0.300
甘油三酯	1.45(0.98,2.12)	1.33(0.91,1.94)	1.823	0.177
c-ldl	2.39(1.73,3.14)	2.42(1.68,2.88)	0.924	0.336

CT凝血时间、C-LDL低密度脂蛋白胆固醇、C-HDL高密度脂蛋白胆固醇、FDPs纤维蛋白原降解产物

表3风险因素分析

	酸	控制	*X2/z*	*p*	或	95%ci
性别(M)	143(47.7)	51(43.6)	0.562	0.512	1.179	0.767-1.812
年龄/年龄	70(63,77)	70(63,76)	1.237	0.216	1.002	0.999-1.004
吸烟	78(26.0)	23(19.7)	1.844	0.204	0.696	0.412-1.176
饮酒	36(12.0)	7(6.0)	3.295	0.075	0.467	0.202-1.081
血脂异常	167(55.7)	73(62.4)	1.559	0.226	0.927	0.600-1.432
t2dm	90(30.0)	19(16.2)	8.256	0.004	1.452	1.261-1.784

讨论

我国高血压患病率仍呈逐年上升趋势。In认为高血压的危险因素包括遗传因素、年龄和多种不健康的生活方式[17]。随着经济的不断发展，吸烟、饮酒、高脂肪饮食在越来越多的人群中逐渐成为不健康的生活方式，这些也被认为是“传统的危险因素”。“许多疾病都是由这些危险因素引起的，而高血压是最常见的疾病之一。

据报道，高血压与ACI密切相关，近60%的卒中可归因于高血压[18]。高血压可使出血性脑卒中的发病风险增加约10倍，缺血性脑卒中的发病风险增加约4倍，显著高于其他疾病[19]。同时，伴有其他危险因素的高血压患者会加重脑卒中的发生。根据全国脑卒中流行病学调查(NESS-China)，2016年中国脑卒中发病率为403.09/100000[20,21]。因此，在重视高血压作为重要危险因素的同时，有效预防和控制与高血压有协同作用的危险因素，可以降低卒中的发生。

糖尿病是高血压患者发生和复发ACI最重要的危险因素之一[22,23]。糖尿病是心血管疾病的重要危险因素，而超过一半的糖尿病患者死于心血管疾病[24,25]。糖尿病的发病率近年来一直呈上升趋势，同时也显著增加了心血管疾病的发病风险。本研究中，T2DM是高血压患者ACI的独立危险因素。另外，虽然ACI组与对照组血糖水平无显著差异，但两组糖化血红蛋白水平有显著差异，说明与对照组相比，ACI组在发病近2-3个月血糖控制较差，这与既往研究[27]得出的结论相似。这表明了风险合并糖尿病的患者脑梗死的发生率增加了2-3倍，合并糖尿病的高血压患者脑梗死的患病率也大大增加了[28]。然而，糖尿病对大脑血管的影响仍存在争议。Chen等[26]认为糖尿病主要影响脑小血管，但也有研究认为糖尿病仅与主动脉卒中的发生有关，与小动脉卒中和心源性卒中无关[28-30]。因此，糖尿病对脑血管的影响有待进一步研究。

血浆中d-二聚体和FDPs可反映纤维蛋白溶解情况，是评价血栓形成或溶出程度的重要指标。ACI期间血栓形成和纤溶，d-二聚体显著增加[32]。我们的研究结果也显示ACI组d-二聚体和FDPs高于对照组，这与之前的研究一致。然而，本研究也存在一定的局限性。研究人群中不同的缺血性卒中亚型将在未来进行研究。脑缺血和糖尿病患者有较高的卒中复发风险，女性是与预后差相关的人口统计学因素。以后会增加的。

综上所述，糖尿病是高血压患者ACI的独立危险因素，是脑血管病高发的重要危险因素。此外，高血压患者的高血糖血红蛋白也可能与ACI有关。因此，高血压患者应注意血糖控制和糖化血红蛋白，防止并发ACI。

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参考文献

1.Grassi G, Calhoun DA, Mancia G, Carey RM(2019)难治性高血压管理:2017年美国和2018年欧洲高血压指南的比较。Curr Hypertens代表21:67

2.周勇，贾玲，吕波等(2019)基于2017年acc /AHA高血压指南更新了高血压患病率、认知和控制率。J clinhypertens(格林威治)21:758-765

3.葛文文，陈杰，潘华等(2018)急性缺血性脑卒中后出血转化的危险因素分析。J卒中脑血管病27:3587-3590

4.李芳，杨玲，杨瑞等(2017)中国北方青年缺血性卒中的特点及复发危险因素。欧洲神经学会77:115-122

5.杨坤，朱欣，冯勇等(2020)血压昼夜节律异常与高血压患者脑梗死和白质疏松症相关。BMC Neurol 20:36

6.Carey RM, Whelton PK(2018)成人高血压的预防、检测、评估和管理:2017年美国心脏病学会/美国心脏协会高血压指南概要。安实习医生168:351-358

7.Romano JG, saco RL(2015)卒中十年回顾:急性缺血性卒中治疗和预防的进展。Nat Rev Neurol 11:619-621

8.Feigin VL, Forouzanfar MH, Krishnamurthi R等(2014)1990-2010年全球和区域卒中负担:2010年全球疾病负担研究的结果。柳叶刀383:245-254

9.陈松，郭磊，王铮等(2019)中国2030年健康相关可持续发展目标的现状与进展:系统分析。PLoS Med 16:e1002975

10.Hirano K, Takashima S, Dougu N等(2012)按临床亚型划分的急性缺血性卒中止血生物标志物研究。脑血管病杂志21:404-410

11.Ohta Y, Takao Y, Harada K等(2012)代谢综合征是年轻老年仓鼠人群急性脑梗死的危险因素。脑血管病杂志21:231-239

12.Arboix A, Roig H, Rossich R等(2004)高血压和非高血压性缺血性脑卒中的差异。欧洲神经学杂志11:687-692

13.Unger T, Borghi C, Charchar F等(2020)2020年国际高血压学会全球高血压实践指南。高血压75:1334-1357

14.Powers WJ, Rabinstein AA, Ackerson T等(2018)2018年急性缺血性卒中患者早期管理指南:美国心脏协会/美国卒中协会的医疗保健专业人员指南。笔划49:e46-e110

15.作者/工作组成员;人事编制小组委员会实务指引委员会;ESC国家心脏学会(2019)2019 ESC/EAS血脂异常管理指南:脂质改变以降低心血管风险。动脉粥样硬化290:140-205

16.美国糖尿病协会(2020)糖尿病的分类和诊断:糖尿病的医疗保健标准-2020。糖尿病护理43:S14-S31

17.中国老年学会心脑血管病专业委员会;中国心血管医师学会中华医师协会(2017)中国老年高血压诊疗专家共识。中华内科杂志56:885-893

18.张晓芳(2006)高血压与白种人缺血性、出血性中风的关系:meta分析。Eur J Car- diovasc pre Rehabil 13:429-437

19.Arima H, Murakami Y, Lam TH等(2012)亚太地区高血压前期和高血压亚型对心血管疾病的影响。高血压59:1118-1123

20.王伟，姜波，孙华等(2017)中国卒中的患病率、发病率和死亡率:基于全国480687名成年人的调查结果。循环135:759-771

21.赵秉辉，严峰，华勇等(2021)中国脑卒中防控体系:csppc -卒中项目。国际J中风16:265-272

22.Li W, Jin C, Vaidya A等(2017)血压轨迹与脑出血和脑梗死风险:一项前瞻性研究。高血压70:508-514

23.Rawshani A, Rawshani A, Franzén S等(2018)2型糖尿病患者的危险因素、死亡率和心血管结局。N Engl J Med 379:633-644

24.Espeland MA, Probstfield J, Hire D等(2015)2型糖尿病患者的收缩压控制:三种干预措施的比较有效性分析。J Hyper- tens 28:9 5 - 1009

25.李瑞瑞，蔡世安，陈大勇等(2018)利格列汀与急性冠脉综合征或急性缺血性卒中后2型糖尿病的心血管转归。心血管糖尿病:17:2

26.陈睿，Ovbiagele B，冯伟(2016)糖尿病与中风:流行病学、病理生理、药物和预后。美国医学杂志351:380-386

27.Zinman B, Inzucchi SE, Lachin JM等(2017)心血管风险高的2型糖尿病患者中Empagliflozin与脑血管事件的关系。中风48:1218-1225

28.关键词:脑缺血卒中，Willis环，糖尿病，糖尿病国际医学Res 45:723-732

29.Larsson SC, Scott RA, Traylor M等(2017)2型糖尿病、葡萄糖、胰岛素、BMI和缺血性卒中亚型:孟德尔随机化研究。神经学89:454-460

30.孙斌，李鑫，刘鑫等(2017)2型糖尿病患者颈动脉斑块特征与MRI检测急性脑梗死的关系。心血管糖尿病:16:111

31.[史丹，夏涛，冯华，程强(2014)应用ROC曲线评价vWF:Ag、D-D和FDP对急性脑梗死患者的诊断价值。]Exp Ther Med 7:1573-1577

32.王锐，魏勇，滕杰(2018)血浆n -末端脑利钠肽前体和d -二聚体水平对急性脑梗死患者预后的影响。Pak J医学科学34:855-858

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33.Arboix A, Milian M, Oliveres M等人(2006)女性对缺血性卒中2型糖尿病患者预后的影响。中国神经科学(1):1 - 6