International Journal of Clinical Medicine, 2020, 11, 228-235
https://www.scirp.org/journal/ijcm
ISSN Online: 2158-2882
ISSN Print: 2158-284X

The Correlation between Hypertensive Intracerebral Hemorrhage and Internal Carotid Atherosclerosis Investigated by Carniocervial CTA

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How to cite this paper: Wu, B. and Zhou, C.Z. (2020) The Correlation between Hypertensive Intracerebral Hemorrhage and Internal Carotid Atherosclerosis Investigated by Carniocervial CTA. *International Journal of Clinical Medicine*, **11**, 228-235.
https://doi.org/10.4236/ijcm.2020.115023

Received: April 15, 2020
Accepted: April 27, 2020
Published: April 30, 2020

Abstract

Objective: To investigate the relationship between hypertensive intracerebral hemorrhage and internal carotid atherosclerosis and its risk factors by CTA (Computed tomography angiography). **Methods:** The clinical materials of hypertensive intracerebral hemorrhage patients with carniocervial CTA from January 2018 to August 2019 in Puren Hospital of Wuhan were analyzed retrospectively. The correlation and risk factors between hypertensive intracerebral hemorrhage and internal carotid atherosclerosis were studied by logistic regression and descriptive analysis, at the same time, the application value of carniocervial CTA in patients with cerebral hemorrhage was evaluated. **Results:** There was a correlation between hypertensive intracerebral hemorrhage and internal carotid atherosclerosis ($\chi^2 = 5.319$, $P = 0.021 < 0.05$, OR = 2.70 > 1), which indicated that internal carotid atherosclerosis was the risk factor of hypertensive intracerebral hemorrhage, and there was no significant correlation between the location of internal carotid atherosclerosis, multiple atherosclerosis of internal carotid artery and hypertensive intracerebral hemorrhage. Monofactor analysis showed that the risk factors of hypertensive intracerebral hemorrhage with internal carotid atherosclerosis were sex, age, diabetes and hyperlipidemia. According to the logistic regression analysis, hyperlipidemia and diabetes were independent risk factors for hypertensive. **Conclusion:** The occurrence of hypertensive intracerebral hemorrhage is related to internal carotid atherosclerosis and is affected by many factors. Carniocervial CTA is helpful to the diagnosis of cerebral hemorrhage.

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Keywords

Hypertensive Intracerebral Hemorrhage, Internal Carotid Atherosclerosis, Computed Tomography Angiography

1. Background

Hypertensive intracerebral hemorrhage is a common cerebrovascular disease in clinical work. As the problem of aging population becomes more and more prominent, the incidence of the disease is also increasing year by year. It has the characteristics of disability rate, mortality rate, high recurrence rate and is one of the biggest threats to human health in the 21st century [1]. Studies have shown that carotid atherosclerosis exists in 20% of patients with intracerebral hemorrhage [2]. This paper uses head and neck CTA, to further explore the relationship between the characteristics of carotid atherosclerotic plaque in internal carotid artery and hypertensive intracerebral hemorrhage, and expounds the application value of CTA in intracerebral hemorrhage disease.

2. Objects and Methods

2.1. Object of Study

From January 2018 to August 2019, 50 patients with hypertensive intracerebral hemorrhage who were admitted to Puren Hospital of Wuhan City were selected as the experimental group and 50 patients with non-cranial hemorrhage were selected as the control group, including 9 patients with mild craniocerebral trauma, 20 patients with dizziness and headache, 21 patients with transient ischemic attack. All patients underwent CTA examination.

Inclusion criteria: 1) consistent with the clinical diagnostic guidelines related to hypertensive intracerebral hemorrhage [3]; 2) confirmed by MRI, CT and other imaging examinations; 3) initial onset.

Exclusion criteria: 1) patients with secondary intracerebral hemorrhage, such as aneurysm rupture, cerebrovascular malformation, trauma, tumor, etc.; 2) patients with recurrent hypertensive intracerebral hemorrhage; 3) patients with hemorrhagic cerebral infarction; 4) patients with head and neck CTA with poor imaging and incomplete clinical data.

From January 2018 to August 2019, 50 patients with non-cranial hemorrhage were selected as the control group, including 9 patients with mild craniocerebraltrauma, 20 patients with dizziness and headache, 21 patients with transient ischemic attack, and head and neck CTA were performed during hospitalization or during outpatient visits.

2.2. Methods

2.2.1. Instruments and Reagents

Adopt 128 row GE optima660CT machine, non-ionic contrast agent iodohydrol;

the patient has signed the consent before the examination.

2.2.2. Scanning Mode

Take the supine position, use the head frame to fix the head, ask the subject to keep the head and neck still during the examination, fix the forehead with bandages, ask the patient to breathe calmly, avoid swallowing when scanning. scanning range from the aortic arch to the cranial top. scan parameters: tube voltage 100 KV, tube current 350 mA, scan layer thickness, layer interval scan 0.6 mm scan field of view 400, LW = 40, pitch 0.984:1.000. Iodine sea-alcohol, iodine contrast agent g/50ml. 17.5 all patients were treated with low-dose group injection: through the elbow intravenous injection of contrast agent 15 ml and saline 20 ml flush tube, injection speed 4 - 5 ml/s, delay Xs (x represents the scan delay time, the routine set to 10 s) after the C4 vertebral lam dynamic scan. The micro-calcification region of interest (MROI) analysis software was used to observe and measure the peak concentration of the contrast agent at the C4 carotid artery, and obtain the turning point Y on the time-density curve of contrast enhancement Value, according to the conventional method (X + 2Y + 1) to calculate the enhanced scan delay time, wait for 5 min after injecting 50ml of contrast agent and 50 ml of saline to perform a two-phase scan of the same site with the contrast agent injection flow rate, and obtain a head and neck CTA image.

3. Basic Information

Record the patient's age, gender, diabetes, hyperlipidemia, smoking, drinking history and other data. Carotid atherosclerotic plaque is defined as local bulge thickening, protruding into the lumen, thickness ≥ 1.3 mm [4]. According to carniocervial CTA imaging data and the 7-segment method of internal carotid artery proposed by Bouthillieretal in 1996 [5], the carotid atherosclerosis was divided into extracranial atherosclerosis and intracranial atherosclerosis.

4. Statistical Processing

SPSS17.0 was used for statistical analysis. Counting data is expressed in (n%), using χ^2 test. The measurement data is expressed by (X ± S), and t test is used. Multivariate correlation analysis was performed using binary classification Logistic regression analysis. $P < 0.05$ is a significant difference, with statistical significance.

5. Result

5.1. Comparison of Basic Clinical Data

The patients in the hypertensive cerebral hemorrhage group were 36 - 81 years old, with an average of (62.86 ± 10.38) years old. There were 32 male patients and 18 female patients. The patients in the non-cerebral hemorrhage group were 27 - 82 years old, with an average of (59.86 ± 13.23) years old. There were 26 male patients and 24 female patients. Two independent sample t tests were carried out on the ages of the two groups. The t value was 1.261 and the p value was 0.210. There was no difference in age between the two groups. Chi-square test was conducted on the gender composition of the two groups, and their χ^2 value was 1.478 and p value was 0.224. There was no difference in gender composition between the two groups. There was no statistically significant difference in age and gender between the two groups, and they were comparable.

5.2. Analysis of the Incidence of Internal Carotid Atherosclerosis in Patients with Hypertensive Cerebral Hemorrhage and the Correlation between Internal Carotid Atherosclerosis and Hypertensive Cerebral Hemorrhage

According to the imaging data of the patient's head and neck CTA, the statistics of internal carotid atherosclerotic plaque sclerosis. Among the 50 patients with hypertensive cerebral hemorrhage, 38 patients (76.0%) with internal carotid atherosclerosis, including 11 patients (28.9%) with internal carotid artery intracranial segment alone There were 6 patients (15.8%) with plaque in the extracranial segment of arteries, and 21 patients (55.3%) had both; in the control group, there were 27 patients (54%) with internal carotid atherosclerosis. Among them, 13 patients (48.1%) had plaque in the intracranial segment of the internal carotid artery alone, and 3 patients (11.1%) had plaque in the extracranial segment of the internal carotid artery (11.40%). The formation of internal carotid atherosclerosis is a risk factor for hypertensive cerebral hemorrhage ($P < 0.05$, OR == 2.70 > 1). There is no difference in the probability of plaques in the intracranial and extracranial segments of the internal carotid artery leading to cerebral hemorrhage ($P > 0.05$). Not relevant ($p > 0.05$). See Tables 1-3 for details.

5.3. Single Factor Analysis of Carotid Atherosclerosis in Patients with Hypertensive Cerebral Hemorrhage

Among 50 cases of hypertensive cerebral hemorrhage, patients with internal

Table 1. Correlation analysis of internal carotid atherosclerosis and hypertensive cerebral hemorrhage.

		With internal Carotid atherosclerosis	Without internal Carotid atherosclerosis	χ^2	P
Hypertensive cerebral hemorrhage	With	38	12	5.319	0.021
	Without	27	23		

Table 2. Correlation between different parts of internal carotid artery and hypertensive cerebral hemorrhage.

		Intracranial segment	Extracranial segment	χ^2	P
Hypertensive cerebral hemorrhage	With	32	27	0.340	0.560
	Without	24	14		

Table 3. Correlation between the features of internal carotid atherosclerosis site and hypertensive cerebral hemorrhage.

		Simple part	Mixed parts	χ^2	P
Hypertensive cerebral hemorrhage	With	17	21	1.332	0.248
	Without	16	11		

carotid atherosclerosis were divided into group A, and patients without internal carotid atherosclerosis were divided into group B. There are 38 people in group A and 12 people in group B. Univariate analysis showed that the risk factors for atherosclerosis in patients with hypertensive cerebral hemorrhage were gender, age, diabetes, smoking, hyperlipidemia and so on. The specific situation is shown in Table 4.

5.4. Multivariate Logistic Regression Analysis of Hypertensive Cerebral Hemorrhage

With or without hypertensive intracerebral hemorrhage (with hypertensive intracerebral hemorrhage = 1, without hypertensive intracerebral hemorrhage = 0) as the dependent variable, gender (male = 1, female = 0), age (≥60 is 1, <60 is 0), diabetes (yes = 1, no = 0), smoking (y = 1, no = 0), hyperlipidemia (y = 1, no = 0) and other factors are independent variables, and multivariate logistic is performed after assignment regression analysis. Hyperlipidemia and diabetes are independent risk factors for hypertensive cerebral hemorrhage. The specific situation is shown in Table 5.

6. Discussion

Atherosclerosis is a common cause of cerebrovascular disease. 70% to 80% of blood in the brain is supplied by the internal carotid artery. Previous studies have pointed out that carotid atherosclerotic plaque is a high factor for cerebral infarction. However, regarding carotid artery, there are few studies on the correlation between atherosclerosis and cerebral hemorrhage. This article uses the head and neck CTA to explain the correlation and risk factors of internal carotid atherosclerotic plaque with hypertensive cerebral hemorrhage.

This study found that the formation of internal carotid atherosclerotic plaques is a risk factor for hypertensive intracerebral hemorrhage, but it has no significant correlation with whether the plaques are in the intracranial or extracranial segment of the internal carotid artery. Hypertensive cerebral hemorrhage is based on hypertension, and various types of hypertension can cause cerebral hemorrhage under certain circumstances. At the same time, studies have shown that the incidence of atherosclerosis in patients with hypertension is significantly increased. Patients with hypertension have atherosclerosis 3 - 4 times higher than those with normal blood pressure. May be due to high blood pressure, the arterial wall is under high pressure, increasing the excitability of its sympathetic

Table 4. Single factor analysis of carotid atherosclerosis in patients with hypertensive cerebral hemorrhage.

relevant factor	classification	Group A	Group B	χ^2	P
Gender	Male	28	4	4.813	0.028
	Female	10	8		
Age	≥60	28	3	7.225	0.007
	<60	10	9		
Diabetes	With	22	2	6.211	0.013
	Without	16	10		
Hyperlipidemia	With	30	5	4.31	0.036
	Without	15	7		
Smoking	With	27	3	6.255	0.012
	Without	11	9		
Drinking	With	19	8	1.020	0.313
	Without	19	4		

Note: Group A: patients with internal carotid atherosclerosis among 50 cases of hypertensive cerebral hemorrhage; Group B: patients without internal carotid atherosclerosis among 50 cases of hypertensive cerebral hemorrhage.

Table 5. Multivariate logistic regression analysis of hypertensive cerebral hemorrhage.

	B	S.E,	Wals	df	Sig.	Exp (B)	EXP(B) 95% C.I.
Gender	0.053	0.469	0.013	1	0.909	1.055	0.042 - 2.647
Age	−0.284	0.480	0.352	1	0.553	0.752	0.294 - 1.926
Hyperlipidemia	0.916	0.449	4.163	1	0.041	2.500	1.037 - 6.027
Diabetes	1.221	0.499	5.996	1	0.014	3.391	1.276 - 9.010
Smoking	0.526	0.445	1.397	1	0.237	1.692	0.707 - 4.050
constant	−1.075	0.489	4.841	1	0.028	0.341	

nerves, increasing the amount of adrenaline angiotensin, endothelial cell damage, causing excessive prostaglandins and thromboxane to adhere to the patient's platelets And lipid deposition, and stimulate smooth muscle cell proliferation, eventually leading to the formation of carotid atherosclerosis [6]. In this study, it was found that in the hypertensive cerebral hemorrhage group and the control group, the incidence of atherosclerosis in the intracranial segment of the internal carotid artery was higher than that in the extracranial segment, respectively, 64% and 48%. The specific reason is not clear, and it may be caused by the relatively tortuous blood vessels of the internal carotid artery from the rock section to the communication section in the cranial, resulting in relatively unstable hemodynamics.

Multivariate analysis of whether patients with hypertensive cerebral hemorrhage have internal carotid atherosclerosis found that age greater than 60 years old, hyperlipidemia, diabetes, smoking, and gender are all influencing factors. And multivariate Logistic regression analysis of hypertensive cerebral hemorrhage pointed out that hyperlipidemia (OR = 2.500, 95% CI: 1.037 - 6.027, P = 0.041) and diabetes (OR = 3.391, 95% CI: 1.276 - 9.010, P = 0.014) is an independent risk factor for hypertensive cerebral hemorrhage. Therefore, for hypertensive patients over 60 years old, in addition to actively controlling blood pressure, blood lipid and blood sugar levels should also be paid attention to. It has positive significance for preventing hypertensive cerebral hemorrhage.

With the development of CT angiography (Computed tomography angiogram, CTA) technology, we can use CTA image data to observe and measure the plaque in the blood vessels of the head and neck and related data. Some research results show that in detecting the number of internal carotid artery plaques, the results of ultrasound examination are significantly lower than the results of CTA examinations. The relationship between the characteristics of plaque and hypertensive cerebral hemorrhage. CT angiography of the head and neck is one of the important examination methods of cerebrovascular disease. Its operation is simple, the result is faster, safe and efficient, and it can accurately display the position, size, and shape of the examiner's blood vessel and surrounding tissue. The doctor provides a reliable basis for the diagnosis of the disease [7]. For patients with cerebral hemorrhage, CTA examination can further investigate cerebral hemorrhage caused by aneurysm and arteriovenous malformation. Compared with ultrasound, the imaging of blood vessels by CTA is clearer, especially for the examination of intracranial blood vessels.

7. Conclusion

In summary, patients with high blood pressure and diabetes who are over 60 years old are actively controlling blood lipid levels and quitting smoking, which is one of the important measures to prevent hypertensive cerebral hemorrhage. Reducing the prevalence of carotid atherosclerosis has certain significance for controlling hypertensive cerebral hemorrhage. As an auxiliary examination method of cerebrovascular disease, CTA is conducive to improving the accuracy of diagnosis and is worthy of promotion in the clinic.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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