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Analysis of Factors of Complications in Patients with Moyamoya Disease After Revascularization

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Abstract: *Objective:* In this study, the driving factors of complications in patients with moyamoya disease after revascularization are analyzed and discussed. *Methods:* A total of 1500 cases with moyamoya disease after revascularization in Yunan Shuifu People's Hosptial and Beijing University of Chinese Medicine Third Affiliated Hospital from November 2017 to November 2022 were selected retrospectively, and they were divided into an observation group (with postoperative complications) and a control group (with no complications), resulting in 313 cases and 1187 cases in each group, respectively. Univariate and multivariate analysis were performed to screen out independent risk factors for complications in patients with moyamoya disease after revascularization. *Results:* Univariate analysis showed that the proportion of patients with cerebral ischemia, history of hypertension, and modified Rankin scale (mRs) score of 3-5 in the observation group were significantly higher than those in the control group. Complications were used as the dependent variable, and the indicators with statistically significant differences based on the univariate analysis were included as independent variables in the logistic regression analysis. The results showed that the first symptoms before operation were cerebral ischemia, history of hypertension, and mRs score of 3 to 5 were risk factors for complications in patients with moyamoya disease after revascularization, and there were significant differences in the data (OR = 1.781, 1.811, 1.859, all $P < 0.05$). *Conclusion:* Cerebral ischemia is the first symptom before operation, and history of hypertension and mRs score of 3 to 5 are all risk factors for complications in patients with moyamoya disease after revascularization. Therefore, clinical prevention should be strengthened, and corresponding treatment measures should be given in time to reduce the risk of postoperative complications in patients with moyamoya disease.

Keywords: Moyamoya disease; Revascularization; Complications; Driving factors

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1. Introduction

Moyamoya disease is a type of progressive cerebrovascular disease caused by occlusion of the skull base arteries. The main feature of the disease is progressive stenosis or occlusion of the end of the internal carotid artery and its branches, combined with an abnormal vascular network of the skull base. The etiology is yet to be determined, and the course of the disease is complex, which can pose varying degrees of threats to the lives and health of patients [1-2]. Nowadays, revascularization has become the main treatment method for patients with moyamoya disease. This surgical method can repair the broken blood vessels in the body, and then restore the patency of blood flow in the blood vessels [3-4]. The application of revascularization in the treatment of moyamoya disease can significantly reduce the risk of bleeding and improve the blood

circulation of their distal extremities, which has a good therapeutic effect. However, due to the differences in the patients' conditions and symptoms, there is still a risk of postoperative complications [5-6]. Determining the influencing factors of complications in patients with moyamoya disease after revascularization can aid subsequent prevention and treatment measures [7-8]. Therefore, in this study, the driving factors of complications in patients with moyamoya disease after revascularization are analyzed and discussed, and the research content and results are summarized in the following sections.

2. Materials and methods

2.1. General information

1,500 patients with moyamoya disease after revascularization in Yunan Shuifu People's Hosptial and Beijing University of Chinese Medicine Third Affiliated Hospital from November 2017 to November 2022 were selected retrospectively, and they were divided into observation group (with postoperative complications) and control group (with no postoperative complications), resulting in 313 cases and 1187 cases in each group, respectively. This study was approved by the Medical Ethics Committee of our hospital. The diagnostic criteria were based on the Diagnostic Criteria for Moyamoya Disease [9]. Inclusion criteria: those who were highly in line with the above diagnostic criteria, with complete clinical data and normal blood vessels after postoperative reexamination. Exclusion criteria: those with mental disorders and unable to cooperate and those with carotid atherosclerosis or abnormal heart and kidney function.

2.2. Assessment method

The age, gender, first preoperative symptom, history of hypertension, history of diabetes, preoperative modified Rankin scale (mRs) score [10], Suzuki staging [11], etc. were investigated and recorded through the self-made questionnaire of the hospital.

2.3. Observation indicators

(i) The clinical baseline data of all subjects were collected, and univariate analysis was carried out. (ii) Multivariate logistic regression analysis was performed with the occurrence of complications in patients with moyamoya disease after revascularization as the dependent variable, and the indicators with statistically significant differences from the univariate analysis as independent variables.

2.4. Statistical methods

SPSS 20.0 statistical software was used to analyze the data, the count data was represented by [case (%)], and the χ^2 test was used; the measurement data was represented by (mean ± SD), and *t* test was performed; multivariate logistic regression analysis was performed to screen relevant risk factors, where $P < 0.05$ was considered statistically significant.

3. Results

3.1. Univariate analysis

The results of univariate analysis showed that the proportion of patients with cerebral ischemia, history of hypertension, and mRs score of 3-5 in the observation group were significantly higher than those in the control group (mean $P < 0.05$), see **Table 1**.

Table 1. Univariate analysis affecting the occurrence of complications in patients with moyamoya disease after revascularization

Factor	Observation group (n = 313)	Control group (n = 1187)	χ^2/t	P
Gender [example (%)]			0.034	> 0.05
Male	159 (50.80)	596 (50.21)		
Female	154 (49.20)	591 (49.79)		
Age (mean ± SD)	46.59 ± 4.22	46.62 ± 4.24	0.111	> 0.05
Preoperative symptoms [cases (%)]			147.075	< 0.05
Cerebral ischemia	134 (42.81)	150 (12.64)		
Cerebral infarction	62 (19.81)	343 (28.90)		
Epilepsy	59 (18.85)	345 (29.06)		
Asymptomatic	58 (18.53)	349 (29.40)		
History of hypertension			90.887	< 0.05
Yes	192 (61.34)	379 (31.93)		
No	121 (38.66)	808 (68.07)		
History of diabetes			0.003	> 0.05
Yes	155 (49.52)	590 (49.71)		
No	158 (50.48)	597 (50.29)		
mRs score			123.641	< 0.05
0–2	103 (32.91)	801 (67.48)		
3–5	210 (67.09)	386 (32.52)		
Suzuki staging			0.210	> 0.05
I–II	104 (33.23)	398 (33.53)		
III–IV	101 (32.27)	395 (33.28)		
V–VI	108 (34.50)	394 (33.19)		

3.2. Multivariate analysis

Multivariate logistic regression analysis was carried out with the complication of patients with moyamoya disease after revascularization as the dependent variable and included the indicators with statistically significant differences in the univariate analysis results as independent variables. The results showed that the cerebral ischemia being the first preoperative symptom, history of hypertension, and mRs score of 3 to 5 were all risk factors for complications in patients with moyamoya disease after revascularization, and there were significant differences in the data (OR = 1.781, 1.811, 1.859, all $P < 0.05$), see **Table 2** .

Table 2. Logistic regression analysis of factors of the complications of patients with moyamoya disease after revascularization

Variable	*β*	*SE*	*Wald* χ^2	*P*	*OR* (95% *CI*)
Cerebral ischemia being the first preoperative symptom	0. 577	0. 149	14.966	< 0.05	1.781 (1. 330–2.385)
History of hypertension	0.594	0. 155	14.686	< 0.05	1.811 (1. 337–2.454)
mRs score 3~5 points	0.620	0.132	22.062	<0.05	1.859 (1.435–2.408)

4. Discussion

Moyamoya disease is a cerebrovascular disease caused by occlusion or stenosis of the terminal branches of the internal carotid artery, and its incidence has been increasing year by year [12-13]. Revascularization can effectively control the progression of the patient's condition, prevent the development of stroke, and improve the prognosis, but postoperative complications are still relatively common. Common postoperative complications include cerebral infarction and secondary cerebral hemorrhage, which can seriously threaten the lives of patients [14-16]. Therefore, clinical factors that affect the occurrence of complications of moyamoya disease patients after revascularization should be identified.

The results of this study showed that cerebral ischemia as the first preoperative symptom, history of hypertension, and mRs score of 3–5 were all risk factors for complications in patients with moyamoya disease after revascularization. It is mainly caused by blood circulation disorder caused by intracranial vascular disease in patients, and the body's blood supply reduces as the disease progresses [17-18]. In patients with a history of hypertension, blood vessels are often blocked to varying degrees, which can reduce the regulatory function of cerebral blood vessels [19-20]. Patients with mRs scores of 3 to 5 points have decreased internal regulatory function, are prone to abnormal perfusion, and have an increased risk of complications [21-22]. Besides, patients with cerebral ischemia as the first symptom before operation should be closely observed, and the compensatory contraction and expansion of small arteries and capillary smooth muscle should be adjusted in time to ensure the dynamic stability of cerebral blood flow in patients and avoid postoperative complications [23]. As for patients with hypertension, their blood pressure should be strictly monitored, relevant drug treatment should be given, and patients should be instructed to quit smoking and drinking. Besides, the patients should also exercise regularly to improve blood pressure and reduce the probability of complications. Patients with an mRs score of 3 to 5 should be evaluated for brain function, undergo revascularization as soon as possible. In addition, the patients' condition changes were closely observed during the whole treatment process to reduce the incidence of postoperative complications.

5. Conclusion

In conclusion, cerebral ischemia as the first symptom before operation, history of hypertension, and mRs score of 3 to 5 are all risk factors for complications in patients with moyamoya disease after revascularization, and clinical prevention should be strengthened, and corresponding treatment measures should be given in time, so as reduce the risk of postoperative complications. However, since the research subjects in this study were all from our hospital and the sample size is relatively small, there may be some limitations in the data and results. Therefore, multicenter studies should be done with a bigger sample size to further demonstrate the risk factors affecting complications in patients with moyamoya disease after revascularization.

Disclosure statement

The author declares no conflict of interest.

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