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Original Article

Effect of different operation time on surgical effect and quality of life in patients with severe hypertensive intracerebral hemorrhage

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Abstract: Objective: To investigate the effect of different operation time on the surgery effect and quality of life of patients with severe hypertensive cerebral hemorrhage. Methods: A total of 98 patients with severe hypertensive cerebral hemorrhage were selected in this prospective study. According to the random number table, 98 patients were divided into group A and group B. About 47 patients in group A received surgical treatment within 6 hours after onset of a cerebral hemorrhage and 51 patients in group B received surgical treatment within 6-24 hours after onset of a cerebral hemorrhage. The effect of the operation, quality of life (the World Health Organization Quality of Life Scale Brief Version, WHOQOL-BREF) score, neuro function (National Institute of Health stroke scale, NIHSS), the ability of daily living (Barthel index), athletic ability (Fugl-Meyer motor function score), complications and prognosis (GOS) were compared between the two groups. Results: The total effective rate of operation in group A (91.49%) was higher than that in group B (76.47%), and the incidence of complications (8.70%) was lower than that in group B (27.08%; all P<0.05). NIHSS score of group A was lower than that of group B, and the WHOQOL-BREF score was higher than that of group B three months after the operation (all P<0.05). Barthel Index and Fugl-Meyer motor function scores of group A were higher than those of group B three months after the operation (all P<0.05). The prognosis of group A was better than group B three months after the operation (P<0.05). Conclusion: Operation performed within 6 hours after the onset of cerebral hemorrhage is useful in the treatment of severe hypertensive intracerebral hemorrhage. It can effectively improve patients' neurological function, the ability of daily living and motor function without increasing complications and, the quality of life, as well as the prognosis of patients.

Keywords: Severe hypertensive intracerebral hemorrhage, operation time, surgery effect, quality of life

Introduction

Hypertensive intracerebral hemorrhage is a common disease in neurosurgery, which has the characteristics of rapid onset and rapid progress. Affected by physical labor, emotional excitement and excessive mental activity, patients' blood pressure rises sharply, which can lead to vascular rupture and hemorrhage. The space-occupying effect of hematoma can induce secondary brain injury [1, 2]. Severe hypertensive intracerebral hemorrhage refers to the hypertensive intracerebral hemorrhage with the volume of intracerebral hemorrhage >50 mL or Glasgow Coma Score (GCS) <8 or midline structure shift >1 cm. The clinical symptoms are mainly severe headache, nausea and vomiting. The enlargement of hematoma can increase the intracranial pressure, damage the nerve function. It may be complicated with circulatory system and respiratory dysfunction, resulting in a high mortality rate and disability rate [3]. Therefore, timely relief of compression of a hematoma on the surrounding brain tissue, removal of hematoma, prevention of secondary brain injury are critical for efficient clinical treatment of such patients.

At present, the treatment of severe hypertensive cerebral hemorrhage is mainly surgical operation. A traditional craniotomy can observe whether there is active hemorrhage and to remove the hematoma directly. However, the effect to remove deep hematoma is usually

inefficient, and may cause secondary injury of brain tissue and thus poor prognosis [4]. In recent years, with the continuous improvement of minimally invasive technology, small bone window hematoma evacuation has become an important means for treating intracerebral hemorrhage with the volume of hematoma >30 ml. This operation can drain hematoma and stop bleeding, shorten the duration of edema, and relieve the displacement and pressure of brain tissue induced by hematoma. It has the advantages of light trauma, quick recovery and simple procedure [5]. However, the curative effect of the operation is affected by many factors, such as bleeding, bleeding site, operation time, etc. The selection of operation time has absolute significance in reducing the secondary injury of brain tissue to restore nerve function [6]. Some scholars have proposed that surgical treatment within 6 hours after hemorrhage (at ultra-early stage) can avoid brain function damage and remove hematoma as soon as possible. However, some scholars have found that ultra-early surgical treatment can induce short-term rebleeding, and would prefer surgical treatment within 6-24 hours after onset to operation [7, 8]. Given this, this study analyzed the clinical data of 98 patients with the severe hypertensive intracerebral hemorrhage who received small bone window hematoma evacuation in Wuzhou Red Cross Hospital and further explored the effect of different surgical time on patients with hypertensive intracerebral hemorrhage.

Materials and methods

General information

This prospective study recruited 98 patients with severe hypertensive intracerebral hemorrhage in Wuzhou Red Cross Hospital from March 2017 to February 2019, including 57 males and 41 females, aged 42-75 years, with an average of (60.1±5.2) years. The blood loss was 51-86 mL, with an average of (71.36±5.24) mL. The GCS score was 4-7 points and the average was (6.06±0.38) points. According to the random number table method, they were divided into two groups, 47 cases in group A and 51 cases in group B. The study has been reviewed and approved by the Medical Ethics Committee of Wuzhou Red Cross Hospital. All the patients have signed the informed consent form for the study.

Inclusion criteria

Patients met the diagnosis and treatment criteria of a severe hypertensive cerebral hemorrhage in Chinese guidelines for the diagnosis and treatment of cerebral hemorrhage (2019), and confirmed by cranial CT patients had the first bleeding; patients with previous history of hypertension; patients with the time from onset to operation ≤24 h; patients in line with the indications of small bone window hematoma evacuation [9].

Exclusion criteria

Patients had coagulation dysfunction, benign and malignant tumor in the brain; patients with cerebral hemorrhage induced by brain trauma, hematologic disease, hemangioma, vascular malformation, etc.; patients received long term anticoagulant treatment; patients accompanied by intracranial and systemic infection; patients had severe infection of the local scalp; patients had severe renal, liver, and lung failure.

Methods

The patients in group A were treated with ultra-early small bone window hematoma evacuation within 6 hours from the onset of the disease. The patients were placed in the supine position, disinfected and anesthetized by endotracheal intubation. Under the CT positioning of the skull, all the openings were taken along the scalp with a length of about 3 cm. The subcutaneous tissue was separated and the skull was fully exposed. A small bone window with a diameter of 2.5 cm was opened, and puncture was carried out in the relatively small functional area or non-functional area to remove the hematoma. Gelatin sponge was filled and a drainage tube was placed routinely. Electrocoagulation was used to stop bleeding, and an incision was sutured. Patients in group B were treated with delayed small bone window hematoma evacuation within 6-24 hours from onset to operation, and the specific steps were the same as those in group A. All patients received symptomatic treatment, such as intracranial pressure control, brain nerve nutrition, de-

hydration and anti-infection. The training contents included language ability, daily life self-care ability, walking ability, bed exercise, sitting and standing up and standing balance training.

Outcome measures

Main outcome measures: Surgical effect: Three months after the operation, the curative effect was evaluated according to the neurological deficit score formulated by the fourth national cerebrovascular disease academic conference Group [10]. It is considered a basic cure when the neurological deficit score decreased by more than 90% and neurological deficit score is reduced by 50%-90%, and the degree of disability is 0 grade. It is considered as significant progress when the neurological deficit score was reduced by 50%-90%, and the degree of disability was 1-3. It is considered as progress when the neurological deficit score is reduced about 15%-49%. It is regarded as invalid when the neurological deficit score is reduced by 15%, or the patient dies. Total effective rate (%) = basic cure rate + significant progress rate + progress rate.

Quality of life: The quality of life of patients was evaluated based on the World Health Organization Quality of Life-BREF (WHOQOL-BREF) scale. The scale involves six dimensions: social relationship, independent ability, psychology, physiology, personal belief and environment. The total score is 100 points. A high score represents that the overall quality of life after the operation is increased.

Secondary outcome measures: Neurological function: National Institute of Health stroke scale (NIHSS) was used to assess the neurological function of the patients 3 months before and after the operation. The score was 0-42, and the low score represents a low degree of the neurological deficit.

Ability of daily living: Barthel index was used to evaluate the self-care ability of patients 3 months before and after the operation, involving 10 items such as bathing, toilet, eating, bathing, dressing and so on. The total score was 100 points. A high score means strong self-care ability.

Athletic ability: The patients' motor ability was measured by a simple Fugl-Meyer motor function score 3 months before and after the operation. The scale included 50 items, each item was scored by 0-2 points and 3 grades, with 100 points. A high score means a good motor function.

Complications: The complications such as pulmonary infection, renal failure, gastrointestinal bleeding and stress ulcer were observed within three months after the operation.

Prognosis: The prognosis was evaluated according to the Glasgow Outcome Score (GOS) during a three-month follow-up. That patient's return to everyday life with minor defects is considered as good recovery. The patients who were disabled but could live independently and could work under protection were regarded as a mild disability. Those who were disabled, awake and could live under others' care were considered to be a severe disability. Those with weak reactions such as eyes opening were regarded as vegetative survival.

Statistical methods

Spss 22.0 software was used. The measurement data were expressed as a mean ± standard deviation ($\bar{x}$ ± sd). The comparison between groups and within groups was conducted by independent sample t and paired sample t-test respectively. χ^2 test was used for count data, which was expressed by percentage. A rank sum test was used for grade data. The difference was statistically significant ($P<0.05$).

Results

General information

There was no significant difference in age, gender, duration of hypertension, body mass index, bleeding volume, GCS score, diabetes mellitus, bleeding site and hypertension grade between group A and group B ($P>0.05$). See **Table 1**.

Effect of surgery

The total effective rate of group A (91.49%) was higher than that of group B (76.47%) ($P<0.05$). It suggests that ultra-early surgery's

Table 1. Comparison of general data between the two groups ($\bar{x}$ ± sd, n)

Group	Group A (n=47)	Group B (n=51)	t/χ^2	P
Male/female	28/19	29/22	0.074	0.786
Age (years)	60.4±5.1	59.2±4.9	1.188	0.238
Course of hypertension (years)	8.7±4.2	8.7±4.4	0.000	1.000
Body mass index (kg/m^2)	26.37±3.46	25.89±4.01	0.632	0.529
Amount of bleeding (mL)	70.67±5.11	71.19±5.88	0.466	0.642
GCS (points)	6.16±0.45	5.98±0.63	1.615	0.110
Complicated with diabetes mellitus	18	24	0.767	0.381
Bleeding site				
Basal nucleus/lobe	32/15	37/14	0.234	0.629
Classification of hypertension				
Grade II/Grade III	13/34	16/35	0.162	0.687
Smoking				
Yes/No	30/17	31/20	0.097	0.756
Hypertension grouping				
High risk group/extremely high risk group	28/19	27/24	0.437	0.509

Note: GCS: Glasgow Coma Score.

Table 2. Comparison of surgery effect between two groups (n, %)

Group	Group A (n=47)	Group B (n=51)	Z/χ^2	P
Basic cure	15 (31.91)	10 (19.61)	2.178	0.029
Significant progress	18 (38.30)	16 (31.37)		
Progress	10 (21.28)	13 (25.49)		
Invalid	4 (8.51)	12 (23.53)		
Total effective rate	43 (91.49)	39 (76.47)	4.039	0.044

Table 3. Comparison of prognosis at three months after the surgery between the two groups (n, %)

Group	Group A (n=47)	Group B (n=51)	Z	P
Good recovery	19 (40.43)	11 (21.57)	2.880	0.004
Mild disability	17 (36.17)	15 (29.41)		
Severe disability	9 (19.15)	14 (27.45)		
Vegetative survival	1 (2.13)	8 (15.69)		
Death	1 (2.13)	3 (5.88)		

curative effect in the treatment of severe hypertensive intracerebral hemorrhage is high and ultra-early surgery can promote the remission of clinical symptoms. See **Table 2**.

Prognosis

The prognosis of group A was better than that of group B (P<0.01) 3 months after the operation, which indicates that ultra-early surgical treatment helps improve the prognosis of patients with severe hypertensive intracerebral hemorrhage. See **Table 3**.

Neurological function and quality of life

The preoperative NIHSS score and the World Health Organization Quality of Life Scale Brief Version (WHOQOL-BREF) score of patients in group A had no significant difference compared with those of patients in group B (P>0.05). NIHSS score of patients in group A was lower than that of patients in group B at three months after the operation, and the WHOQOL-BREF score was higher than that of patients in group B (P<0.05). It can be seen that ultra-early surgery can reduce the degree of nerve defect and improve the quality of life of patients with severe hypertensive intracerebral hemorrhage. See **Table 4** and **Figure 1**.

Activities of daily living and exercise ability

There was no significant difference in Barthel Index and Fugl-Meyer motor function score between group A and group B before the surgery (P>0.05). Barthel Index and Fugl-Meyer motor function score of group A three months after the surgery was higher than group B (P<0.05). It has been suggested that ultra-early surgery helps improve the self-care ability

Table 4. Comparison of NIHSS score and WHOQOL-BREF score between the two groups ($\bar{x}$ ± sd)

Group	Group A (n=47)	Group B (n=51)	t	P
NIHSS				
Before the operation	24.75±4.11	23.37±4.97	1.464	0.147
3 months after the operation	14.68±3.01	19.14±3.34	6.791	<0.001
t	13.407	4.894		
P	<0.001	<0.001		
WHOQOL-BREF				
Before the operation	40.98±4.16	41.46±5.12	0.498	0.620
3 months after the operation	64.16±7.29	49.14±5.67	11.177	<0.001
t	18.731	6.965		
P	<0.001	<0.001		

Note: NIHSS: National Institute of Health stroke scale; WHOQOL-BREF: the world Health Organization Quality of Life Scale Brief Version.

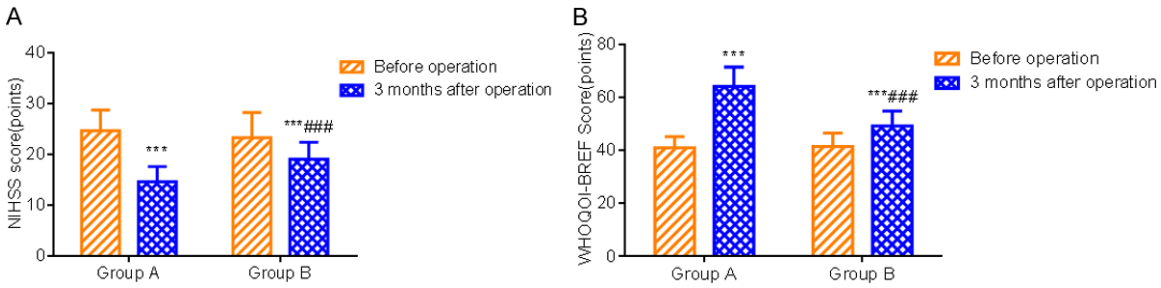

Figure 1. Comparison of NIHSS score and WHOQOL-BREF score between the two groups. A: NIHSS score. B: WHOQOL-BREF score. Compared with that before the operation, ***P<0.001; compared with that of group B after the operation, ###P<0.001. NIHSS: National Institute of Health stroke scale; WHOQOL-BREF: the world Health Organization Quality of Life Scale Brief Version.

Table 5. Comparison of Barthel Index and Fugl-Meyer motor function score between the two groups ($\bar{x}$ ± sd, points)

Group	Group A (n=47)	Group B (n=51)	t	P
Barthel index				
Before the operation	51.34±6.77	50.09±7.13	0.871	0.386
3 months after the operation	65.54±8.01	59.34±8.12	3.725	<0.001
t	9.183	5.931		
P	<0.001	<0.001		
Fugl-Meyer motor function score				
Before the operation	54.32±8.34	55.57±7.63	0.759	0.440
3 months after the operation	69.91±8.42	62.27±7.13	4.755	<0.001
t	8.922	4.445		
P	<0.001	<0.001		

and motor function of patients with severe hypertensive cerebral hemorrhage. See **Table 5** and **Figure 2**.

Complications

The incidence of complications in group A (8.70%) was lower than that in group B (27.08%; P<0.05). It shows that ultra-early surgery for severe hypertensive intracerebral hemorrhage has high safety and can reduce complications. See **Table 6**.

Discussion

Severe hypertensive intracerebral hemorrhage can interrupt the blood flow in the local cerebral blood supply area. A large amount of blood in the brain can cause brain tissue compression and induce irreversible

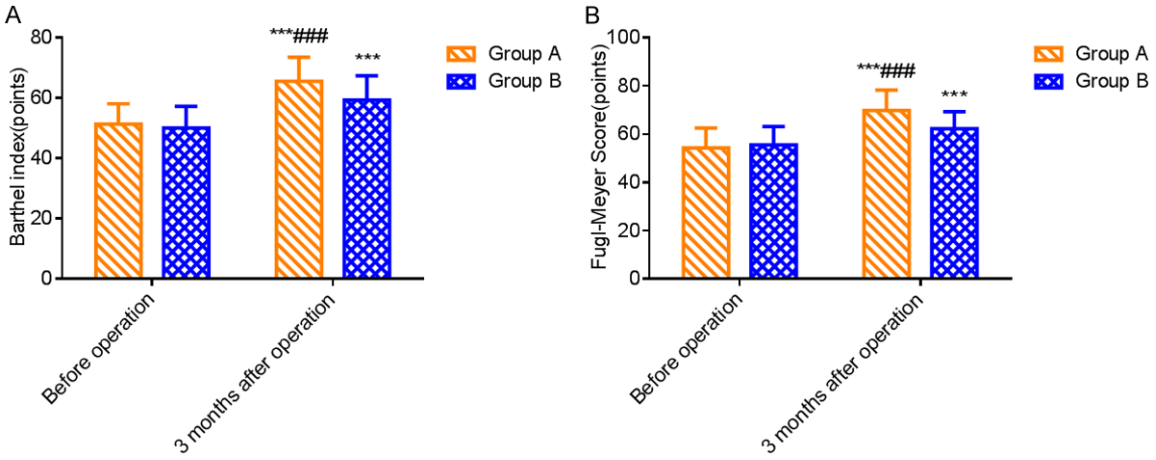

Figure 2. Comparison of Barthel Index and Fugl-Meyer motor function score between the two groups. A: Barthel index. B: Fugl-Meyer motor function score. Compared with that before the operation, ***P<0.001; compared with that of group B after the operation, ###P<0.001.

Table 6. Comparison of complications between the two groups (n, %)

Group	Group A (n=47)	Group B (n=51)	χ^2	P
Pulmonary infection	1 (2.17)	2 (4.17)	0.302	0.583
Renal failure	0 (0)	2 (4.17)	1.958	0.162
Rebleeding	1 (2.17)	3 (6.25)	0.958	0.328
Gastrointestinal bleeding	1 (2.17)	4 (8.33)	1.769	0.183
Stress ulcer	1 (2.17)	2 (4.17)	0.302	0.583
Total	4 (8.70)	13 (27.08)	5.361	0.021

nerve function damage [11, 12]. Hematoma occupying effect can lead to the regional ischemic and hypoxic injury of brain tissue, and necrosis and degeneration of the surrounding brain tissue. Therefore, the operation time is critical to ensure a good prognosis.

Studies have found that in the early stage, the survival rate of nerve cells in the brain tissue of patients with hypertensive intracerebral hemorrhage is high. If the blood supply of brain tissue is restored and the compression of brain tissue is relieved at this stage, the degree of nerve function damage can be reduced and patients' will have a good prognosis [13, 14].

Small bone window hematoma evacuation is a common surgical method for treating severe hypertensive intracerebral hemorrhage at present. It can stop bleeding and remove hematoma under direct vision or microscope, which is conducive to complete hemostasis and sufficient decompression. However, there are still some disputes regarding this operation's timing in clinical practice [15]. In our study, the results showed that the total effective rate, WHOQOL BREF score, Barthel index, Fugl-Meyer motor function score were higher in patients who received surgery within six hours since the attack of the disease, while the incidence of complications such as NIHSS score and rebleeding in 3 months after operation were lower than those in patients who received operation within 6-24 hours since the onset of the disease. The prognosis of patients with surgery within six hours improved. The results showed that performing operation within 6 hours after the onset for patients with severe hypertensive intracerebral hemorrhage could reduce the degree of neurological impairment, improve the quality of life and motor function, enhance the ability of self-care, prevent the occurrence of complications such as rebleeding, and is conducive to the prognosis.

The main reason may be that the central nervous system has a low tolerance for oxygen. If the brain tissue is in hypoxia for a long time, the damage of nerve function can be aggravated. Therefore, early removal of hematoma can relieve the hypoxic state of brain tissue, relieve the compression of brain tissue, and avoid damaging the central nervous system by harmful substances produced by blood splitting or coagulation [16, 17]. It is also related to the fol-

lowing mechanisms of ultra-early surgery: (1) Cerebral hemorrhage hematoma is generally formed about 30 minutes after the onset and brain tissue appears sponge-like changes. Necrosis of the brain tissue occurs about 6 hours after the onset and 12 hours later secondary lesions can occur. Irreversible damage could be induced without timely evacuation [18]. Li et al. found that the volume of hematoma and the degree of brain tissue damage increased with the extension of intracerebral hemorrhage time [19]. Therefore, ultra-early surgical treatment can prevent secondary brain tissue damage and reduce edema around hematoma. (2) The intracranial pressure and the degree of cerebral edema did not reach the peak within 6 hours after intracerebral hemorrhage, so it was more convenient for operation. (3) Ultra-early hemostasis and hematoma evacuation can prevent hematoma enlargement, reduce hematoma damage to brain tissue and prevent postoperative rebleeding [20]. (4) Ultra-early surgery can reduce the damage of deep thalamus and other structures and reduce gastrointestinal bleeding caused by visceral autonomic nerve disorders. Besides, dehydrating agents and other drugs are less, so the incidence of renal failure will be reduced. (5) Ultra-early surgery can recover cough reflex function and respiratory self-purification function of patients quickly, reduce the degree of pulmonary infection, and then prevent complications such as pulmonary infection [21].

Yong et al. found that ultra-early surgical treatment for elderly patients with hypertensive intracerebral hemorrhage helps improve the Barthel Index and Fugl-Meyer motor function score of the patients is similar to the results of our study [22]. The reason may be that the extent and degree of brain tissue damage in patients with delayed surgery are large. At this time, the brain tissue around the hematoma has irreversible damage, and the residual motor nerve cells in the surrounding normal brain tissue are reduced, so the recovery effect of motor ability and self-care ability of patients is not ideal. Ultra-early surgery can save the damaged motor nerve cells to the maximum extent, reduce the degree of nerve damage, and provide a physiological basis for an adaptive structural reorganization of the central nervous system, to improve the motor ability and self-care ability of patients [23, 24]. To further improve the curative effect of surgery, the following points should be paid attention to in the process of small bone window hematoma evacuation: (1) To reduce the degree of injury of central nervous system, we should pay attention to protect the important blood vessels and prevent the cerebral tissue infarction in the blood supply area after injury. (2) To ensure the vital signs such as blood pressure etc are stable before operation. (3) During the operation, the normal brain tissue should not be pulled to reduce the injury. There are still some deficiencies in this study, such as small sample size and a single sample source. Further research about the pathogenesis is needed to reduce the occurrence of stress ulcers and other complications.

In conclusion, the effect of ultra-early surgery (within 6 hours from onset to operation) on the treatment of severe hypertensive cerebral hemorrhage is noticeable. Ultra-early surgery can improve the patient's neurological function, daily life ability and motor function without increasing complications. It can also enhance the quality of life and the patient has a good prognosis.

Disclosure of conflict of interest

None.

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