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Original Article

Comparative analysis of curative effect of neuroendoscopy and traditional craniotomy in treatment of intracerebral hemorrhage secondary to brain tumor

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Abstract: Objective: To investigate the efficacy and prognosis of neuroendoscopy and traditional craniotomy in the treatment of intracerebral hemorrhage secondary to brain tumor. Methods: A total of 36 patients with intracerebral hemorrhage secondary to brain tumor treated in our hospital from June 2015 to May 2016 were selected. According to the random number table method, they were divided into two groups: 18 cases were treated with neuroendoscopy (endoscopy group), and the other 18 cases were treated with craniotomy to remove hematoma (craniotomy group). The hematoma clearance rate, the score of Glasgow Coma Scale (GCS) one-week after operation, the hospital stays and the prognosis (the score of modified Rankins Scale (mRS) at six-month after operation) were compared between the two groups. Results: There was no statistically significant difference in preoperative general data between the two groups (all P>0.05). The hematoma clearance rate in endoscopy group was slightly higher than that in craniotomy group, but the difference was not statistically significant (P=0.134). Compared with pre-treatment, the GCS scores of two groups were significantly improved one week after operation (P=0.001, P=0.012), but the improvement in endoscopy group was more significant than that in craniotomy group (P=0.041). The length of stay in endoscopy group was shorter than that in craniotomy group, but the difference was not statistically significant (P=0.751). The mRS score at six-month after operation in endoscopy group was significantly higher than that in craniotomy group (P=0.048). Namely, the prognosis in endoscopy group was better than that in craniotomy group. Conclusion: Both neuroendoscopy and traditional craniotomy used to treat intracerebral hemorrhage secondary to brain tumor could alleviate brain hematoma. The hematoma clearance rates and the hospital stays were similar in the two groups. But the GCS score one-week after operation and the mRS score at six-month after operation in endoscopy group were better than those in craniotomy group. Thus, the prognosis of using neuroendoscopy to treat intracerebral hemorrhage secondary to brain tumor was better.

Keywords: Intracerebral hemorrhage secondary to brain tumor, neuroendoscopy, traditional craniotomy

Introduction

In patients with brain tumor, hemorrhage could be caused by repeated collapse and necrosis of blood vessel structures when brain tumor was establishing blood supply, or by brain tumor physically damaging the blood vessels in brain tissues around it. Clinically, the initial symptom of some patients with brain tumor was intracranial hemorrhage. Due to the urgent onset, it was more in need of timely diagnosis and treatment, and clinicians should pay attention to it [1, 2].

The treatment of intracranial tumor hemorrhage included hematoma clearance and tumor resection. If the bleeding of the ruptured intracranial tumor was less and the symptom was not apparent, special treatment might not be very needed. However, for intracranial tumor with a large amount of bleeding, especially when the intracranial bleeding leading to rapidly increase of intracranial pressure and apparent mass effect, emergency surgery must be carried out to prevent the condition from continuous deterioration. The treatment for brain tumor in clinic was mainly surgical treatment.

Neuroendoscopy and traditional craniotomy were used for the treatment of intracerebral hemorrhage caused by brain tumor [3, 4]. For the further understanding and evaluation of the significance of the two methods in the treatment of intracerebral hemorrhage secondary to brain tumor, this study summarized the curative effect of the two treatments, which patients with intracerebral hemorrhage secondary to brain tumor received in the neurosurgery department of our hospital and reported as follows.

Materials and methods

Subjects

This study has been approved by the Ethics Committee and obtained the informed consents from all the guardians of patients.

Patients with intracerebral hemorrhage secondary to brain tumor treated in Department of Neurology of our hospital from June 2015 to May 2016 were selected. Inclusion criteria: Patients with symptoms of whole brain or focal neurologic impairment such as headache, varying degrees of disturbance of consciousness, limb paralysis and paresthesia; patients were diagnosed as cerebral hemorrhage (confirmed as cerebral hemorrhage caused by brain tumor) by CT scan, without brain hernia; patients who aged 20-65 years old with complete case data. Exclusion criteria: Patients who had cerebral hemorrhage with intracranial arteriovenous malformation or rupture; patients with cerebral hemorrhage caused by hypertension or secondary to cerebral infarction; patients with traumatic cerebral hemorrhage; patients with brain stem hemorrhage or brain stem functional failure; patients with severe infection; patients with anesthetic contraindication.

Grouping method

A total of 36 intracerebral hemorrhage secondary to brain tumor patients were selected and divided into two equal groups according to the random number table method, 18 cases in operation treatment group (craniotomy group) and 18 cases in neuroendoscopy treatment group (endoscopy group).

Therapeutic methods

The vital signs of patients were strictly monitored after admitting to hospital, and expectant treatment was carried out for patients. Patients in the two groups underwent surgical treatment by the same group of doctors.

The hematoma volume was reconstructed and calculated by image analysis software 3D Slicer. The CT data in accordance with Digital Imaging and Communications in Medicine were obtained from our hospital's system. It was imported into the 3D Slicer software for automatic plotting of the hematoma as well as for the three-dimensional reconstruction to calculate the hematoma volume.

Traditional craniotomy for hematoma clearance and intracranial tumor operation were used in craniotomy group. General anesthesia with tracheal cannula was carried out for patients. The craniotomy site was confirmed for the exposure of hematoma according to the cranial imaging examination. Intracranial hematoma was softly cleared away with an aspirator. If active bleeding was found in small blood vessels around the brain tissues, bipolar coagulation hemostasis was performed, at the same time, damages to normal arterial trunk should be avoided for fear of bleeding in a larger area. After the hematoma clearance operation, the drainage tube was routinely placed for postoperative drainage, and all the layers of the head were sutured tightly. When hematoma clearance was performed to reduce intracranial pressure, in the mean time, the intracranial tumor was removed. The principles of general and postoperative treatment for intracranial tumors were the same as those for patients in endoscopy group.

Neuroendoscopy was used for hematoma clearance and tumor resection in endoscopy group. After general anesthesia with tracheal cannula successfully performed in all patients, three-dimensional reconstruction and the localization of intracranial hematoma in patients were performed with 3D Slicer software [5]. After that, we located the appropriate puncture site. An incision with length of 2.5-4 cm was performed with center on the set puncture point. And the scalp was cut apart layer by layer to the cerebral dura mater layer, which was cut radially and the brain tissues were slightly cut apart. We used new endoscopic guide, when the guide reached the ideal puncture depth, the inner core was removed, and then the endoscopy was connected to a syringe to reduce intracranial pressure by the suction

Table 1. The data of patients with intracerebral hemorrhage secondary to brain tumor before treatment

	Endoscopy group	Craniotomy group	P
Gender (n)			0.825
Male	9	10	
Female	9	8	
Age (year)	53.3±11.7	52.9±11.2	0.782
Hypertension (n)	8	7	0.645
Chronic headache (n)	12	13	0.576
Epileptic seizure (n)	11	10	0.627
Hemiplegia symptom (n)	5	7	0.341
Tumor type (n)			0.517
Glioma	10	9	
Meningioma	3	5	
Pituitary tumors	5	4	
History of chemotherapy (n)	10	9	0.746
Onset time (hour)	13.8±3.83	14.2±4.25	0.261

of intracranial hematoma. Hematoma removal was performed under direct vision of neuroendoscopy. As for intraoperative hemorrhage, we used metal suction apparatus for the suction of the bleeding site and performed electric coagulation hemostasis. Tumor resection was performed without traction of brain tissues, related blood vessels and nerves.

Two groups of patients were admitted to the care unit after treatment, and the changes of their vital signs were closely observed for expectant treatments like oxygen inhalation, given diuretics or neurotrophic drugs. According to their condition, enteral or parenteral nutrition support was applied for avoiding the occurrence of complications such as stress ulcer, alimentary tract hemorrhage and intracranial infection.

Postoperative follow-up and observation indexes

Hematoma clearance rate: All patients underwent cranial CT scan before treatment and 24 h after treatment. The changes of hematoma volume before and after treatment were calculated and evaluated. The volume of hematoma was reconstructed and calculated by image analysis software 3D Slicer. The CT data in accordance with Digital Imaging and Communications in Medicine were obtained from the hospital system and imported into the 3D Slicer software for automatic plotting of the hematoma as well as for the three-dimensional reconstruction and calculation of the hematoma volume. Hematoma clearance rate=(hematoma volume before treatment-hematoma volume after treatment)/hematoma volume before treatment * 100%.

The scores of Glasgow Coma Scale before and after treatment: The score of Glasgow Coma Scale (GCS) was used to measure and express the state of consciousness of patients. At admission and one-week after operation were set as observation points. Integral evaluation was based on the eyes opening, language and movement of the patients during the examination. The total score was 15 points, and 13 to 14 points was regarded as mild coma, 9 to 12 points as moderate coma, 3 to 8 points as severe coma.

Hospital stay: The hospital stays of patients were observed and recorded, length of stay=discharge time-admission time.

Prognosis: Six months after the treatment, the score of modified Rankins Scale (mRS) was used to evaluate the recovery state of neurological function in patients after intracerebral hemorrhage. The lower the score was, the better the prognosis was. Specific classifications were as follows: level 0, no symptom; level 1, symptomatic, but no obvious dysfunction, patients were able to complete all daily duties and activities; level 2, mild disability, patients were unable to complete all activities they did before illness, but they could take care of their affairs without assistance; level 3, moderate disability, patients would ask for some help, but they could walk without help; level 4, severe disability, they couldn't walk independently and couldn't handle their own needs without help; level 5, severe disability, they should lie in bed, became incontinent and required continuous care and attention; level 6, death.

Among the indexes above, prognosis was the main observation index. The clearance rate of hematoma, GCS scores before and after treatment and hospital stays were the secondary observation indexes.

Statistical processing

Data analysis and process were performed with SPSS19.0 statistical software. The mea-

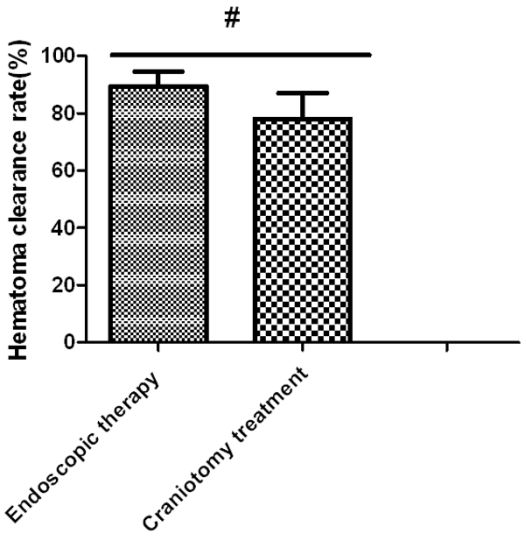

Figure 1. Comparison of hematoma clearance rate in the two groups (#P>0.05).

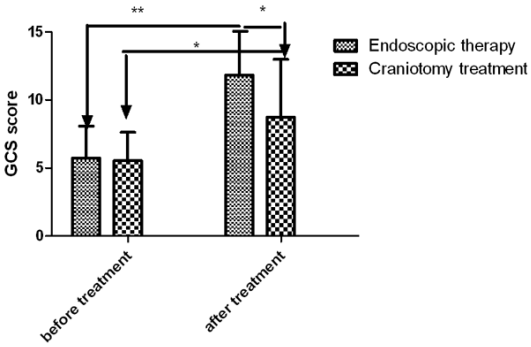

Figure 2. The GCS scores of the two groups before and after treatment (*P<0.05, **P<0.01).

surement data were expressed as mean ± standard deviation ($\bar{x}$ ± sd); paired t-test was used for comparison of before and after treatment in a group; single-factor analysis of variance was used for comparison between groups at the same time point. Enumeration data were expressed as rate, and the chi square test was used for the comparison of rates among groups. The difference was statistically significant when P<0.05.

Results

General data

A total of 36 cases were selected, and the difference of general data in the two groups was not statistically significant (all P>0.05, see **Table 1**).

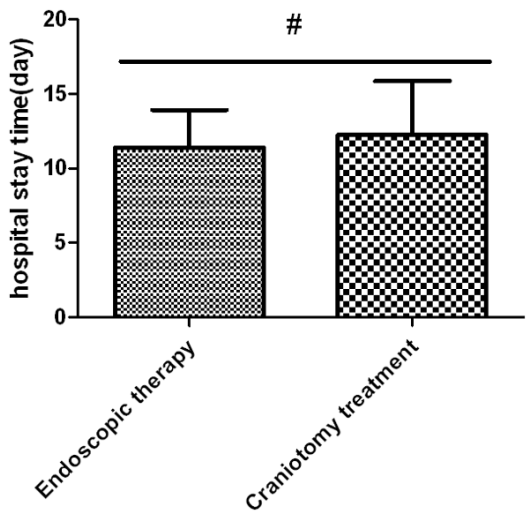

Figure 3. Comparison of hospital stays between the two groups (#P>0.05).

Comparison of hematoma clearance rates in the two groups

The hematoma clearance rates in endoscopy group and craniotomy group were (89.3±10.2) % and (78.3±8.4) % respectively. The difference between the two groups was not statistically significant (P=0.134, see **Figure 1**).

Comparison of GCS scores before and after treatment

The GCS scores at admission in endoscopy group and craniotomy group were 5.6±2.2 and 5.8±2.4 respectively, which were similar (P=0.615). The scores of GCS one-week after operation in endoscopy group and craniotomy group were 11.6±6.2 and 8.3±4.4 respectively, which were significantly increased compared with the GCS scores at admission (P=0.001, P=0.012), but the improvement in endoscopy group (6.1±3.5) was more obvious than that in craniotomy group (2.8±1.9) with significant difference (P=0.041), see **Figure 2**.

Hospital stay

The length of stay of the two groups was compared, and the difference was not statistically significant, see **Figure 3** (P=0.752).

Prognosis

The follow-up was carried out for all patients six months after treatment. The mean scores of

Table 2. The follow-up survey of the two groups

Grading/grouping	Endoscopy group	Craniotomy group	P
No symptom	4	2	
Mild disability	5	3	
Moderate disability	4	4	
Severe disability	3	5	
Death	2	4	
mRS score	3.4±1.9	4.2±1.5	0.048

mRS were 3.4±1.9 in endoscopy group, and 4.2±1.5 in craniotomy group. The comprehensive evaluation showed that the prognosis of the patients in the endoscopy group was superior to that in craniotomy group with significant difference (P=0.048), see **Table 2**.

Discussion

Intracranial hemorrhage, which is one of the common clinical complications in patients with brain tumors, has very high incidence and mortality resulting in heavy financial burden and severe psychological harm to society and family [4, 5]. Generally, treatment methods for intracerebral hemorrhage in clinic include surgery and conservative internal medical treatment. But all the treatments were controversial, and no consensus had yet been formed until now. The drug therapy during internal medical treatment was intravenous infusion of mannitol to reduce brain edema and to decrease intracranial pressure [6]. However, most researchers in clinical practice didn't recommend merely using drug treatment after cerebral hemorrhage happened in patients with brain tumor.

Many researchers believed that surgery for hematoma removal and brain tumor resection was needed in patients with intracerebral hemorrhage secondary to brain tumor. Study showed that surgery could effectively remove clots and necrotic tissue in the brain of patients with brain tumor and intracerebral hemorrhage, so as to reach the purpose of reducing intracranial hematoma mass, and to prevent the occurrence of cerebral hernia and other life-threatening complications, thus, it was of great significance for improving the therapeutic effect and prognosis in patients with intracerebral hemorrhage secondary to brain tumor [7]. In addition, hematoma clearance could improve local ischemia and reduce the secondary injury caused by various toxic and harmful substances which came from the release of hematoma, therefore, the survival rate and life quality of patients could be improved. The Guidelines for the American Heart Association also recommended that hematoma removal should be performed within 12 hours after intracerebral hemorrhage, and minimally invasive surgery was especially recommended

At present, the surgical treatment for intracerebral hemorrhage secondary to brain tumor mainly included traditional craniotomy, trepanation and drainage as well as endoscopic evacuation of hematoma [8-10]. Traditional craniotomy for hematoma evacuation had disadvantages of long operation time, large amount of intraoperative blood loss, and excessive exposure and traction of normal brain tissues during the operation. The above factors not only caused great trauma in the craniotomy and severe edema after the operation, but also aggravated postoperative neurological function loss, and they greatly impacted on the prognosis of the patients [10]. Although trepanation and drainage of hematoma damaged less on the brain tissues, the hematoma clearance rate was low, so the rate of repeatedly trepanation for the removal of hematoma was increased, also, repeatedly injection of urokinase should be performed into the brain after operation. On the one hand, the factors above increased not only the financial burden and psychological trauma of patients, but also the risk of intracranial infection, on the other hand, trepanation and drainage couldn't stop bleeding completely for its indirect vision, so it increased the risk of rebleeding resulting in increasing risk of secondary lesions such as cerebral edema and cerebral ischemia.

Nowadays, many scholars used minimally invasive neuroendoscopy for the evacuation of hematoma and the resection of intracranial tumor. This surgical technique established a minimally invasive surgical approach, and operators could use transparent endoscopic guide to timely confirm the position of the hematoma during the operation, so that precise operation could be carried out, the hematoma could be rapidly and thoroughly removed, and the degree of hematoma clearance could be assessed at any time. The results of this study showed that the hematoma clearance rate in endoscopy group was slightly higher than that in cranioto-

my group, which was similar to the results of related literatures and researches [11-13]. The high clearance rate of hematoma in endoscopy group mainly because of the favorable exposure of deep intracranial hematoma by using neuroendoscopy, which provided widely visual operative field for operators to perform surgical operations such as evacuation of the hematoma under direct vision. In addition, the hemostasis on the small hemorrhage lesions in the deep part could also be performed, which greatly reduced the incidence of postoperative rebleeding, thus a variety of secondary pathological lesions which might be caused by hematoma were blocked [14]. However, there was a research showed that the hematoma clearance rate between endoscopy group and craniotomy group was not statistically significant, and the hematoma clearance rate in the craniotomy group was slightly higher [15]. In this study, the hematoma clearance rate in endoscopy group was a bit higher than that in craniotomy group, and the possible reasons of the different results might be small sample size and large deviation in that research which led to inconformity of hematoma clearance rates. In addition, we used medical image analysis software 3D-Slicer for the calculation of hematoma volume in this study to avoid the comparatively large calculation error caused by Tada Formula method [16, 17]. Therefore, we believe that the result of hematoma clearance rates in this study could be more reliable.

The results of this study showed that in endoscopy group, the length of hospital stays was relatively decreased; the conscious score was better one-week after operation; the 6-month after operation prognosis was better. The reasons were as follows: compared with traditional craniotomy for hematoma evacuation, neuroendoscopy belonged to minimally invasive surgery. Additionally, the operative procedures of hematoma evacuation and tumor resection by neuroendoscopy were relatively simple; the surgical trauma was small and it had less interference to other normal brain tissues. Thus, the prognosis of patients undergoing endoscopic surgery was superior to that of patients undergoing craniotomy, which was similar to the relevant literatures and researches in China and abroad [18-20].

In conclusion, surgical treatment was significant for patients with intracerebral hemorrhage secondary to brain tumor, and for them, treated by neuroendoscopy was more beneficial than by craniotomy. Endoscopic surgery had little damage to the patients, relatively high clearance rate of hematoma and better prognosis in patients. But neuroendoscopy as a newly developed surgical technique in recent years; its use in surgery was relatively less and it required clinical studies with larger sample size to demonstrate its importance in intracerebral hemorrhage of patients with brain tumors.

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Disclosure of conflict of interest

None.

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