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Therapeutic Effect of Neuroendoscopic Removal of Hematoma from Elderly Patients with HCH and Its impact on Neurological Functions and Inflammatory Factors

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Abstract

Objective To explore the effect of neuroendoscopic hematoma removal in elderly patients with hypertensive intracerebral hemorrhage (HIH) and its impact on neurological functions and inflammatory factors. **Method** A total of 66 patients with HIH who attended our hospital from Jan. 2019 to Mar. 2020 for treatment were selected as the research objects. The patients were divided into control group and observation group by random number table method, with 40 cases in each group. The control group was treated with small bone window, while the observation group was treated with neuroendoscopic removal of haematoma. The clinical effect, nerve defect score and inflammatory factor level of the two groups were compared. **Result** Compared with the control group, the operation time was shorter, intraoperative bleeding volume was smaller and hematoma clearance rate was higher in the observation group (P<0.05). After treatment, the neurological deficit score of the two groups was significantly lower than that before treatment (P<0.05), and the NDS of the observation group was noticeably lower than that of the control group (P<0.05). After treatment, moreover, the levels of tumor necrosis factor-α (TNF-α), interleukin-6 (IL-6) and hypersensitive C-reactive protein (hs-CRP) in the two groups were noticeably lower than those before treatment (P<0.05), and the levels of TNF-α IL-6 and hs-CRP in the observation group were greatly lower than those in the control group (P<0.05). **Conclusion** Neuroendoscopic removal of haematoma could effectively improve neurological functions and reduce inflammatory factors in elderly patients with HIH.

Introduction

Hypertensive intracerebral hemorrhage (HIH) is one of the most serious complications of hypertension occurring to middle-aged and elderly patients aged 50 to 70 years old. Hypertension often causes lesions in the small arteries of the brain. The blood pressure of middle-aged and elderly patients with HIH will rise rapidly when they became active or emotional, leading to rupture of the diseased cerebral blood vessels and cerebral hemorrhage. The clinical manifestations are severe headache, nausea, coma or Hemiplegia, Aphasia and other neurological impairment symptoms. HIH has the characteristics of acute onset, severe disease, high rates of disability and mortality [1]. Therefore, it is particularly important to adopt an effective treatment plan. At present, small bone window craniotomy and neuroendoscopic surgery are commonly used in clinical treatment of HIH. Thus, the clinical effects of the two surgical operations were discussion in this study.

Materials and methods

General information

Sixty six elderly HIH patients admitted to our hospital between January 2019 and March 2020 were selected as the research objects, and divided into the control group and the observation group using a random number table method. In the observation group, there were 23 males and 17 females aged 65-78 years old, with an average age of 71.37±4.21 years old, a disease course of 3-18 years, and an average disease course of 9.75±1.46 years. In the control group, there were 21 males and 19 females aged 66-81 years old, with an average age of 72.09±4.15 years old, disease course of 4-21 years, and an average course of 9.93±1.37 years. There was no significant difference between the two groups in terms of gender, age and disease course (P>0.05), and they were comparable. Inclusion criteria: ① those who met the diagnostic criteria of HIH [2]; ② those who suffered from essential hypertension; ③ those who had a cerebral hemorrhage of 30-50 ml diagnosed by head CT; ④ elderly patients. Exclusion criteria: ①patients with trauma, vascular malformations or arterial tumor bleeding; ②patients with coagulation dysfunction; ③patients with cardiopulmonary dysfunction.

Treatment methods

The control group was treated with small bone window craniotomy under general anesthesia. The hematoma was located according to the results of the head CT examination, and while carefully avoiding important nerve and blood vessel areas, a straight or horseshoe-shaped incision was made at the site closest to the location of the hematoma. After the dura mater was punctured with a needle, the hematoma was removed, hemostatic measures were taken and the drainage tube was indwelled. Finally the skull was routinely closed.

The observation group was treated with minimally invasive neuroendoscopic surgery under general anesthesia. The hematoma was located according to the results of head CT examination. Surgical incision was made by a straight cut of 2~3cm at the site closest to the hematoma. After the incision, the skull was drilled with a bone hole at a diameter of 1~1.5cm while carefully avoiding important nerves and blood vessels. A neuroendoscopy channel was established after opening the dura mater to completely remove the hematoma. The bleeding was stopped by electrocoagulation, a drainage tube was placed, and the skull was routinely closed.

Observation indicators

①The operation time, intraoperative blood loss and hematoma clearance rate in the two groups were recorded. Hematoma clearance = (preoperative CT hematoma volume-head CT hematoma volume within 24 hours after the surgery) / preoperative CT hematoma volume. ②Clinical NDS was used to evaluate the degree of neurological deficit in all the patients before and 3 months after the surgery, the score range is 0 to 45 points, with a higher score indicating a poorer neurological function. ③The fasting venous blood before and after treatment were taken to separate the serum after centrifugation. Radioimmunoassay, enzyme-linked immunoassay and latex-enhanced immune transmission method were

applied to detect the levels of tumor necrosis factor (TNF-α) and interleukin-6 (IL-6), high-sensitivity C-reactive protein (hs-CRP) before and after treatment.

Statistical analysis

The data were analyzed with SPSS 22.0 statistical software. The measurement data are expressed by the mean ± standard deviation ($\bar{x}\pm s$). The comparison of data was conducted by t test. The difference was defined as significant when P<0.05.

Results

Comparison of clinical efficacy between the two groups

The operation time and intraoperative blood loss in the observation group were significantly shorter and less than those in the control group (P<0.05), and the removal rate of hematoma in the observation group was noticeably higher than that in the control group (P<0.05), see Table 1.

Table 1 Comparison of clinical efficacy between the two groups

Groups	Cases	Operation time（h）	Intraoperative blood loss（mL）	Hematoma clearance（%）
Observation group	33	1.65±0.82	122.45±12.34	93.32±5.49
Control group	33	3.64±1.21	276.31±22.45	85.47±7.11
t		-7.821	-34.502	5.020
P		0.000	0.000	0.000

Comparison of two groups of NDS

Before treatment, there was no significant difference in NDS between the two groups (P>0.05). After treatment, the NDS of the two groups was significantly lower than before treatment (P<0.05), and the NDS of the observation group was obviously lower than that of the control group (P<0.05), see Table 2.

Table 2 Comparison of two groups of NDS

Groups	Cases	Before treatment	After treatment	*t*	*P*
Observation group	33	40.66±6.12	24.45±4.32	12.431	0.000
Control group	33	39.78±5.97	29.76±5.13	7.313	0.000
t		0.591	-4.548		
P		0.556	0.000		

Comparison of the levels of inflammatory factors between the two groups

Before treatment, there was no significant difference in the levels of TNF-α, TL-6, and hs-CRP between the two groups (P>0.05). However, after treatment, the levels of TNF-α, TL-6 and hs-CRP in the two groups were lower than those before treatment (P< 0.05), and the levels of TNF-α, TL-6 and hs-CRP in the observation group were significantly lower than those in the control group (P<0.05), see Table 3.

Table 3 Comparison of the levels of inflammatory factors between the two groups

Groups	Cases	TNF-α（ng/L）		IL-6（ng/L）		hs-CRP（mg/L）	
		Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Observation group	33	56.41±6.54	18.45±3.24[a]	65.47±6.87	27.31±4.08[a]	27.31±5.02	7.26±2.03[a]

Control group	33	57.22±6.63	31.33±4.67[a]	66.98±6.41	39.87±4.78[a]	26.64±4.85	15.59±3.21[a]
t		-0.500	-13.018	-0.923	-11.481	0.551	-12.599
P		0.619	0.000	0.359	0.000	0.583	0.000

Note: compared with before treatment, [a]P<0.05.

Discussion

HCH tends to occur to middle-aged and elderly people and is one of the common acute cerebrovascular diseases. If not treated in time, hematoma caused by HCH can compress brain tissues, nerves and blood vessels, causing intracranial hypertension, or secondary reactions, thereby leading to neurological dysfunction that seriously threatens the life of patients [3].

Clinically, medication is the main treatment for HIH patients with blood loss ≤30ml, and surgery is more applicable to patients with blood loss >30ml [4]. At present, many surgical methods have been developed for the treatment of HIH in clinical practice. As a traditional surgical treatment, small bone window craniotomy is also effective in removing hematoma, but it could lead to great trauma and long operation time. HIH is more likely to occur to the middle, elderly people, and this group of patients often has a variety of basic diseases and declined physical functions, thus, elderly HIH patients often cannot tolerate such a surgical treatment [5]. With the continuous development of minimally invasive endoscopic technology, neuroendoscopic surgery can remove hematoma, and is relatively simple to operate, with shorter operation time, small incision and less bleeding [6]. Under the guidance of neuroendoscopy, the patient's brain tissue imaging becomes open and clear, which not only facilitates a more accurate removal of deep hematoma, but also avoids intraoperative damage to the brain tissues and reduces the amount of intraoperative blood loss [7]. The results of this study showed that the operation time and intraoperative blood loss of the observation group were significantly shorter and less than those of the control group, and that the hematoma clearance of the observation group was obviously more than that of the control group. The results indicated that treating HIH patients with neuroendoscopic removal of hematoma has shorter operation time and better clinical effect than small bone window surgery.

Under long-term hypertension, patient's systemic arterial walls will become thin and fragile, and underdeveloped adventitia of the intracranial arteries without the protection from elastic makes it more likely for intracranial hemorrhage to occur. If the HIH patients fail to be treated in time at the early stage of onset, the brain tissues with nerves compressed by blood clot will experience secondary damage and death of brain nerve cells due to ischemia and hypoxia [8]. Zhang Liang [9] et al have shown that neuroendoscopic removal of hematoma can effectively improve the state of neurological deficits and the prognosis of elderly patients with HIH. The results of this study demonstrated that the NDS of the observation group was significantly lower than that of the control group, indicating that neuroendoscopic removal of hematoma can reduce brain damage and help restore neurological function after surgery. During the process of small bone window surgery, to better expose the hematoma, the cerebral cortex is inevitably stretched, and the stretched brain tissues after the operation will be mechanically compressed, causing secondary cell damage and edema, which aggravates the neurological damage at normal brain tissues [10]. However, neuroendoscopic removal of hematoma takes a safer surgical approach, which largely avoids the traction of other tissues and controls the damage to neurological function.

Studies have shown that the development of HCH is mainly caused by the secondary damage, and inflammatory factors, which are the key regulators of secondary damage, can therefore effectively reflect the degree of intracranial hematoma and edema [11]. TNF-α is a key regulator of inflammatory response. Elevated level of IL-6 indicates that macrophages are active, neurological function is impaired, and brain edema is aggravated.

hs-CRP represents the activity of hypersensitivity C-reactive protein, and will promote the formation of atherosclerosis in HIH patients and continues to aggravate HIH condition. The results of this study showed that TNF-α, IL-6, hs-CRP levels in the observation group were significantly better than the control group, indicating that neuroendoscopic removal of hematoma effectively improved the patient's levels of inflammatory factors, relieved the symptoms of edema, and will facilitate recovery. Such results can be explained by the fact that the neuroendoscopy technology leads to a small surgical incision, correct surgical access established by puncture will reduce the traction of other normal tissues, thus relieving inflammation caused by the operation to a certain extent. At the same time, neuroendoscope allows a direct and clear vision for the removal of hematoma, with sufficient the endoscopic light source and flexible rotation, moreover, it also has a flushing function. Under the premise of a clear surgical field of vision, the hematoma could be completely removed and bleeding would be stopped in time. In addition, the operation time is greatly shortened compared with small bone window craniotomy, which can therefore significantly reduce the incidence of infection and the levels of inflammatory factors [12].

In summary, neuroendoscopic surgery to remove brain hematoma shows a high clinical effect in the treatment of elderly HIH patients, helps restore the patient's neurological function, reduces their inflammatory factors, and effectively improves patient's prognosis.

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Not applicable.

Conflict of Interest

The authors declare no conflicts of interest.

Author Contributions

Conceptualization, Data curation,S.J.Y; Formal analysis, Methodology, C.B.W; Writing-Original draft, J.J.L; Writing-review and editing, G.Y; All authors have read and agreed to the published version of the manuscript.

Ethics Approval and Consent to Participate

The study was approved by the Medical Ethics Committee, and the patients were informed and consented.

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Availability of Data and Materials

The data presented in this study are available on request from the corresponding author.

Supplementary Material

Not applicable.

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