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Clinical Summary and Score System of 91 Cases of Cerebellar Hemorrhage

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Abstract

Objective: To analyze the clinical results and CT (Computed Tomography) manifestations of cerebellar hemorrhage, and to explore a scoring system of cerebellar hemorrhage CT score (Cerebellar Hemorrhage Computed Tomography Scale CHCTS).

Methods: The clinical factors and CT features of 91 patients with cerebellar hemorrhage were summarized and analyzed, and CHCTS was compared with GCS, GOS and hematoma diameter ≥.

Results: There was a negative correlation between CHCTS and GCS (Pearson correlation, P<0.01, R^2=0.93). The proportion of operation (CHCTS ≥ 4) was higher than that of GCS ≤ 13 (X^2=5.19, P=0.02). The proportion of operation (CHCTS ≥ 4) was larger than that of hematoma diameter ≥ 3 cm (X^2=5.77, P=0.02). The conservative-to-good ratio < 3cm was better than that of CHCTS ≤ 3.

Conclusion: CHCTS ≥ 4 can be used as a good index for judging operation. Patients with less than 3 score have a good prognosis. Conservative treatment should be actively recommended for hematoma diameter <3 cm.

Keywords: Cerebellar hemorrhage; CT; Score; Operation; Prognosis

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Introduction

Spontaneous cerebellar hemorrhage (Cerebellar Hemorrhage, CH) refers to cerebellar parenchyma hemorrhage caused by non-trauma. Hypertension is the main cause of spontaneous cerebellar hemorrhage. Other causes include arteriovenous malformations, aneurysms, and cavernous hemangiomas and so on. Cerebellar hemorrhage is located in the lower part of the brain stem close to the brain stem, so a small amount of hemorrhage may be life-threatening. It is suggested in the guidelines that the operation should be performed as soon as possible with deterioration of neurological function, brain stem compression and or ventricular obstruction hydrocephalus. The indication of operation is hematoma volume >10 ml, diameter ≥ 3 cm, or GCS ≤ 13 [1]. Cerebellar hemorrhage is often not limited, so a scoring system CHCTS is proposed according to the imaging characteristics of CT. Combined with the retrospective analysis of the cases of cerebellar hemorrhage in our hospital from 2017.01 to 2020.12, the advantages of CHCTS and GCS and the diameter of hematoma are compared.

Materials and Methods

General data

Ninety-one patients with spontaneous cerebellar hemorrhage (excluding brain trauma, hematopathy, vascular malformation, aneurysm, cavernous hemangioma, cerebellar tumor hemorrhage, etc.) from 2017.01 to 2020.12 in our hospital, 61 males and 30 females, aged from 15 to 90 years old. The average age was 61.12 years old (male 59.70 years old, female 64.00 years old), 58 cases of previous hypertension (63.74%). Seven cases of diabetes mellitus (7.69%). This study was approved by the Review Committee of Jiangxi Provincial People's Hospital (IRBNo.: 1521722). The initial neurological state of each patient was scored with Glasgow Coma Scale (GCS) on admission. According to the standard of neurosurgical treatment, 49 patients were treated conservatively, with an average age of 62.71 ± 13.56 years old, 1 case died of refusing operation (GCS 3 score), 48 cases got GOS 5 (GCS ≤ 13, 11 cases, hematoma diameter ≥ 3 cm in 15 cases). Surgical removal of hematoma was performed in 42 cases (mean age 59.26 ± 14.29 years). Endoscopic surgery was performed in 11 cases (1 case with hematoma diameter less than 3 cm, 1 case died after discharge, 5 cases with GOS 2-3 score, 5 cases with GOS 4-5 score (including 1 case with GCS 15 score), 31 cases with craniotomy (1 case died after discharge, 7 cases with GOS 2-3 score, 23 cases with GOS 4-5 score (including 7 cases with GCS 14-15 score).

Clinical manifestation

Symptoms and signs: Sudden coma in 10 cases, progressive coma in 15 cases, disturbance of consciousness in 6 cases, headache in 32 cases (with vomiting in 13 cases, dizziness in 3 cases, fatigue in 2 cases, standing instability in 2 cases, coma after admission in 3 cases), dizziness in 24 cases (with vomiting in 15 cases, speech disturbance in 1 case, blurred vision in 1 case, standing instability in 1 case, progressive coma in 1 case), vomiting in 1 case, weakness in speech in 1 case, blackness in 2 cases.

CT findings: All patients underwent cranial CT examination on arrival, including hematoma diameter ≥ 3 cm 57 in 41 cases (operation in 41 cases, 71.93%), fourth ventricle in 61 cases (casting and compression of brainstem in 34 cases, operation in 30 cases, death in 3 cases), third ventricle in 22 cases (operation in 11 cases), and subarachnoid space in 57 cases (operation in 42 cases).

Treatment: Improve the examination and examination of admission, eliminate contraindications, and give treatment after obtaining the consent of the family members; the treatment should be carried out in strict accordance with the clinical treatment guidelines according to the clinical characteristics of the patients.

Statistical analysis: SPSS software version 26.0 (SPSSInc., Chicago, Illinois) was used for statistical analysis, and the statistical test was bilateral. The data correlation was analyzed by Pearson correlation analysis, the classified variables were expressed by counts and percentages (%), the continuous variables were expressed by mean ± Standard Deviation (SD), and the factor analysis was carried out by T-test and chi-square test, p<0.05 or p<0.01 are significant results.

Prognostic evaluation: The discharged patients were followed up for 6 months with Glasgow Outcome Scale (GOS): Grade 1: Death; Grade 2: Vegetative state; Grade 3: Severe disability, unable to live independently; Grade 4: Moderate disability, can live independently; Grade 5: Good recovery, but with small disability. Follow-up was mainly conducted in the outpatient department and was terminated due to death or the end of the study (June 2021). GOS ≥ 4 is considered to be improved, and GOS<4 is considered to have a poor prognosis.

Results

Forty-nine patients (53.85%) were treated with conservative treatment, such as dehydration, control of blood pressure, improvement of brain function and so on. One case of critical GCS3 died of respiratory failure after occipital foramen hernia respiratory failure, 1 case developed mild chronic hydrocephalus, 48 cases had a good GOS5 score, and the cure rate was 95.92%. Forty-two cases underwent hematoma removal operation, 2 cases died after operation, intracranial infection in 5 cases (11.90%), chronic hydrocephalus in 7 cases (16.67%), and improvement in 28 cases (66.67%).

According to CT findings

Hematoma diameter <3 cm for 0-point, hematoma diameter ≥ 3 cm for 1 point; breaking into subarachnoid space for 1 point; breaking into fourth ventricle/oppressing fourth ventricle for 1 point, fourth ventricle casting/brainstem compression for 2 points. Break into the third ventricle for 1 point, cast for the third ventricle for 2 points, and break into the lateral ventricle for 1 point.

The scores were divided into 8 groups according to the score of CHCTS 0 to 7, and the corresponding GCS averages were compared, and the results were negatively correlated (Pearson correlation R^2=0.93, P<0.01). The comparison between CHCTS ≥ 4 group and CHCTS ≤ 3 group is statistically significant (p<0.01).

There were 31 cases with CHCTS ≥ 4: 29 cases died after operation, 2 cases died after discharge, 1 case improved after conservative treatment, 60 cases with CHCTS ≤ 3, 13 cases with GCS 14-15, 5 cases with GCS ≤ 13, 47 cases with conservative treatment (GCS 14-15 in 37 cases, GCS ≤ 13 in 10 cases). There was no significant difference in age between conservative treatment and surgical treatment, P=0.25, T=1.168; Gender in conservative and surgical treatment, Chi-square test has no statistical significance, P=0.61, X^2=0.27; Hypertension in conservative and surgical treatment, Chi-square test has no statistical significance, P=0.74, X^2=0.11. CHCTS, GCS and GOS showed significant difference in T test between conservative group and treatment group (P<0.01) (Table 1). Multiple forms of cerebellar hemorrhage cannot be accurately calculated by Tada formula [2], so no research factors have been made.

Comparing the proportion of operation between GCS ≤ 13 group and CHCTS ≥ 4 group, the results showed that the proportion of CHCTS ≥ 4 group was 93.55%, which was better than that of GCS ≤ 13 group (72.73%) (X^2=5.19 p=0.02). The comparison of operation proportion between hematoma diameter ≥ 3 cm group and CHCTS ≥ 4 group showed that the proportion of CHCTS ≥ 4 group (93.55%) was better than that of hematoma diameter ≥ 3 cm group (80.39%) (Chi-square test, X^2=5.77, p=0.02). Comparing the conservative improvement rate between the GCS ≥ 14 group and the CHCTS ≤ 3 group, the analysis shows that: The improvement rate of CHCTS ≤ 3 group 78.72% is slightly better than that of GCS ≥ 14 group 72.97% (X^2=0.38, p=0.54. The conservative improvement rate of hematoma diameter <3 cm group was compared with that of CHCTS ≤ 3 group.

Table 1: Analysis of related factors of cerebellar hemorrhage.

		Operation	Conservative	Statistics	P
Gender	Man	27	34	X^2=0.27	P=0.61
	Woman	15	15		
High blood pressure	Yes	26	32	X^2=0.11	P=0.74
	No	16	17		
Age		59.26 ± 14.29	62.71 ± 13.56	T=1.168	P=0.25
CHCTS		4.31 ± 1.47	1.29 ± 1.17	T=10.90	P<0.01
GCS		9.95 ± 3.76	13.65 ± 2.72	T= -5.43	P<0.01
GOS		3.95 ± 1.34	4.90 ± 0.57	T= -4.46	P<0.01

Table 2: Comparison of clinical judgment between CHCTS and GCS and hematoma diameter.

Proportion of operation %	Operation	Non-operative	Non-operative (Proportion %)	Improvement	Non-improvement
GCS ≤ 13 (44) 72.37	32	12	GCS ≥ 14 (47) 37 (78.72)	27	10
≥ 4 (31) 93.55	29	2	≤ 3 (60)47 (78.33)	37	10
Statistics	X^2=5.19			X^2=0.38	
P	P=0.02			P=0.54	
≥ 3 cm (57) 80.39	41	16	<3 cm (34) 33 (97.06)	33	0
≥ 4 (31) 93.55	29	2	≤ 3 (60) 47 (78.33)	37	10
Statistics	X^2=5.77			X^2=8.02	
p	P=0.02			P<0.01	

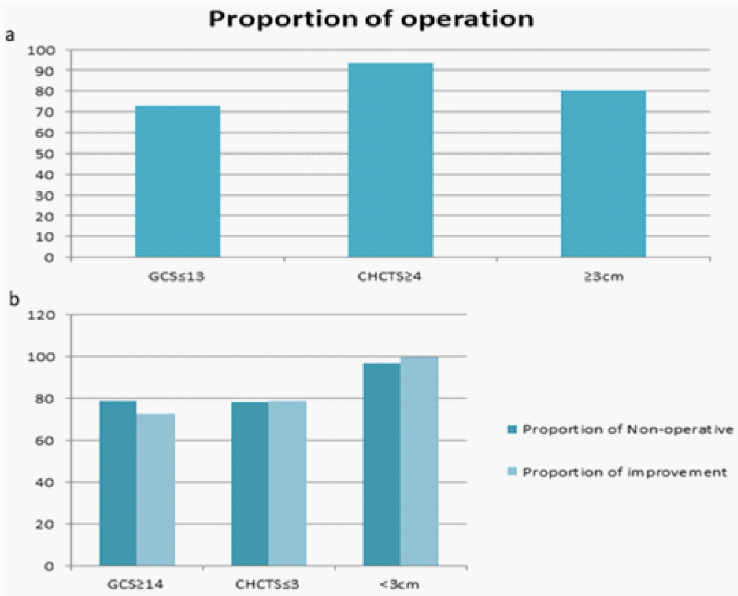

Figure 1: a: The proportion of operation in GCS ≤ 13 group, CHCTS ≥ 4 group and hematoma diameter ≥ 3 cm group was higher; b: Comparison of conservative percentage and conservative improvement rate in GCS ≥ 14 group and CHCTS ≤ 3 group. Conservative proportion and conservative improvement rate in hematoma diameter <3 cm group.

The improvement rate of hematoma diameter <3 cm group was significantly better than that of CHCTS ≤ 3 group (78.72%) (X^2=8.02, P<0.01) (Table 2, Figure 1).

CHCTS<3 grouping 48 cases: Conservative in 40 cases, operation in 8 cases, and improvement of 100% in 12 cases: Conservative in 5 cases, operation in 7 cases, and improvement of 100% in 12 cases.

Discussion

Clinical characteristics

The most common cause of spontaneous cerebellar hemorrhage is hypertensive atherosclerosis [2]. Among the patients in this group, 49 cases were treated conservatively and 42 cases were treated by surgical removal of hematoma. Comparative analysis of conservative and surgical treatment: Age had no statistical significance, t-test P=0.25, T=1.17; gender has no statistical significance, chi-square test P=0.61, X^2=0.27; Hypertension has no statistical significance, chi-square test P=0.74, X^2=0.11. However, CHCTS, GCS and GOS had significant statistical significance (P<0.01).

The cerebellum is located in the inferior posterior cranial fossa and adjacent to the brainstem structure. After cerebellar hemorrhage, a hematoma may oppress the brainstem or break into the ventricle to block the ventricular system, resulting in obstructive hydrocephalus, which is rapid and critical [3,4]. The first symptoms of the patients were headache, dizziness, nausea, vomiting and disturbance of balance, and things of some patients were blurred [5]. When the hematoma oppressed the brainstem, the disturbance of consciousness could be aggravated or even comatose in a short time. Some patients died of occipital foramen hernia respiratory failure [4]; when obstructive hydrocephalus was formed, the disturbance of consciousness was gradually aggravated. The American Stroke Association guidelines recommend surgical hematoma evacuation with level I evidence for patients with hematoma diameter ≥ 3 cm or brainstem compression and/or hydrocephalus [1,6].

Imaging findings

The first choice of examination for cerebellar hemorrhage is the cranial CT [7]. Which can determine the location and size of the hemorrhage and the relationship between the adjacent brain structure. Therefore, early CT examination can make a definite diagnosis as soon as possible, so as to take further conservative treatment or surgical treatment. The 91 patients in this group included various conditions of cerebellar hemorrhage, such as being confined to the cerebellum, breaking backward into the subarachnoid space, breaking into the fourth ventricle, massive hematoma oppressing the fourth ventricle or brain stem, and the hemorrhage rapidly progressed to the third ventricle. It even caused casting of the third ventricle and breaking into the lateral ventricle [8]. A large number of articles have shown that the third and fourth ventricle casting is a key factor affecting the prognosis of brain stem compression after cerebellar hemorrhage [9,10]. Sixty-one cases of hematoma diameter ≥ 3 cm 57 (34 cases of casting and compression of brain stem), 22 cases of third ventricle (11 cases of casting) and 57 cases of subarachnoid space.

CHCTS

Cerebellar hemorrhage has various forms. According to the treatment guidelines, clinicians should actively give surgical treatment to patients with hematoma diameter ≥ 3 cm or brainstem compression and/or hydrocephalus [1]. An analysis of prognostic factors in 155 patients with cerebellar hemorrhage found that only neurological deterioration, coma, base cistern occlusion, hydrocephalus and decreased GCS were statistically significant, and it was pointed out that base cistern occlusion was an independent risk factor [2]. There may be some deviations in the decision of whether or not to operate according to the results of CT and the progress of the disease, for example, some patients who will be improved by conservative treatment have taken surgery. Therefore, it is worthwhile for us to consider whether there is a more effective quantitative basis to determine surgery or conservative treatment.

The author designed the cerebellar hemorrhage score CHCTS according to the CT characteristics of cerebellar hemorrhage, with a minimum of 0 and a maximum of 7. In order to explore the effectiveness and practicability of the scoring system, the clinical conditions of 91 patients were reviewed, and a significant negative correlation was found between CHCTS and GCS. Pearson correlation was found R^2=0.93, p<0.0. In order to verify the effect of CHCTS on the proportion of operation and the improvement rate of conservative treatment, it was compared with the key factors GCS and the diameter of hematoma. The results showed that the operation proportion of 93.55% in the group of CHCTS ≥ 4 was better than that of GCS ≤ 1372.73% (X^2=5.19, p=0.02). 93.55% of CHCTS ≥ 4 group is better than 80.39% of hematoma diameter ≥ 3 cm group (X^2=5.77, p=0.02). Conservative improvement rate comparison: the improvement rate of CHCTS ≤ 3 group 78.72 is slightly better than that of GCS ≥ 14 group 72.97% (X^2=0.38, p=0.54); the improvement rate of hematoma diameter <3 cm group was significantly better than that of CHCTS ≤ 3 group (X^2=8.02, p<0.01); it can be seen that CHCTS is of great significance, and surgical treatment is more valuable when CHCTS ≥ 4. Further analysis showed that the CHCTS < 3 group was conservative in 40 cases, improved in 8 cases, improved in 100% CHCTS= 3 in 5 cases, and improved in 7 cases. Therefore, the prognosis of CHCTS ≤ 3 group is good, whether to take surgery to remove hematoma should be based on the specific clinical condition, but there is no doubt that the score of CHCTS ≤ 3 should be used as a reference for clinicians.

Conclusion

In summary, we designed the CT score system of cerebellar hemorrhage according to the imaging characteristics of a large number of patients with cerebellar hemorrhage. The patients were divided into two groups: ≥ 4 and ≤ 3, and then compared with whether GCS ≤ 13 in the guidelines and whether the hematoma was larger than 3 cm. Statistical analysis showed that the surgical treatment of cerebellar hemorrhage with CT score ≥ 4 was better than that of GCS ≤ 13 and greater than 3 cm. The CT score ≤ 3 in conservative treatment was lower than that in hematoma less than 3cm group, but the prognosis in CT score ≤ 3 group was very good. As a scoring system, CT score of cerebellar hemorrhage may have reference significance in guiding clinical treatment of cerebellar hemorrhage. The limited number of cases in this paper cannot fully reflect the clinical situation and needs to be supported by more clinical data.

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Author Contributions

Ru-En Liu and **Xiao Bu** conceived and supported this research. **Zhi-Wen Wang**, **Xin-Hui Zhou** and **Chang-Feng Wang** designed, conducted the present study, and drafted the manuscript. **Ru-En Liu** and **Xiao Bu** revised the manuscript. **Zhi-Wen Wang**, **Xin-Hui Zhou** and **Chang-Feng Wang** conducted the statistic analyze and interpreted the data. **Xin-Hui Zhou** and **Chang-Feng Wang** collected the primary data. **Zhi-Wen Wang** completed the follow-up and collected the associated data. All authors of this work met ICMJE criteria for authorship, made substantial contributions to the conception and design, acquisition of data, analysis and interpretation of data, drafting, critical revising, and final approval of this manuscript.

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