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Original Article

Impact of perioperative care and cognitive training on neurological recovery and life ability in hypertensive intracerebral hemorrhage patients undergoing minimally invasive hematoma evacuation

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Abstract: Objective: To evaluate the effects of perioperative care combined with cognitive training on neurological recovery and life ability in patients with hypertensive intracerebral hemorrhage undergoing minimally invasive hematoma evacuation. Methods: A retrospective analysis was conducted using electronic records and data from patients treated at the Central South Hospital of Wuhan University from March 2022 to March 2023. The control group consisted of 44 patients receiving routine care, while the research group included 56 patients who received perioperative care combined with cognitive training. Baseline characteristics were analyzed, and neurological function, cognitive function, motor function, life ability, emotional status, and quality of life were assessed before and after intervention. Additionally, recovery time of gastrointestinal function, hospital stay, complications, and nursing satisfaction were compared between the groups. Results: Post-intervention, both groups showed significant decreases in NIHSS (National Institutes of Health Stroke Scale), SAS (Self-Rating Anxiety Scale), and SDS (Self-Rating Depression Scale) scores ($P<0.05$), with the research group showing significantly lower scores than the control group (all $P<0.05$). Significant improvements in MMSE (Mini-Mental State Examination), ADL (Activities of Daily Living), SS-QOL (Stroke Specific Quality of Life Scale), and motor function scores were observed in both groups, with the research group achieving significantly higher scores (all $P<0.05$). The research group had shorter recovery time for gastrointestinal function, reduced hospital stays, and lower complication rates compared to the control group (all $P<0.05$). Nursing satisfaction was significantly higher in the research group ($P<0.05$). Logistic multivariate analysis identified hemorrhage volume and nursing methods as independent risk factors affecting prognosis ($P<0.05$). Conclusion: Perioperative care combined with cognitive training significantly enhances neurological recovery, cognitive function, motor ability, and overall life quality in patients with hypertensive intracerebral hemorrhage undergoing minimally invasive hematoma evacuation.

Keywords: Perioperative care, cognitive training, hypertensive intracerebral hemorrhage, minimally invasive hematoma evacuation

Introduction

Hypertensive intracerebral hemorrhage is a prevalent and severe neurological disorder, typically resulting from the rupture of cerebral arteries due to chronic hypertension. This condition leads to bleeding into the brain tissue, causing significant damage [1, 2]. Globally, the incidence and disability rates of hypertensive intracerebral hemorrhage are increasing [3, 4]. Patients often experience neurological dysfunction and a decline in their ability to perform daily activities post-hemorrhage, significantly impacting their quality of life and social functioning [5, 6].

In recent years, advances in minimally invasive surgical techniques have made hematoma evacuation a common treatment for hypertensive intracerebral hemorrhage, offering advantages such as reduced trauma and faster recovery [7, 8]. However, surgical treatment alone often fails to meet the comprehensive rehabilitation needs of patients. Perioperative care is

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essential for postoperative recovery, encompassing early intervention, thorough assessments, pain management, and nutritional support to reduce the risk of complications, promote neurological recovery, and enhance daily living abilities [9-12].

Cognitive training is an effective rehabilitation intervention widely used in cerebrovascular disease treatment [13]. Through cognitive remodeling and training, patients can significantly improve attention, memory, language, and executive functions, aiding in neurological recovery and enhancing overall quality of life [14].

Currently, there is a lack of research on the impact of combining perioperative care with cognitive training on the recovery of neurological function and daily living abilities in patients with hypertensive intracerebral hemorrhage undergoing minimally invasive hematoma evacuation. This study aims to evaluate the influence of this combined approach on patient recovery, providing scientific evidence to support clinical practice.

Materials and methods

Study design and procedure

This retrospective study analyzed electronic records of patients with hypertensive intracerebral hemorrhage treated at the Central South Hospital of Wuhan University from March 2022 to March 2023. It was approved by the medical ethics committee of the Central South Hospital of Wuhan University prior to commencement. Data were collected from patients who met the following inclusion and exclusion criteria.

Inclusion criteria: 1. Admitted within 24 hours of symptom onset. 2. Diagnosed with hypertensive intracerebral hemorrhage via cranial CT, clinical symptoms, and signs. 3. Met the diagnostic criteria for hypertensive intracerebral hemorrhage [15]. 4. Surgical indications and stable vital signs post-surgery. 5. History of hypertension.

Exclusion criteria: 1. Hematological diseases, severe cardiovascular conditions, or serious primary liver or kidney diseases. 2. Pregnant women. 3. Abnormal mental health status. 4. Cerebral hemorrhage due to trauma or vascular malformations. 5. Muscular dystrophy or arteriovenous malformations.

After screening, data from 100 patients were included for analysis.

Therapeutic schemes

Control group: The control group included 44 patients who received routine care, which involved assisting with preoperative examinations, providing medication guidance, alleviating emotional stress through communication, and offering postoperative care.

Research group: The research group was comprised of 56 patients who received perioperative care in conjunction with cognitive training.

Perioperative care included: Preoperative care: Nursing staff engaged in detailed communication with patients, explaining the surgery's purpose, procedure, and potential risks while providing psychological support to reduce anxiety. Patients were instructed on fasting and drinking restrictions to minimize intraoperative risks, and proper surgical identification (e.g., name, surgical site, and time) was ensured for accuracy and safety. Intraoperative care: The nursing staff ensured operating room safety, including maintaining the patient's body temperature and preventing falls. They monitored fluid intake and output according to medical instructions, adjusted fluid infusions as needed, and preheated blood and fluids. They also assisted physicians during surgery and closely monitored vital signs, ensuring airway patency by clearing respiratory secretions. Postoperative care: Post-surgery, nursing staff monitored patients' consciousness levels and neurological functions, including motor and sensory function, speech, pupillary reactions, and electroencephalogram readings. Immediate intervention was sought if adverse conditions were detected. Patients were repositioned regularly and given passive exercises to prevent pressure ulcers and muscle atrophy. The surgical site was kept clean and dry, with dressings changed frequently to prevent infection. Postoperative care guidance was provided, including instructions on precautions, dietary advice, medication usage, and follow-up arrangements.

Table 1. Comparison of general data

	Control group (n = 44)	Research group (n = 56)	t/X^2	P
Time from onset to admission (h)	8.73±1.27	8.98±1.41	0.896	0.372
Duration of hypertension (years)	6.33±1.21	6.31±1.26	0.044	0.965
Cerebral hemorrhage volume (mL)	30.12±2.67	29.71±2.23	0.846	0.399
Location of cerebral hemorrhage (basal nucleus/frontal lobe/occipital lobe)	16/15/13	24/18/14	0.477	0.788
Age (years)	58.88±4.40	58.82±4.19	0.064	0.949
Education level (below high school/High school and above)	24/20	30/26	0.009	0.923
BMI (kg/m^2)	24.22±1.05	24.05±0.95	0.856	0.394
Gender (male/female)	28/16	33/23	0.230	0.632

Note: BMI, Body Mass Index.

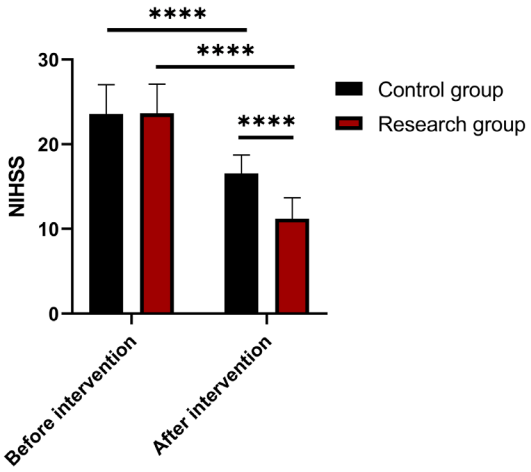

Figure 1. Comparison of neurological function. Note: ****, P<0.0001. NIHSS, National Institutes of Health Stroke Scale.

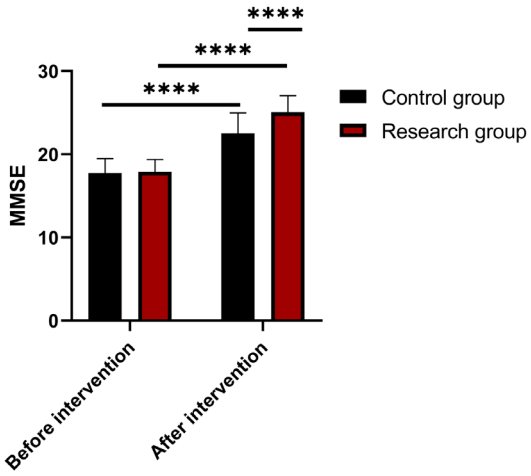

Figure 2. Comparison of MMSE scores. Note: ****, P<0.0001. MMSE, Mini-Mental State Examination.

Cognitive training included: Cognitive assessments covered attention, memory, language, comprehension, and problem-solving. Based on the evaluations, individualized training plans were developed. Language recovery was facilitated through targeted exercises and communication activities, starting with simple words and advancing to full sentences. Memory improvement techniques such as organizing information, segmented learning, and retrieval exercises were implemented. Cognitive adaptability and task-switching abilities were enhanced through multitasking scenarios and flexibility training. The complexity of the training was gradually increased according to patient progress, promoting further cognitive recovery.

Measures

Data were collected from patient records, including general information, functional and emotional assessment results, and nursing satisfaction.

General data: Information such as time from onset to admission, duration of hypertension, volume and location of cerebral hemorrhage, age, educational level, body mass index (BMI), and gender were analyzed.

Functional assessment results: Neurological function: The National Institutes of Health Stroke Scale (NIHSS) [16] was used to evaluate neurological function before and after intervention. The scale ranges from 0 to 42 points, with lower scores indicating less severe neurological damage. Cognitive function: Cognitive function was assessed using the Mini-Mental State Examination (MMSE) [17], with a total score of 30 points. Higher scores indicate better cognitive function. Motor function: The Fugl-Meyer Assessment (FMA) scale [18] was used to evaluate motor function before and after

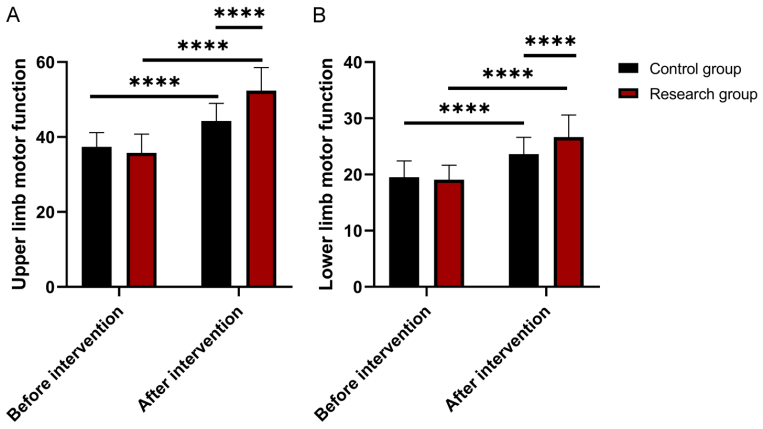

Figure 3. Comparison of FMA scores. A: Comparison of upper limb motor function scores; B: Comparison of lower limb motor function scores. Note: ****, P<0.0001. FMA, Fugl-Meyer Assessment.

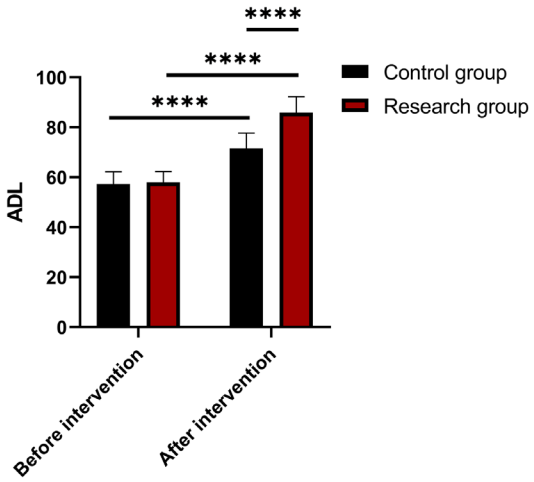

Figure 4. Comparison of ADL scores. Note: ****, P<0.0001. ADL, Activity of Daily Living.

intervention. The scale has a total of 100 points, divided into upper limb motor function (66 points) and lower limb motor function (34 points). Higher scores indicate stronger motor function. Living ability: The Activity of Daily Living (ADL) scale [19] assessed living ability before and after intervention, with a total score of 100 points. Higher scores indicate greater independence in daily activities.

Emotional assessment results: The Self-Rating Anxiety Scale (SAS) [20] and Self-Rating Depression Scale (SDS) [21] were used to evaluate emotional status before and after intervention, each with a total score of 100 points. Higher scores indicate more severe anxiety or depression.

Quality of life: Quality of life was evaluated using the Stroke Specific Quality of Life Scale (SS-QOL) [22], with a total score of 245 points. Higher scores indicate a better quality of life.

Perioperative indexes: Recovery time of gastrointestinal function and hospital stay were recorded for analysis.

Nursing satisfaction: Nursing satisfaction was assessed using a self-developed Nursing Satisfaction Questionnaire. Scores ranged from 0 to 100 points, with scores below 60 indicating dissatisfaction, 60-89 indicating basic satisfaction, and 90 or above indicating satisfaction. Overall satisfaction was calculated as follows: Satisfaction rate = (number of satisfied patients + number of basically satisfied patients)/total number of cases × 100%.

Complications: The incidence of complications was documented and analyzed.

Statistical analysis

Data were processed and analyzed using GraphPad Prism 8 and SPSS 20.0 software to visually present research results and trends. The Chi-square test (χ^2) was used to compare the distribution of categorical data between the two groups, with results expressed as percentages. For quantitative data, the mean ± standard deviation (Mean ± SD) was used to describe differences between groups. Paired t-tests were used to compare means within the same group under different conditions, while independent samples t-tests compared means between two independent groups. Logistic multivariate regression analysis was performed to identify risk factors affecting patient prognosis. Statistical significance was set at P<0.05.

Results

Comparison of general data

No statistically significant differences were observed between the two groups in terms of time from onset to admission, duration of hypertension, volume and location of cerebral

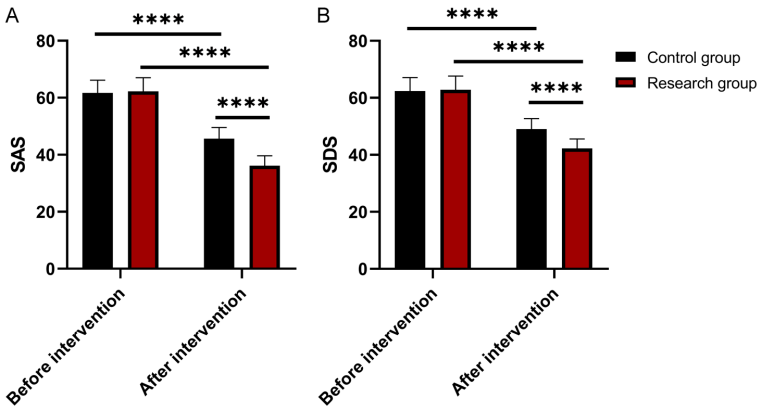

Figure 5. Comparison of emotional status. A: Comparison of SAS scores; B: Comparison of SDS scores. Note: ****, P<0.0001. SAS/SDS, Self-Rating Anxiety/Depression Scale.

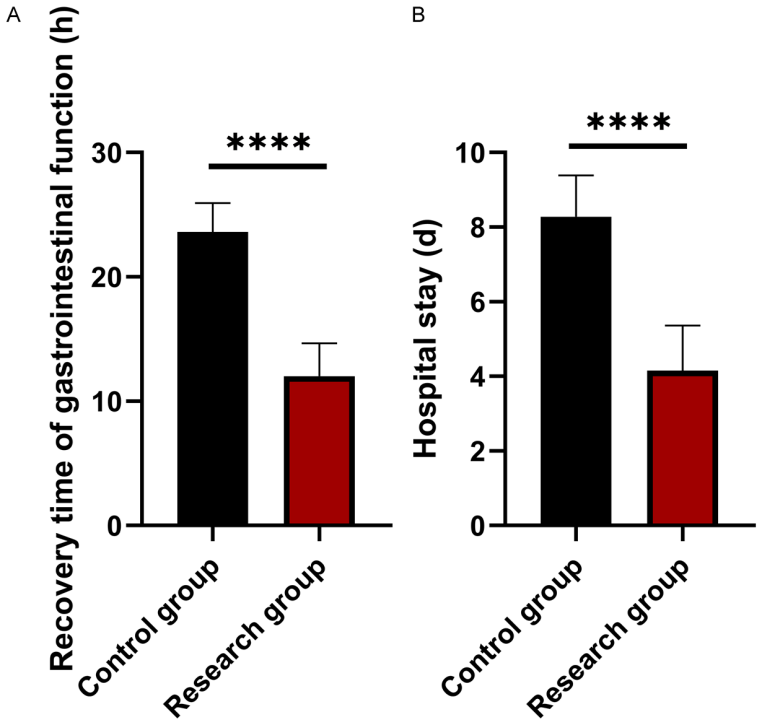

Figure 6. Comparison of perioperative indexes. A: Comparison of the recovery time of gastrointestinal function; B: Comparison of hospital stay. Note: ****, P<0.0001.

hemorrhage, age, educational level, BMI, and gender (all P>0.05) (**Table 1**).

Comparison of neurological function

Neurological function, assessed by NIHSS scores, showed no significant difference between the two groups before intervention (P>0.05). Post-intervention, the research group had significantly lower NIHSS scores compared to the control group (P<0.05). Additionally, both groups demonstrated a significant decrease in NIHSS scores following intervention (P<0.05) (**Figure 1**).

Comparison of cognitive function

Cognitive function, measured by MMSE scores, did not differ significantly between the two groups before intervention (P>0.05). After intervention, the research group exhibited significantly higher MMSE scores than the control group (P<0.05). Intra-group comparisons also showed a significant increase in MMSE scores after intervention for both groups (P<0.05) (**Figure 2**).

Comparison of motor function

Motor function, evaluated by upper and lower limb motor function scores, revealed no significant differences between the two groups before intervention (both P>0.05). Post-intervention, the research group showed significantly higher motor function scores compared to the control group (both P<0.05). Both groups also demonstrated significant improvements in upper and lower limb motor function scores after intervention (both P<0.05) (**Figure 3**).

Comparison of living ability

Living ability, assessed by ADL scores, showed no significant difference between the two groups before intervention (P>0.05). However, after intervention, the research group had significantly higher ADL scores compared to the control group (P<0.05). Intra-group comparisons indicated that both groups experienced significant increase in ADL scores after intervention (P<0.05) (**Figure 4**).

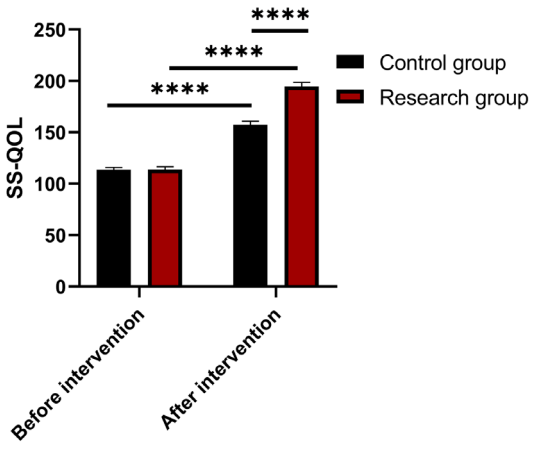

Figure 7. Comparison of SS-QOL scores. Note: ****, P<0.0001. SS-QOL, Stroke-Specific Quality of Life Scale.

Comparison of emotional status

Emotional status, evaluated by SAS and SDS scores, showed no significant differences between the two groups before intervention (both P>0.05). After intervention, the research group had significantly lower SAS and SDS scores compared to the control group (both P<0.05). Additionally, both groups exhibited significant decreases in SAS and SDS scores post-intervention (both P<0.05) (**Figure 5**).

Comparison of perioperative indexes

The perioperative indexes comparison revealed that the research group had significantly shorter recovery time for gastrointestinal function and hospital stays compared to the control group (both P<0.05) (**Figure 6**).

Comparison of quality of life

Quality of life, measured by SS-QOL scores, showed no significant difference between the two groups before intervention (P>0.05). After intervention, the research group had significantly higher SS-QOL scores compared to the control group (P<0.05). Intra-group comparisons also revealed a significant increase in SS-QOL scores for both groups after intervention (P<0.05) (**Figure 7**).

Comparison of nursing satisfaction

Nursing satisfaction was significantly higher in the research group compared to the control group (P<0.05) (**Table 2**).

Comparison of complications

The incidence of complications was significantly lower in the research group compared to the control group (P<0.05) (**Table 3**).

Prognosis analysis

Patients with mild and moderate NIHSS scores were categorized into the good prognosis group (54 individuals), while those with moderate to severe NIHSS scores were categorized into the poor prognosis group (46 individuals) (**Table 4**).

Univariate analysis identified cerebral hemorrhage volume, age, and nursing methods as risk factors influencing patient prognosis (all P<0.05) (**Table 5**). Variables with significant differences in **Table 5** were assigned values (**Table 6**) and included in a multivariate regression analysis. Logistic multivariate analysis indicated that cerebral hemorrhage volume and nursing methods were independent risk factors affecting patient prognosis (both P<0.05) (**Table 7**).

Discussion

Hypertensive intracerebral hemorrhage is a severe cerebrovascular disease with a significant impact on neurological function and overall abilities [23-25]. Perioperative care is essential during both the surgical process and postoperative period [26, 27], encompassing comprehensive care to ensure patient safety and promote recovery [28, 29]. Cognitive training is aimed at improving and maintaining cognitive function through various activities and training methods [30]. Within the perioperative care framework, cognitive function training helps manage potential cognitive impairments during surgery and rehabilitation, enhancing self-care abilities and quality of life [31].

This study aimed to evaluate the impact of combining perioperative care with cognitive training on neurological function recovery and daily living abilities in patients with hypertensive intracerebral hemorrhage undergoing minimally invasive hematoma evacuation. The retrospective analysis revealed that the research group, which received this combined approach, demonstrated significant improvements in neurological function, cognitive function, motor function, daily living ability, and emotional well-being. Additionally, there were

Table 2. Comparison of nursing satisfaction

	Control group (n = 44)	Research group (n = 56)	χ^2	P
Satisfactory	18	36		
Basically satisfaction	15	18		
Unsatisfactory	11	2		
Satisfaction	33 (75.00)	54 (96.43)	10.00	0.002

Table 3. Comparison of complications

	Control group (n = 44)	Research group (n = 56)	χ^2	P
Pulmonary infection	3 (6.8%)	0 (0.0%)		
Incision infection	2 (4.5%)	1 (1.8%)		
Uroschesis	1 (2.3%)	1 (1.8%)		
Lower extremity venous thrombosis	2 (4.5%)	0 (0.0%)		
Total	8 (18.2%)	2 (3.6%)	5.844	0.016

Table 4. Distribution of individuals

	Mild	Moderate	Moderately severe	Severe
NIHSS	≤4 points	5-15 points	16-20 points	21-42 points
Cases	0	54	44	2

Note: NIHSS, National Institutes of Health Stroke Scale.

significant reductions in both gastrointestinal recovery time and hospital stay duration. Patient satisfaction with nursing care also significantly increased.

The study results indicated that the combination of perioperative care and cognitive training positively influenced the neurological recovery of patients with hypertensive intracerebral hemorrhage. Neurological function, assessed by NIHSS scores, significantly decreased in the research group, suggesting that comprehensive nursing interventions and cognitive training helped mitigate the severity of neurological damage. Additionally, the research group showed significant improvement in cognitive ability, as evidenced by the notable increase in MMSE scores. This improvement can be attributed to cognitive training, which includes memory, attention, language, and executive function exercises, promoting cognitive recovery and brain function reconstruction.

Furthermore, perioperative care combined with cognitive training had a positive impact on motor function and daily living abilities. The research group exhibited significant increases in upper and lower limb motor function scores and ADL scores, indicating that these interventions enhanced motor abilities, restoring autonomy and independence in daily activities. This is crucial for patient recovery and quality of life.

Similar findings were reported by Ji et al. [32], who studied the impact of perioperative care on postoperative recovery in patients undergoing hip replacement with hypertension. Their study showed that enhanced perioperative care significantly improved life abilities and alleviated adverse emotions. Early rehabilitation training helped patients regain hip joint function and independence in daily activities, while psychological support and counseling improved mental well-being and quality of life.

Additionally, the study showed that the research group had significantly reduced recovery times for gastrointestinal function and shorter hospital stays. This can be attributed to the combination of perioperative care and cognitive training, which enhanced overall patient condition and accelerated recovery, leading to earlier rehabilitation and discharge. Shorter hospital stays reduce medical resource utilization and alleviate financial burdens on patients and their families.

Patient satisfaction with care was also evaluated, revealing significantly higher satisfaction levels in the research group compared to the

Table 5. Univariate analysis

	Poor prognosis group (n = 46)	Good prognosis group (n = 54)	X^2	P
Time from onset to admission (h)			0.190	0.663
<9	19	20		
≥9	27	34		
Duration of hypertension (years)			0.539	0.463
<6	15	14		
≥6	31	40		
Cerebral hemorrhage volume (mL)			7.582	0.006
<29.9	18	36		
≥29.9	28	18		
Location of cerebral hemorrhage			1.558	0.459
Basal nucleus	21	19		
Frontal lobe	15	18		
Occipital lobe	10	17		
Age (years)			4.944	0.026
<59	17	32		
≥59	29	22		
Education level			0.549	0.459
Below high school	23	31		
High school and above	23	23		
BMI (kg/m^2)			0.094	0.759
<24.1	21	23		
≥24.1	25	31		
Gender			0.150	0.699
Male	29	32		
Female	17	22		
Nursing methods			7.466	0.006
Routine care	27	17		
Perioperative care combined with cognitive training	19	37		

Note: BMI, Body Mass Index.

Table 6. Assignment

Factors	Assignment
Cerebral hemorrhage volume (mL)	<29.9 = 0, ≥29.9 = 1
Age (years)	<59 = 0, ≥59 = 1
Nursing methods	Routine care = 1, Perioperative care combined with cognitive training = 0
Prognosis	Good = 0, Poor = 1

Table 7. Multivariate analysis

	B	S.E.	Wals	Sig.	Exp (B)	EXP (B) for 95% C.I.
Cerebral hemorrhage volume	0.901	0.440	4.190	0.041	2.461	1.039-5.831
Age	0.787	0.437	3.242	0.072	2.196	0.933-5.170
Nursing methods	0.932	0.441	4.470	0.035	2.540	1.070-6.028

control group. This suggests that combining perioperative care with cognitive training provides more comprehensive and personalized care, meeting specific patient needs and

enhancing trust and satisfaction with the nursing team.

These findings underscore the importance of perioperative care, particularly for patients with hypertensive intracerebral hemorrhage. Combining perioperative care with cognitive training allows for comprehensive and personalized nursing services tailored to patient needs, optimizing rehabilitation outcomes. By meeting patient needs and fostering trust and satisfaction with the nursing team, effective promotion of patient recovery is possible.

This study still has a few limitations. First, the retrospective design may introduce recall bias. Future research should consider using randomized controlled trial designs to validate these findings. Second, the relatively small sample size may introduce selection bias. Larger-scale, multicenter studies could provide more robust and generalizable evidence. Additionally, the short observation period limits the assessment of long-term recovery effects. Future studies should extend the observation period to evaluate the long-term impact of perioperative care combined with cognitive training on patient recovery.

In conclusion, the combination of perioperative care and cognitive training has a significant positive impact on the recovery of patients with hypertensive intracerebral hemorrhage undergoing minimally invasive hematoma evacuation. Patients showed improvements in neurological function, cognitive function, motor function, and daily living abilities. These results offer crucial insights for clinical practice, emphasizing the importance of perioperative care and the benefits of individualized treatment approaches. Further research could explore the mechanisms underlying this combined approach and refine care strategies to enhance patient recovery outcomes and overall quality of life.

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Disclosure of conflict of interest

None.

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