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Research on the Impact of the Early Rehabilitation Management Model Based on Efficacy Linkage on Functional Recovery of Patients After Cerebral Hemorrhage Surgery

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Abstract: *Objective*: To investigate the effects of performance-linked early rehabilitation management model on the recovery of neurological function, motor function and activities of daily living in patients after intracerebral hemorrhage surgery. *Methods*: A randomized controlled trial design was adopted. A total of 120 patients after cerebral hemorrhage surgery admitted to our hospital from June 2023 to June 2024 were selected as the research subjects and were randomly divided into the experimental group and the control group, with 60 cases in each group according to the random number table method. The control group received routine postoperative care and rehabilitation guidance in neurosurgery, while the experimental group implemented an efficacy linkage early rehabilitation management model on the basis of routine care. Before the intervention, 4 weeks after the intervention, and 12 weeks after the intervention, the National Institutes of Health Stroke Scale (NIHSS), the Fugl-Meyer Assessment of Motor Function (FMA), and the Barthel Index (BI) were used to assess the degree of neurological deficits, motor function, and activities of daily living in patients, respectively. *Results*: After 4 weeks and 12 weeks of intervention, the NIHSS scores of the experimental group [(8.5 ± 2.1) points, (5.2 ± 1.8) points] were significantly lower than those of the control group [(10.8 ± 2.4) points, (7.9 ± 2.2) points] ($P < 0.01$); FMA scores [(58.4 ± 10.2) points, (78.6 ± 12.4) points] and BI scores [(55.3 ± 11.5) points, (72.8 ± 13.2) points] were significantly higher than those of the control group [(45.2 ± 9.8) points, (62.3 ± 11.7) points; (42.1 ± 10.6) points, (58.4 ± 12.5) points] ($P < 0.01$). *Conclusion*: The performance-linked early rehabilitation management model can effectively promote the recovery of neurological and motor functions in patients after cerebral hemorrhage surgery and significantly improve their ability to take care of themselves in daily living. It is an efficient rehabilitation management strategy.

Keywords: Cerebral hemorrhage; Early rehabilitation; Efficacy linkage; Functional recovery; Postoperative recovery; Randomized controlled trials

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1. Introduction

Cerebral hemorrhage (intracerebral hemorrhage, for example) is a common emergency and severe cases of neurosurgery, its incidence, morbidity and mortality rates are higher. Surgical removal of the hematoma is a key treatment for massive intracerebral hemorrhage, but postoperative patients often have neurological deficits of varying degrees, such as hemiplegia, aphasia, dysphagia, etc., which seriously affect their quality of life and impose a heavy burden on families and society.

Early rehabilitation intervention has been proven to be a key measure to improve the prognosis of stroke patients, with the aim of preventing complications, promoting functional compensation and reorganization, and restoring patients' ability to take care of themselves to the greatest extent. However, the traditional rehabilitation model often has problems such as poor coordination among various disciplines (neurosurgery, rehabilitation department, nursing unit, etc.), inconsistent timing and intensity of rehabilitation intervention, and low participation of patients and their families, resulting in poor rehabilitation outcomes.

Performance-linked rehabilitation management is a new type of management model that is patient-centered, emphasizes multi-disciplinary collaboration (MDT), process standardization, and maximization of effectiveness. By integrating medical, rehabilitation, nursing and family support systems to form a seamless rehabilitation chain, it aims to achieve early, individualized, continuous and efficient rehabilitation interventions.

At present, there is a lack of large-sample empirical research on the application effect of this model in patients after cerebral hemorrhage surgery. Therefore, this study constructs an efficacy-linked early rehabilitation management model and applies it to patients after cerebral hemorrhage surgery to systematically evaluate its impact on neurological function, motor function and activities of daily living in patients, with the aim of providing evidence-based evidence for optimizing the rehabilitation management process after cerebral hemorrhage surgery and improving the prognosis of patients [1].

2. Data and methods

2.1. Research subjects

A total of 120 postoperative patients with cerebral hemorrhage who were admitted to the neurosurgery department of our hospital from June 2023 to June 2024 were selected as the study subjects.

Inclusion criteria are as follows:

(1) Diagnosed with supratentorial spontaneous intracerebral hemorrhage by CT or MRI and undergoing hematoma evacuation;

(2) Age: 18–80 years;

(3) Stable vital signs, GCS score > 8, rehabilitation assessment initiated within 24–48 hours after surgery;

(4) Informed consent from the patient or family member and the signing of the consent form.

Exclusion criteria:

(1) Combined with severe dysfunction of the heart, liver, kidneys, etc.;

(2) Previous sequelae or dysfunction of neurological disorders;

(3) Accompanied by consciousness disorder or cognitive impairment and unable to cooperate with rehabilitation training;

(4) Expected survival time < 3 months. Patients were randomly divided into the experimental group and the control group, with 60 cases in each group, using a random number table.

There was no statistically significant difference ($P > 0.05$) between the two groups of patients in terms of gender, age, bleeding site, bleeding volume, surgical method, and general data such as preoperative NIHSS, FMA, and BI scores, and they were comparable. This study was approved by the Hospital Ethics Committee (Batch number: 2023-Yan Lun Shen - No. 045) [2].

2.2. Methods

2.2.1. The control group received routine postoperative care and rehabilitation in neurosurgery

It included disease observation, medication guidance, complication prevention, and routine phased rehabilitation guidance by a rehabilitation therapist (once daily, 30 minutes each time), and home rehabilitation advice upon discharge.

2.2.2. The experimental group implemented an effect-linked early rehabilitation management model on the basis of routine care

The details are as follows:

(1) Establish MDT teams consisting of neurosurgeons, rehabilitation physicians, rehabilitation therapists, specialist nurses, nutritionists, and psychotherapists;

(2) Develop standardized procedures:

(i) Rehabilitation risk assessment and functional evaluation will be conducted jointly by the MDT team within 24 hours after the operation;

(ii) Based on the assessment results, an individualized and phased rehabilitation program will be jointly developed and initiated within 48 hours after the operation;

(iii) Coordinated implementation:

(a) In-hospital stage: The rehabilitation therapist conducts two one-on-one training sessions daily (including good limb placement, passive/active joint range of motion training, bed movement, sitting balance, etc.) for 45 minutes each time; Nurses incorporate rehabilitation care into daily care operations and supervise the training; Physicians monitor changes in the condition and adjust medical plans; Nutritionists and psychologists provide corresponding support;

(b) Transition phase: Establish a discharge preparation plan and provide rehabilitation skills training to family members;

(c) Family/community phase: Establish We-chat follow-up groups for weekly online guidance; Home visits or outpatient follow-ups once a month for the MDT team to re-evaluate and adjust the plan;

(3) Effectiveness assurance mechanism: Establish daily morning shift handover and weekly MDT case discussion to ensure information exchange and timely plan adjustment [3].

2.3. Observation indicators

The observation indicators are as follows:

(1) Degree of neurological deficits: Assessed using the NIHSS, higher scores indicate more severe neurological deficits;

(2) Motor function: The upper limb part (66 points) and lower limb part (34 points) were evaluated using the FMA for a total of 100 points, with a higher score indicating better motor function;

(3) Activities of daily living: The BI is used for assessment, with a total score of 100, and a higher score

indicates better independence [4].

2.4. Statistical methods

Data analysis was performed using SPSS 26.0 software. Measurement data were expressed as mean ± standard deviation (SD), repeated measures analysis of variance was used for intra-group comparison, and independent sample t-test was used for inter-group comparison; Count data were expressed as rates (%), and the χ^2 test was used for comparison between groups. A difference was considered statistically significant when $P < 0.05$.

3. Results

3.1. Comparison of NIHSS scores before and after intervention between the two groups of patients

Before the intervention, there was no statistically significant difference in NIHSS scores between the two groups ($P > 0.05$). After 4 and 12 weeks of intervention, the NIHSS scores of both groups were significantly lower than those before intervention ($P < 0.05$), and the scores of the experimental group were significantly lower than those of the control group in the same period, and the difference was statistically significant ($P < 0.01$). See **Table 1**.

Table 1. Comparison of NIHSS scores before and after intervention between the two groups mean ± SD, n = 60)

Group	Before intervention	4 weeks after the intervention	After 12 weeks of intervention
Experimental group	15.8 ± 3.2	8.5 ± 2.1 *#	5.2 ± 1.8 *#
Control group	16.1 ± 3.5	10.8 * 2.4 mm	7.9 * 2.2 mm
t value	0.485	5.732	7.415
P value	0.629	< 0.001	< 0.001

Note: Compared with before the intervention in the same group, *$P < 0.05$; *Compared with the control group of the same period,* #$P < 0.01$.

3.2. Comparison of FMA scores before and after intervention between the two groups of patients

Before the intervention, there was no statistically significant difference in FMA scores between the two groups ($P > 0.05$). After 4 and 12 weeks of intervention, the FMA scores of both groups were significantly higher than those before intervention ($P < 0.05$), and the scores of the experimental group were significantly higher than those of the control group in the same period, and the difference was statistically significant ($P < 0.01$). See **Table 2**.

Table 2. Comparison of FMA scores before and after intervention between the two groups mean ± SD, n = 60)

Group	Before intervention	4 weeks after the intervention	After 12 weeks of intervention
Experimental group	25.6 ± 8.4	58.4 ± 10.2 *#	78.6 ± 12.4 *#
Control group	24.9 ± 7.8	45.2 * 9.8 mm	62.3 * 11.7 mm
t value	0.461	7.318	7.842
P value	0.646	< 0.001	< 0.001

Note: Compared with before the intervention in the same group, *$P < 0.05$; Compared with the control group of the same period, #$P < 0.01$.

3.3. Comparison of BI scores before and after intervention between the two groups of patients

Before the intervention, there was no statistically significant difference in BI scores between the two groups ($P > 0.05$). After 4 and 12 weeks of intervention, the BI scores of both groups were significantly higher than those before intervention ($P < 0.05$), and the scores of the experimental group were significantly higher than those of the control group in the same period, and the difference was statistically significant ($P < 0.01$). See **Table 3**.

Table 3. Comparison of BI scores before and after intervention between the two groups of patients (mean ± SD, n = 60)

Group	Before intervention	4 weeks after the intervention	After 12 weeks of intervention
Experimental group	20.5 ± 9.2	55.3 ± 11.5 *#	72.8 ±13.2 *#
Control group	21.2 ± 8.7	42.1 * 10.6 mm	58.4 * 12.5 mm
t value	0.423	6.572	6.128
P value	0.673		

Note: Compared with before the intervention in the same group, *$P < 0.05$; Compared with the control group of the same period, #$P < 0.01$.

4. Discussion

The findings suggest that the early rehabilitation management model based on efficacy linkage significantly promotes functional recovery in patients after cerebral hemorrhage surgery. After 4 and 12 weeks of intervention, the improvement in neurological deficits (NIHSS), motor function (FMA), and activities of daily living (BI) in the experimental group was significantly better than that in the control group receiving conventional rehabilitation ($P < 0.01$). This significant advantage was attributed to the multi-faceted innovations and optimizations of the model.

Early intervention and systematicness are key to achieving good results. This study initiated the assessment within 24 hours after the operation and initiated the rehabilitation plan within 48 hours, firmly seizing the "golden window" of neurological function recovery after cerebral hemorrhage surgery. Early, scientific and moderate rehabilitation training can effectively stimulate the plasticity of the central nervous system and promote the reorganization and compensation of impaired functions. The MDT team's co-developed program ensures the scientific and safe nature of the rehabilitation intervention and avoids rehabilitation delays or program conflicts caused by poor communication between departments in the traditional model [5].

MDT breaks down professional barriers and forms a rehabilitation synergy. Neurosurgeons precisely control medical safety, rehabilitation physicians and therapists formulate and execute precise rehabilitation prescriptions, and specialist nurses incorporate rehabilitation concepts into the 24-hour care process to ensure the continuity and high frequency of rehabilitation training. This "medical-nurse-treatment integration" work model achieves a "seamless connection" from treatment to care and then to rehabilitation, avoids "breakpoints" in the rehabilitation process, and greatly enhances rehabilitation efficiency.

The full-process management path ensures the continuity of the rehabilitation effect. The model not only focuses on the rehabilitation of patients during their stay in the hospital, but also effectively extends rehabilitation intervention to families and communities through family training, online follow-up, and regular re-evaluation, addressing the common problem of interrupted or reduced effectiveness of rehabilitation training after discharge

and achieving continuity and consistency in in-hospital and out-of-hospital rehabilitation, which is difficult to achieve with the traditional model.

5. Conclusion

To sum up, the performance-linked early rehabilitation management model, by systematically integrating multidisciplinary resources and optimizing the rehabilitation process, has achieved early, individualized, continuous and efficient rehabilitation after cerebral hemorrhage surgery, significantly improving the neurological function and quality of life of patients, and is worthy of clinical promotion and application.

Disclosure statement

The authors declare no conflict of interest.

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