RESEARCH ARTICLE

Comparision of early interventional rehabilitation training with delayed training on motor function recovery in patients with cerebral haemorrhage

Jingjing Yu, Fen Zhou and Yan Zhang

Abstract

Objective: To study the effect of early interventional rehabilitation training with delayed rehabilitation on the recovery of motor function in patients with cerebral haemorrhage.

Methods: A total of 82 patients with cerebral haemorrhage admitted to the Hai'an People's Hospital, Jiangsu, China during the period January 2014 to January 2015 were selected for the study. They were randomized into interventional group and control group with 41 cases in each group. Patients in the early interventional group received early intervention measures 2-7days after the onset, while patients in the control group were given rehabilitation training within 3-4 weeks after the onset. The changes in motor function, neurological function and daily living ability of the two groups before and after rehabilitation training were evaluated.

Results: After rehabilitation training, the Fual-Meger (FMA) score and Barthel index score of both upper and lower limbs of patients in the two groups were significantly higher than that before the training ($P<0.01$), while the Neurological deficit(ND) score was significantly lower than that before the training ($P<0.05$).However, after the training, the Fual-Meger (FMA) score and Barthel index score of the patients in the early intervention group were significantly higher than those in the control group ($P<0.01$), and the Neurological deficit (ND) score was significantly lower than those in the control group ($P<0.01$).

Conclusion: Early intervention training was more conducive to the improvement of motor function, neurological function, and daily living ability in patients with cerebral haemorrhage.

Keywords: Cerebral hemorrhage, Early rehabilitation, Rehabilitation training, Motor function.

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Introduction

Cerebral haemorrhage refers to haemorrhage caused by rupture of blood vessels without any trauma to the brain parenchyma, which accounts for 20% to 30% of all strokes, with an acute phase mortality of 30% to 40%. The causes are mainly related to the pathological changes of cerebral blood vessels, such as hyperlipidaemia, diabetes, hypertension, aging of blood vessels and smoking. Patients with cerebral haemorrhage tend to have sudden onset due to emotional agitation and excessive exertion. The early mortality rate is high. Most survivors have different degrees of sequelae such as dyskinesia, cognitive impairment, and dysphagia.[1] Common causes are hypertension associated with arteriosclerosis, microaneurysm or microhaemangioma, with other factors including cerebral vascular malformation, meningeal arteriovenous malformation, amyloid cerebrovascular disease, cystic haemangioma, intracranial venous thrombosis, specific arteritis, mycotic arteritis, fungal arteritis and arterial anatomic variation, vasculitis, and haemorrhagic brain tumour. In addition, blood factors include anticoagulation, antiplatelet or thrombolytic therapy, haemophilus infection, leukaemia, thrombotic thrombocytopenia, intracranial tumours, alcoholism and sympathetic nerve stimulants. The inducing factors include excessive exertion, climate change, smoking, alcohol abuse, excessive salt intake, obesity, blood pressure fluctuation, emotional agitation and overwork.[2]

Hypertensive cerebral haemorrhage often occurs at the age of 50-70 years, more in males than females, which is prone to onset during winter and spring, usually in the event of exertion and emotional excitement. There is no sign of bleeding before haemorrhage, and half of the patients complain of a severe headache and vomiting is commonly present. The blood pressure increases significantly after haemorrhage and clinical symptoms often appear in quick succession. The clinical symptoms and signs vary according to the location and amount of bleeding. Mild hemiplegia caused by haemorrhage in the thalamus and internal capsule is a common early symptom. A few cases have epileptic seizures, which are often focal. Severe cases quickly shift into confusion or coma.[3] Clinical examination mainly includes the Cerebrospinal fluid (CSF) examination. Those who have a

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definite diagnosis do not usually require the CSF test to prevent cerebral hernia. However, when the brain CT scan or brain MRI examination is not accessible, lumbar puncture still has a certain diagnostic value. The intracranial pressure is generally high after cerebral haemorrhage due to brain oedema.[4] In 80% of patients, cerebrospinal fluid is bloody or yellow after 6 hours of onset. However, the possibility of cerebral haemorrhage could not be completely ruled out, if the CSF is clear. Dehydrating agent is given to reduce intracranial pressure before surgery, and lumbar puncture is contra-indicated if the intracranial pressure is increased or there is a possibility of cerebral hernia.[5] Brain CT scan can clearly show the location of bleeding, the amount of bleeding, and the shape of the haematoma. It can also show whether the haematoma extends into the ventricles or whether there is the low-density oedema band and mass effect around the haematoma. Most of the lesions are round or oval along with high-density areas with clear boundaries. The ventricle with a large amount of haemorrhage will look like a high-density cast mould and the ventricle is widened, as shown in Figure-1.

Clinical researchers have conducted many rehabilitation studies in recent years with a view to improving the success rate of cerebral haemorrhage treatment, promoting comprehensive postoperative recovery, and reducing the incidence of sequelae. The results show that timely and effective rehabilitation intervention for patients with cerebral haemorrhage is one of the most effective measures to improve the motor function of patients.[6] The acute phase (early) and stable phase (late) from 3 weeks to 4 weeks after the onset are the two main time points for rehabilitation interventions. In order to verify the specific effects of early and late rehabilitation interventions on recovery of motor function, 82 patients were selected to conduct a comparative study. This research was conducted to see the effect of interventional rehabilitation training at different times on the recovery of motor function in patients with cerebral haemorrhage.

Patients and Methods

A total of 82 patients with cerebral haemorrhage admitted to the hospital from January 2014 to January 2015 were included in the study. Based on the preliminary test results of 10, patients with cerebral haemorrhage were evaluated by FMA scale, neurological impairment scale, and Barthel index, respectively. After comparing the three methods, the mean value κ of test was 0.856. According to the results of literature 0.624, the sample size estimation equation of the two groups of measurement data was as follows.

$$n_1 = n_2 = 2[(z_{\alpha/2} + z_\beta)^2 \sigma^2 / \delta^2]$$

Among them, $\alpha = 0.05$, $\beta = 0.1$, $z_\alpha = 1.6449$, $z_\beta = 1.2816$, $\sigma = 0.856$, $\delta = 0.624$. After calculation, n_1 and n_2 were 32. Since about 10% of the estimated cases need to be excluded, there were 42 cases we in each group, a total of about 80 cases.

They were divided into early intervention group and control group according to the random number method with 41 cases in each group. The study was approved by the hospital ethics committee and all the participants gave

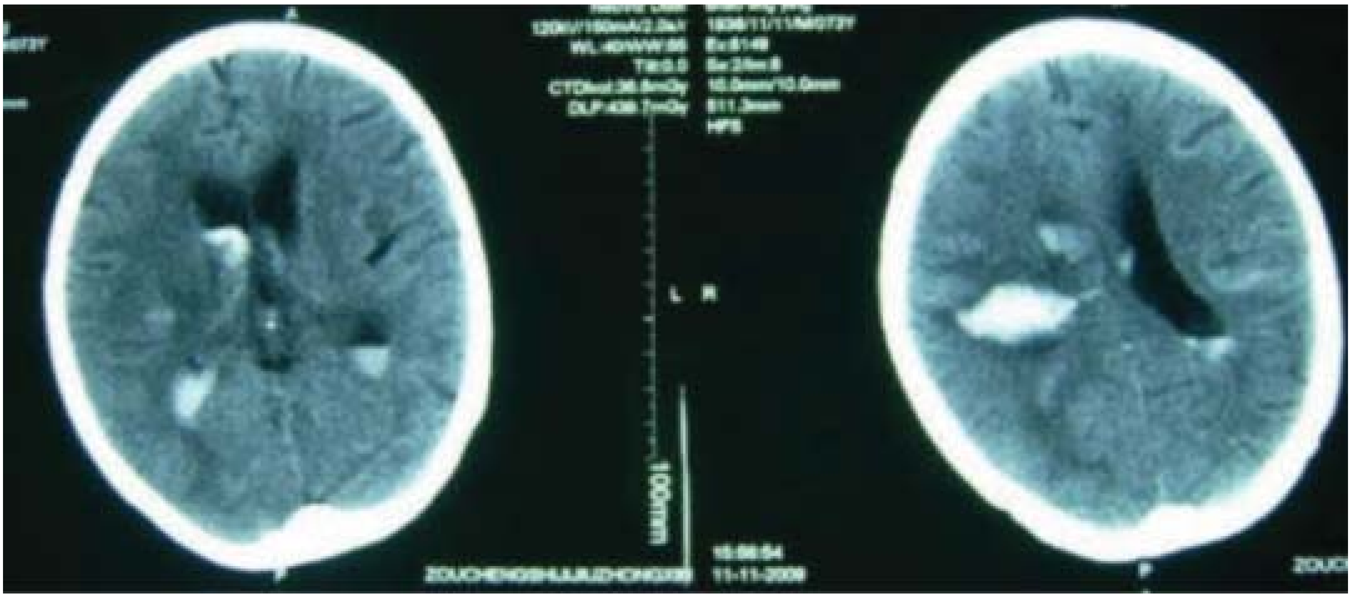


Figure-1: CT image of a patient with a brain.

an informed consent. The inclusion criteria were:

1. The clinical diagnosis of cerebral haemorrhage was consistent with the diagnostic criteria according to the 2007 guidelines for the treatment of spontaneous intracerebral haemorrhage in adults;[7] 2. It is the first episode for the patient with the location I the basal nucleus.[8] 3. All patients were diagnosed by magnetic resonance imaging (MRI) or CT. 4. All patients were fully conscious and could follow the instructions of the medical staff to complete the study.

The exclusion criteria were: 1. Patients with intracerebral haemorrhage accompanied with subarachnoid haemorrhage; 2. Patients with re-bleeding or worsening of the conditions during treatment; 3. Patients with mental retardation; 4. Patients with abnormal liver and kidney functions.

Figure-2: Gait trainer.

All patients had the same treatment for intervention training. The treatment plans included the use of the joint programme Bobath[9] and the application of psychotropic drugs. The early intervention group were given training, starting 2-7 days after the onset of the symptoms when neurological function and vital signs were stable. The patients in the control group received late interventional rehabilitation training 3-4 weeks after the onset of the stroke. The steps of interventional rehabilitation training were as follows: 1. Adjust the position of the patients at rest, with lying positions for selection including recumbent position on the healthy side, supine position and recumbent position on the affected side. Attention was paid to avoiding the compression of the affected limbs and the patients' posture adjusted timely and effectively. 2. Passive and active exercise training was performed for the patients' affected limbs, paying particular attention to the training of naked joints, hip joints, hand joints, and shoulder joints (as shown in Figure 2); 3. The patients were guided to effectively adjust the position to turn over in bed and to maintain the balance at a standing or sitting position. Gait training was provided at any time needed;[10] 4. Training for carrying out daily living ability to the patients, so that they could eat, wash, dress and go to the toilet independently. In the first half of the treatment, guidance was given on the patients' body movements, sit-ups, back and forth movements, turning over in bed and others once a day for about 45 minutes, based on their actual recovery status. Secondly, guidance was gradually given on the basic skills such as self-standing and walking, so that the patients could stand and walk on their own.

The evaluation of motor function, neurological function and daily living ability before and after the treatment of patients was performed by two professional rehabilitation trainers. Among them, the evaluation criteria of motor function were as follows: The simple motor function assessment method was used to evaluate the motor function before and after treatment. The motor function score included a score of 34 points for the lower limbs and 66 points for the upper limbs. The degree of neurological deficit was evaluated according to the neurological deficit score, with the lowest score being 0 points and the highest score being 45 points. The higher the score, the worse was the neurological function.[11] The ability of daily living was evaluated by using the Barthel index,[12] with evaluation criteria as follows: The lowest score is 0, and the highest score is 100. A higher score was considered a better neurological function.

SPSS 22.0 statistical software was used for analysis, and the measurement data was expressed as mean ± standard deviation. The mean of each sample was compared using t-test or analysis of variance. $P<0.5$ was considered statistically significant.[13-15]

Results

As shown in Table-1, the early intervention group had 25 males and 16 females with ages between 54-78 years (mean age 63.4±1.7 years). The blood loss was 15-37mL (mean 23.7±2.6) mL, and body mass index of 22-25 kg/m^2 (mean 23.7±0.6) kg/m^2. There were 19 cases of left limb paralysis, and 22 cases of right limb paralysis. The control group consisted of 28 males and 13 females aged 53-79 years (mean age 64.0±1.7 years). The blood loss was 17-39 mL (mean 24.2±2.6) mL, and the body mass index was 23-26 kg/m^2 (mean 24.2±0.6) kg/m^2. There were 17 cases of

Table-1: General data comparison of the two groups.

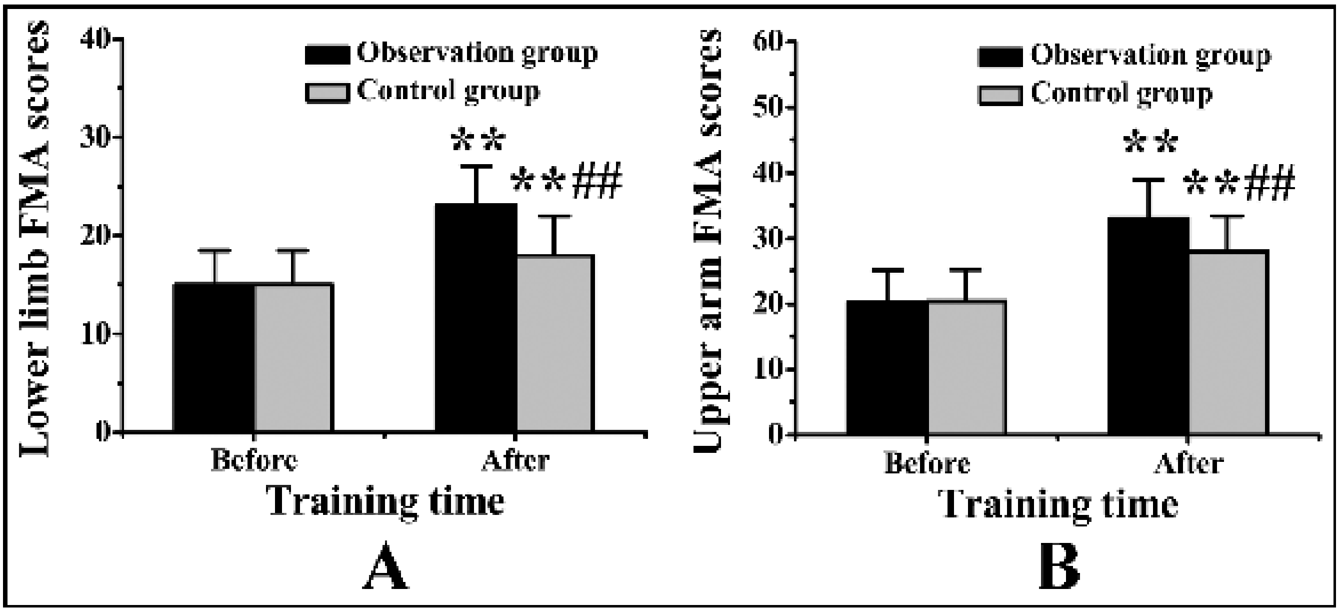
General data	Control group	Observation group	P-value
Gender (male/female)	28/13	25/16	>0.05
Age (year)	64.0±1.7	63.4±1.7	>0.05
Amount of bleeding(mL)	24.2±2.6	23.7±2.6	>0.05
Weight index(kg/m^2)	24.2±0.6	23.7±0.6	>0.05
Paralysis of the parts (left/right)	17/24	19/22	>0.05

left limb paralysis, and 24 cases of right limb paralysis. There were no statistically significant differences between the two groups in gender, age, blood loss and body mass index (P <0.05), so they were comparable.

The difference in FMA scores of upper and lower limbs FUG 1m-m before and after training was compared between the control group and the observation group, and the results are shown in Figure-3. According to Figure-3A, there was no significant difference in lower limb FMA scores between the two groups before training (P>0.05). After training, FMA scores of lower limbs in both groups were significantly higher than those before training (P<0.01). After training, the lower limb FMA score of the control group was significantly lower than that of the early intervention group (P<0.01). According to figure 3B, there was no significant difference in upper limb FMA score between the two groups before training (P>0.05). After the training, the FMA score of the upper extremity of patients in both groups was significantly higher than the pre-training score. (P<0.01). After training, FMA score of the control group was significantly lower than that of the early intervention group (P<0.01).

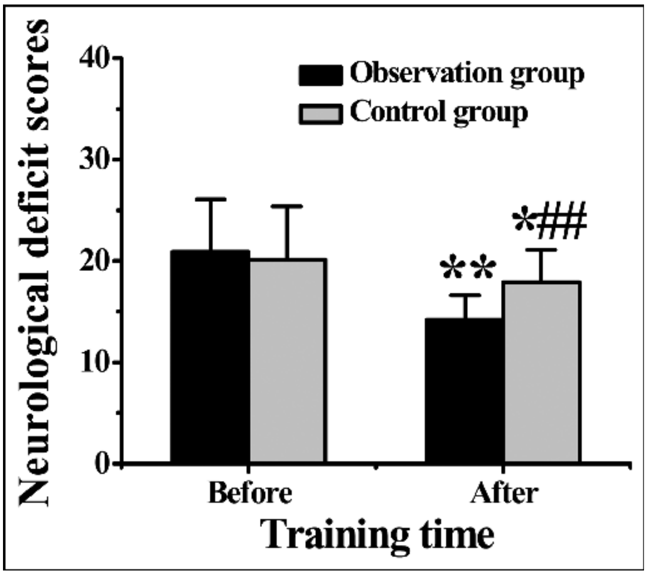
The scores of neurological defects in the two groups before and after training were compared, and the results were shown in Figure-4. It showed that before rehabilitation training, there was no significant difference in the scores of neurological defects between the two groups (P>0.05). After rehabilitation training, the score of neurological defects in the control group was significantly lower than the before training score (P<0.05), whereas the score of the early intervention group was significantly lower than the pre-training score (P<0.01). The score of neurological defects in the control group was significantly higher than that of the early intervention group (P<0.01).

The score of Barthel index before and after training was compared between the two groups, and the results were shown in Figure-5. Before rehabilitation training, there was no significant difference in Barthel index score between the two groups (P> 0.05). After the rehabilitation training, the Barthel index score in both the early intervention group and the control group was significantly higher than that before the training (P<0.01). After rehabilitation training, the score of neurological defects in the control group was significantly lower than that in the early intervention group (P<0.01).



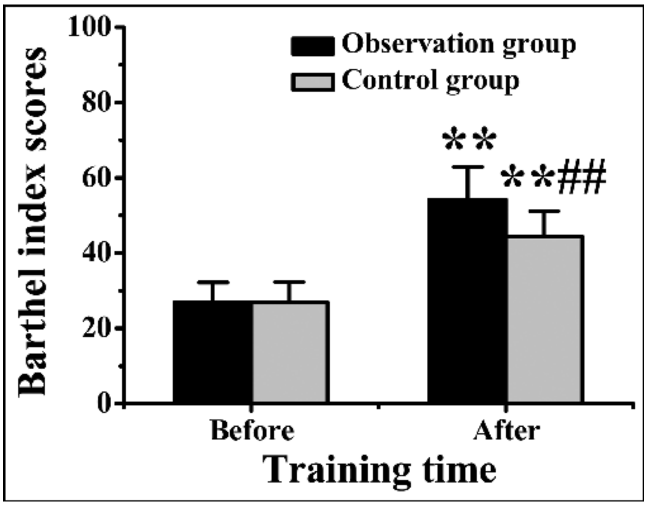
Note: figure A showed the difference of lower limb FMA scores between the two groups before and after training. Figure B was the comparison of FMA scores of upper limbs between the two groups before and after training. indicated that there was an extremely significant difference compared with before training, P<0.01; compared with the observation group, there was an extremely significant difference (P<0.01)**

Figure-3: The difference of Fual-Meger (FMA) score between the two groups before and after training.



Note: * meant there was a significant difference compared with before training, P<0.05; ** indicated that there was an extremely significant difference compared with before training, P<0.01; compared with the observation group, there was an extremely significant difference (P<0.01)

Figure-4: The difference of neurological defect scores between the two groups before and after training.



Note: ** meant that there was an extremely significant difference compared with before training, P<0.01; compared with the observation group, there was an extremely significant difference (P<0.01)

Figure-5: The difference of Barthel index score between the two groups before and after training.

Discussion

Rehabilitation training comprised of re-learning the skills of daily life. During the training, patients were required to reasonably and effectively adapt to the current environment. Early rehabilitation training is beneficial to patients' recovery after surgery and improve the quality of life. A shorter onset time was advantageous for the brain plasticity which refers to the adaptability of the brain by modifying its function and structure to the injury.

Many animal researches have verified the effect of exercise training on cerebral haemorrhage. It has been proved that motor skill training can improve the motor function after cerebral haemorrhage in rats, and enhance the neural activity and synaptic plasticity of striatum and sensorimotor cortex.[16] A case report on a 57 year old man with severe upper extremity disability after right frontoparietal haemorrhagic stroke of 9 months history, reported clinically significant improvements in arm injury (strength), activity (arm and hand tasks) and participation (arm use in daily tasks). This helped to achieve independence, ensure family and user friendliness, maintain motivation for adherence and move and integrate towards daily life.[17] Liu et al. found that early rehabilitation training combined with nursing intervention could effectively improve postoperative Fual-Meyer score of patients with hypertensive intracerebral haemorrhage and reduce the probability of postoperative adverse reactions.[18] In this research, it showed that early rehabilitation training for patients with spontaneous intracerebral haemorrhage could effectively improve FMA score and Barthel index, which was consistent with the results of Poltavskaya et al.[19]

However, cardiovascular and cerebrovascular diseases sometimes cause the damage of nerve function. Cai et al. found that cerebral haemorrhage would cause the defect of nerve function and accompanied by nerve inflammation.[20]

Rehabilitation training can improve the situation. Sheng et al. found that using Vitalstim electroacupuncture combined with rehabilitation training can effectively improve the neurological impairment of patients.[21] In this research, it was concluded that early rehabilitation training could effectively improve the degree of postoperative nerve injury in patients with spontaneous intracerebral haemorrhage, which was consistent with the results of Olshinka et al.[22] Therefore, the sooner the rehabilitation training, the earlier would be the recovery of postoperative brain function, and the re-establishment of central nervous function, which would help patients adapt to the current living environment in a short period.[23]

Cerebral haemorrhage is a series of devastating cerebrovascular diseases with high mortality, high morbidity and high recurrence rate. Intracerebral haemorrhage accounts for 15-20% of stroke subtypes, with poor prognosis.[24] The mortality rate of patients with cerebral haemorrhage ranges from 40% to 50%, of which at least half occurs in the first two days, and 75% of the survivors could not live independently after one year. With the aging of population, stroke is more commonly encountered in many countries. Its long-term sequelae can be relieved by early reperfusion in stroke unit, treatment of complications in early rehabilitation center and rapid functional recovery. In terms of functional recovery, progress has been made in physiology of early rehabilitation training and nerve enhancement, supportive drug therapy and robotics. On the basis of current scientific knowledge, early rehabilitation treatment in the acute and middle stage of stroke can provide the best functional effect for patients.

Conclusion

The results of this study showed that the FMA score increased, the ND score decreased, and the MBI score increased in both groups after rehabilitation, suggesting that both early and late interventional rehabilitation training was beneficial to the recovery of the motor function, neurological function and daily living ability of patients with cerebral haemorrhage. However, early rehabilitation training had a more significant effect on the recovery of all these functions,indicating that early interventional rehabilitation training was more effective.

Disclaimer: I hereby declare that this research paper is my own and autonomous work. All sources and aids used have been indicated as such. All texts either quoted directly or paraphrased have been indicated by in-text citations. Full bibliographic details are given in the reference list which also contains internet sources. This work has not been submitted to any other journal for consideration.

Conflict of Interest: None to declare.

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