Int J Clin Exp Med 2020;13(8):5815-5822
www.ijcem.com /ISSN:1940-5901/IJCEM0113218

Original Article

Observations about the effects of compulsory rehabilitation for aphasia patients

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Received April 24, 2020; Accepted June 2, 2020; Epub August 15, 2020; Published August 30, 2020

Abstract: Objective: To explore the effects of compulsory rehabilitation on, Language function, quality of daily life and neurological function of aphasia patients. Methods: Patients with aphasia after acute cerebral infarction (ACI, n=80) admitted to the neurology department of The First Affiliated Hospital of Anhui Medical University were selected as our research subjects. Clinical data of patients was first retrospectively analyzed. The patients were then placed into the control group or the observation group according to their corresponding rehabilitation methods, with 40 cases in each group. Patients in the control group and the observation group received routine rehabilitation and compulsory rehabilitation, respectively. Corresponding therapeutic effects of the two groups were compared, including aphasia quotient scores, language communication ability in daily life, quality of daily life and neurological function. Results: Total effective rate of aphasia patients was markedly higher in the observation group than that in the control group with a significant difference (P=0.032). Compared to the control group after intervention, the scores of aphasia quotient, Chinese functional communication profile (CFCP) and stroke and aphasia quality of life scale-39 (SAQOL-39) were all memorably elevated and the scores of National institute of health stroke scale (NIHSS) was sharply decreased in the observation group with a significant difference (all P<0.05). Conclusion: Compulsory rehabilitation intervention can significantly reduce the degree of aphasia, enhance language and neurological function and improve quality of daily life in patients with aphasia.

Keywords: Aphasia, compulsory rehabilitation, acute cerebral infarction, therapeutic effect

Introduction

Aphasia is a common complication of acute cerebral infarction (ACI). Epidemiological investigation shows that the incidence rate of acute aphasia after stroke is about 25% [1, 2]. Aphasia patients mainly manifest with issues in hearing, reading, speaking and writing dysfunction, and even aphasia, which all seriously affect the quality of daily life and damage the physical and mental health of patients [3, 4]. However, there is no particularly effective drug treatment for aphasia at the present in addition to the treatment of the primary disease. In the clinic, the main treatment principles for aphasia include language function training and nerve function recovery, among which the recovery of language function is particularly important for the rehabilitation of aphasia patients [5, 6]. At present, clinical application of conventional rehabilitation training for aphasia patients is still far from satisfactory. Related symptoms, neurological recovery and other indicators have no significant improvement, thus conventional rehabilitation training is completely unable to meet the needs of aphasia patients' rehabilitation treatment [7, 8]. With the changing of rehabilitation concepts and the continuous enhancement of medical quality requirements, it is important to find a new rehabilitation intervention mode to improve the prognosis of aphasia patients.

In recent years, the compulsory rehabilitation intervention mode has been gradually applied to the treatment of clinical diseases. It aims to accelerate the recovery of function by repeated training and making the best use of the patients' ability of re-organization [9, 10]. Some studies have point out that compulsory rehabilitation

Table 1. Comparison of general data ($\bar{x} \pm sd$), n/%

Index	Control group	Observation group	t/χ^2	P
Age (year)	62.3±15.2	62.5±12.8	0.063	0.949
Gender (cases)	13/27	14/26	0.056	0.813
Diabetes (cases)	20	12	0.691	0.406
Hypertension (cases)	23	27	0.853	0.356
Smoking history (cases)	7	9	0.313	0.576
Atrial fibrillation history (cases)	1	2	0.346	0.556
Onset time (hour)	2.8±2.4	2.7±2.5	0.183	0.856

Table 2. Comparison about the intervention effect of patients (n/%)

Groups	Cases	Cure	Markedly effective	Effective	Invalid	Total effective rate
Control group	40	3	9	15	13	27 (67.5%)
Observation group	40	8	15	12	5	35 (87.5%)
χ^2						4.588
P						0.032

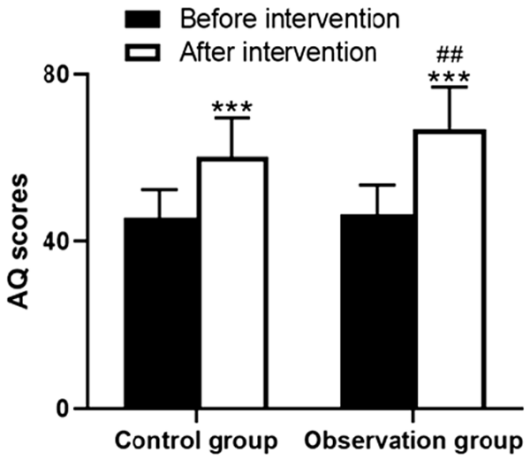

Figure 1. Comparison of AQ scores. Compared with the same group before intervention, ***P<0.001; compared with the control group after intervention, ##P<0.01. AQ: Aphasia quotient.

can significantly promote the brain to form dependent cortical reorganization by affecting the tissues around the damaged brain area, and even the tissues farther away [11]. At present, the reports about compulsory rehabilitation are mostly found in the rehabilitation of motor function, but there are few reports about its therapeutic effect on aphasia patients. Thus, our present study compared the effects of compulsory rehabilitation and routine rehabilitation on language function, quality of daily life and neurological function in aphasia patients. Through exploring the effect of compulsory rehabilitation on the prognosis of aphasia patients, we aimed to provide experimental basis for compulsory rehabilitation as a better rehabilitation treatment for aphasia patients.

Materials and methods

Subjects in the study

Patients with aphasia after ACI (n=80) admitted to the Neurology Department of The First Affiliated Hospital of Anhui Medical University during January 2017 to August 2018 were selected as our research subjects. Clinical data of these patients was analyzed. According to the corresponding language rehabilitation training methods, the aphasia patients were placed into the following two groups: 40 patients in the control group who received conventional rehabilitation; and 40 cases in the observation group who received compulsory rehabilitation. All the selected patients signed an informed consent and passed the examination and approval of the Ethics Committee of The First Affiliated Hospital of Anhui Medical University.

Inclusion criteria: (1) Aged over 18 years. ACI was diagnosed for the first time by clinical manifestations and imaging examination. Related diagnostic criteria refer to the guidelines for ACI issued by the European Stroke Promotion Association in 2000 [12]. (2) Aphasia was diagnosed by screening for the first time [13]. (3) Have a clear consciousness and can actively cooperate with this study.

Exclusion criteria: (1) Patients with other cerebrovascular diseases. (2) Patients with mental disorders, hearing disorders, vision disorders or dysarthria. (3) Patients with severe cardiopulmonary disease, hepatorenal dysfunction and psychiatric disorders.

Methods

Patients in the control group received routine rehabilitation, including retelling, naming, listening comprehension, reading comprehension

Table 3. Comparison of AQ scores ($\bar{x}$ ± sd)

Groups	Before intervention	After intervention	t	P
Control group	45.6±6.8	60.2±9.4	7.959	<0.001
Observation group	46.4±7.1	66.9±10.1	10.500	<0.001
t	0.515	3.071		
P	0.608	0.003		

Note: AQ: Aphasia quotient.

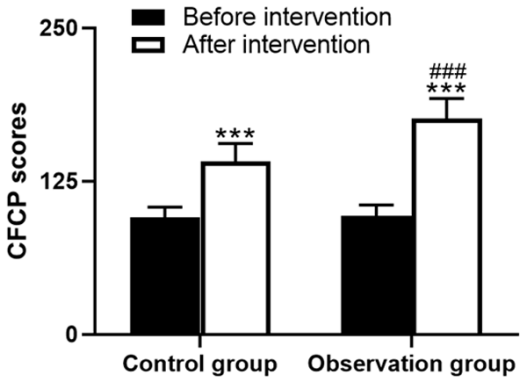

Figure 2. Comparison of CFCP scores. Compared with the same group before intervention, ***P<0.001; compared with the control group after intervention, ###P<0.001. CFCP: Chinese functional communication profile.

and communication ability. Each rehabilitation training period lasted for half an hour, occurred once a day for five days a week, for three months.

Patients in the observation group received compulsory rehabilitation: The patients were placed into 5 groups, with 8 aphasia patients in every group and the rehabilitation training was carried out in groups. The rehabilitation methods, including retelling, naming, listening comprehension, reading comprehension and communication ability, were trained repeatedly and circularly. The patients were instructed to use spoken language, vocabulary or sentences only instead of gestures or postures or other forms of communication. Medical staff provided assistance, guidance and reinforcement according to the feedback of patient communication. Every rehabilitation training lasts for 90 minutes, twice a day, five days a week, for three months.

Outcome measures

Comparison of the therapeutic effect between the two groups: Therapeutic effect evaluation criteria are as follows [14]: Invalid: After intervention, the severity of aphasia has no improvement, or the language functional score is elevated less than 30%. Effective: After intervention, the severity of aphasia improves by 1 grade, or there is a 30% to 60% improvement in language functional score. Markedly effective: After intervention, the severity of aphasia improves by 2 grades, or there is a 60% to 90% improvement in language functional score. Cure: After intervention, the severity of aphasia improves more than 2 grades, or there is a more than 90% improvement in language functional score. Total effective rate = cases of (cure + markedly effective + effective)/total cases * 100%.

Comparison of the language function between the two groups: Western Aphasia Battery (WAB) was used to access the language function of patients [15]. WAB contains four parts: Self-speech, listening comprehension, retelling and naming. Self-speech checks the information quantity and fluency, grammar ability and use of wrong words, with 0-10 points scoring range. Listening comprehension includes the right and wrong questions, word recognition and sequential instructions, with a total score of 200 points. The retelling ability test has a highest score of 100 points. Naming ability test includes the following four items: object naming, spontaneous naming, sentence completion and response naming, with a total score of 100 points. Calculate the aphasia quotient scores based on the scores of WAB with the formula as follows: Aphasia quotient (AQ) scores = scores of (self-speech + listening comprehension/20 + retelling ability/10 + naming ability/10) * 2. Lower score of aphasia quotient means more serious aphasia.

Comparison of the ability of language communication in daily life between the two groups: Chinese functional communication profile (CFCP) was adopted to value the ability of daily life language communication of the patients. CFCP score includes 5 items [16]: Speaking (with a maximum score of 50 points), reading (with a maximum score of 20 points), comprehension (with a maximum score of 100 points), writing (with a maximum score of 40 points), and other (with a maximum score of 40 points). The score range is 0-250. Higher score means stronger communication ability.

Table 4. Comparison of CFCP scores ($\bar{x}$ ± sd)

Groups	Before intervention	After intervention	t	P
Control group	95.4±8.5	141.2±14.5	17.230	<0.001
Observation group	96.8±8.7	176.1±16.3	27.140	<0.001
t	0.728	10.120		
P	0.469	<0.001		

Note: CFCP: Chinese functional communication profile.

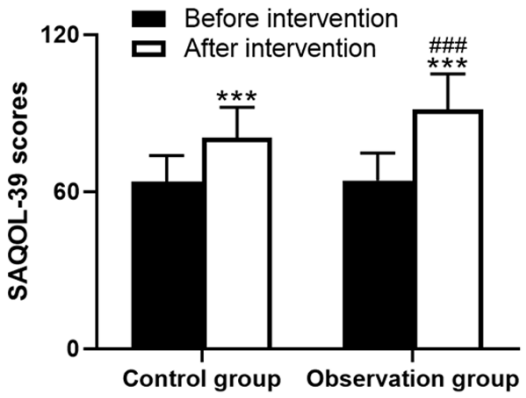

Figure 3. Comparison of SAQOL-39 scores. Compared with the same group before intervention, ***P<0.001; Compared with the control group after intervention, ###P<0.001. SAQOL-39: Stroke and aphasia quality of life scale-39.

Comparison of the quality of daily life between the two groups: Stroke and aphasia quality of life scale-39 (SAQOL-39) was used to value the quality of daily life. There are 39 items in the assessment of SAQOL-39 [17], including physical, communication and psychosocial aspects. SAQOL-39 is a 5-grade system. Higher score means better quality of life.

Comparison of the neurological function between the two groups: National institute of health stroke scale (NIHSS) was used to evaluate the neurological function of patients. NIHSS has 11 items, including consciousness level, gaze, visual field, facial paralysis, upper limb movement, lower limb movement, limb movement, sensation, language, dysarthria and neglect. The score range is 0-42. The higher the score is, the more serious the nerve damage is, and vice versa.

Statistical analysis

SPSS 23.0 software was used to analyze the collected data. The measurement data conforming to the normal distribution are represented by mean ± standard deviation ($\bar{x}$ ± sd), and the independent sample t-test is applied to the comparison between the two groups. The enumeration data is expressed as percentage or rate and chi square test is applied to the comparison between two groups. P<0.05 means there is a difference with statistical significance.

Results

Comparison of general data

There was no significant difference in age, sex ratio, onset time, basic diseases and other general data between the two groups (P>0.05). So the two groups are comparable. As shown in **Table 1**.

Comparison about the intervention effect of patients

In the control group, 3 cases were cured, 9 cases were markedly effective, 15 cases were effective, 13 cases were invalid, with a total effective rate of 67.5%. In the observation group, 8 cases were cured, 15 cases were markedly effective, 12 cases were effective, 5 cases were invalid, with a total effective rate of 87.5%. The difference of the total effective rate between the two groups was statistically significant (P=0.032). As shown in **Table 2**.

Comparison of AQ scores

AQ scores between the two groups have no significant difference before intervention (45.6± 6.8 vs 46.4±7.1). After intervention, the AQ scores of the two groups were both significantly elevated compared to before intervention with a statistically significant difference (P<0.001). After intervention, the AQ scores of the observation group was substantially higher than that of the control group (66.9±10.1 vs 60.2±9.4), also with significant difference (t=3.071, P= 0.003). As shown in **Figure 1** and **Table 3**.

Comparison of CFCP scores

Before intervention, no significant difference was found in CFCP scores between the two groups (95.4±8.5 vs 96.8±8.7). After intervention, the CFCP scores of the two groups were both significantly elevated (P<0.001). Besides, after intervention, the CFCP scores of the observation group was much higher than that of the control group, with statistical differences

Table 5. Comparison of SAQOL-39 scores ($\bar{x}$ ± sd)

Groups	Before intervention	After intervention	t	P
Control group	63.7±10.1	80.5±11.8	6.841	<0.001
Observation group	64.2±10.5	91.4±13.5	10.060	<0.001
t	0.217	3.845		
P	0.829	<0.001		

Note: SAQOL-39: stroke and aphasia quality of life scale-39.

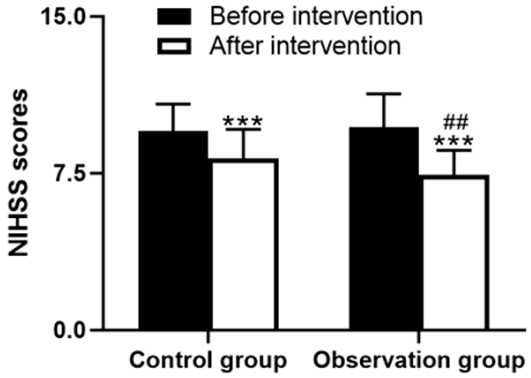

Figure 4. Comparison of NIHSS scores. Compared with the same group before intervention, ***P<0.001; Compared with the control group after intervention, ##P<0.01. NIHSS: National institute of health stroke scale.

(t=10.120, P<0.001). As shown in **Figure 2** and **Table 4**.

Comparison of SAQOL-39 scores

After intervention, the SAQOL-39 scores of the two groups were both clearly elevated with a significant difference (P<0.001). No significant difference exists in SAQOL-39 scores between the two groups before intervention (63.7±10.1 vs 64.2±10.5). However, after intervention, the SAQOL-39 scores of the observation group was sharply increased comparing to that of the control group with a significant difference (91.4± 13.5 vs 80.5±11.8, t=3.845, P<0.001). As shown in **Figure 3** and **Table 5**.

Comparison of NIHSS scores

Before intervention, no significant difference in NIHSS scores was found between the two groups (9.5±1.3 vs 9.7±1.6). After intervention, the NIHSS scores of the two groups were both largely decreased with significant difference (P<0.001). Compared with the patients in control group after intervention, the NIHSS scores of patients in the observation group was strongly reduced (8.2±1.4 vs 7.4±1.2), with statistical differences (t=2.744, P=0.008). As shown in **Figure 4** and **Table 6**.

Discussion

Aphasia is a kind of acquired language disorder syndrome, which is considered to be from the damage or loss of postnatal language learning ability caused by nervous system damage due to local pathological changes of brain tissue. Previous research pointed out that aphasia is one of the common sequelae and disability-causing diseases of patients with ACI [18]. Aphasia patients after ACI often have clear consciousness, but are often accompanied by oral expression obstacles, writing and reading ability reductions, hearing comprehension obstacles and so on, largely decreasing the communication ability of patients. Thus, how to effectively improve aphasia patients' language ability disorders is of great significance to improve the curative effect of ACI.

In recent years, with the continuous renewal of clinical nursing modes, medical nursing is playing more and more important roles in improving the therapeutic effects and prognosis of patients. Language rehabilitation training is considered to be one of the effective measures for the treatment of aphasia after ACI. Some studies have shown that timely language rehabilitation training for aphasia patients is conducive to both early mobilization of potential, and reorganization and reappearance of brain nerve function, thus improving language disorders [19]. Although language rehabilitation training plays an important role in the recovery of aphasia patients' language function, it still needs to be further improved for better clinical application [20]. Conventional language rehabilitation training only has limited improvement on aphasia patients and is far from optimal. In this study, compulsory rehabilitation training intervention model was applied to aphasia patients. Compared with conventional rehabilitation training, compulsory rehabilitation training has the following characteristics: a lot of training is conducted in a short time frame; it forces the patients to say expressions or words

Table 6. Comparison of NIHSS scores ($\bar{x}$ ± sd)

Groups	Before intervention	After intervention	t	P
Control group	9.5±1.3	8.2±1.4	4.304	<0.001
Observation group	9.7±1.6	7.4±1.2	7.273	<0.001
t	0.614	2.744		
P	0.541	0.008		

Note: NIHSS: National institute of health stroke scale.

which are usually avoided; and training content is related to daily life. The results of this study show that the patients in the observation group have much better improvement of aphasia degree than patients in the control group. Compulsory rehabilitation limits the use of non-verbal expressions such as gestures, writing, painting and so on. Through short-term and high-intensity language training, the damaged language function helps local brain tissue to be greatly repaired, which is consistent with the results reported by Rose et al [21].

WAB is a test tool of speech function, which mainly involves self-speech, listening comprehension, retelling and naming, etc. In previous studies, WAB has been employed as an evaluation scale for the diagnosis and treatment of aphasia. AQ score is calculated according to the test results of self-speech, listening comprehension, retelling and naming. The higher the AQ score is, the lighter the aphasia degree is. In addition, studies have confirmed that the CFCP scale has an objective role in the diagnosis and treatment of aphasia, and is suitable for the Chinese language environment [22]. Our study showed that the AQ scores and CFCP scores of the patients in the observation group who received compulsory rehabilitation were both significantly higher than those in the control group. Our above results indicate that the effects of compulsory rehabilitation training are significantly better than that of conventional rehabilitation training. The research of Pierce et al [23] also showed that compulsory rehabilitation training had obvious advantages in improving language function for aphasia patients.

The quality of daily life is one of the important indicators to evaluate the clinical efficacy which mainly includes subjective feeling and activity ability [24]. In our study, SAQOL-39 scale is used to value the life quality. Our results showed that the SAQOL-39 scores of the observation group were much higher than that of the control group, indicating that the compulsory rehabilitation can significantly improve the quality of daily life of aphasia patients after ACI. NIHSS scale reflects the neurological function of patients, which is also widely used in clinical practice. Our study showed that the NIHSS scale score of the observation group was much lower than that of the control group, indicating that compulsory rehabilitation can significantly improve the neurological function of aphasia patients. The possible reason is that compulsory rehabilitation training can stimulate the brain with high frequency and intensity in a short time, largely enhancing the speed of nerve cells to form new synapses and establish synaptic communication. Besides, compulsory rehabilitation training helps to maintain and improve the excitability of patients' nervous system, protects neurons, promotes the recovery of residual nervous system functions, and accelerates the reconstruction and regeneration of dendrites and axons [25].

There are also some limitations in this study, such as the small number of samples, being a single center study, and lacking of long-term follow-up results, etc. In our follow-up study, we plan to increase the number of samples and carry out the prospective study of multicenter randomized controls. Besides, we will further confirm our study by observing the changes of index values at different time points, exploring related effects on various types of aphasia patients and conducting long-term follow-up.

In conclusion, for aphasia patients after ACI, compulsory rehabilitation can significantly improve the degree of aphasia, improve the quality of daily life of patients and promote the recovery of neurological function, which is worthy of clinical promotion.

Disclosure of conflict of interest

None.

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