



Effect of rehabilitation training based on the ICF concept on the recovery of construction workers with craniocerebral trauma: a randomized study

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Background: Craniocerebral trauma is a common neurosurgical disease. In recent years, there has been a significant increase in craniocerebral injuries caused by accidental injuries of construction workers. We aimed to analyze the effect of International Classification of functioning, disability and health (ICF) concept rehabilitation training on the recovery of patients (construction workers) with craniocerebral trauma.

Methods: A total of 142 patients with craniocerebral trauma from construction sites were randomly divided into two groups. The control group (n=71) received routine rehabilitation training, and the ICF group (n=71) received ICF concept rehabilitation training. Before and after rehabilitation training, the NIHSS was used to evaluate neurological function, the MMSE was used to evaluate cognitive function, the FMA method was used to evaluate limb motor ability, the BI index was used to evaluate self-care ability, and the ICF scale was used to evaluate the rehabilitation outcome.

Results: There were no significant differences in general information and NIHSS, MMSE, FMA, and BI scores before rehabilitation training between the control and ICF groups. After rehabilitation training, NIHSS scores decreased significantly, while MMSE, FMA, and BI scores increased significantly compared with the control group.

Conclusions: ICF concept rehabilitation training significantly improved neurological function and cognitive function, enhanced the motor function of limbs, improved self-care ability, and led to a better rehabilitation outcome of patients with craniocerebral trauma.

Trial registration: Chinese Clinical Trial Registry ChiCTR1800018819.

Keywords: International Classification of functioning, disability and health (ICF); rehabilitation training; craniocerebral trauma

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Introduction

The “International Classification of Functioning, Disability and Health” (ICF) is a new health classification system developed by the World Health Organization (WHO) in accordance with the development of health services in countries around the world since 1996. The classification system of disability was promoted worldwide in 2001, and the application of ICF to research, testing, and reporting in the field of health and disability was advocated (1,2). Since the second national sample survey of persons with disabilities in our country in 2006, some of the disability classification indicators in the ICF have been used as a reference, and academic circles have continuously deepened the exploration of ICF, not only applying it in clinical practice, but also in special education and the disabled. Applications have been launched in areas such as services (3).

With the vigorous development of our country’s economy, the rapid development of the construction industry has greatly increased the demand for workers. In the process of working on construction sites, traumatic brain injuries caused by violent external forces occur frequently (4). Hemorrhage, changes in intracranial pressure, hypoxia, shock, and other serious threats pose risks to the lives and safety of workers after craniocerebral trauma, and it is also very likely to cause disability (5). Although the treatment of craniocerebral trauma continues to improve, reasonable and effective rehabilitation training is still an important part of improving the rehabilitation outcomes of patients with craniocerebral trauma (6). Among them, rehabilitation training based on the concept of ICF plays a role in the rehabilitation of craniocerebral trauma, and this role of is worthy of further in-depth study.

In this study, 142 patients with craniocerebral trauma from construction sites admitted to our hospital from January 2018 to January 2020 were randomly divided into two groups and received conventional rehabilitation training or ICF concept rehabilitation training. The National Institute of Health Stroke Scale (NIHSS) was used to assess neurological function, the mini-mental state examination (MMSE) was used to assess cognitive function, the Fugl-Meyer score (FMA) method was used to assess limb motor ability, and the Barthel index (BI) score was used to assess self-care ability. We analyzed the effect of ICF concept rehabilitation training on the rehabilitation of patients with craniocerebral trauma from construction work

in order to provide a reference for the application of ICF in the rehabilitation of craniocerebral trauma.

We present the following article in accordance with the CONSORT reporting checklist (available at <https://dx.doi.org/10.21037/apm-21-993>).

Methods

General information

A total of 142 patients with craniocerebral trauma from construction sites were selected in Sichuan Academy of Medical Sciences and Sichuan Provincial People’s Hospital from January 2018 to January 2020. The inclusion criteria were: (I) head CT or MRI diagnosis of head trauma; (II) no other mental disorders or dementia; (III) patients or family members could sign informed consent. All procedures performed in this study involving human participants were in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the ethics committee of Sichuan Academy of Medical Sciences and Sichuan Provincial People’s Hospital (No.: 2017082) and informed consent was taken from all the patients.

Intervention method

The 142 cases of craniocerebral trauma patients who were included in the study were in a stable condition and could undergo rehabilitation training. They were randomly divided into two groups, namely the control group and the ICF group. There were no significant differences in general clinical data such as gender and age between the two groups. Both groups of rehabilitation training were conducted for 8 weeks, and patients were evaluated before and after the training.

The 71 patients in the control group received routine rehabilitation training as follows: training patients to change the positions of their limbs regularly and put them in a good position; passive or active movement of the limbs and joints by turning the body, sitting up, standing, walking, balance, trunk control, and gait training; training patients’ daily life abilities by eating, dressing, using the toilet, washing their face, and going up and down stairs.

The 71 patients in the ICF group received ICF concept rehabilitation training. According to the ICF core element scale, the patient’s condition was thoroughly studied and comprehensively analyzed, and individualized rehabilitation training was carried out after

the best patient-centered rehabilitation training program was formulated under the guidance of the ICF core elements. One-to-one rehabilitation training guidance was completed by full-time staff, and the amount of training was adjusted at any time according to the patient's condition. There was active communication with patients during the training, and psychological counseling was performed well.

Evaluation indicators

NIHSS assessment of neurological function

According to the NIHSS assessment, the neurological function of patients was evaluated. The total score was 45 points, and the higher the score, the more serious the injury. The 0–15 range was divided into mild nerve function damage, 16–30 was divided into moderate nerve function damage, and 31–45 was divided into severe nerve function damage.

MMSE assessment of cognitive function

According to the MMSE, the cognitive function of patients was assessed. The total score was 30 points. The higher the score, the stronger the cognitive ability. The 0–9 range was divided into severe cognitive impairment, 10–20 was divided into moderate cognitive impairment, 21–26 was divided into mild cognitive impairment, and 27–30 was divided into normal.

FMA method to assess limb movement ability

According to the FMA method, the patient's limb movement ability was evaluated. The total score was 100 points. The higher the score, the better the physical ability. The 0–50 range was divided into severe movement disorder, 50–85 was divided into obvious movement disorder, 86–95 was divided into moderate movement disorder, 96–99 was divided into mild movement disorder, and 100 was good.

BI index assessment of self-care ability

According to the BI score method, the self-care ability of patients was evaluated. The total score was 100 points. The higher the score, the lower the degree of dependence. The 0–25 range indicated an inability to take care of themselves, 26–40 meant severe dependence, 41–60 meant moderate dependence, 61–99 meant mild dependence, and 100 was good.

ICF rating scale to assess the rehabilitation situation

According to the ICF rating scale, the patient's body function (b110 consciousness function, b130 energy and drive system, b152 emotional function), body structure (s110 brain structure), and activity and participation (d175 for solving the problem, d230 for daily affairs, and d310 for communication-receiving-verbal messages) were evaluated in 7 categories. The general metric score for each category was 0–4 points, and 0 was for barrier-free, 1 was for mild barrier, 2 was for moderate barrier, 3 was for severe barrier, and 4 was for complete barrier. In addition, 8 meant that the severity of the injury was uncertain, and 9 meant that it was not applicable to the patient.

Statistical analysis

The data was analyzed statistically using SPSS 22.0 software. Measurement data were expressed as mean \pm standard deviation ($\bar{x} \pm s$), and analyzed by the *t* test. Differences of $P < 0.05$ were statistically significant.

Results

Flow chart and baseline data for patients with craniocerebral trauma

In this study, the flow chart of 142 patients with craniocerebral trauma participating in conventional rehabilitation training and ICF rehabilitation training is shown in *Figure 1*. The 142 patients who met the inclusion criteria were randomly divided into two groups, and 71 of each type received conventional rehabilitation training and ICF Concept Rehabilitation Training. Before and after training, NIHSS was used to assess neurological function, MMSE to assess cognitive function, FMA method to assess physical ability, BI index to assess self-care ability, and ICF scale to assess the outcome of rehabilitation. Analysis of patients' baseline data showed that there were no significant differences in age, gender, height, and weight between the two groups (*Table 1*).

The impact of ICF concept rehabilitation training on the NIHSS scores of patients with craniocerebral trauma

The NIHSS was used to evaluate the neurological damage of the 142 patients with head injuries before and after rehabilitation training (*Table 2*). The results showed that there was no significant difference between the control

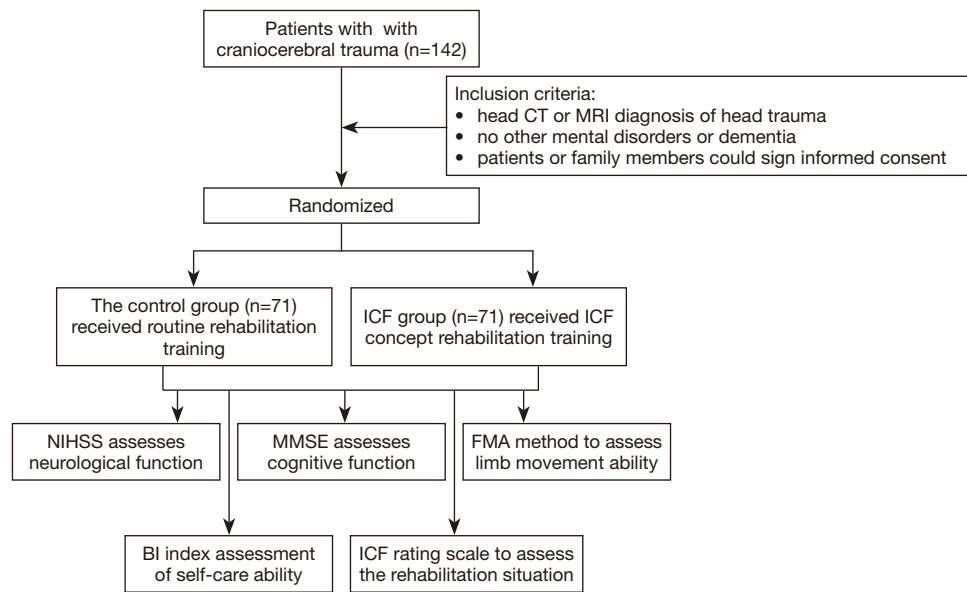


Figure 1 Process of 142 patients with craniocerebral trauma in the study. ICF, International Classification of functioning, disability and health.

Table 1 Comparison of baseline material in 142 patients with craniocerebral trauma

Group	Age (year)	Men/women	Weight (cm)	Height (kg)
Control group (n=71)	47.6±5.4	42/29	166.9±7.2	64.9±6.2
ICF group (n=71)	48.0±5.3	43/28	167.9±7.4	64.6±5.3
P	0.6825	0.4751	0.4274	0.7952

ICF, International Classification of functioning, disability and health.

Table 2 Effect of ICF concept rehabilitation training on the NIHSS scores of patients with craniocerebral trauma

Group	Before rehabilitation training	After rehabilitation training	t	P
Control group (n=71)	33.68±2.29	15.38±1.66	6.47	0.0029
ICF group (n=71)	34.02±2.34	9.34±1.22	9.36	0.0007
t	0.10	2.94		
P	0.9223	0.0425		

ICF, International Classification of functioning, disability and health; NIHSS, National Institute of Health Stroke Scale.

group and the ICF group in the NIHSS score before the rehabilitation training. After conventional rehabilitation training and ICF rehabilitation training, NIHSS scores were significantly reduced. After rehabilitation training, the NIHSS score of the ICF group was significantly lower than that of the control group. Therefore, ICF concept rehabilitation training can significantly alleviate the nerve function damage of patients with head injury.

The impact of ICF concept rehabilitation training on the MMSE scores of patients with craniocerebral trauma

There was no significant difference in the MMSE scores of the 142 patients with craniocerebral trauma before receiving rehabilitation training. There was no difference in the cognitive ability of the two groups of patients before receiving rehabilitation training. The cognitive ability scores of the two groups of patients increased significantly

Table 3 Effect of ICF concept rehabilitation training on the MMSE scores of patients with craniocerebral trauma

Group	Before rehabilitation training	After rehabilitation training	<i>t</i>	P
Control group (n=71)	10.24±1.34	20.24±1.16	5.64	0.0049
ICF group (n=71)	10.41±1.43	25.61±1.31	7.86	0.0014
<i>t</i>	0.07	3.08		
P	0.9349	0.0371		

ICF, International Classification of functioning, disability and health; MMSE, mini-mental state examination.

Table 4 Effect of ICF concept rehabilitation training on the FMA scores of patients with craniocerebral trauma

Group	Before rehabilitation training	After rehabilitation training	<i>t</i>	P
Control group (n=71)	20.84±3.94	61.27±3.08	8.08	0.0013
ICF group (n=71)	20.51±3.81	74.07±2.47	11.81	0.0003
<i>t</i>	0.06	3.24		
P	0.9548	0.0316		

ICF, International Classification of functioning, disability and health; FMA, Fugl-Meyer score.

Table 5 Effect of ICF concept rehabilitation training on the BI scores of patients with craniocerebral trauma

Group	Before rehabilitation training	After rehabilitation training	<i>t</i>	P
Control group (n=71)	23.67±4.18	70.14±2.23	9.80	0.0006
ICF group (n=71)	24.01±4.61	87.86±3.77	10.72	0.0004
<i>t</i>	0.05	4.04		
P	0.9591	0.0156		

ICF, International Classification of functioning, disability and health; BI, Barthel index.

after rehabilitation training, but the cognitive ability of the ICF group was better than that of the control group, as shown in *Table 3*.

The impact of ICF concept rehabilitation training on the FMA scores of patients with craniocerebral trauma

The FMA score results of the 142 patients showed that the physical ability of limbs before rehabilitation training was similar between the two groups (*Table 4*). After rehabilitation training, the FMA scores increased significantly. The FMA score of the ICF group was significantly higher than that of the control group, suggesting that ICF rehabilitation training has a more significant effect on improving the physical ability of patients with craniocerebral trauma.

The impact of ICF concept rehabilitation training on the BI scores of patients with craniocerebral trauma

The BI index was used to assess the self-care ability of the 142 patients (*Table 5*). The results show that rehabilitation training based on the concept of ICF can more significantly improve the self-care ability of patients, and its effect was better than conventional rehabilitation training.

The influence of ICF concept rehabilitation training on the results of the ICF scale in patients with craniocerebral trauma

After rehabilitation training, according to the 7 categories in the ICF, the patient's rehabilitation outcome was evaluated in terms of the patient's physical function (b), body structure (s), and activities and participation (d)

Table 6 Effect of ICF concept rehabilitation training on the ICF scale results of patients with craniocerebral trauma

ICF code	ICF category	Control group (n=71)	ICF group (n=71)	t	P
b110	Consciousness function	1.21±1.09	0.85±0.78	2.26	0.0252
b130	Energy and drive system	1.32±0.98	0.88±0.64	3.17	0.0019
b152	Affective function	1.27±0.94	0.83±0.62	3.30	0.0013
s110	Brain structure	0.98±0.62	1.04±1.00	0.43	0.6681
d175	Solve the problem	1.29±0.93	0.91±0.86	2.53	0.0126
d230	Carry out daily affairs	1.67±0.84	1.11±0.92	3.79	0.0002
d310	Communicate-Receive-Oral Message	0.94±0.73	0.67±0.50	2.57	0.0112

ICF, International Classification of functioning, disability and health.

(Table 6). There was no significant difference in the body structure (s110 brain structure) between the two groups, but the body functions (b110 consciousness function, b130 energy and drive system, b152 emotional function) and activities and participation (d175 to solve problems, d230 to carry out daily affairs, d310 communication-reception-verbal message) were better than the control group.

Discussion

With the rapid development of our country's construction industry, the situation of construction workers with craniocerebral trauma is also increasing. The mortality and disability rate of craniocerebral trauma is extremely high, which will cause great loss and pressure to society and the patients' families, and the surviving patients with craniocerebral trauma are also painful and sad (7). Patients will not only experience changes in intracranial pressure, blood pressure, breathing, pulse, and other vital signs, but also changes in nervous system signs such as convulsions, language disorders, and physical disorders, which greatly affect the patients' physical and mental health (8). Therefore, in order to reduce the disability rate of patients and improve the physical function of patients, rehabilitation treatment and functional exercise are very important for patients with craniocerebral trauma (9).

As a universal functional assessment tool, the ICF is currently recognized as a standard language for describing health conditions (10). In recent years, the research and application status of ICF has fully demonstrated its positive effect on the development of the causes of the disabled. It not only establishes and perfects the concept of the "social model" for persons with disabilities, but also contributes outstanding professional strength to the

construction of a barrier-free social environment. It can also provide effective and feasible reference concepts for the rehabilitation of the disabled on the basis of continuously optimizing the service system for the disabled (11). In the ICF terminology system, function is a general term that integrates five components: body function, body structure, and activity and participation, environmental factors and personal factors. Physical function not only refers to the physiological functions of the body's various systems, but also includes mental functions. The body structure is the anatomical parts of the body, such as organs, limbs, and their components. Activities and participation respectively represent the individual and social aspects of function, that is, the individual performs an action or task, or participates in a life situation. The function of an individual is not only the result of disease, but also the result of the interaction between health and background factors (environmental and personal factors). Background factors will promote or hinder function (12). Therefore, rehabilitation training based on the concept of ICF can more specifically promote the functional recovery of patients with craniocerebral trauma. This study analyzed the impact of rehabilitation training based on the ICF concept on the rehabilitation of construction workers with craniocerebral trauma. The results show that the rehabilitation training effect of the ICF concept is significantly better than conventional rehabilitation training.

As a classic evaluation method, the NIHSS method is widely used in the assessment of neurological function of craniocerebral trauma, and its score can effectively reflect the degree of neurological damage in patients with craniocerebral trauma (13). The results of this study show that the higher NIHSS values of patients with craniocerebral trauma can be significantly reduced after

rehabilitation training. Specifically, rehabilitation training based on the ICF concept is more effective in repairing the neurological damage of patients with craniocerebral trauma. After craniocerebral trauma, the MMSE is often used to evaluate the cognitive function of patients. The physical ability of limbs is often evaluated by the FMA method. The BI index is the most classic tool for evaluating the self-care ability of patients. The higher the scores of the above three evaluation methods, the better the rehabilitation outcome of the patient in terms of cognitive function, limb movement ability, and self-care ability (14,15). The results of this study suggest that rehabilitation training can significantly increase the values of the MMSE, FMA, and BI in patients with craniocerebral trauma. However, rehabilitation training based on the ICF concept improves the cognitive function, motor ability of limbs, and self-care ability of craniocerebral trauma patients significantly better than conventional rehabilitation training.

In summary, the results of this study suggest that, compared with conventional rehabilitation training, rehabilitation training based on the ICF concept has a good effect on the functional recovery of construction workers from craniocerebral trauma. The rehabilitation outcome is better than conventional rehabilitation training, and it is worthy of being widely promoted and applied in clinical practice.

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Footnote

Reporting Checklist: The authors have completed the CONSORT reporting checklist. Available at <https://dx.doi.org/10.21037/apm-21-993>

Trial Protocol: Available at <https://dx.doi.org/10.21037/apm-21-993>

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Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at <https://dx.doi.org/10.21037/apm-21-993>). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All procedures performed in this study involving human participants were in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the ethics committee of Sichuan Academy of Medical Sciences and Sichuan Provincial People's Hospital (No.: 2017082) and informed consent was taken from all the patients.

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