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Original Article

Effect of Taichi-oriented exercise rehabilitation on the quality of life of patients with acute myocardial infarction after interventional therapy: a retrospective study

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Abstract: Objective: Retrospectively analyze and summarize the effect of Taichi-oriented exercise rehabilitation on cardiac function of patients with acute myocardial infarction (AMI) after interventional therapy. Methods: A retrospective study was performed on 59 patients with the first episode of AMI after interventional surgery who were admitted to the Department of Cardiology in the Shanghai Changzheng Hospital from July 2015 to June 2016. According to the different methods of exercise intervention, the patients were divided into the Taichi exercise group (n=30) and the routine exercise group (n=29). Patients in the routine exercise group received routine exercise nursing, and those in the Taichi exercise group were given the exercise program with Taichi as the core category. Baseline data were collected from all patients, including the cardiac function, quality of life and sense of coherence (SOC) before the intervention, as well as 3 months and 6 months after the intervention. The two groups of patients were compared in the aspects of the baseline data, the cardiac function, quality of life and SOC before and after the intervention. Results: There was no significant difference between clinical data of the two groups (P>0.05), indicating the comparability between the groups. According to the inter-group comparison of the Taichi exercise group and the routine exercise group, there were statistically significant differences in other indexes between groups (all P<0.05), except in stem cell mobilization level 3 months after the intervention (P=0.1415), emotional role function in the quality of life (P>0.05), and comprehensibility in sense of coherence (SOC) (P>0.05). Conclusion: Taichi-centered exercise rehabilitation program can obviously improve the heart function, the quality of life, and the effect of cardiac rehabilitation (CR) in patients with AMI after interventional therapy.

Keywords: Taichi exercise, acute myocardial infarction, cardiac rehabilitation, exercise rehabilitation

Introduction

Acute myocardial infarction (AMI) refers to acute myocardial necrosis due to prolonged and severe myocardial ischemia. Percutaneous coronary intervention (PCI) has been accepted as an effective method for the treatment of AMI at present. It can rapidly restore the blood circulation of the coronary artery, improve myocardial ischemia and save cardiac function. However, PCI cannot completely eliminate potential pathogenic factors causing atherosclerosis [1]. Unhealthy lifestyle and cardiovascular risk factors can accelerate the process of coronary restenosis, and patients may still develop angina pectoris again or even myocardial infarction, which will affect the prognosis [2]. Therefore, cardiac rehabilitation (CR) has been considered as the key to sustainable treatments for patients with cardiovascular diseases. The report of the World Health Organization Expert Committee on Rehabilitation of Patients with Cardiovascular Diseases has proposed that the purpose of CR is to improve cardiac function, alleviate or reduce symptoms caused by physical activity, relieve inappropriate weakness, and enable patients with heart diseases to return to the society. Massive data have documented that scientific CR scheme can promote the cultivation of healthy behavior

and significantly reduce the incidence of cardiovascular diseases, their recurrences and adverse events [3-5].

Critically, exercise and the core of CR have been widely confirmed useful [6-8], which can reduce the mortality of various cardiovascular diseases by about 20-30%. Physical activity/exercise training can reduce the risk of cardiovascular diseases/coronary heart disease, which is independent of drug and nutritional interventions. Therefore, scientific exercise program plays an important role in the rehabilitation of AMI patients after intervention.

Nevertheless, at present, the majority of exercise rehabilitation models in countries except China are carried out in cardiac rehabilitation centers or rehabilitation clinics. The professional doctors and therapists in cardiac rehabilitation centers guide patients to take safe exercise and improve their exercise ability through rehabilitation exercise equipment and cardiac monitoring equipment. However, the participation and compliance rate is low due to high rehabilitation costs. Moreover, in China, there are problems even more serious in exercise rehabilitation, which are manifested in the lack of scientific evidence-based nursing research and systematic exercise rehabilitation program for PCI patients with AMI. Therefore, there is still a long way to go to promote the development of CR nursing in China.

"Taichi" is a type of body-building movement based on the cultural connotation of "Taichi" founded by the Chinese thousands of years ago. Different from the general Chinese boxing, Taichi is characterized by light, quick and flexible movements with the emphasis on systemic coordination. Practicing Taichi can promote metabolism and improve the blood supply of the cardiovascular system to improve the condition of certain chronic diseases in particular. Taichi can regulate the psychological state of patients with scientific movements following the rehabilitation concept of integration of motion and quietness and cultivation of both the mind and the body. Similar findings have been reported by a large number of studies at home and abroad [9-12], which supports that Taichi can bring down the practitioner's blood pressure and increase physical sensitivity, balance and quality of life, thereby achieving the effect of rehabilitation.

In this study, we retrospectively analyzed the impact of Taichi-oriented exercise rehabilitation program on the cardiac function and quality of life of AMI patients after intervention. It is expected to provide a clinical basis for the rehabilitation effect of patients with AMI after an intervention.

Clinical data

Source of subjects

The study subjects were enrolled from Shanghai Changzheng Hospital and the ethics committee of Shanghai Changzheng Hospital approved this study (Ethical statement approval number: GZYB-0042015-36). A total of 59 patients with the first episode of AMI who underwent intervention in the Department of Cardiology in Shanghai Changzheng Hospital from July 2015 to June 2016 were retrospectively enrolled.

Inclusion criteria

(1) Patients who met the diagnostic criteria of AMI [13]; (2) patients with stable condition and without serious complications after PCI; and (3) patients with complete information.

Exclusion criteria

(1) Patients who suffered from acute systemic disease or had a fever over 38°C; (2) patients with cardiac complications, such as severe arrhythmia, congestive heart failure, cardiogenic shock, etc.; (3) patients with hepatic and renal dysfunction, and anemia; and (4) high-risk patients according to the risk stratification of CR [14].

Experimental methods

Grouping

According to different methods of exercise intervention, the patients were divided into the routine exercise group (n=29) and the Taichi exercise group (n=30).

Intervention measures

Routine nursing measures were taken for patients from both groups, including medication, health education, perioperative care and mental nursing. ① Medications covered nitrates, anticoagulants, antiplatelet agents, statins,

β-receptor blockers, ACE-I or ARB, diuretics, aldosterone antagonists, etc., and the dosage was adjusted by the doctor on the basis of the condition of the patients. ② Health education mainly comprised of controlling the risk factors of coronary heart disease, the treatment of angina pectoris, the precautions and adverse reactions of taking medicine, self-monitoring, etc. ③ Perioperative care included postoperative attention and diet instruction, etc. ④ Mental nursing consisted of communicating with patients and listening to their complaints patiently. Appropriate use of support, encouragement, comfort, distraction and other ways can give psychological counseling, reduce the psychological burden, and enhance their confidence in the fight against disease.

Routine exercise group

Patients in the routine exercise group received routine exercise education. There was no special education during the hospitalization. Before being discharged from the hospital, patients were trained to walk in the morning or evening to achieve the best exercise state with the target heart rate. The initial exercise time was 5-10 min, which was gradually increased by 5-10 min according to physical strength of the patient. Exercise could be continued after proper rest. Total exercise time should be at least 30 min, and walking speed should be kept at a uniform level of 80-100 pace/min. After a walking distance of 500 m, daily walking distance could be increased by 100 m every two days and maintained at least 700 m per day in the later stage.

Taichi exercise group

In the Taichi exercise group, patients were treated in line with the Taichi-oriented exercise rehabilitation program. The nurse was responsible for teaching Taichi movements during the hospitalization and guiding patients to perform out-of-hospital practice after discharge. Simultaneously, patients were provided with exercise rehabilitation books, Taichi exercise records and video discs. Besides, patients were taught to use WeChat to communicate test results. Telephone follow-up was performed by the primary nurse every week, and outpatient follow-up was conducted every 3 and 6 months. Individualized guidance was given on the problems existing in the rehabilitation process of the patients during follow-up, and the rehabilitation effect was evaluated afterwards.

In-hospital exercise program: Absolute bed rest should be guaranteed on the first day after surgery, associated with passive activity of the joint and major muscle group, and health education of the superiority of Taichi was also carried out in those patients. Two and three days after the operation, the patients could have some active movements such as standing by the bedside. In the meantime, the patients were tutored of the basic techniques of Taichi by watching videos. On the fourth day after surgery, patients were allowed to have slow walking for a distance of 75-100 m in the corridor, accompanied with the feeling practice of "Yunshou Taichi". On the fifth day postoperatively, patients were allowed to walk 100-200 m or walk up and down stairs of one floor and the first and the second styles of "Yunshou Taichi" were taught during that period. On the sixth and seventh day after operation, patients were allowed to walk 400-500 m or walk up and down stairs of two floors and an assessment of the grasping of "Yunshou Taichi" was made in combination with guidance before discharge.

The exercise program was carried out under close supervision of the doctor. Exercise should be stopped immediately in case of any following event: ① Heart rate ≥110 times/min. ② Angina pectoris, chest tightness, heart palpitations and other symptoms. ③ ST segment depression ≥0.1 mV or elevation of 0.2 mV. ④ Systolic pressure rising to 200 mmHg, or drop ≥10 mmHg. ⑤ Severe arrhythmia. Afterwards, the exercise procedures shall be adjusted accordingly to the specific condition of patients.

Out-of-hospital exercise program: At discharge, the patient was instructed to have Taichi exercise 3 times/week, 25-55 min/time, and the specific time was arranged by the patient individually. Among them, the warm-up and the tidy up time for Taichi was 15 min, respectively, and the time for Taichi was 30 min. The exercise was recommended to be performed in accordance with the "Yunshou Taichi" video for AMI patients after PCI. Ideally, exercise intensity was 60% of the maximum heart rate. In fact, the comfort of the participants should be ensured. The movement should be slowed

down, and the difficulty/intensity should be reduced if dyspnea occurred. Participants should have a rest or stop exercising at any time if they have any pain or discomfort.

Measurements

Cardiac function index

The cardiac function was evaluated by a 6-minute walk test (6MWT), concentration of pro-B-type natriuretic peptide (Pro-BNP) in plasma, and stem cell mobilization level. The 6MWT was used to record the distance a patient could walk on foot at the fastest speed within 6 minutes. A longer walking distance indicates a better cardiac function of the patient. Furthermore, the Pro-BNP level has generally been considered as a good serum biomarker reflecting cardiac function and cardiovascular disease. In this study, the level of Pro-BNP in plasma was detected by a blood test. In addition, stem cell is an important source of cardiomyocyte proliferation. The effectiveness of stem cell mobilization is of great significance for myocardial repair after AMI. The number of stem cells such as c-kit+ or sca-1+CPSs in peripheral blood was detected by flow cytometry. A higher level indicates a better stem cell mobilization.

Quality of life assessment

The MOS 36-item short-from health survey (SF-36) scale was used to evaluate the quality of life of patients. The SF-36 scale included 8 dimensions: body function, physiological function, physical pain, general health, vitality, social function, emotional function and mental health. The quality of life score was the sum of the scores in eight dimensions. Increasing scores suggested improvements in the quality of life, and decreasing scores indicated deterioration in the quality of life [15].

SOC assessment

Sense of Coherence 13-item (SOC-13) scale was used to assess the SOC of the patients. SOC represented the level of psychological protection mechanism composed of comprehensibility, manageability and meaningfulness [16]. The scale consisted of 13 items, which were divided into three dimensions: comprehensibility, manageability and meaningfulness. Each dimension was made of 4-5 items. Grading of all the items adopted a 7-point checklist; five of them were reverse-scored items. A higher score might indicate higher level of SOC.

Statistical analysis

All data were analyzed using the SAS 9.4 statistical analysis software. A two-tailed test was used for statistical analysis, with the level of significance set as $P<0.05$. According to the distribution of quantitative data, continuous variables were statistically described by mean ± standard deviation (SD) or median (Q1, Q3), and categorical variables were expressed by N (%). The comparisons of demographic data and other basic value indicators were realized by using t-test/nonparametric test (depending on the distribution of quantitative data) or test/correction test/Fisher exact probability method (qualitative data) or CMH test (ordinal multi-classification data).

With the measured values of each index of the two groups before intervention as the baseline value for data analysis, hypothesis tests were conducted 3 and 6 months after the intervention. Among them, paired t-test or signed rank test were used for intra-group comparison of the changes of each outcome index before and after the intervention, while two independent sample t-test or rank sum test was used for inter-group comparison of the differences in changes between groups in each intervention stage. In the presence of an imbalance between groups in demographic data or baseline values, analysis of covariance was conducted for the primary outcome indicators, and the differences between groups were compared with demographic indicators and baseline values as covariates.

The difference was statistically significant when $P<0.05$.

Results

General information

This study recruited 59 patients with the first attack of AMI, including 33 male patients and 26 female patients, aged 45 to 74 years, with a mean age of 56.58±7.81 years. Comparison of general information such as gender, age, educational level, body mass index (BMI), marriage status, payment of medical expenses, family income, and site of myocardial infarction showed that there was no significant difference

Table 1. Comparison of general information between the two groups

Items	Group	Taichi exercise group (n, %)	Routine exercise group (n, %)	X^2/t	*P* value
Gender	Male	16 (53.33)	17 (58.62)	0.17	0.6826
	Female	14 (46.67)	12 (41.38)		
Age	≤50 years old	3 (10.00)	2 (6.90)	0.06	0.8029
	51-60 years old	12 (40.00)	12 (41.38)		
	61-70 years old	12 (40.00)	12 (41.38)		
	>70 years old	3 (10.00)	3 (10.34)		
Educational level	Junior high school and below	17 (56.67)	17 (58.62)	0.09	0.7662
	Senior middle school	10 (33.33)	10 (34.48)		
	University and above	3 (10.00)	2 (6.90)		
BMI	<20	2 (6.67)	2 (6.90)	0.00	0.9460
	20-25	17 (56.67)	16 (55.17)		
	25-30	9 (30.00)	9 (31.03)		
	30-35	2 (6.67)	2 (6.90)		
Marriage status	Married	27 (90.00)	27 (93.10)	0.00	1.0000
	Divorced	3 (10.00)	2 (6.90)		
Payment methods for medical expenses	Self insurance	5 (16.67)	4 (13.79)	0.00	1.0000
	Medical insurance	25 (83.33)	25 (86.21)		
Family monthly income (yuan/person)	≤4000	12 (40.00)	13 (44.83)	0.00	0.9672
	4000-8000	13 (43.33)	10 (34.48)		
	≥8000	5 (16.67)	6 (20.69)		
Myocardial infarction site	Anterior wall	6 (20.00)	7 (24.14)	0.22	0.9751
	Inferior wall	8 (26.67)	8 (27.59)		
	Anteroseptal	5 (16.67)	4 (13.79)		
	Posterior wall	11 (36.67)	10 (34.48)		
Combination of other diseases	No	18 (60.00)	18 (62.07)	0.03	0.8706
	Yes	12 (40.00)	11 (37.93)		
Combined hypertension	Without	22 (73.33)	22 (75.86)	0.05	0.8235
	With	8 (26.67)	7 (24.14)		
Combined diabetes	Without	24 (80.00)	23 (79.31)	0.00	0.9475
	With	6 (20.00)	6 (20.69)		
Daily exercise	No	26 (86.67)	24 (82.76)	0.00	0.9559
	Yes	4 (13.33)	5 (17.24)		
Mode of exercise	Walking	2 (50.00)	3 (60.00)	.	1.0000
	Jogging	2 (50.00)	2 (40.00)		
Risk stratification	Low-risk	18 (60.00)	17 (58.62)	0.01	0.9141
	Moderate-risk	12 (40.00)	12 (41.38)		

between the groups (P>0.05), suggesting a comparability between the groups. Detailed information is presented in **Table 1**.

Comparison of 6MWT distance between the groups

The results showed that the 6MWT distance between groups was not statistically different before the intervention (P=0.4383). Furthermore, the 6MWT distance 3 months and 6 months after intervention was significantly prolonged as compared with that before intervention (P<0.0001). Inter-group comparison results indicated that the distance was significantly longer in the Taichi exercise group than that of the routine exercise group at postoperative 3rd and 6th months (P<0.0001), as shown in **Table 2**.

Comparison of Pro-BNP between the groups

The results showed that there was no statistical difference in Pro-BNP before intervention between the groups (P=0.6629). Compared with the data before intervention, the Pro-BNP

Table 2. A comparison of 6 minutes walking test distance (m) between the two groups ($\bar{x}$±sd)

Group	n	Before intervention	3 months after intervention	Difference between groups	6 months after intervention	Difference between groups
Taichi exercise group	30	251.97±26.55	320.43±28.01	68.47±17.04*	373.03±34.32	121.07±29.49*
Routine exercise group	29	246.45±27.76	270.17±25.36	23.72±15.63*	287.24±36.16	40.79±30.82*
t		0.78		10.50		6.29
P value		0.4383		<0.0001		<0.0001

Note: *Comparison within groups before intervention, P<0.0001.

Table 3. The comparison of Pro-BNP (pg/ml) between the two groups ($\bar{x}$±sd)

Group	n	Before intervention	3 months after intervention	Rate of change between groups	6 months after intervention	Rate of change between groups
Taichi exercise group	30	1208.23±486.14	597.43±298.14	51.07±11.65*	259.67±141.45	78.62±7.07*
Routine exercise group	29	1148.10±566.02	660.03±400.15	42.59±14.88*	382.41±224.53	66.16±9.84
t		0.44		2.44		5.60
P value		0.6629		0.0177		<0.0001

Note: *Comparison within groups before intervention, P<0.0001.

Table 4. The comparison of stem cell mobilization levels (cell/100 leu) between the two groups ($\bar{x}$±sd)

Group	n	Before Intervention	3 months after intervention	Difference between groups	6 months after intervention	Difference between groups
Taichi exercise group	30	0.02±0.01	0.05±0.01	0.02±0.01*	0.06±0.02	0.04±0.02*
Routine exercise group	29	0.02±0.00	0.04±0.01	0.02±0.01*	0.04±0.01	0.02±0.01*
t		1.43		1.49		2.08
P value		0.1585		0.1415		0.0371

Note: *Comparison within groups before intervention, P<0.0001.

level significantly decreased 3 months and 6 months after intervention in both groups (all P<0.0001). Furthermore, the level of Pro-BNP significantly decreased in the Taichi exercise group compared with that of the routine exercise group at postoperative 3rd and 6th months (P=0.0177, and P<0.0001, respectively), as shown in **Table 3**.

Comparison of stem cell mobilization levels between the groups

The results showed that there was no significant difference in stem cell mobilization between the groups before intervention (P= 0.1585). However, the stem cell mobilization in both groups was statistically improved 3 months and 6 months after intervention (P<0.0001), and the stem cell mobilization level was significantly higher in the Taichi exercise group compared with that of the routine exercise group at postoperative 6th month (P=0.0371) but without statistical difference at postoperative 3rd month (P=0.1415), as shown in **Table 4**.

Comparison of the total score of quality of life and the scores of each dimension between the groups

According to the results (**Table 5**), the overall QoL of the Taichi exercise group was significantly better than that of the routine exercise group at 3 months and 6 months after intervention (P<0.001) except for the dimension of emotional role (P>0.05).

Comparison of the total score of SOC and the scores of each dimension between the groups

After the analysis, as described in **Table 6**, the results showed that SOC in the Taichi exercise group at 3 months and 6 months after intervention was significantly better than that of the routine exercise group (P<0.001) except for the dimension of comprehensibility (P>0.05).

Discussion

In our study, the cardiac function of patients was significantly improved compared with that in the routine exercise group at 3rd and 6th

Table 5. The comparison of the total score of quality of life and the scores of each dimension between the two groups 3 months and 6 months after intervention

Dimension	Group	Before intervention	3 months after intervention	Difference between groups	t	*P* value	6 months after intervention	Difference between groups	t	*P* value
Physical health	Taichi exercise group	17.03±1.79	19.20±1.79	2.17±1.02	5.15	<0.0001	20.93±1.62	3.90±1.71	5.06	<0.0001
	Routine exercise group	19.41±1.52	19.93±1.41	0.52±0.95			20.86±1.48	1.45±1.38		
Somatic role	Taichi exercise group	3.73±1.01	4.73±0.98	1.00±0.59	3.16	0.0016	4.77±0.86	1.03±0.81	2.10	0.0354
	Routine exercise group	3.90±1.08	4.38±0.82	0.48±0.74			4.45±0.63	0.55±0.91		
Somatic pain	Taichi exercise group	6.38±1.07	8.42±1.06	2.04±0.98	5.00	0.0016	9.34±1.16	2.95±1.25	6.60	<0.0001
	Routine exercise group	6.86±1.06	7.61±0.98	0.75±0.88			7.82±0.82	0.96±1.06		
Overall health	Taichi exercise group	16.13±1.76	18.33±1.56	2.20±1.13	3.80	0.0001	20.00±1.23	3.87±1.43	4.74	<0.0001
	Routine exercise group	17.21±1.86	18.10±1.45	0.90±1.21			18.79±1.37	1.59±1.55		
Energy	Taichi exercise group	16.30±1.97	18.10±1.63	1.80±1.86	2.90	0.0037	19.60±1.67	3.30±2.35	4.23	<0.0001
	Routine exercise group	17.48±1.64	18.03±1.18	0.55±0.99			18.31±1.23	0.83±1.39		
Social function	Taichi exercise group	4.87±0.86	5.57±0.68	0.70±0.79	3.19	0.0014	19.60±1.67	2.30±1.34	3.70	0.0002
	Routine exercise group	5.17±0.97	5.17±0.66	0.00±0.85			18.31±1.23	0.90±1.26		
Emotional role	Taichi exercise group	2.73±0.83	3.10±0.66	0.37±0.72	0.57	0.5670	4.00±1.02	1.27±1.23	0.71	0.4807
	Routine exercise group	3.38±0.82	3.62±0.62	0.24±0.51			4.38±0.56	1.00±0.96		
Mental health	Taichi exercise group	19.00±1.74	20.87±1.28	1.87±1.41	3.87	0.0001	22.83±2.09	3.83±2.39	3.96	<0.0001
	Routine exercise group	18.66±1.63	19.14±1.13	0.48±0.95			20.00±1.71	1.34±1.93		
Total scores	Taichi exercise group	86.18±5.18	98.32±3.39	12.14±4.10	5.71	<0.0001	108.64±4.29	22.45±6.67	5.81	<0.0001
	Routine exercise group	92.07±5.53	95.99±3.58	3.92±3.88			100.68±3.49	8.61±5.93		

Table 6. The comparison of the total score of SOC and the scores of each dimension between the two groups 3 months and 6 months after intervention

Dimension	Group	Before intervention	3 months after intervention	Difference between groups	t	*P* value	6 months after intervention	Difference between groups	t	*P* value
Comprehensibility	Taichi exercise group	22.40±2.08	23.43±1.87	1.03±1.96	0.06	0.9533	25.33±2.02	2.93±3.15	0.29	0.7747
	Routine exercise group	22.03±1.99	23.00±2.09	0.97±1.68			25.21±2.74	3.17±3.04		
Manageability	Taichi exercise group	21.33±1.86	24.67±2.90	3.33±3.18	3.93	<0.0001	27.50±2.75	6.17±3.27	3.76	0.0002
	Routine exercise group	22.10±1.78	22.76±1.75	0.66±1.82			24.76±3.08	2.66±3.11		
Meaningfulness	Taichi exercise group	16.23±1.28	17.83±1.18	1.60±1.25	3.99	<0.0001	18.80±1.19	2.57±1.55	4.22	<0.0001
	Routine exercise group	16.45±1.53	16.72±1.03	0.28±0.96			17.14±0.83	0.69±1.31		
Total scores	Taichi exercise group	59.97±2.71	65.93±4.23	5.97±3.69	4.33	<0.0001	71.63±3.22	11.67±4.02	4.74	<0.0001
	Routine exercise group	60.59±2.86	62.48±2.94	1.90±2.62			67.10±4.36	6.52±4.32		

month after discharge. First, there was an improvement in walking distance measured by 6MWT in the Taichi exercise group compared with the routine exercise group, which was consistent with the research results reported by Waite et al. [17, 18]. Taichi is characterized by "mind-body alignment and cultivation of the form and spirit" on the basis of the theory of "tonifying the innate Qi with acquired Qi" in traditional Chinese medicine. It has a unique way of movement, which is gentle in relaxed posture without rigid movement, sudden rise and fall or fierce jumping. The movements take the waist as the axis to drive the limbs, rotate the waist, and turn the back to achieve spiraling and winding, with the imagination of energy transmission to run through all acupoints and distribute all over the body. Consequently, it can promote QI-blood circulation, dredge the meridians, and accelerate the venous and lymphatic return, so as to reduce the burden on the heart and effectively improve the cardiac function of patients. Second, brain natriuretic peptide, i.e., B-type natriuretic peptide (BNP), is a polypeptide mainly secreted by the ventricle. The concentration of BNP has an intimate association with infarct size. The Pro-BNP level has generally been considered as a reliable serum biomarker to indicate cardiac function and predict cardiovascular diseases [19, 20]. In our study, it was found that after the intervention, the level of Pro-BNP decreased significantly in both groups, and the decrease in the Taichi exercise group was more obvious than that in the routine exercise group ($P<0.05$), which was basically consistent with previous reports [21]. Finally, stem cells are considered as an important source of cardiomyocyte proliferation. The effectiveness of stem cell mobilization is of great significance for myocardial repair after AMI. Previous research has documented that exercise can promote the activation of c-kit+ and sca-1+CPSs [22]. Regular exercise in patients with myocardial infarction can increase the number and migration ability of CPSs, which can last until 3 months after exercise. For instance, Brehm et al. discovered in their research that after regular exercise, there was an increased number of CD34+ and CD45+ as well as CD133+/CD45+ stem cells in circulation, indicating that regular exercise can mobilize and improve the functional activity of stem cells. In this study, there was no significant difference in stem cell mobilization between the two groups in the first three months after discharge. While at 6 months after discharge, stem cell mobilization in the Taichi exercise group was significantly enhanced than that in the routine exercise group. It illustrates that autologous stem cell mobilization has long-term significance in the repair of cardiac injury in patients with myocardial infarction. Taichi exercise can activate multiple cytokines and signal molecules, various stem cell mobilization and related microRNA expressions in patients with myocardial infarction, promote the proliferation of cardiomyocytes and ameliorate myocardial infarction.

Findings in our study revealed that Taichi-oriented rehabilitation program could significantly improve the quality of life for patients with AMI after PCI. It supports that the program can assist medical staff in performing scheduled and individualized exercise guidance for patients; and patients can keep exercise for rehabilitation according to the guidance of the program, constantly clarify their rehabilitation goals, and guide healthy lifestyle and positive life attitude, so as to improve the quality of life. However, it was inconsistent with that reported by Gao et al. [23]. It may be explained by the reason that multiple quality control methods were applied in the early stage to ensure the exercise compliance of patients; moreover, patients carried out standardized exercise and received follow-up continuously according to the exercise program, resulting in significantly improved quality of life.

Furthermore, it was found in our study that Taichi-oriented rehabilitation program had a significant effect on most dimensions of quality of life in patients with AMI, yet without statistical significance in the dimension of emotional role function. It may be related to the inability of patients with myocardial infarction to return to routine work within a short time after discharge. It also reminds us of the importance of psychological nursing, which requires nurses to gain professional proficiency constantly, learn new knowledge to enhance their communication ability, improve nursing quality, create high-quality, diversified and humanized nursing services.

SOC [24] is a scoring system to evaluate self-confidence. Individuals with a high level of SOC not only believe that stress is challenging, but also consider that they can deal with these

pressures. In this study, after 1-6 months of Taichi-oriented rehabilitation, the overall score of SOC in the Taichi exercise group was significantly higher than that in the routine exercise group. Among the three dimensions, manageability and meaningfulness were significantly improved compared with those before the intervention, indicating that Taichi-oriented rehabilitation program can improve self-confidence in patients with AMI after PCI. Taichi emphasizes the practice of essence, Qi and spirit, with the purpose to achieve smooth movement of Qi and blood and thereby the inner peace, so as to improve the physiological, psychological and social adaptability of the population. In the course of "Yunshou Taichi" practice, psychic communion and relaxation of the mind and body are required to eliminate distracting thoughts and intensify them in a positive direction. Simultaneously, the mind should be focused on the actions, and the amount of unhelpful stimulation should be reduced, leading to a unique state of quietness eventually. In such a way, the body is fully adjusted to improve self-efficacy and to strengthen the patients' confidence and willpower to overcome the disease.

At 3rd and 6th month after discharge, there was no significant difference in the score of the dimension of comprehensibility between the Taichi exercise group and the routine exercise group, indicating that Taichi-oriented rehabilitation had no obvious effect on the improvement of comprehensibility for patients with AMI after PCI. It may be explained by the fact that the level of comprehensibility is quite stable in each person. In addition, our study suggests a prolonged follow-up to observe the long-term effect of the rehabilitation program on the improvement of comprehensibility.

Conclusion

Taichi-oriented rehabilitation is a new attempt for CR in AMI patients after PCI. It can improve the heart function of patients, reduce the cost of rehabilitation treatment and increase the compliance of patients according to the national conditions and living habits of people. This study was designed as a retrospective study, and hence there is certain bias in results due to the relatively smaller sample size and limited duration of study. In the future, study with larger sample size and prolonged research duration is warranted. In addition, the ideal CR program emphasizes multidisciplinary integration that is implemented by multiple medical professionals, including doctors, nurses, cardiologists, professional rehabilitation therapists, psychologists, exercise experts, and other experts in related fields.

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Disclosure of conflict of interest

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