Original Article
Effect of comprehensive cardiac rehabilitation management on SAQ score, risk stratification in coronary artery disease, exercise tolerance and quality of life in patients with PCI

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Abstract: Objective: This study aims to analyze the effect of comprehensive cardiac rehabilitation management on Seattle Angina Questionnaire (SAQ) score, risk stratification in coronary artery disease (CAD), exercise tolerance and quality of life (QOL) of patients underwent percutaneous coronary intervention (PCI). Methods: Ninety-three patients who received PCI in our hospital from January 2018 to July 2019 were included as the study objects for retrospective analysis and divided into two groups based on the intervention modes. The control group (n=46) was routinely nursed after the surgery, while the observation group (n=47) received comprehensive cardiac rehabilitation management on the basis of the control group. The two groups were compared for risk stratification in CAD, mental state, exercise tolerance, QOL and SAQ score. Results: (1) As compared with the control group, the observation group demonstrated a higher proportion of low-risk layer to middle-risk layer, and a lower proportion of high-risk layer to extremely high-risk layer (P<0.05). (2) After intervention, the observation group yielded a self-rating depression scale (SDS) score of 4.01±0.08 and a self-rating anxiety scale (SAS) score of 3.89±0.16, both lower than those of the control group which were 7.88±0.16 and 6.98±0.26, respectively (P<0.05). (3) A higher six-minute walk distance (6MWD) was observed in the observation group as compared with the control group (P<0.05). (4) Six months after intervention, the observation group excelled the control group in mental health (MH), role emotional (RE), social function (SF), vitality (VT), general health (GH), body pain (BP), physical role (PR) and physical function (PF), degree of disease cognition, treatment satisfaction, onset of angina pectoris, stabilization of angina pectoris and score of restriction to physical movement in SAQ (P<0.05). Conclusion: Comprehensive cardiac rehabilitation management shall be popularized based on its contributions to the improvement of depression, anxiety, exercise tolerance, body functions and QOL in patients underwent PCI.

Keywords: Percutaneous coronary intervention, comprehensive cardiac rehabilitation management, seattle angina score, exercise tolerance, quality of life

Introduction

Currently, percutaneous coronary intervention (PCI) is a major clinical therapy against coronary heart diseases (CHDs), after which, enhancement of cardiac rehabilitation management is preferred as the surgery may result in restenosis of coronary artery [1].

After PCI, most CHD patients may be compromised in quality of life (QOL), social adaptability and mental state to various degrees, which not only affects their quality of life, but also brings a heavy burden to the patients, their families and the society [2, 3]. As China is currently in the primary stage of cardiac rehabilitation management after PCI, most domestic studies focus on the formulation of scientific and reasonable exercise programs after PCI for CHD patients, and the measures are limited to exercise [4, 5]. While the present study puts emphasis on the exploration of a scientific and comprehensive cardiac rehabilitation management program after PCI, which stresses the domination of professional nurses, enhances postoperative exercise guides, nutritional intervention

as well as cardiological and psychological management, and establishes a dedicated follow-up system to improve the cardiac functions and QOL of CHD patients after PCI.

This study explored the effects of comprehensive cardiac rehabilitation management on Seattle Angina Questionnaire (SAQ) score, risk stratification in coronary artery disease (CAD), exercise tolerance and QOL of patients with PCI based on the control group which was routinely managed, and the observation group which received comprehensive cardiac rehabilitation management on the basis of routine management, thus to provide a new guideline for postoperative rehabilitation of CHD patients with PCI.

Materials and methods

Materials

Ninety-three patients underwent PCI in our hospital from January 2018 to July 2019 were included as the study objects for retrospective analysis and divided into two groups according to the intervention modes. The control group (n=46), including 32 males and 14 females with an age range between 50 and 76 years, was routinely nursed, while the observation group (n=47), including 34 males and 13 females with an age range between 51 and 78 years, received comprehensive cardiac rehabilitation management on the basis of the control group. (1) Inclusion criteria: patients who satisfied the American Heart Association diagnosis criteria of CHDs and received only one PCI, after which the minimum percent diameter stenosis was under 20% according to coronary arteriongraphy, were included and their written informed consents to participate in the study had been approved by the medical ethic committee were provided. (2) Exclusion criteria: patients who had concurrent severe chronic diseases, renal, cerebral, hepatic and pulmonary function damages, cognitive dysfunction or uncontrolled diabetes, hypertension and arrhythmia, or diseases in nerve system, muscles and bone joints were excluded from the study.

Methods

The control group was routinely nursed after PCI, including enhancing health education in a proper manner based on the patients' actual conditions, and strengthening guides upon discharge by informing them or their family members the follow-up dates, places and times.

The observation group was applied with comprehensive cardiac rehabilitation management on the basis of nursing services offered to the control group. A professional cardiac rehabilitation team was set up with the members including professional nutritionists, psychological therapists, professional cardiovascular nurses, and cardiologists. The specific management measures are as follows:

Enhancement of exercise guides: One month after PCI, patients who had not suffered from myocardial infarction or unstable angina pectoris attack received a 6-min walking rest (6MWT). The test results were based on the establishment of individual exercise intervention program that prioritized jogging for 20 to 40 min. The initial exercise time was controlled at 20 min, which was gradually increased according to the patients' exercise ability. In each week they were required to take exercise for 3 to 5 times; by heart rate reserve method (HRR), patients' target heart rate was calculated and monitored electronically, based on which, proper adjustment was made to exercise intensity. Patients received 6MWT once a month and learned the skills to correctly recognize any possible danger signals in the process of exercise. In case of any discomforts, exercise was stopped and doctors were contacted for emergency treatment.

Enhancement of cardiological and psychological management: After PCI, patients were provided with a health manual, which contained knowledge about the causes of CHD attack, hazards, identification of discomfort symptoms, means of self-rescue, notes after PCI and cardiac rehabilitation. Professional nurses explained those knowledge to patients according to the specific conditions, and answered the questions from patients or their family members patiently. An Hospital Anxiety and Depression Scale (HADS) was adopted to evaluate both groups' anxiety and depression status, and those with a hospital anxiety and depression-depression (HAD-D) or hospital anxiety and depression-anxiety (HAD-A) score over 8 were intervened by a professional psychological therapist.

Enhancement of nutritional intervention: Professional nutritionists judged patients' nutritional status based on the serological examina-

tion results such as serum albumin and patients' body mass index (BMI), and formulated targeted nutritional intervention program accordingly, which required patients to consume less than 5 g of salt, less than 25 g of edible oil, 250-400 g of grains, 200-400 g of fruits, and 300-500 g of vegetables on a daily basis. In the meanwhile, patients were required to give up smoking and drinking alcohol.

Establishment of a follow-up system: A WeChat group was established for patients who might share their problems and seek for answers and guides from professional nurses, and members of the cardiac rehabilitation management team who could publish an article about management of hazards related to angiocardiopathy, mental regulation, nutrition, exercise and drug use. In the first month after discharge, professional nurses called patients once a week to know about their mental status, exercise, dietary and conditions, and after 1 month, the call frequency decreased to once a month. Patients were required to communicate with managements in case of any problems to find the correct solution. Upon their discharge, patients were provided with a notebook of cardiac rehabilitation, which was presented to doctors during the clinical visit each month for their reference together with the examination results and exercise tests. Drug utilization and exercise programs were rationally adjusted. In the meantime, professional nurses would guide patients to properly adjust their way of life based on the follow-up records and cardiac rehabilitation diaries.

Both groups were intervened for 6 months.

Observation indices

(1) Risk stratification in CAD: before and after intervention, prospective cardiovascular Munster (PROCAM) was adopted for assessment which consisted of 8 hazards, i.e., diabetes, triglyceride (TG), high density lipoprotein (HDL), low density lipoprotein (LDL), systolic blood pressure (SBP), family history of myocardial infarction, history of smoking and age, based on which, each scale was scored and summed up to obtain the total score of PROCAM which ranges from 0 to 87. Patients with a PROCAM score at or below 35, between 36 and 42, between 43 and 54, at or above 55 were classified as the low-risk layer, middle-risk layer, high-risk layer and extremely high-risk layer,

respectively [6, 7]. The Cronbach's α assigned to this scale is 0.89.

(2) Mental state: before and after intervention, a HADS was adopted to evaluate patients' anxiety and depression, and consisted of self-rating depression scale (SDS) and self-rating anxiety scale (SAS) scores. Patients with an anxiety and depression score at or above 9 were identified as anxious and depressed [8, 9]. The Cronbach's α assigned to this scale is 0.90.

(3) Exercise tolerance: before and after intervention, both groups received a 6MWT to assess their exercise tolerance. The test required patients to complete a round trip as far as they can in a specific interval, after which the 6-min walking distance was measured [10, 11]. The Cronbach's α assigned to this scale is 0.96.

(4) QOL score: 6 months after intervention, the medical outcomes study item short form health survey (SF-36) was adopted for assessment, which consisted of 8 dimensions, namely, mental health (MH), role emotional (RE), social function (SF), vitality (VT), general health (GH), body pain (BP), physical role (PR) and physical function (PF), each valuing 100 points in full and positively reacting with the QOL [12, 13]. The Cronbach's α assigned to this scale is 0.86.

(5) SAQ score: 6 months after intervention, SAQ was adopted to assess patients' body functions, which consisted of 5 assessment dimensions of 19 items, namely, degree of disease cognition, treatment satisfaction, onset of angina pectoris, stabilization of angina pectoris and restriction to body movement. The score of each item was forwardly treated and positively related with body functions [14, 15]. The Cronbach's α assigned to this scale is 0.92.

Statistical analysis

Statistical analysis was performed with SPSS22.0. In case of numerical data expressed as mean ± standard deviation, comparison studies were carried out through independent-samples T test for data which were normally distributed, and Mann-Whitney U test for data which were not normally distributed, and paired t test for intra-group comparison before and after intervention; in case of nominal data expressed as [n (%)], comparison studies were carried out through X^2 test for intergroup com-

Table 1. Comparison of general materials between the observation group and the control group [n (%)]/(Mean ± SD)

Materials		Observation group (n=47)	Control group (n=46)	t/X^2	P
Gender (n)	Male	34 (72.34)	32 (69.57)	0.087	0.768
	Female	13 (27.66)	14 (30.43)		
Age (y)		62.15±3.18	62.09±3.12	83.845	0.927
Disease type					
Unstable angina pectoris		29 (61.70)	28 (60.87)	0.007	0.934
Myocardial infarction		18 (38.30)	18 (39.13)		
Cardiac functional grading					
I		12 (25.53)	12 (26.09)	0.052	0.996
II		26 (55.32)	24 (52.17)		
III		9 (19.15)	10 (21.74)		

Figure 1. Comparison of risk stratification in CAD between the observation group and the control group before intervention. Patients at low-risk layer, middle-risk layer, high-risk layer, and extremely high-risk layer accounted for 17.02%, 21.28%, 46.81% and 14.89% in the observation group, and 15.22%, 19.57%, 50.00% and 15.22% in the control group according to risk stratification in CAD (P>0.05).

parison. For all statistical comparisons, P<0.05 was considered as statistically significant.

Results

Comparison of general materials between the observation group and the control group

The two groups had no statistical difference in terms of gender, mean age, disease type and cardiac functional grading (P>0.05, **Table 1**).

Comparison of risk stratification in CAD between the observation group and the control group

Before intervention, patients at low-risk layer, middle-risk layer, high-risk layer and extremely high-risk layer were 8 (17.02%), 10 (21.28%), 22 (46.81%) and 7 (14.89%) in the observation group, and 7 (15.22%), 9 (19.57%), 23 (50.00%) and 7 (15.22%) in the control group, which indicated that there was no statistical difference for intergroup comparison (P>0.05, **Figure 1**).

After intervention, patients at low-risk layer, middle-risk layer, high-risk layer and extremely high-risk layer were 13 (27.66%), 22 (46.81%), 10 (21.28%) and 2 (4.26%) in the observation group, and 7 (15.22%), 12 (26.09%), 21 (45.65%) and 6 (13.04%) in the control group. As compared with the control group, the observation group was higher in proportions of patients in the low-risk layer and middle-risk layer, and lower in the proportions of patients in the high-risk layer and extremely high-risk layer (P<0.05, **Figure 2**).
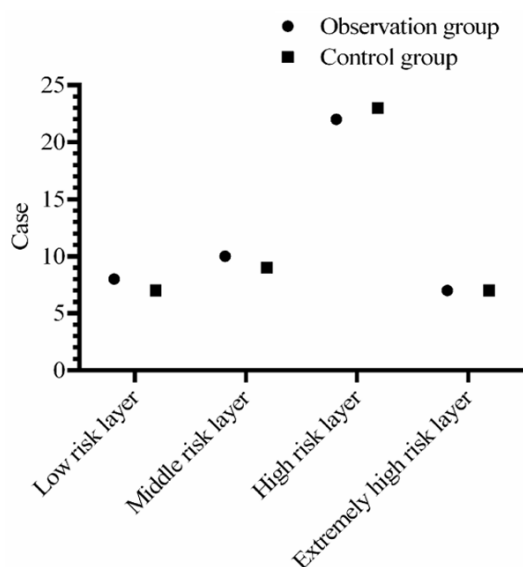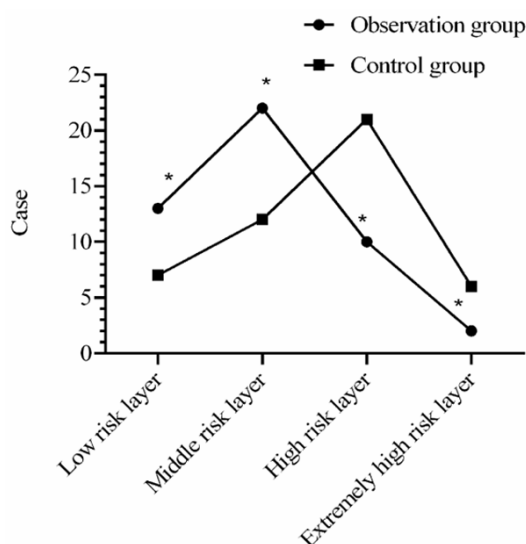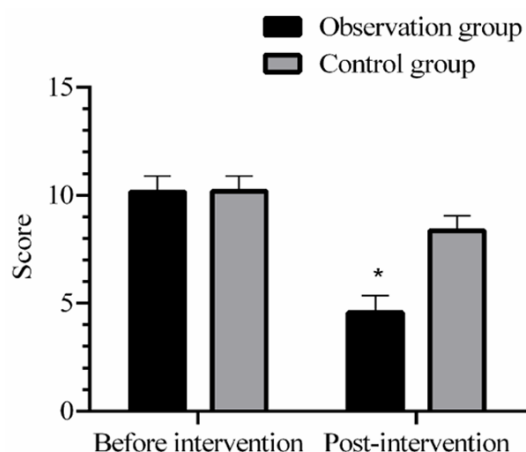
Comparison of mental state between the observation group and the control group

The SDS scores of 9.63±0.12 in the observation group and 9.68±0.11 in the control group (P>0.05) before intervention were significantly reduced to 4.01±0.08 and 7.88±0.16, respectively after intervention (P<0.05, **Figure 3**).

The SAS scores of 9.16±0.96 in the observation group and 9.20±0.92 in the control group (P>0.05) before intervention were significantly reduced to 3.89±0.16 and 6.98±0.26, respectively after intervention (P<0.05, **Figure 4**).

Comparison of exercise tolerance between the observation group and the control group

There was no statistical difference in both groups before intervention (P>0.05), while after intervention, both groups demonstrated a sig-

Figure 2. Comparison of risk stratification in CAD between the observation group and the control group at 6 months after intervention. Patients at low-risk layer, middle-risk layer, high-risk layer, and extremely high-risk layer accounted for 27.66%, 46.81%, 21.28% and 4.26% in the observation group, and 15.22%, 26.09%, 45.65% and 13.04% in the control group according to risk stratification in CAD ($P<0.05$). Note: *indicates $P<0.05$ as compared with the control group.

Figure 3. Comparison of SDS scores between the observation group and the control group before and after intervention. As compared with the control group, SDS score of the observation group had no statistical difference before intervention ($P>0.05$), and was lower after intervention ($P<0.05$). Note: *indicates $P<0.05$ as compared with the control group.

nificant increase in 6MWD ($P<0.05$), of which the observation group excelled the control group in this regard ($P<0.05$, **Table 2**).
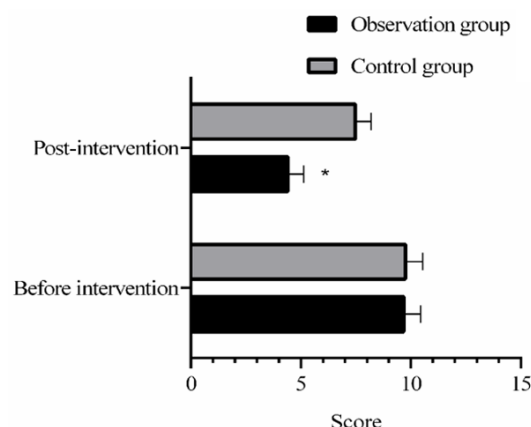
Figure 4. Comparison of SAS scores between the observation group and the control group before and after intervention. As compared with the control group, SAS score of the observation group had no statistical difference before intervention ($P>0.05$), and was lower after intervention ($P<0.05$). Note: *indicates $P<0.05$ as compared with the control group.

Comparison of QOL score between the observation group and the control group

As compared with the control group, the observation group achieved higher scores of MH, RE, SF, VT, GH, BP, PR and PF 6 months after intervention ($P<0.05$, **Table 3**).

Comparison of SAQ score between the observation group and the control group

As compared with the control group, the observation group achieved higher scores in degree of disease cognition, treatment satisfaction, onset of angina pectoris, stabilization of angina pectoris, score of restriction to physical movement in SAQ 6 months after intervention ($P<0.05$, **Table 4**).

Discussion

Presently, PCI has been extensively applied in the treatment of CHDs, but requires to enhance cardiac rehabilitation management [16, 17] as the surgery may result in restenosis of coronary artery though it can effectively improve patients' cardiac function.

In the present study, both groups were assessed by PROCAM. A PROCAM consists of 8 hazards, of which, diabetes, family history of myocardial infarction, history of smoking and age are unmodifiable while TG, HDL, LDL and

Table 2. Comparison of 6MWD between the observation goup and the control group (Mean ± SD, m)

Group	Before intervention	After intervention
Observation group (n=47)	382±45	462±58[#,*]
Control group (n=46)	385±42	403±48[#]
t	0.332	5.338
P	0.741	0.000

Note: [#]represents $P<0.05$ as compared with conditions before intervention, and [*]indicates $P<0.05$ as compared with the control group.

SBP can be changed [18]. The scale not only assesses various hazards intuitively, but also predicts the risk of adverse cardiac events after PCI [19]. Results of the study revealed that, 6 months after intervention, the observation group was higher than the control group in the proportions of low-risk layer and middle-risk layer, and lower in high-risk layer and extremely high-risk layer ($P<0.05$), indicating that enhancement of comprehensive cardiac rehabilitation management after PCI is advantageous to the reduction of CHD criticality through various intervention measures such as exercise and nutritional guides, which contributes to the improvement of modifiable factors.

Generally, PCI patients have to bear mental and economic burdens during the surgery, and are susceptible to unhealthy moods such as depression and anxiety arising from pains afterward [19]. Toma et al. [20] learned through a 1-year follow-up of patients with CIP that about 81.4% of them had concurrent depression symptoms and around 75.6% were depressed, while in the present study, patients in the observation group were assessed by HADS after PCI, and intervened by professional psychological therapists if they were anxious or depressed. Professional nurses would provide them with a rehabilitation manual based on their severity, experience, personalities and mental status to enhance health education and correct their incorrect understandings, so as to eliminate various unhealthy emotions. According to this study, 6 months after intervention, the observation group was lower than the control group in SDS and SAS scores ($P<0.05$), fully demonstrating the effectiveness of comprehensive cardiac rehabilitation management in patients with PCI.

Though clinically it is believed that more precise exercise programs can be established for patients based on their cardio-pulmonary exercise test results, this method relies on expensive instruments and sophisticated operation skills, which limits its clinical application to a certain degree [21]. In contrast, 6MWT is a sub-maximal exercise test characterized by low costs and simple operations, which has been accepted by more patients. Based on 6MWT results in the present study, patients' exercise program was rationally adjusted, and the results indicated that, as compared with the control group, the observation group reported higher 6MWD results 6 months after intervention ($P<0.05$), indicating the effectiveness of comprehensive cardiac rehabilitation management in improving patients' exercise tolerance after PCI. The same results were also observed by Dai et al. [22].

QOL is defined as an individual's expectation, goals, criteria, and experience in affairs they concern in various value and cultural systems [23]. At the present stage, improvement of CHD patients' QOL after surgery has been the focus of clinical attention. The study revealed that, as compared with the control group, the observation group was higher in MH, RE, SF, VT, GH, BP, PR and PF 6 months after intervention ($P<0.05$), which indicates the importance of comprehensive cardiac rehabilitation management in improving patients' QOL. The underlying causes, in addition to enhancement of cardiological and psychological management, also include professional nurses' active guides to patients to build healthy faith, and formulation of targeted exercise and dietary formulas as appropriate. Upon discharge, patients were educated on the WeChat, communicated on the phone, required for regular return visits, and monitored by cardiac rehabilitation diaries to effectively control CHD hazards. Their rehabilitation plan was flexibly adjusted [24]. Secondly, as compared with the control group, the observation group reported higher degree of disease cognition, treatment satisfaction, stabilization of angina pectoris, and score of restriction to physical movement ($P<0.05$), which further evidenced the effectiveness of comprehensive cardiac rehabilitation management after PCI and advantage of improving body functions. Patients were supervised to change their adverse life style as a way to

Table 3. Comparison of QOL between the observation group and the control group (Mean ± SD, Score)

Group	MH	RE	SF	VT	GH	BP	PR	PF
Observation group (n=47)	92.63±0.26[*]	95.67±0.37[*]	90.26±1.98[*]	92.16±3.18[*]	93.05±2.33[*]	94.06±3.18[*]	95.36±4.57[*]	93.22±2.88[*]
Control group (n=46)	71.25±2.63	70.06±1.25	74.12±2.33	74.96±2.24	75.06±1.63	75.16±3.20	76.25±1.36	78.63±1.52
t	55.462	134.578	36.025	36.987	52.327	63.258	72.023	70.188
P	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note: [*]indicates $P<0.05$ as compared with the control group.

Table 4. Comparison of SAQ score between the observation group and the control group (Mean ± SD, Score)

Group	Degree of disease cognition	Treatment satisfaction	Onset of angina pectoris	Stabilization of angina pectoris	Restriction of body movement
Observation group (n=47)	76.12±2.36[*]	80.36±5.26[*]	76.12±2.39[*]	80.69±7.16[*]	74.56±6.02[*]
Control group (n=46)	45.12±2.12	70.12±0.25	62.02±1.25	65.12±1.28	52.12±5.13
t	66.592	52.368	42.785	40.124	52.635
P	0.000	0.000	0.000	0.000	0.000

Note: [*]indicates $P<0.05$ as compared with the control group.

reduce various CHD-related hazard level and further improve the physical functions and QOL of patients.

In conclusion, comprehensive cardiac rehabilitation management can improve depression, anxiety, exercise tolerance, body functions and QOL in patients with PCI, which is worthy of application.

However, as the study included few objects, the results are less representative, and it is necessary to make a depth study with a larger sample size in the future.

Disclosure of conflict of interest

None.

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