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Individualized Cardiac Rehabilitation in Elderly Patients with Coronary Heart Disease and Chronic Heart Failure

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Abstract: *Objective:* To study the changes and clinical effects of elderly patients with coronary heart disease and chronic heart failure after applying individualized cardiac rehabilitation. *Methods:* 85 cases of elderly patients with coronary heart disease and chronic heart failure admitted from June 2023 to May 2024 were divided into the control group (42 cases) and the experimental group (43 cases), and were given conventional rehabilitation guidance and individualized cardiac rehabilitation training programme respectively, comparing the indexes of exercise endurance, level of cardiac function, quality of life, and incidence of adverse cardiovascular events in the two groups. *Results:* Before intervention, the LVEF, LVEDD and LVEDS of the control group and the experimental group were (37.11 ± 3.96)%, (62.15 ± 4.06) mm and (45.75 ± 4.33) mm and (37.06 ± 3.92)%, (2.20 ± 4.23) mm and (45.81 ± 4.27) mm, respectively, with no statistically significant difference. and test group LVEF increased and LVEDD and LVESD decreased by (45.75 ± 5.12)%, (55.18 ± 3.97) mm, (41.14 ± 3.29) mm and (51.79 ± 4.26)%, (48.23 ± 3.58) mm, (36.62 ± 3.75) mm, respectively, with statistically significant differences between the groups ($P < 0.05$)). Before intervention, the 6 min walk test (6MWT) and maximum exercise load of the control group and the experimental group were (325.55 ± 37.79) m, (91.02 ± 15.74) W and (324.17 ± 37.68) m, (90.92 ± 14.78) W, respectively, and the difference was not statistically significant ($P > 0.05$). After intervention, all the indicators of both groups were significant ($P > 0.05$). After the intervention, all indicators in both groups were significantly higher, respectively (386.28 ± 42.95) m, (135.67 ± 22.75) W and (460.43 ± 39.91) m, (152.83 ± 25.64) W, and the difference between the groups was not statistically significant ($P < 0.05$). The quality of life scores of the experimental group on somatic symptoms, daily activities, psychological quality, and social functioning were respectively (80.01 ± 6.02), (73.75 ± 7.32), (80.56 ± 6.41), (71.42 ± 6.87), significantly higher than the control group's (67.03 ± 6.98), (64.19 ± 7.16), (63.78 ± 6.13) and (60.72 ± 6.47), while the difference was statistically significant ($P < 0.05$). Cardiac arrhythmia occurred in the experimental group. The incidence of adverse cardiovascular events such as myocardial infarction was 4.65%, which was significantly lower than that of the control group (23.81%), and the difference was statistically significant ($P < 0.05$). *Conclusion:* Individualized cardiac rehabilitation exercise in elderly patients with coronary heart disease and chronic heart failure can promote the recovery of clinical symptoms, improve cardiorespiratory function, enhance exercise endurance, improve the quality of life, and effectively improve the prognosis.

Keywords: Coronary heart disease in the elderly; Chronic heart failure; Individualized cardiac rehabilitation

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1. Introduction

Relevant surveys show that in the number of deaths caused by diseases in China, cancer does not occupy a dominant position, coronary heart disease and other cardiovascular diseases are the main factors causing death [1]. Atherosclerosis leads to lumen narrowing and shock when blood pressure is significantly lowered, inducing myocardial ischaemia, which is the basic etiology of coronary heart disease combined with heart failure. With the increasing age of patients, primary or secondary cardiac ischaemia leads to a gradual reduction in myocardial blood supply, the heart's compensation ability significantly decreases, resulting in a lack of oxygen supply to the myocardium, ultimately leading to heart failure [2]. According to various statistics, the number of people suffering from chronic heart failure (CHF) in China is increasing year by year, and the death rate is also rising. Cardiac rehabilitation, as a kind of non-pharmacological therapy, can significantly improve the cardiac function of patients with chronic heart failure, reduce the average length of hospital stay, and lower the rate of re-hospitalization through exercise, dietary guidance, control of cardiovascular risk factors, psychological intervention and other measures. In recent years, the application of individualized cardiac rehabilitation training in the field of cardiac rehabilitation has been widely promoted. Compared with traditional rehabilitation methods, individualized cardiac rehabilitation can develop personalized exercise programmes for patients' specific conditions, thus better meeting their rehabilitation needs. Through scientific exercise training, it can not only improve the patient's cardiovascular function and myocardial tolerance, but also strengthen the patient's psychological health and improve the quality of life. Individualized cardiac rehabilitation refers to some exercises that can reduce the probability of recurrence of cardiovascular events and facilitate the recovery of cardiac function. This study investigates the effect of applying individualized cardiac rehabilitation training interventions to elderly patients with coronary heart disease and chronic heart failure, and analyzes its effect on exercise tolerance, cardiorespiratory function and other aspects, which are reported as follows.

2. Information and methodology

2.1. General information

Eighty-five cases of elderly patients with coronary heart disease and chronic heart failure admitted from June 2023 to May 2024 were selected and divided into the control group and the study group, of which 42 cases were in the control group and 43 cases were in the experimental group. In the control group, there were 25 males and 17 females; age 62–82 years old, mean (72.32 ± 5.32) years old; disease duration 2–8 years, mean (5.88 ± 1.12) years; cardiac function classification: 22 cases of class II, 20 cases of class III. In the experimental group, there were 27 males and 16 females; age (70.56 ± 5.88) years old; disease duration 1–10 years, mean (5.54 ± 1.46) years; There were 24 cases of grade II and 19 cases of grade III. Comparing the baseline data of the two groups, the difference was not statistically significant ($P > 0.05$) and was comparable.

Inclusion criteria: (1) Meet the diagnostic conditions of chronic heart failure of coronary heart disease, that is age over 60 years, duration of heart failure over 6 months, and left ventricular ejection fraction less than 45%; (2) According to the American New York Heart Association (NYHA) cardiac function grading of class II–III; (3) The patient's family knowingly signed an informed agreement.

Exclusion criteria: (1) Combination of severe liver and renal function abnormalities; (2) Previous history of

cardiac surgery; (3) With diabetes mellitus, hypertension and other underlying diseases; (4) Presence of psychiatric disorders, communication disorders; (5) Withdrawal in the middle of the course.

2.2. Methodology

Control group: Intervention with standard anti-heart failure treatment and nursing measures and appropriate health education on the disease.

Trial group: Individualized cardiac rehabilitation training intervention based on conventional treatment. The cardiac rehabilitation training methods are as follows:

(1) Exercise mode

The main aerobic exercise rehabilitation training, the specific exercise is walking, bicycle rehabilitation training, Baduanjin exercise, etc., 20 min/time, 4 times/week. Based on the aerobic exercise rehabilitation training, moderate resistance training and limb flexibility training were added according to the individualization of patients. Flexibility training [3]: including trunk distraction training (anterior flexion, posterior extension), upper limb distraction training (shoulder extension, shoulder abduction, shoulder anterior flexion), lower limb distraction training (anterior leg compression, "4" stretching, holding the knee), 10 min/times, 1 time/d, to local stretching painless is appropriate.

(2) Exercise intensity

According to the patient's tolerance to develop exercise intensity, to avoid affecting the patient's safety, as far as possible, let the patient in a smooth state. The overall principle of rehabilitation training to maintain a gradual and orderly progress, the amount of exercise should not be too large and too strong, adjust the intensity of exercise to adapt to the patient.

(3) Exercise frequency

All patients should keep at least 4d effective rehabilitation training, try to take multiple periods of short-time exercise methods, avoid continuous multi-day exercise rehabilitation training. On this basis, in order to improve the patients' cardiorespiratory function, the shortest aerobic exercise time should be maintained, and the shortest time is 30 min each time, which is completed in 3 groups, and gradually converted to be completed in 2 groups.

(4) Rehabilitation training guidance

Detailed understanding of the patient's daily exercise, assessment of the patient's physical condition, and each patient in the group to establish a more appropriate individualized training content. At the same time, patients should be correctly instructed during exercise, closely monitor patients for discomfort, and prepare rescue measures to fully ensure patient safety. In addition, according to the patient's preference, the training programme should be adjusted appropriately to improve the patient's interest. At the same time, through the WeChat group to patients to push health education courses, through WeChat punch card feedback exercise and health education content implementation, at any time to give the patient online question and answer, dynamic adjustment of exercise treatment and give timely individualized guidance.

2.3. Observation indicators

(1) Cardiac function indicators: The cardiac function indexes of the patients were monitored using echocardiography. Specific indexes included left ventricular ejection fraction (LVEF), left ventricular end-diastolic internal diameter (LVEDD), and left ventricular end-systolic internal diameter (LVEDS).

(2) Exercise endurance: 6 min walking distance (6MWD) was used, and a load test was carried out by using a power bike.

(3) Quality of life: A quality of life evaluation scale (SF- 36) was used [4]. This is to analyze the somatic symptoms of the two groups, daily activities, psychological quality and social functioning, with a total of 19 entries in 5 dimensions, and the higher the score, the higher the quality of life in this dimension.

(4) The occurrence of adverse cardiovascular events: Record the occurrence of adverse events such as cardiac arrest, angina pectoris, myocardial infarction, and arrhythmia in the two groups. Incidence rate = number of cases/ total number of cases × 100%.

2.4. Statistical methods

The software SPSS 23.0 was applied to statistically analyze the data of this study, and the count data were expressed as n(%), using the χ^2 test. The measurement data conforming to the normal distribution were expressed as mean ± standard deviation (SD), using the t-test, and the difference was statistically significant at $P < 0.05$.

3. Results

3.1. Comparison of cardiac function between the two groups

After the intervention, LVEF increased and LVEDD and LVESD decreased in both groups, and LVEF was higher in the experimental group than in the control group, and LVEDD and LVESD were lower than in the control group ($P < 0.05$) (**Table 1**).

Table 1. Comparison of cardiac function between the two groups (mean ± SD)

Groups	*n*	LVEF/%		LVEDD/mm		LVESD/mm	
		Pre-intervention	Post-intervention	Pre-intervention	Post-intervention	Pre-intervention	Post-intervention
Control group	42	37.11 ± 3.96	45.75 ± 5.12*	62.15 ± 4.06	55.18 ± 3.97*	45.75 ± 4.33	41.14 ± 3.29*
Trial group	43	37.06 ± 3.92	51.79 ± 4.26*	62.20 ± 4.23	48.23 ± 3.58*	45.81 ± 4.27	36.62 ± 3.75*
t		0.059	5.918	0.056	8.808	0.064	5.902
P		0.954	< 0.01	0.956	< 0.01	0.949	< 0.01

Note: *$P < 0.05$ compared to pre-intervention in this group.

3.2. Comparison of exercise endurance between the two groups before and after intervention

After the intervention, 6MWD and maximal exercise load were significantly elevated in both groups, with a more significant increase in the experimental group ($P < 0.05$) (**Table 2**).

Table 2. Comparison of exercise endurance between the two groups (mean ± SD)

Groups	*n*	6MWD/m		Maximum movement load/W	
		Pre-intervention	Post-intervention	Pre-intervention	Post-intervention
Control group	42	325.55 ± 37.79	386.28 ± 42.95	91.02 ± 15.74	135.67 ± 22.75

Trial group	43	324.17 ± 37.68	460.43 ± 39.91	90.92 ± 14.78	152.83 ± 25.64
t		0.169	8.248	0.030	3.261
P		0.867	< 0.01	0.976	0.002

Note: *$P < 0.05$ compared to pre-intervention in this group.

3.3. Comparison of quality of life between the two groups after intervention

After the intervention, the quality of life scores of somatic symptoms, daily activities, psychological quality, and social functioning of the test group were significantly higher than those of the control group, and the difference was statistically significant ($P < 0.01$) (**Table 3**).

Table 3. Comparison of quality of life (mean ± SD, points)

Groups	*n*	Somatic symptom	Routine	Psychological quality	Social function
Control group	42	67.03 ± 6.98	64.19 ± 7.16	63.78 ± 6.13	60.72 ± 6.47
Trial group	43	80.01 ± 6.02	73.75 ± 7.32	80.56 ± 6.41	71.42 ± 6.87
t		9.188	6.085	12.3296	7.389
P		< 0.01	< 0.01	< 0.01	< 0.01

3.4. Comparison of the incidence of adverse cardiovascular events between the two groups

After the intervention, arrhythmias occurred in the test group. The incidence of adverse cardiovascular events such as myocardial infarction was significantly lower than that of the control group, and the difference was statistically significant ($P < 0.05$) (**Table 4**).

Table 4. Comparison of the incidence of adverse cardiovascular events (*n*, %)**Groups**

	n	Arrhythmia	Cardiac arrest	Angina pectoris	Myocardial infarction	Rate of occurrence
Control group	42	4	2	3	1	10 (23.81)
Trial group	43	1	0	1	0	2 (4.65)
χ^2						6.432
P						0.011

4. Discussion

CHF is relatively common in the clinic, with the middle-aged and elderly groups as the main incidence, and the incidence rate has continued to increase in recent years, which seriously affects the life of patients and leads to a decline in the quality of life, and needs to be paid attention to [5]. At the same time, heart failure is not an independent disease, but the end stage of the development of various cardiovascular diseases. Especially in the elderly, there is a natural decline in body function, accompanied by multiple syndromes and coexisting risk factors, so the diagnosis, treatment, rehabilitation, and long-term management of this population are different from those of other populations [6]. Currently, percutaneous coronary intervention is well known and is widely used in clinical treatment for its rapid onset of action and minimal trauma. However, as percutaneous coronary intervention may

bring some complications to patients during operation, and coronary atherosclerosis is difficult to reverse, it is difficult to climinate the plaque in the blood vessel once it is formed [7]. Conventional rehabilitation guidance includes monitoring of the patient's vital signs, simple exercise rehabilitation training, etc. Although it can relieve some of the symptoms to a large extent, it is difficult for the patient to cooperate with the nursing care due to his age and memory loss.

Individualized cardiac rehabilitation, as a non-pharmacological treatment without increasing the burden on patients, has become a new means of adjuvant therapy for CHF patients. Although cardiac rehabilitation in China started late, the development is relatively slow and difficult, the popularity is not as good as neurological rehabilitation, but cardiac rehabilitation as a method of treating cardiac diseases, its main synergistic role, through targeted scientific training of patients, prompting patients to improve cardiac function, while enhancing physical fitness, to meet the patient's need for social participation, which can prevent the occurrence of adverse cardiovascular events and improve the Quality of life, has been generally recognized by the clinic [3].

The findings of this study indicate that the overall efficiency of rehabilitation was higher in the experimental group than in the control group and showed superiority in all assessed indicators. This suggests that a cardiac rehabilitation programme centred on individualized exercise training has a significant positive impact on the physical and psychological recovery of patients with chronic heart failure (CHF), including improvements in cardiac function, exercise tolerance and quality of life. This result is consistent with the findings of previous studies. National studies [8] have also pointed out that individualized exercise training can improve cardiac endurance and adaptability, and reduce the likelihood of coronary artery spasm and thrombosis. Individualized exercise training can reduce cardiac load by improving oxygen consumption and promoting a balance of cardiac function [9]. This helps protect the heart from further damage and improves cardiac function. In this study, by carrying out orderly and reasonable aerobic exercise and brisk walking, as well as adjusting the speed of brisk walking according to the 6-minute walking distance of the patients, the recovery and strengthening of the myocardium is promoted by gradually increasing the intensity and duration of the exercise, which prompts the myocardial tissues to better supply oxygen and eliminate metabolites, thus enhancing the pumping capacity of their hearts, the dilation and contraction of blood vessels, and so on. It helps to improve the cardiac function and overall cardiovascular health of patients with coronary heart disease [10]. Through feedback based on the actual situation of the patient, thus gradually increasing the exercise load, exercise frequency and intensity, it can help the patient to gradually improve the exercise endurance, individualized rehabilitation exercise to maintain the patient's organism function, improve muscle strength, and then improve the quality of life.

5. Conclusion

In conclusion, the application of individualized cardiac rehabilitation exercise in elderly patients with coronary heart disease and chronic heart failure can promote the recovery of clinical symptoms, strengthen cardiopulmonary function, enhance patients' exercise endurance, alleviate negative emotions, and effectively improve prognosis, which is worthy of being widely used in clinical treatment.

Disclosure statement

The authors declare no conflict of interest.

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