Research Paper

Analysis of Application Effect of Conventional Drugs Combined with Aerobic Exercise in the Treatment of Patients with Heart Failure

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To retrospectively analyze the efficacy of polypharmacy conventional drugs and aerobic exercise diagnosed in the treatment of chronic heart failure is the objective of the study. From January 2021 to June 2022, 106 patients with chronic heart failure were hospitalized in cardiovascular department of Zhejiang hospital. The control group was taken conventional anti-heart failure drug treatment. On the basis of the control group, the research group implemented 12 w of scientific aerobic exercise and monitored the patient's exercise status and treatment effect on the mobile phone exercise applications. After receiving medication and 12 w of aerobic exercise training, left ventricular systolic dysfunction and left ventricular diastolic dysfunction in the study were lower than those in the control group and the left ventricular ejection fraction increased significantly compared to the study group and differences between the two groups was statistically significant ($p<0.05$). The red blood cell distribution width and the opposite association were seen in the subjects studied using New York heart association grade and left ventricular ejection fraction in cardiac function was determined. Manifestations of red blood cells were negatively associated with the maximal oxygen consumption in exercise capacity. Maximum power and time of exhaustion were negatively correlated. The two different groups have marked differences in the left ventricular ejection fraction and New York heart association classification, improvement of maximal oxygen consumption and time of exhaustion ($p<0.05$). Failure in the application of anti-heart failure drug therapy combined with moderate aerobic exercise application in long-term heart failure patients can effectively reduce the red blood cell distribution width and improve the patient's health. Cardiac function and exercise capacity, and aerobic exercise can effectively reduce the degree of myocardial damage, improve exercise tolerance, and promote medical recovery of heart failure patients.

Key words: Coronary heart disease complicated with chronic heart failure, anti-heart failure drugs, aerobic exercise training, cardiac function, blood lipid indexes

Chronic Heart Failure (CHF) refers to a cardiovascular disease characterized by weakened myocardial contractility, reduced cardiac blood output and clinically cardiac output performance deficit, reduced index perfusion and lungs congestion with a high mortality rate[1]. Patients with symptoms such as dyspnea, fatigue, decreased exercise tolerance and fluid retention, show difficulties in the patient's daily life and health. Relevant studies have shown that moderate aerobic exercise can promote cardiac rehabilitation, improve myocardial function, prevent comorbidities and improve the patient's life well-being index[2]. In this paper, 53 CHF patients were intervened by the combination of drug therapy and aerobic exercise, and achieved obvious clinical effects. The experimental process is reported and explained below.

MATERIALS AND METHODS

Data sources:

The research objects are from January 2021 to June 2022. 106 patients with CHF were hospitalized in Cardiovascular Department of Zhejiang hospital. This study includes 52 males and 54 females between 55-72 y old, with a mean age of 63.5±2.2 y old. Among them people with basic diseases are 38 cases of hypertensive heart disease, 32 coronary heart disease patients and 36

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patients are of rheumatic heart valve disease.

Inclusion criteria: Echocardiography examination of left atrial ejection score was 50 %, cardiac function grouping of New York Heart Association (NYHA) was I-II, 72 cases were in grade I and 34 cases were in grade II. A total of 106 patients were divided into a study group and a control group by lottery, with 53 cases in each group. The research group consisted of 25 male patients and 28 female patients, with a mean age of (62.5±2.2) y; in the control group, 27 males and 26 female patients, with a mean age of (63.5±2.0) y.

Exclusion criteria: Patients with cardiac function grade III or above or those with obvious angina pectoris, severe arrhythmia, chronic obstructive pulmonary disease, limb movement disorders, long-term smoking, alcoholism, tumors, acute and chronic inflammation, and renal insufficiency, as well as those with poor medical compliance are excluded from the study.

There was no difference in all aspects of two research groups of patients ($p<0.05$), which can be used for comparison. All selected objects understood the content of the experiment and gave informed consent with high medical compliance and reported to the hospital ethics committee regarding the experiment.

Methods:

Patients in the control group were treated with oral medication for heart failure, class II routine nursing measures were used and no change in their daily life and eating habits. On the basis of comparing the treatments of the study groups, the research group formulated a 12 w scientific and regular aerobic exercise program and implemented it strictly like playing table tennis, stepping stairs and brisk walking.

Drug therapy:

Both groups of patients were given routine anti-heart failure drugs, metoprolol (manufacturer AstraZeneca Pharmaceutical Co., Ltd., approved by H32025391, specification: 25 mg/tablet, 20 tablets/plate/box) once a day, 100 mg/time; isosorbide mononitrate (manufacturer: Lunan Beite Pharmaceutical Co., Ltd., Chinese medicine Zhunzi H10940039, specification: 20 mg×48 tablets/box) 2 times a day, 10-20 g times;, Frusemide (manufacturer: Shanghai Zhaohui Pharmaceutical Co., Ltd., Chinese medicine Zhunzi H31021074, specifications: 20 mg after 100 s) once a day, 20~40 mg/time, if necessary, add 20~40 mg after 6~8 h, until a satisfactory diuretic effect occurs. Those with other symptoms were given symptomatic treatment.

Psychological care:

Psychological care do a good job in the ideological work of the family members of the treatment subject, help them understand the ideological changes, spiritual and psychological needs; fully accompany and take care of the patient and provide strong ideological and emotional support. Chatting and heart-to-heart interaction with patients more often reduce their psychological pressure and relieve tension; encourage patients to vent their emotions, reveal their inner thoughts, and avoid pessimism and disappointment; support patients in the successful treatment of this disease and cases of recovery and discharge, so as to enhance patients confidence in treatment, and confidence and compliance in nursing work can effectively improve the treatment effect.

Health guidance:

Strengthen the management of patient's diet, maintain personal and environmental hygiene, keep the ward environment ventilated and encourage patients to regularly exercise outdoors to improve their immunity. Patients in the research group should have personal protection and prepare themselves, before doing aerobic exercise. The clothes should be loose and comfortable and avoid too tight or too loose clothes to prevent accidents. There should be reasonable arrangement of exercise intensity and training time, reasonable training and proper rest.

Aerobic exercise training guidance:

Aerobic exercise training time is 12 w, 3 to 4 times a week, 30 min each time, 2 to 5 min of rest after 10 min of exercise, the exercise intensity is 20 % to 79 % of the heart rate, the body sweats slightly and there is no obvious discomfort or shortness of breath, which is appropriate to avoid overwork. The exercise should be carried out gradually, walking or jogging for 30 min each time in the first 6 w, running for 40 min in the next 6 w and then gradually increasing the endurance exercise. After 12 w, the cardiac function and other the research indicators of different groups of patients were detected and compared.

Before performing aerobic exercise training, check the patient's clothing to make it comfortable and appropriate, and avoid excessive cold or excessive heat. Later, a 5 min warm-up was undertaken and then finish exercise, which include massage and limb activity, stretching exercises for large muscle groups, slow walking, etc., and trial walk can also be performed for a

5 min. This process is mainly to observe the flexibility of the patient's limbs and exercise. If there is no problem, then formal training will be carried out. The instructor should observe the changes of the patient's vital signs at any time. For patients with cardiac function class I, the appropriate exercise distance is 100 m and the exercise is performed three times a day. For patients with cardiac function class II, they are instructed to stand up from the bed, get out of bed independently and step on the bed rail. Those with adverse reactions should stop training immediately to avoid fatigue.

Observation indicators:

Before and after the experiment, the symptom-restricted exercise load test was used to detect the exercise capacity of the patients. The main items are: Maximal Oxygen Consumption (VO_2 max) parameter, maximum power parameter and exhaustion time, etc.; NYHA classification index was used to detect cardiac function classification; Hitach's EUB525 color doppler ultrasound diagnostic instrument was used to measure the cardiac function indicators such as Left Ventricular End-Systolic Diameter (LVESD), Left Ventricular End Diastolic Diameter (LVEDD) and Left Ventricular Ejection Fraction (LVEF).

The blood cell analyzer was used to detect the hemoglobin, total number of red blood cells, blood divider and length of red blood cell distribution area of the patients; the blood lipid level of the two groups of patients before and after the experiment was monitored by the automatic biochemical instrument; the 6 min walking distance of the two research division groups was entered in detail according to 36-Item Short Form Survey (SF-36). According to the scoring standard, the quality of life is evaluated[3] and the evaluation items mainly include physical, psychological and social functions and daily activities.

Statistical methods:

The statistical software system used for statistical analysis was Statistical Package for the Social Sciences (SPSS) 20.0 and t-test was used for verification, count data by Chi square (χ^2) test, and $p<0.05$ was considered statistically significant.

RESULTS AND DISCUSSION

Comparision of echocardiographic examinations between two different groups of patients before and after the experiment was explained here. After drug treatment and a 12 w of aerobic exercise, the cardiac function indexes of both the study group and comparative study group were improved. Before the experiment, there was no significant difference in cardiac function indexes Left Ventricular Diastolic Dysfunction (LVDD), Left Ventricular Systolic Dysfunction (LVSD), LVEF and Left Ventricular Systolic Function (LVSF) between the two research groups ($p>0.05$). After the experiment, the indexes of the study group were significantly better than those of the control group ($p<0.05$), the LVEF obviously improved a lot ($p<0.05$) and the NYHA classification and resting heart rate was obviously less ($p<0.05$), suggesting that the patients in the research group received drug treatment combined with aerobic exercise. After 12 w of rehabilitation exercise, the cardiac contraction and ejection level were better than those of the prevention and control group, and the differences in results were statistically significant ($p<0.05$), as shown in Table 1.

Comparison of Total Cholesterol (TC), Triglycerides (TGs), High-Density Lipoprotein Cholesterol (HDL-C) and Low-Density Lipoprotein Cholesterol (LDL-C) blood lipid indexes in the two groups of patients before and after the intervention was explained here. There was no significantly difference in blood lipid indexes between the study group and the control group before the experiment ($p>0.05$). There was a marked difference in the results between the two groups after the experiment ($p<0.05$) as shown in Table 2.

Comparison of changes in erythrocyte width in patients before and after aerobic exercise was described here. After the experiment, the changes in red blood cells width in the control group was not significantly different ($p>0.05$), but there was reduction in red blood cells width in the research group and the difference was statistically significant ($p<0.05$), and there was clear differences between the two research groups ($p<0.05$) as shown in Table 3.

Partial correlation study on the length of red blood cell distribution area, cardiac function and exercise capacity before and after intervention in the two groups was shown here. The study adjusted the patient's age, gender, underlying etiology, disease course and drug use and other variables. The partial correlation analysis of the parameters of the length of the red blood cell distribution area and the atrium function, classification and exercise capacity showed that length of red blood cell distribution area in the study group was closely related to NYHA classification and LVEF. Both were negatively correlated; length of red blood cell distribution area was negatively associated with VO_2 max, maximum power and time for failure in exercise

capacity. It can be seen that 12 w of aerobic exercise training can greatly improve the LVEF and NYHA classification of patients, and improve VO_2 max and time of failure, and the difference between the study group and the control group show statistical significance ($p<0.05$) as shown in Table 4.

6 min walk and life happiness index evaluation before and after intervention in the two groups was explained here. There isn't any noticeable difference in walking distance and quality of life score of the two groups before training ($p>0.05$); after the experiment, there was significant differences between the two groups ($p<0.05$), as shown in Table 5.

TABLE 1: COMPARISON OF CARDIAC FUNCTION INDEXES BETWEEN STUDY AND CONTROL GROUP BEFORE AND AFTER THE EXPERIMENT (x̄±s)

Groups	N	LVESD (mm)		LVEDD (mm)		LVEF (mm)		LVSF (%)	
		Before	After	Before	After	Before	After	Before	After
Research group	53	47.2±6.8	44.1±5.4	61.0±6.5	55.2±5.1	45.1±4.0	51.12±5.9	44.7±4.6	50.6±6.0
Control group	53	47.9±7.5	46.2±5.0	62.0±7.05	58.0±5.6	44.9±4.5	49.4±6.0	45.2±4.8	48.2±5.8
t		-0.202	-2.421	-0.469	-2.198	-0.64	-2.068	1.902	2.321
p		0.851	0.021	0.655	0.028	0.531	0.045	0.061	0.022

Note: Before: Before the experiment and After: After the experiment

TABLE 2: COMPARISON OF BLOOD LIPID LEVELS OF TC, TG, HDL-C AND LDL-C OF THE TWO RESEARCH GROUPS OF PATIENTS BEFORE AND AFTER INTERVENTION (x̄±s)

Group	N	TC (mmol/l)		TG (mmol/l)		HDL (mmol/l)		LDL (mmol/l)	
		Before	After	Before	After	Before	After	Before	After
Research group	53	5.19±0.51	3.90±0.41	1.90±0.23	1.41±0.33	1.14±0.28	1.49±0.30	3.29±0.44	2.85±0.31
Control group	53	5.15±0.50	4.76±0.42	1.85±0.25	1.67±0.33	1.17±0.25	1.27±0.24	3.21±0.45	3.16±0.35
t		0.697	9.159	1.507	3.12	0.695	2.976	0.504	3.967
p		0.241	0	0.147	0.001	0.245	0.002	0.307	0

Note: Before: Before the experiment and After: After the experiment

TABLE 3: COMPARISON OF CHANGES IN RED BLOOD CELLS BEFORE AND AFTER THE EXPERIMENT IN TWO GROUPS (x̄±s)

Parameters	Research group (n=53)		Control group (n=53)	
	Before	After	Before	After
Red blood cell count (10-12/l)	4.56±0.44	4.59±0.55	4.70±0.42	4.86±0.51
Hb (g/l)	133.5±10.8	134.0±8.9	134.6±9.8	138.2±10.6
HCT (%)	41.1±4.9	44.1±6.9	45.1±5.8	45.7±4.1
RDW (%)	14.0±1.55	13.5±1.56	13.5±2.5	13.7±2.1

Note: Hb: Hemoglobin; HCT: Hematocrit; RDW: Red Blood Cell Distribution Width; Before: Before the experiment and After: After the experiment

TABLE 4: ANALYSIS OF PARTIAL CORRELATION LENGTH OF RED BLOOD CELL DISTRIBUTION AREA, CARDIAC EFFICIENCY AND EXERCISE CAPACITY IN TWO GROUPS (x̄±s)

Contents	Research group (n=53)		Control group (n=53)		r	p
	Before	After	Before	After		
Cardiac function parameters	-	-	-	-	-	-
NYHA classification	1.78±0.47	1.42±0.41	1.49±0.51	1.51±0.41	-0.319	0.029
LVEF	39.3±4.40	42.2±3.45	38.1±4.65	39.39±3.35	-0.383	0.048
Resting heart rate (beats/min)	75.8±4.1	73.2±3.1	76.8±6.1	76.3±6.1	-0.211	0.235
RSBP (mmHg)	137.5±9.1	138.2±10.8	136.1±9.2	137.8±10.9	-0.096	0.718
RDBP (mmHg)	76.1±6.8	76.2±7.9	77.7±9.1	79.1±8.2	0.169	0.131
Athletic ability parameters	-	-	-	-	-	-
VO_2 max (ml/kg/min)	18.5±3.5	21.0±2.7	17.7.2±4.4	18.2±5.1	-0.429	0.0047
Maximum power (W)	94.2±11.9	122.4±17.2	97.8±10.2	97.3±14.1	0.331	0.0081
Time for exhaustion (s)	557.1±74.2	718.9±67.8	576.0±97.8	571.2±87.7	0.284	0.0019

Note: RSBP: Resting Systolic Blood Pressure; RDBP: Resting Diastolic Blood Pressure; r: correlation coefficient; Before: Before the experiment and After: After the experiment

TABLE 5: THE 6 MIN WALK AND LIFE HAPPINESS INDEX EVALUATION BEFORE AND AFTER INTERVENTION IN THE TWO STUDY GROUPS

Group	N	6 min walking distance (m)		Quality of life score	
		Before	After	Before	After
Research group	53	321.05±24.50	454.55±26.40	60.85±5.60	89.63±4.30
Control group	53	322.45±23.45	391.55±26.32	60.81±5.54	69.43±4.20
t		0.027	5.459	0.087	8.62
p		0.471	0	0.447	0

Note: Before: Before the experiment and After: After the experiment

Chronic cardiac dysfunction is a clinical manifestation of the development of coronary heart disease to the end stage and patients have clinical symptoms such as dyspnea, fatigue and fluid retention. Due to the decreased mobility of patients, a variety of complications are prone to occur, such as pulmonary edema, hypoxemia and insufficient perfusion of vital organs, which seriously affects the life happiness index and health of sufferers[4].

First, during the development of CHF disease, the hemodynamic changes are large[5], the patient's left ventricle thickens, the contractility decreases, the ejection capacity decreases, the left ventricular blood storage volume decreases and the cardiac output is significantly reduced. It leads to the reduction of tissue blood supply and at the same time, skeletal muscle is remodeled under the influence of hemodynamics, the number of mitochondria decreases, oxidase decreases, and the slow and fast muscle conversion of muscle fibers occurs[6], so CHF patients are intolerant to exercise, prone to fatigue.

Second, the length of red blood cell distribution area of CHF also changes. Length of red blood cell distribution area is an important parameter to evaluate the variation of circulating volume of red blood cells. When the length of red blood cell distribution area increases, it indicates that the volume of red blood cells in peripheral blood is uneven[7], red blood cells are destroyed and ineffective hematopoiesis occurs, resulting in oxidative stress and inflammation in the body. This reaction further affects erythropoiesis and makes the oxygen transport system function plummet in the body, indicating that length of red blood cell distribution area is related to the increased morbidity and mortality of CHF patients[8].

Third, there are many factors that affect the length of red blood cell distribution area. Among them, nutritional deficiencies, renal insufficiency, oxidative stress, inflammation and bone marrow dysfunction, etc., have an important impact on the distribution width of red blood cells. This length affects the degree of disease in CHF, but also has a close relationship with exercise capacity, so the detection of length of red blood cell distribution area can be used to detect the type of anemia or as an auxiliary diagnostic method. It shows that the distribution width of red blood cells is closely related to patients with heart failure[9].

Fourth, aerobic exercise refers to various forms of physical exercise performed by CHF patients in an environment with sufficient oxygen supply to maintain a physiological balance between the inhaled oxygen and the body's needs. At the same time, aerobic exercise training can improve skeletal muscle function and exercise endurance, enhance myocardial contractility, further improve left atrial ejection score, and effectively improve symptoms of myocardial ischemia. In addition, aerobic exercise can greatly reduce the oxidation consequences in patients, reduce the inflammatory effect of the body, improve the efficiency of erythropoiesis, increase myocardial oxygen supply rate, relieve symptoms of dyspnea and fatigue, and effectively improve exercise endurance[10]. It is safe and feasible to improve the shrinkage level of the patient's heart, specially for CHF, with different categories of patients with I-II cardiac levels.

In recent years, professional scholars research on the change of myocardial level and exercise tolerance in healing object with moderate aerobic exercise has gradually increased, and the clinical treatment of CHF has also shifted from drug therapy to drugs and moderate aerobic exercise. The development of the combination method, the application of anti-heart failure drug therapy combined with aerobic exercise training in the treatment of CHF patients can effectively improve the disease manifestations of CHF healing objects and promotes the improvement of the prognosis. From this experiment, it can be seen that the echocardiographic examination results and blood lipid indexes of the research group levels were obviously better than control analysis panel and after 12 w of aerobic training, the

6 min walk and life happiness index evaluation in the study group were obvious better than those of control groups, and the overall rehabilitation effect was stronger than that of the patients in the reference group, and during the aerobic training process, the subjects treated by the research group had good treatment compliance, significantly improved exercise tolerance and did not experience aggravation of heart failure or malignant arrhythmia and has high safety.

There was a negative correlation between aerobic exercise and cardiac levels in subjects treated for long-term heart failure, under the premise of aerobic exercise and anti-heart medication. It can significantly increase the patient's exercise tolerance and quality of life. At the same time, aerobic exercise training can cultivate patient's long-term regular exercise habits and follow-up guidance enables patients to strictly abide by the routine work and rest, which can effectively enhance the therapeutic effect and is worthy of clinical application.

Conflict of interests:

The authors declared no conflict of interest.

REFERENCES

1. Bermejo RM, Ferreiro RG, Román AV, Otero IG, Kreidieh O, Sabarís PC, *et al.* Nutritional status is related to heart failure severity and hospital readmissions in acute heart failure. Int J Cardiol 2017;230:108-14.
2. Chen YQ, Long LH, Wang LY. The role of cluster management strategy in the promotion of 4G mobile nursing. China Contemp Med 2020;26(16):187-8.
3. Velazquez EJ, Morrow DA, Devore AD, Duffy CI, Ambrosy AP, McCague K, *et al.* Angiotensin-neprilysin inhibition in acute decompensated heart failure. N Engl J Med 2019;380(6):539-48.
4. Tang ZP, Li CH, Liu C, Li JF. Efficacy of sacubitril valsartan combined with cyclic adenosine in the treatment of acute left heart failure and its effect on neuroendocrine hormone levels. Chin J Hosp Pharm 2020;(9):1027-32.
5. Perino J, Gouverneur A, Bonnet F, Lahouati M, Bernard N, Breilh D, *et al.* Targeting of under-75 years for the optimization of medication reconciliation with an approach based on medication risks: An observational study. Therapies 2021;76(6):629-37.
6. Li H, Wang YX, Wang HH. Clinical analysis of oprinone combined with sodium nitroprusside in the treatment of elderly patients with acute heart failure. J Clin Res 2019;(7).
7. Keteyian SJ, Kerrigan DJ, Lewis B, Ehrman JK, Brawner CA. Exercise training workloads in cardiac rehabilitation are associated with clinical outcomes in patients with heart failure. Am Heart J 2018;204:76-82.
8. Wang D, Li XP. Research progress of exercise training in the treatment of chronic heart failure. Chin J Phys Med Rehabil 2019;41(11):877-80.
9. Wang H, Jiang LB, Jiang Y, Zhang AR. Effects of aerobic exercise combined with resistance exercise rehabilitation training on patients with coronary heart disease. J Cardiovasc Rehabil Med 2021;30(6):676-82.
10. Karagoz E, Ulcay A, Tanoglu A, Kara M, Turhan V, Erdem H, *et al.* Clinical usefulness of mean platelet volume and red blood cell distribution width to platelet ratio for predicting the severity of hepatic fibrosis in chronic hepatitis B virus patients. Eur J Gastroenterol Hepatol 2014;26(12):1320-4.

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