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Franchini Alessio[1], Murugesan Jeganath[2], Cioffi Veronica[1] and Caminiti Giuseppe[1]*

[1]S.Raffaele, Istituto di Ricovero e Cura a Carattere Scientifico, Rome, Italy
[2]Dipartimento di Medicina Fisica e Riabilitazione, Università Tor Vergata, Rome, Italy

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***Corresponding author:** Giuseppe Caminiti, MD, Cardiovascular Research Unit, Department of Medical Sciences, IRCCS San Raffaele – Roma, via della Pisana 235, 00163 Roma, Italy, Tel: +39-06-660581; Fax: +39-06-66058274; E-mail: giuseppe.caminiti@sanraffaele.it

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Research Article

Effects of Progressive Muscular Relaxation Combined With Aerobic Continuous Training on Exercise Tolerance, Hemodynamics, and Life Quality in Patients with Chronic Heart Failure

Abstract

Purpose: To assess if the addiction of progressive muscular relaxation (PMR) to aerobic continuous training (ACT) is more effective than ACT alone in order to improve exercise tolerance of patients with chronic heart failure (CHF).

Methods: Thirty CHF patients, age 67±6 years; ejection fraction 34±2. NYHA II–III was enrolled. Fifteen patients were randomized to group 1 and performed PMR and ACT; 15 to group 2 and performed ACT alone. At baseline and after 8 weeks all patients underwent: 6-minute walking test (6 MWT), measurement of blood pressure and heart rate, administration of a quality of life questionnaire (WHOQOL-brief). PMR and ACT were performed 3 times/week.

Results: After 8 weeks, 6MWT distance increased in both groups without between groups difference. Patients of the group 1 had a greater decreased of systolic blood pressure and resting heart rate compared to group 2. Patients of the group 1 had a greater significant improvement on psychological domain and a greater, despite not significant, improvement in the social domain.

Conclusions: The addiction of PMR to ACT, do not improves exercise tolerance but strengthen the effects of ACT on hemodynamic profile and psychological status of patients with CHF.

Background

Patients with chronic heart failure (CHF) exhibit impaired exercise tolerance that limits their functional capacity and deteriorates their quality of life. Exercise training, especially aerobic continuous training (ACT), has been established as adjuvant therapy in CHF due its broad spectrum of effects including improvement of exercise tolerance and quality of life [1].

Progressive muscular relaxation (PMR) is a well-established behavioural therapy for alleviating psychological distress in patients with chronic illnesses and cardiac diseases. According to the available literature PMR is particularly useful in the contest of cardiac rehabilitation/prevention programs. In a review of 27 studies, conducted on patients with ischemic heart disease, intensive supervised relaxation practice enhanced the recovery from an acute cardiac event and contributed to secondary prevention [2]. However while substantial research exists on PMR for patients with ischemic heart disease, there are few data on the value of PMR on patients with CHF. In particular, whether the addiction of a PMR program to ACT in subjects with CHF determine further improvement of their exercise tolerance it is not well established.

The first endpoint of this study was to evaluate whether a combined intervention of PMR and ACT is more effective than ACT alone in order to improve exercise tolerance of patients with CHF. Secondary endpoints were blood pressure, resting heart rate and quality of life (QOL).

Methods

Study population and study design

Subjects participating in this study were recruited from the cardiac rehabilitation department at S.Raffaele IRCCS, Rome, Italy. 30 patients with diagnosed CHF, mean age 67 ± 6 years, M/F=21/9 were included. Inclusion criteria were CHF of more than six months duration due to ischemic or nonischemic dilated cardiomyopathy; left ventricular ejection fraction (LVEF) ≤ 40%, NYHA functional class II-III; stable clinical conditions and optimal CHF treatment without changes for at least 3 months. Exclusion criteria were history of myocardial infarction or angina less than three months, decompensated heart failure, complex ventricular arrhythmias, neurological or orthopaedic conditions limiting the exercise protocol. This was an open randomized pilot study. At baseline, in order to estimate their maximal exercise capacity, all subjects performed a cardiopulmonary test with assessment of peak oxygen consumption. Subsequently, participants were randomized by lot into two groups. Fifteen patients were included into group 1 and received an associated treatment (PMR+ACT) 3 times/week; 15 patients were included into group 2 and received ACT 3 times/week.

All patients gave informed consent to participate in the study, which was approved by the local Ethics Committee and conforms to the principles outlined in the Declaration of Helsinki and to the GCP guidelines of the European Community.

Progressive muscular relaxation: In this study we adopted the progressive muscle relaxation technique as described by Bornstein and Borkovec [3]. PMR sessions were performed in a quiet room with suffused lights under the supervision of a physical therapist. The first session of the training was an introductory group discussion of stress anxiety in CHF, as well as a rationale and a general description of the purpose of relaxation; then subjects were taught how to relax and contract their muscles. From the second to last session patients only performed progressive muscular relaxation. During each session patients sat down comfortably on a chair, in a half lying position; they were asked to tense and relax major muscle groups of their body in a prefixed and systematic order, beginning at the proximal body parts and progressing to distal parts. We performed PMR for 30 minutes, three days/week at each session before starting ACT.

Aerobic continuous training: ACT was performed once a day, three days/week, according to the AHA guidelines [4]: every exercise session included 10 min of warm-up, cool-down and flexibility exercises, and 30 min of aerobic exercise with cycling at 60–70% of VO2 peak.

Changes on exercise tolerance were evaluated by 6 minute walking test (6MWT). The test was performed at baseline and at the end of the study according to the standardized procedure [5]. Each test was supervised by a physical therapist. Patients were asked to walk at their own maximal pace a 100m long hospital corridor. Every minute a standard phrase of encouragement was told. Patients were allowed to stop if signs or symptoms of significant distress occurred (dyspnoea, angina) though they were instructed to resume walking as soon as possible. Results of 6MWT were expressed in distance walked (metres).

Quality of life scores were calculated from the responses to the World Health Organization Quality of Life (WHOQOL) questionnaire (brief version), which includes 26 questions that evaluate four domains: physical, psychological, social relations and environment [6].

Statistical analysis

Differences in baseline characteristics between group 1 and 2 were evaluated by the chi-square and unpaired *t* test. Within-group changes in the reported variables were evaluated by the paired *t*-test or Wilcoxon signed rank test for nonnormally distributed variables. Between groups comparisons were performed by the unpaired *t*-test and Mann-Whitney rank sum test. The primary and secondary outcomes were evaluated comparing the delta (baseline—12 weeks) of CT versus ET using the Mann-Whitney test. Results are expressed as mean ± SD. A 2-tailed p value of <.05 was considered significant. All analyses were performed with a commercially available statistical package (SPSS for Windows version 13.0, Chicago, Illinois).

Results and Discussion

Clinical characteristics of the study patients are reported in table 1. At baseline no differences on anthropometric, clinical, echocardiographic or ergometric parameters between the two groups examined were noted.

The exercise protocols were well tolerated by both groups and no side effects occurred during the study period.

After 8-weeks, patients of both groups had a significant improvement of 6MWT distance without between groups difference (group 1= +44%; group 2 = +28%; between groups p= 0.23) (Table 2). Therefore our data show that the addiction of PMR to ACT do not further increased the exercise tolerance of patients with CHF. Our result is in line with the current literature. Although previous studies led to conflicting results, the majority of them showed modest effects of relaxation therapy on exercise tolerance [7-9].

Systolic blood pressure had a greater significant decrease in the group 1 compared to group 2 (-11.1% vs -4.2%; between groups p=0.04). Diastolic blood pressure had a similar mild decrease in both groups. Resting heart rate had a greater significant decrease in the group 1 compared to group 2 (-16.3% vs -8.1%; between groups p=0.02). Our data are in agreement with those of Shinde et al. [10]

Table 1: Baseline Features of patients of the two groups.

	Group 1 (MR+ACT)	Group 2 (ACT)
Age, years	67.2±6	68.65
Male/female	11/4	9/6
NYHA class II/III	10/5	8/7
Heart failure ethiology: Ischemic/not ischemic	10/5	12/3
Ejection Fraction,%	34.5±6	33.8±5
VO2 peak	15.6±.5	16.44
Comorbidities		
Hypertension	10	8
COPD	5	4
Atrial fibrillation	3	1
Chronic kidney disease	2	3
Treatment Beta-blokers ACE-i / ARBS Diuretics Digoxyn Aldosteron-antagonists Warfarin	 13 15 7 5 6 4	 14 13 6 3 7 2

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Table 2: Changes of exercise tolerance, haemodynamic and quality of life after 8 weeks of training in the two groups.

	Group 1 (MR+ACT)		Group 2 (ACT)	
	baseline	8-weeks	baseline	8-weeks
Exercise tolerance				
6mwt, m	236.4±44	305±56*	228.3±49	294.0±61*
Hemodynamic				
Resting heart rate, bpm	72.8±13	61.4±11*°	71.5±8	66.6±9
Systolic BP, mmHg	127.1±25	113±34*°	126.4±42	122.7±31
Diastolic BP, mmHg	72.3±16	72.0±15	75.5±11	69.4±16
QOL assessment#				
WHOQOL-brief				
Phisical	12.7±3	13.1±3	12.9±2	13.2±4
Psycological	12.9±3	16.4±4*°	12.8±5	13.8±2
Social	12.1±2	15.1±5*	12.5±1	13.6±2
Environment	13.7±2	14.1±1	13.4±3	14.6±4

BP: blood pressure; WHOQOL: Word Heart Organization Quality Of Life;
Frequency responses (%) for Items of the WHOQOL-brief
*= intragroup p<0.05
°= betweengroup p<0.05

who showed a significant decrease of both systolic and diastolic blood pressure in hypertensive patients after a single session of PMR. Instead the decrease of resting heart rate observed in our study was higher compared to previous studies, performed in patients with ischemic heart disease, in which a reduction of approximately 4 bpm has been registered after PMR [2]. There could be several explanations for this difference: in the majority of previous studies PMR was not associated to ACT; most important, only a small proportion of subjects enrolled in those studies had CHF. According to our results we can hypothesize that PMR and ACT strengthen each other and have additive effects on parameter, as blood pressure and resting heart rate that are under control of the autonomic nervous system. Therefore it is possible that when administered together PMR and ACT exert a greater modulation of the sympathetic tone compared to ACT alone. In this sense our data agree with those of Leonaide et al. [11] who showed significant decrease in sympathetic tone in patients after myocardial infarction undergoing PMR therapy. From a clinical point of view this effect on blood pressure observed in the group combining PMR and ACT is particularly welcomed in such patients. In fact a great proportion of them had hypertension though their BP levels were normal because they were taking several anti-hypertensive drugs.

Patients of the group 1 had a greater significant improvement in the psychological domain (+24.3% vs +7.8%; between groups p =0.04) and a greater, despite not significant, improvement in the social domain (+20.9% versus +8.8%; between groups p = 0.07). Our study confirms previous observations. The adoption of relaxation techniques, using physical or non-physical approaches, has been associated to improvements in the psychological status as recently observed in patients with CHF [9,12].

PMR and ACT were both well tolerated. No patients had adverse events during water immersion. No patients were withdrawn during the study period.

Conclusions

Limitations: this is a small study including only 30 patients and has a very short follow up period. Therefore our results need to be validated in larger studies. Despite our data on blood pressure and heart rate suggest strong effects of PMR plus ACT on autonomic nervous system we did not directly measured the neurohormonal activity in our patients.

In conclusion the results of this study suggest that the association of PMR to ACT does not improve further exercise tolerance of CHF patients compared to ACT alone. However this association enhances the positive effects of ACT on hemodynamic parameters and psychological status of these patients. Given the registered effects on such significant parameters, our results support the hypothesis of using PMR during the rehabilitation of CHF.

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