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COMPARISON OF CHANGES IN EXERCISE TOLERANCE AND QUALITY OF LIFE BETWEEN CONGESTIVE HEART FAILURE AND CORONARY ARTERY BYPASS GRAFT PATIENTS FOLLOWING A HOSPITAL-BASED CARDIAC REHABILITATION PROGRAM

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ABSTRACT

COMPARISON OF CHANGES IN EXERCISE TOLERANCE AND QUALITY OF LIFE BETWEEN CONGESTIVE HEART FAILURE AND CORONARY ARTERY BYPASS GRAFT PATIENTS FOLLOWING A HOSPITAL-BASED CARDIAC REHABILITATION PROGRAM. **Craig Brubaker, E. Lea Witte, Theodore J. Angelopoulos. JEPonline.** 2003;6(1):18-23. Few studies have compared cardiac rehabilitation program outcomes between individuals with congestive heart failure (CHF) and post coronary artery bypass graft (CABG), perhaps due to the lack of insurance reimbursement for a CHF diagnosis. Therefore, we examined the exercise tolerance and quality of life outcomes for 56 individuals with CHF (age=73±9 yrs; ejection fraction=34±11%) and 52 individuals post CABG (age=73±7 yrs; ejection fraction=57±10 %) following a 12-week cardiac rehabilitation program, respectively. Both groups exercised a minimum of 24 sessions over 12-weeks while attending up to 12 educational seminars. Pre- and post- exercise tolerance was measured by a graded treadmill test and quality of life was assessed using the SF-36 Health Survey. Following the 12-week cardiac rehabilitation program there were significant improvements in exercise tolerance in individuals with CHF (163±61 to 251±70 s; p<0.01) and CABG (208±62 to 309±90 s; p<0.01). All nine quality of life constructs improved significantly (p<0.01) within both groups. There were no significant differences in exercise tolerance or quality of life between groups (p=0.17). Furthermore, a positive and significant correlation was found between exercise tolerance and patient perceived physical function (R²=0.34, p<0.01). The data presented in this study suggest that patients with CHF can safely benefits from cardiac rehabilitation and that their outcomes are similar to patients post CABG.

Key Words: SF-36, Treadmill testing, Cardiomyopathy, Left ventricular dysfunction

INTRODUCTION

Congestive heart failure (CHF) afflicts 4.7 million Americans while accounting for about 7% of the total cost of heart disease each year (1). Poor physical condition, emotional distress, and frequent hospital admissions contribute to a decreased quality of life (QOL) among individuals with heart failure (2,3) which can lead to social impairments, depression, and psychological disorders (4,5).

Most major insurance companies do not reimburse cardiac rehabilitation for individuals with CHF despite their high hospital readmission rate. However, programs providing a multidisciplinary educational approach have shown to increase the QOL (6) of individuals with CHF, while also improving physical functioning (7-10). Interestingly, when these exercise programs are offered on an outpatient basis in hospitals, individuals have demonstrated a high level of compliance while making significant improvements in exercise tolerance and muscular strength (11). Furthermore, these documented benefits in quality of life can occur in as little as eight to twelve weeks (12,6).

Perhaps due to the lack of insurance reimbursement for a CHF diagnosis in cardiac rehabilitation programs, there has been limited research comparing outcomes between individuals with CHF and other forms of heart disease. Thus, the purpose of this research was to determine if increases in quality of life and exercise tolerance differ in individuals with CHF or coronary artery bypass graft (CABG) following 12-weeks of cardiac rehabilitation.

METHODS

Patient Selection

Florida Hospital Fish Memorial is a 97 bed acute care hospital that offers both inpatient and outpatient cardiac rehabilitation services and follows the guidelines required by an American Association of Cardiovascular and Pulmonary Rehabilitation Certified program. Thus, the cardiopulmonary wellness staff provides inpatient education to those individuals with symptoms of CHF and other forms of heart disease prior to their hospital discharge.

Individuals recovering from a CABG are routinely entered into the cardiac rehabilitation program with a physician referral and insurance reimbursement. However, individuals discharged with a primary discharge of CHF, indicated by an ICD/9 code of 428.0, were recruited for this study by offering a free 12-week cardiac rehabilitation program, pending specific exclusions. Exclusions for the CHF outpatient program included ejection fraction greater than 45%, discharge to a skilled nursing facility, a pre-transplant individuals, individuals or physician refusal, hospice patient, individuals receiving dialysis, a previous or scheduled CABG, or a primary ICD/9 diagnosis code other than 428.0. Exclusions for individuals with CABG this study included an ejection fraction less than 45%, a co-morbidity of CHF, a primary diagnosis code indicating treatment other than bypass surgery, or patient refusal.

Data Collection

Physician referral was obtained prior to participation and the Wellness Staff directed any patient care questions to each respective office during the program.

Following an initial nursing assessment of individuals with CHF and CABG, subjects underwent a graded treadmill test designed to measure exercise tolerance. The American College of Sports Medicine Guidelines for Exercise Testing (13) was used for indications and contraindications to treadmill testing. All subjects wore a telemetry monitor during the treadmill test to measure rate and rhythm based on lead II. Subjects began each treadmill test by gently holding onto the rails and walking at 1.0 mi/hr with 0% elevation and progressed through a protocol of increasing speed by 0.5 mi/hr and incline by 1.0% after each one-minute stage. The speed

in stage six terminally increased to 3.2 mi/hr but elevation continued to increase 1.0% each minute. Vitals and RPE (rate of perceived exertion) were reported at the end of each stage or whenever the patient felt a change in RPE.

Treadmill test endpoints included reaching 80% of their maximum predicted heart rate, as determined by $220 - \text{age}$, and/or a 15 (hard) on the 6-20 RPE scale.¹³ Exercise tolerance time was determined by the total seconds completed.

Subjects completed a SF-36 Health Survey[®] (14) pre- and post-program to determine their physical and mental QOL constructs. Physical constructs included physical functioning, role-functioning physical, bodily pain, and general health. Mental constructs included role-functioning emotional, social functioning, vitality, and mental health, and health transition. All scales were interval/ratio and scored from 0 (worst case) to 100 (best case) except for health transition, which was measured on a scale of 1 (best case) to 5 (worst case).

All subjects were offered three telemetry monitored sessions/week lasting up to one hour. Every subject was weighed prior to each exercise session to monitor for possible fluid retention. Cardiovascular exercise prescriptions were written for 50-70% of maximum heart rate and 11-13 on the RPE scale. To meet a goal of improved functional capacity, cardiovascular and resistance exercise progression was based on target heart rate, disease symptoms, and RPE, where duration preceded increases in intensity. Heart rate, blood pressures, and pulse oximetry were obtained pre- peak and post-exercise. Exercise time was distributed between Trackmaster[®] treadmills, Schwinn[®] stationary bicycles, Monarch[®] upper body arm ergometers, Nautilus[®] resistance equipment, and hand weights.

All subjects were encouraged to attend the 12 weekly education seminars taught by cardiac nurses, respiratory therapists, and exercise physiologists. The seminars covered topics such as coronary artery disease, dietary concerns, anatomy and physiology of the heart and lungs, home exercise, risk factors for heart disease, food label reading, stress management, diabetes, cholesterol, smoking cessation, and medications. Subjects had the opportunity to ask questions during and after class or in a one-on-one situation with a clinical staff member.

Statistical Analyses

One difficulty associated with testing differences in individuals with heart disease is they start an exercise program at different stages of progression and cardiorespiratory endurance. Consequently, the naturally occurring differences between individuals within a group may produce excessive variability thus masking true gains in score. Repeated measures designs allow a reduction in overall variability by using a common subject pool for all treatments while allowing removal of subject differences from the error term, leaving the error components independent from treatment to treatment (15). This procedure is sometimes referred to as using subjects as their own controls. In addition, the use of multiple tests of statistical significance inflates the error rejection rate.

To avoid type I error, within and between group pre-post exercise tolerance and quality of life constructs were examined using a doubly multivariate split plot repeated measures analysis of variance. That is, initially differences in all quality of life constructs were evaluated simultaneously for between group differences (between CABG and CHF groups) and within group differences (pre-post scores and interaction of pre-post score with group). Individual constructs were further examined only if there was an omnibus difference.

A Pearson correlation was used to measure the strength of the relationship between change in exercise tolerance and the change in self-reported SF-36 Health Survey physical functioning score. A significance level of $p < 0.05$ was considered significant for all outcomes. All continuous data are expressed as mean \pm standard deviation.

RESULTS

Baseline demographics for individuals with CHF and post CABG completing the cardiac rehabilitation program in 2000 and 2001 (≥ 24 sessions) were similar and are shown in Table 1. Cardiac rehabilitation was well tolerated for both groups with no untoward events occurring during the 12-week program. Pre-post changes for exercise tolerance and quality of life constructs within and between groups are shown in Table 2. Quality of life scores and exercise tolerance in both groups improved significantly statistically with the cardiac rehabilitation program explaining 62% of the variance ($F(9,98)=17.9$ $p<0.001$). There was no statistically significant interaction between the CHF and CABG groups ($F(9,98)=1.47$, $p=0.17$). In addition, exercise tolerance and the self-reported SF-36 physical functioning (PF) quality of life construct were significantly correlated for both CHF and CABG patients ($r^2=0.34$, $p<0.01$).

Table 1. Patient Characteristics

	<i>CHF</i>	<i>CABG</i>
<i>n</i>	56	52
<i>Male</i>	36	29
<i>Female</i>	20	23
<i>EF %*</i>	34±11 [§]	57±10
<i>Age (yrs.)</i>	73±9	73±7

n Number of participants completing program (≥ 24 sessions in 12-weeks)

* Ejection Fraction

[§] Values in mean±standard deviation

Table 2. Outcomes for QOL Constructs and Exercise Tolerance^h

<i>Outcome</i>	<i>CHF</i>		<i>CABG</i>	
	Mean±SD		Mean±SD	
	Pre-test	12-weeks	Pre-test	12-weeks
<i>n=</i>	56	56	52	52
<i>Body Pain**</i>	59±23	66±24	54±27	65±25
<i>General Health**</i>	49±1	58±23	63±18	64±17
<i>Health Transition**</i>	3.5±.2	2.3±1.2	3.1±1.2	2.4±1.2
<i>Mental Health**</i>	69±17	77±17	71±17	76±18
<i>Physical Functioning**</i>	42±20	55±22	43±21	61±21
<i>Role-Functioning Emotional**</i>	42±44	67±39	45±43	69±40
<i>Role-Functioning Physical**</i>	15±30	39±38	17±34	42±37
<i>Social Functioning**</i>	58±5	81±19	80±20	85±20
<i>Vitality**</i>	39±22	54±21	44±19	55±21
<i>Exercise Tolerance**</i>	163±61	251±70	208±62	309±90

^h For readability, all numbers rounded to nearest 1.0 except for Health Transition. *n* Number of patients completing program (≥ 24 sessions in 12-weeks). SD Standard Deviation. [§] Exercise Tolerance measured in seconds. Significant pre-post changes: ** $p \leq .001$. * $p \leq .05$. Denotes significance within-groups.

DISCUSSION

This study suggests that a significant improvement in exercise tolerance and QOL constructs can occur equally for both individuals with CHF and post CABG following a 12-week cardiac rehabilitation program. Both groups showed significant similar increases quality of life constructs and exercise tolerance from pre to post-program. Interestingly, in both groups, self-reported patient perceived physical functioning increased linearly with their improved treadmill test exercise tolerance.

Our outcomes were consistent with previous research studies involving outpatient intervention programs designed to increase the functional capacity (9) and QOL (12) of individuals with CHF. As mentioned earlier,

few studies are available comparing outcomes of individuals with CHF and post CABG following a cardiac rehabilitation program. However, one observational study similar to ours in sample size and study design found equal improvements between individuals with and without left ventricular dysfunction in the six-minute walk distance and quality of life scores (16). Studies such as these are necessary and serve as an important indication that individuals with CHF can safely benefit from cardiac rehabilitation programming while learning lifestyle modifications that may improve overall health. Although there may never be complete restoration of pre-disease physical functioning levels in individuals with CHF, these initial increases, if sustained, may be meaningful in terms of the quality of a potentially prolonged life span.

Individuals with CHF have plenty to gain from exercise, so it should be included in their treatment regimen. However, we feel it is important to employ a symptom-limited exercise test prior to starting the exercise program, as most individuals are sedentary prior to program entry. Although it may not be safe for all individuals with CHF to exercise, a safe beginning target heart rate zone is 40-60% of maximum. It is also important to note that many individuals with CHF have a high resting heart rate, which should be considered when calculating the target heart rate.

In our program we used three to five minute warm-ups to facilitate vasodilation before increasing into the higher intensity and longer duration of the exercise prescription. Our CABG subjects walked or rode a stationary bicycle in their target heart rate zone for 20 to 40 min two to three days/week with little unusual fatigue. However, when needed, we employed interval training for individuals with CHF to build their endurance slowly without discouraging them from returning to the program. Alternating activity with rest, closely resembles the demands of their daily life so we generally started interval training with one to two minutes of rest, until they could complete 15 to 20 min of exercise.

We feel it is important to teach all individuals about their medications, the signs of angina, decompensation, oxygen desaturation, and water retention to assist in their own healthcare. To this point, clinicians should not be apprehensive about discussing appropriate regimens with the individual's primary physician or specialist.

Limitations

A limitation of this study is the lack of a control group for comparison to treatment withheld. We also were not able to use a maximal stress test with gas exchange analysis for measuring actual maximal functional capacity. However, we believe that our treadmill test was useful within its parameters in measuring the actual increases in exercise tolerance, verified by the subjects in their SF-36 physical functioning QOL construct score. In addition, this efficient and inexpensive graded treadmill protocol can be implemented in any cardiac rehabilitation facility to provide a baseline for exercise tolerance.

Conclusion

Large, randomized studies are needed to accurately assess the impact of long-term exercise therapy on CHF morbidity and mortality rates, maintenance of functional capacity and quality of life. Currently, we are examining if these short-term outcomes can be sustained for a longer period of time in the individuals with CHF. In addition, hospital-based cardiac rehabilitation programs may also find they can increase program revenue by safely integrating individuals with CHF into their maintenance programs. In conclusion, the data presented in this study suggest that major insurance companies may want to consider reimbursing cardiac rehabilitation programs for individuals with CHF, or with left ventricular dysfunction (ejection fraction < 45%) as they do with other diseases of the heart.

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