

CLINICAL STUDIES

A Controlled Pilot Study of Stress Management Training of Elderly Patients With Congestive Heart Failure

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The purpose of this study was to evaluate the effect of stress management training on quality of life, functional capacity, and heart rate variability in elderly patients with New York Heart Association class I-III congestive heart failure (CHF). While substantial research exists on stress management training for patients with coronary heart disease, there are few data on the value of psychosocial training on patients with CHF. Thirty-three multiethnic patients (mean age, 66±9 years) were assigned through incomplete randomization to one of two treatment groups or a wait-listed control group. The 14 participants who completed the treatment attended eight training sessions during a 10-week period. The training consisted of 75-minute sessions adapted from the Freeze-Frame stress management program developed by the Institute of HeartMath. Subjects were assessed at baseline and again at the completion of the training. Depression, stress management, optimism, anxiety, emotional distress, and functional capacity were evaluated, as well as heart rate variability. Significant improvements ($p<0.05$) were noted in perceived stress, emotional distress, 6-minute walk, and depression, and positive trends were noted in each of the other psychosocial measures. The 24-hour heart rate variability showed no significant changes in autonomic tone. The authors noted that CHF patients were willing study participants and their emotional coping and functional capacity were enhanced. This program offers a simple and cost-effective way to augment medical management of CHF. Given the incompleteness of CHF medical management and the exploding interest in comple-

mentary medical intervention, it seems imperative that further work in psychosocial treatment be undertaken. (Prev Cardiol. 2002;5:168-172, 176)

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Congestive heart failure (CHF) is the only major cardiovascular disorder that is increasing in incidence, prevalence, and overall mortality. Recent studies estimate the prevalence of CHF at almost 5 million persons in the United States, leading to hospitalization of 900,000 patients each year.¹ Improvements in survival after myocardial infarction, better management of diabetes and hypertension, and an increase in the aging population have contributed to the rise in CHF.² The hallmark of CHF is exercise intolerance and activity restriction, most commonly due to symptoms of dyspnea and fatigue. These symptoms are debilitating and result in low functional capacity and progressive physical disability, often requiring intensive medical management, follow-up, and hospitalization.

In addition to physical decline, these patients often report depressed mood, anxiety, and increased hostility.³ A structured interview with 60 hospitalized CHF patients (aged 70+ years) showed that 17% of the participants met the *Revised Diagnostic and Statistical Manual of Mental Disorders* (DSM III) criteria for major depression. The patients who were depressed required a greater number of inpatient hospital days and, at 1 year, showed greater mortality.⁴

Patients with CHF are known for very high mortality rates, as well as the highest hospital readmission rates of all patient populations.⁵ This may be partly due to the psychosocial consequences of the disease process, which includes behavioral restrictions, as well as comorbid depression and anxiety. A study that evaluated quality of life of CHF patients found no significant relationship between a patient's cardiac ejection fraction and any quality of life measure.² However, self-reported functional status, depression, and hostility were significant indicators of quality of life among these patients.

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Recent studies have shown that sympathetic activation is one of the hallmark physiologic abnormalities in CHF. Circulating catecholamine levels have been associated with increased severity of disease and unfavorable prognosis.⁶ As a result of these studies, the “neurohormonal” hypothesis has emerged as the leading paradigm for understanding the progression of CHF.⁷

Pharmacologic therapies that alter autonomic balance, such as angiotensin-converting enzyme inhibitors and β blocking agents, have become standard therapy for CHF patients.⁸ However, noncompliance can be a significant problem in pharmacologic treatment. Monane et al.⁹ noted that among elderly CHF patients on digoxin, only 10% were completely compliant with the prescribed regimen over the course of a year. The use of β blockers elicits better adherence, yet medical management of CHF is still incomplete.¹⁰ Sullivan and Hawthorne¹¹ reviewed the nonpharmacologic interventions for CHF. They cite the effectiveness of long-term aerobic exercise conditioning programs and make the case for offering psychological and biobehavioral interventions to enhance outcome and quality of life.

To test their hypothesis, they examined the effect of structured nursing care for CHF patients in order to reduce readmission rates and improve quality of life.⁴ The study results showed that patients with CHF experienced major mood disturbances greater than those reported by other cardiac patients. This mood disruption was directly related to patients’ quality of life and highlighted the need for concurrent psychosocial intervention. Interestingly, this study found exercise tolerance to be unrelated to patients’ ejection fractions but related to quality of life.

To date, there are two studies that included a psychosocial intervention as an aspect of a clinical trial. As one arm of a study, CHF patients were offered an intervention that included exercise training, structured cognitive therapy, and dietary training. This intervention improved functional capacity, body weight, and mood state.¹² The second¹³ was a pilot study in which New York Heart Association (NYHA) class II–IV CHF patients taught the Freeze-Frame¹⁴ stress management program showed significant improvement in coping with stress and a trend toward increased self-confidence related to their physical fitness. Previous research had shown the short-term positive effects of Freeze-Frame to include enhancement of heart rate variability and modification of sympathetic arousal in healthy volunteers.^{15,16} This study attempted to measure participants’ autonomic balance, but the severity of NYHA class III–IV CHF prevented adequate recording of 24-hour heart rate variability. Compromised heart rate variability was the factor that best predicted early death from progressive heart failure.¹⁷

Stress management and relaxation training are psychosocial practices that can reduce sympathetic arousal. Research shows the usefulness, in both primary and secondary prevention, of stress management training in patients with coronary artery disease.¹⁸ This current study builds upon the authors’ previous study through

recruiting and randomization of a larger number of participants with less severe CHF.

RESEARCH DESIGN AND METHODS

Participants

The initial study sample consisted of 13 men and 20 women with an average age of 66 ± 9 years. Thirteen participants were middle-class Anglo-Americans, with one Asian American woman, and were invited to participate by the nurse at a local cardiac rehabilitation facility. Nineteen participants were inner city, low socioeconomic status African American, Asian American, or Latino patients, and were invited to participate by their cardiologists.

Subjects had been diagnosed as having NYHA class I to very early class III CHF at least 3 months previously and had been on a stable medication regimen for at least 1 month. A cardiologist evaluated each patient’s medical file and certified each participant as eligible for the study. Stanford University’s Institutional Review Board approved this project.

Participants were assigned to either of two treatment groups or to the wait-listed control group through incomplete randomization. Full randomization was attempted, but because only one class was held per location, four participants in the treatment group could not make the training sessions and became control group participants. Subsequently, five control group members were assigned to the treatment groups. Control group members were invited to attend a 1-day training at the completion of the intervention.

Intervention

All participants received the same 10 hours of training offered during eight weekly 75-minute sessions spread over 10 weeks. The two treatment groups followed the same topical outline that was taught by one of the authors (Frederic Luskin), a licensed psychotherapist. The training was primarily didactic in nature, with an emphasis on guided practice of the techniques. A limited amount of time was set aside for participant sharing of personal experience. After each session, participants were given practice assignments for the week.

The stress management techniques taught were Freeze-Frame, Heart Lock-in, Appreciation and Care vs. Overcare. Freeze-Frame is the basic stress management technique and starts with the conscious shifting of attention from a stressful experience to the area around one’s heart. After taking a few slow, deep breaths into the area around the heart, one’s attention is drawn to a visualization or memory of a positive emotion, such as care or love. Then the feeling generated by that positive emotion is held in the area around the heart. Heart Lock-in is an extended Freeze-Frame, while Appreciation is learning to focus attention on positive experiences. Care is distinguished from Overcare. Overcare is defined as the tendency to want something or someone so much that the extra effort and/or anxiety obscures the positive experience of care and leads to distress.

The class outline was as follows:

1. Orientation and class overview. Review research on the effectiveness of practice of Freeze-Frame. Guided practice in Freeze-Frame.
2. Review of research on effectiveness of stress management in cardiovascular disease. Review of what stress does to the body. Review of Freeze-Frame. Guided practice in Heart Lock-in.
3. Discussion of stress management practice as a form of complementary medicine. Discussion of importance of self-care. Presentation of concept of Appreciation. Guided practice in Freeze-Frame.
4. Discussion of secondary gain (behavior that on the surface appears unproductive has personally relevant reason for continuation). Discussion of the difficulty in changing patterns of response. Brainstorming for suggestions. Guided practice in Heart Lock-in.
5. Practice in thinking of ways to include Freeze-Frame in daily life. Teaching of other simple stress management tips, such as deep breathing and taking a moment before making decisions. Guided practice in Heart Lock-in.
6. Discussion of Care vs. Overcare and implications for stress management. Presentation of the concept of finding the Care rather than the Overcare in each situation one encounters. Guided practice in Heart Lock-in.
7. Presentation of mental health as partly the choice of how one responds. Emphasis on decisions that primarily manifest either Care or Overcare. Teaching, through class examples, that suffering is the result of Overcare crowding out Care. Guided practice in Heart Lock-in.
8. Review of course material. Reminders for future practice, creation of an ongoing practice routine that does not vary, and emphasis on continued practice. Participant feedback on training.

At the conclusion of each class period, participants were given homework practice suggestions. Beginning with the second session, each participant was asked to do one Heart Lock-in per day for 15 minutes. Starting with session 4, each participant was asked to do two Heart Lock-ins per day. In addition, starting with the first session, participants were asked to do at least three Freeze-Frames per day, as well as look for opportunities during the day to practice Freeze-Frame.

Measures

All measures were administered 1–2 weeks before the training began (pretest) and 1–2 weeks after the training ended (post-test).

1. Geriatric Depression Scale: measures participant's level of negative affect.¹⁹
2. Perceived Stress Scale: measures participant's perceived level of stress and ability to cope.²⁰
3. Life Orientation Test: measures subject's level of positive expectation or optimism.²¹
4. State Trait Anxiety Inventory: measures stable or dispositional expression of anxiety.²²

5. Medical Outcome Survey Questions 3 and 9: two of the multi-item self-report questions were evaluated that ask participants to rate their ability to complete basic activities and the quality of their emotional experience.²³
6. Minnesota Living with Heart Failure: a quality of life measure evaluating the degree to which CHF interferes with the completion of normal life tasks.²⁴
7. Self-report physical fitness: participants are asked to rate their confidence in their physical ability.²⁵
8. Six-minute walk: participants are measured to see how far they can walk in 6 minutes.
9. Systolic blood pressure: pressure was taken three times with 5-minute intervals and the average pressure was utilized for comparison.
10. Heart rate variability (HRV): evaluates changes in autonomic tone through 24-hour Holter monitoring, with use of the following indices²⁶:

Time domain:

- Mean heart rate in beats per minute
- SDNN: standard deviation of the normal-to-normal (NN) interval in milliseconds; measures overall HRV
- SDNN index: the mean of the 5-minute standard deviation of NN intervals calculated over 24 hours; measures overall HRV
- RMS-SD: the square root of the mean squared differences of successive NN intervals; a measure of vagal tone
- 24-Hour triangle index: total number of all NN intervals divided by the maximum NN interval; a measure of overall HRV frequency domain
- Low frequency: variance in the 0.04–0.15-Hz range; a measure of both parasympathetic and sympathetic tone
- High frequency: variance in the 0.15–4.00-Hz range; a measure of vagal tone
- 5-Minute total power: variance of all 5-minute intervals; a measure of overall HRV
- Total power: variance of all NN intervals; a measure of overall HRV

RESULTS

Data were available for 29 subjects for pre- and post-tests. Two treatment group subjects dropped out due to illness and two control subjects lost interest in the study and did not complete the post-tests. The subjects who were not available for post-testing were not significantly different from the other subjects. The SPSS (version 9) (SPSS Inc., Chicago, IL) general linear model was used to evaluate changes in all dependent variables between the control and treatment groups over time. The results of the psychosocial, functional capacity, and blood pressure recordings are reported in Table I.

The quality of the 24-hour Holter recordings was good and the participants complied without fail with the monitoring. However, autonomic balance could be evaluated in only 23 of the 29 participants both

pre- and post-test, due to excessive ectopic activity in six patients: four of the patients had atrial fibrillation, one had sinus arrhythmia, and one had an excessive number of ectopic ventricular beats. The results of the HRV monitoring are reported in Table II.

On measures of psychosocial functioning, significant improvement in the treatment group was noted on the Geriatric Depression Scale ($p < 0.02$), Perceived Stress Scale ($p < 0.001$), and the Medical Outcome Survey question 9 that evaluated emotional status ($p < 0.001$). On the Life Orientation Test, State Trait Anxiety Scale, Medical Outcome Survey question 3, Minnesota Living with Heart Failure, and the Physical Fitness Scale, positive trends were noted. On a measure of functional capacity—the 6-minute walk—significant improvement was observed ($p < 0.02$). Treatment group members walked, on average, 175 feet further at post-test than at pretest. No change was seen in systolic blood pressure.

No significant treatment-associated changes occurred in HRV. There was a slight increase in SDNN and the SDNN index in the treatment group, coupled with slight decreases in SDNN and the SDNN index in the control group. This same trend was noted in RMS-SD, mean heart rate, low frequency variance as well as total power and 5-min total power. No change was seen in 24-hour triangle index for the treatment subjects, while a slight decrease was seen in the control group. The same pattern appeared for high frequency variance.

DISCUSSION

This controlled pilot study was the authors' second attempt to investigate stress management training in

patients with CHF. It was successful in that participants regularly attended the training, complied with the assessments and reported that the training was both enjoyable and valuable. The treatment group members were able to significantly reduce their stress levels and improve their ability to cope with stress over the course of the training. They made improvement in physical fitness as evidenced by the increase in distance walked during a 6-minute walk test. In addition, they significantly reduced their level of depression and emotional upset and had positive trends in optimism and CHF disease impact.

There were minimal changes in the HRV data, yet most of the indices showed nominal changes in a positive direction for the treatment group and nominal changes in a negative direction for the control group. These results suggest that a longer intervention (9 months to a year) with greater time spent in practice (1 hour per day), and investigated with a larger subject pool might show beneficial changes in autonomic balance.

Of note is the response of the patients to the training. Attendance was excellent and in post-test debriefings the participants expressed singular appreciation for the training. Most of them mentioned the lack of psychosocial support they experienced for their condition and their frustration at the number of drugs required for medical management.

The authors wish to emphasize the need for further investigation of stress management for patients with CHF. As stated, a dearth of information exists in this area as compared to the substantial research that exists for patients with coronary artery disease. This pilot study showed that these patients make good

Table I. Means and Standard Deviations of Dependent Variables at Pre- and Post-Test

	TREATMENT GROUP N=14		CONTROL GROUP N=15		P VALUE*
	PRE X̄ (SD)	POST X̄ (SD)	PRE X̄ (SD)	POST X̄ (SD)	
Depression	8.3 (6.0)	5.5 (3.0)	5.3 (6.3)	6.0 (6.8)	0.02
Stress	25.8 (4.6)	20.2 (5.6)	19.1 (8.9)	20.5 (10.3)	0.001
Optimism	21.1 (3.6)	22.2 (4.0)	25.0 (4.2)	24.5 (4.7)	–
Anxiety	40.2 (8.0)	35.9 (7.1)	36.4 (9.9)	36.6 (11.1)	–
MOS 36-Q3	21.7 (5.6)	23.7 (5.4)	20.4 (5.1)	19.8 (5.5)	–
MOS 36-Q9	24.0 (3.5)	18.8 (4.1)	22.6 (6.9)	22.8 (6.0)	0.000
MLHF	30.9 (20.5)	23.5 (14.8)	36.9 (22.2)	35.4 (21.8)	–
PF	24.8 (7.1)	23.8 (4.2)	24.5 (6.4)	24.6 (5.9)	–
6-Minute walk	1088.0 (360)	1241.0 (318)	1191.0 (238)	1171.0 (277)	0.02
Systolic BP (mm Hg)	126.0 (13.5)	126.0 (17.0)	125.0 (20.0)	121.0 (21.2)	–

**p* for difference in the change pre- to post-test between the treatment and control groups; Depression=Geriatric Depression Scale; Stress=Perceived Stress Scale; Optimism=Life Orientation Test; Anxiety=State Trait Anxiety Scale; MOS 36-Q3=Medical Outcome Survey Question 3—Basic Activities; MOS 36-Q9=Medical Outcome Survey Question 9—Emotional Distress; MLHF=Minnesota Living with Heart Failure; PF=perceived physical fitness; 6-Minute walk=distance covered in 6 minutes measured in feet; BP=blood pressure

Table II. Measures of Heart Rate Variability at Pre- and Post-Test

	TREATMENT GROUP N=14		CONTROL GROUP N=9	
	PRE \bar{X} (SD)	POST \bar{X} (SD)	PRE \bar{X} (SD)	POST \bar{X} (SD)
Time domain				
Mean heart rate	72.2 (10.4)	71.7 (10.2)	75.6 (10.2)	78.1 (12.4)
SDNN	100.7 (38.0)	104.2 (44.6)	99.0 (27.6)	95.4 (21.7)
SDNN index	41.0 (13.9)	43.5 (18.5)	44.1 (17.5)	42.3 (17.4)
RMS-SD	23.9 (6.6)	25.4 (9.8)	32.0 (24.7)	30.0 (21.2)
24-Hr triangle index	29.7 (11.9)	29.5 (14.2)	30.9 (11.0)	29.5 (9.1)
Frequency domain				
High frequency	4.55 (0.7)	4.54 (0.8)	4.90 (1.2)	4.67 (1.3)
Low frequency	5.53 (0.9)	5.68 (1.0)	5.58 (0.9)	5.51 (0.9)
5-Minute total power	7.11 (0.8)	7.19 (0.9)	7.29 (0.9)	7.10 (0.9)
Total power	9.10 (0.8)	9.15 (0.9)	9.10 (0.6)	9.05 (0.5)
SDNN=standard deviation of the normal-to-normal (NN) interval in milliseconds; measures overall heart rate variability; SDNN index=the mean of the 5-minute standard deviation of NN intervals calculated over 24 hours; measures overall heart rate variability; RMS-SD=the square root of the mean squared differences of successive NN intervals; a measure of vagal tone				

study participants and that their psychosocial coping and functional capacity can be enhanced through training. This intervention was inexpensive, and if the results hold up in future studies, can be expected to improve the quality of life in CHF patients. Considering the incompleteness of medical management of this disease, and the exploding interest in complementary medical interventions, it seems imperative that further work in psychosocial adjunctive treatment be undertaken.

LIMITATIONS

The validity of the study results are attenuated because of the lack of full randomization. While scheduling was the primary reason to switch participants from one group to another there is no way to know the effect the incomplete randomization had on the outcome. This study also combined the data from two groups of participants with divergent socioeconomic status and life experience. About 60% of the participants were from an inner city neighborhood and were largely African American and Latino. The other participants were Anglo Americans from a middle class suburb. Therefore, there was insufficient data to complete separate analyses so it is not clear whether the relaxation training intervention is equally as effective for members of the different socioeconomic status and ethnic groups. Finally, a follow-up assessment would help to determine if the positive results seen from the intervention were lasting or whether CHF patients require continued attention to maintain quality-of-life gains.

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REFERENCES

- 1 American Heart Association. 1999 *Heart and Stroke Statistical Update*. Dallas, Texas: American Heart Association; 1998.
- 2 Anonymous. Mortality from congestive heart failure—United States, 1980–1990. *MMWR Morb Mortal Wkly Rep*. 1994; 43:77–81.
- 3 Dracup K, Walden J, Stevenson L, et al. Quality of life in patients with advanced heart failure. *J Heart Lung Transplant*. 1992;11(2 pt 1):273–279.
- 4 Freedland KE, Carney R, Rich MW, et al. Depression in elderly patients with congestive heart failure. *J Geriatr Psychiatry*. 1991;24(1):59–71.
- 5 Hawthorne MH, Hixon ME. Functional status, mood disturbance, and quality of life in patients with heart failure. *Prog Cardiovasc Nurs*. 1994;9(1):22–32.
- 6 Maniolis AJ, Olympios C, Sifaki M, et al. Suppressing sympathetic activation in congestive heart failure, a new therapeutic strategy. *Hypertension*. 1995;26:719–724.
- 7 Bristow M. Mechanism of action of beta-blocking agents in heart failure. *Am J Cardiol*. 1997;80(11A):26L–40L.
- 8 Heart Failure Society of America. HFSA Guidelines for the management of patients with heart failure due to left ventricular systolic dysfunction-pharmacologic approaches: recommendations for pharmacologic therapy. *Congest Heart Fail*. 2000;6(1):16–23.
- 9 Monane M, Bohn RL, Gurwitz JH, et al. Noncompliance with congestive heart failure therapy in the elderly. *Arch Intern Med*. 1988;154:433–437.
- 10 Khan NU, Movahed A. Role of beta blockers in congestive heart failure. *Congest Heart Fail*. 2000;6(6):299–312.
- 11 Sullivan MJ, Hawthorne MH. Nonpharmacologic interventions in the treatment of heart failure. *J Cardiovasc Nurs*. 1996;10(2):47–57.
- 12 Kostis JB, Rosen RC, Cosgrove NM, et al. Nonpharmacologic therapy improves functional and emotional status in congestive heart failure. *Chest*. 1994;106(4):996–1001.
- 13 Luskin FM, Newell KA, Haskell W. Stress management training of elderly patients with congestive heart failure: pilot study. *Prev Cardiol*. 1999;2:101–104.
- 14 Childre D. *Freeze-frame: A Scientifically Proven Technique for Clear Decision Making and Improved Health*. Boulder Creek, CA: Planetary Publications; 1998.

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- 15 Tiller W, McCraty R, Atkinson M. Cardiac coherence: a new, noninvasive measure of autonomic nervous system order. *Altern Ther Health Med*. 1996;2(1):52-65.
- 16 McCraty R, Atkinson M, Tiller W, et al. The effects of emotions on short-term power spectrum analysis of heart rate variability. *Am J Cardiol*. 1995;76:1089-1093.
- 17 Nolan J, Batin PD, Andrews R, et al. Prospective study of heart rate variability and mortality in chronic heart failure. *Circulation*. 1998;98:1622-1630.
- 18 Friedman R, Myers P, Krass S, et al. The relaxation response: use with cardiac patients. In: Allan R, Scheidt S, eds. *Heart and Mind: The Practice of Cardiac Psychology*. Washington, DC: American Psychological Association; 1996;363-385.
- 19 Beck A, Ward C, Mendelson M, et al. An inventory for measuring depression. *Arch Gen Psychiatry*. 1961;4:561-571.
- 20 Cohen S, Kamarack T, Mermelstein R. A global measure of perceived stress. *J Health Soc Behav*. 1983;24:385-396.
- 21 Scheier MF, Carver CS. Optimism, coping and health: assessment and implications of generalized outcome expectancies. *Health Psychiatry*. 1985;4(3):219-247.
- 22 Spielberger CD, Gorsch, RL, Lushene RE, et al. *Manual for the State Trait Anxiety Inventory (Form Y)*. Palo Alto, CA: Consulting Psychologists Press; 1983.
- 23 Stewart A, Ware J. *Measuring Functioning and Well-Being*. Durham, NC: Duke University Press; 1992.
- 24 Rector T, Cohen J. Assessment of patient outcome with the Minnesota Living with Heart Failure Questionnaire: reliability and validity during a randomized, double-blind, placebo-controlled trial of pimobendan. Pimobendan Multicenter Research Group. *Am Heart J*. 1992;124(4):1017-1025.
- 25 Gortner S, Jenkins L. Self-efficacy and activity levels following cardiac surgery. *J Adv Nurs*. 1990;15(10):1132-1138.
- 26 Malik M, Bigger J, Camm AJ, et al. Heart rate variability: standards of measurement, physiological interpretation, and clinical use. *Circulation*. 1996;93:1043-1065.