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Gender Differences in Improvement of Function Capacity and Psychological Status Following Cardiac Rehabilitation Program after Different Cardiac Interventions

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Abstract

Background: Because of lower exercise capacity and energy as well as function score in women, improvement of these indices following cardiac rehabilitation (CR) may be of greater clinical benefit to women than to men. The purpose of the present study was to determine if there were gender differences in risk profiles and function capacity as well as perceptions of quality of life and depression-anxiety status in CR patients.

Methods: Three hundred and eleven consecutive patients who underwent various cardiac interventions and attended 20 or more of the CR sessions in an exercise-based CR program at the Tehran Heart Center between August 2008 and August 2009 were included. The main outcome measures were differences in the changes of exercise parameters, the health-related quality of life (QOL) (assessed by a standardized self-rating Short Form 36 Health Questionnaire), as well as depressed and anxious mood (assessed by the Costello-Comrey Depression and Anxiety Scale).

Results: The metabolic equivalent (METs) level of men was higher than that of women at baseline and at the end of CR, but its changes was not significant between the two genders. At the end of the three-month program, although men had higher post-exercise systolic blood pressure, peak heart rate and peak O2 consumption than women, improvements in these parameters were not statistically different between them. Regarding health-related quality of life scores, both men and women improved in all scores, although men reported more increase in their level of general health, however the changes of all QOL scores and depression-anxiety level were globally similar in both genders.

Conclusion: Improvement in exercise parameters, QOL, and depression-anxiety state is similarly occurred in men and women following complete CR program.

Keywords: Coronary artery disease; Cardiac rehabilitation; Sex

Introduction

Cardiac rehabilitation (CR) is a customized program of myocardial evaluation, prescribed exercise, risk factors modification, education, psychological counseling and behavioral interventions and designed to help the patient recover following a heart attack or different cardiac interventions. Application of CR schedules to patients with heart failure or following cardiac procedures has gained increasing acceptance as their benefits and safety are documented. Despite its potential clinical and psychological benefits, among all survivors following myocardial infarction or cardiac interventions, only 11% to 20% completely participate in CR programs [1], and this participation rate is dramatically lower among women than men [2,3]. It was suggested that women with coronary artery disease, enrollment in CR programs is much less than expected based on their prevalence of cardiac events [4]. (Wenger 1999). Some authors noted the roles of some barriers to enrollment into the CR classes included patient-oriented, provider-oriented, and programmatic factors [5]. Some believed that women were far less likely to have CR discussed or referrals made by healthcare professionals [6], and according to the viewpoint of some others, beliefs about the value of CR, awareness as well as lower exercise capacity are modifiable barriers in women for participating in CR [7]. Despite higher demonstrated poor outcome of cardiac interventions in women [8], data regarding the beneficial effects of a disciplinary CR program on outcome of these procedures in women are also limited. It has been cleared that although women referred for CR have poorer baseline risk profiles than men, but have similar levels of compliance and improvement in exercise capacity and physical parameters [9,10]. It seems that because of lower exercise capacity and energy as well as function score in women, improvement of these indices following CR may be of greater clinical benefit to women than to men [11]. The purpose of the present study was to determine if there were gender differences in risk profiles and function capacity as well as perceptions of quality of life and depression-anxiety status in CR patients.

Materials and Methods

The Tehran Heart Center (THC) provides a multidisciplinary approach to rehabilitation following different cardiac interventions such as coronary artery bypass grafting (CABG), Percutaneous Coronary Interventions (PCI), valvular surgeries as well as acute myocardial events. A computerized database of electronic patient charts for patients enrolled in the CR program was organized and mentioned. The charts of all patients who attended at least a session of cardiac rehabilitation

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were reviewed. Noted program was arranged on referral from different hospital wards especially post-surgery, post-CCU and clinics. This protocol was programmed to make lifestyle choices through combining physical activity with education and counseling about lifestyle, quality of life and psychosocial issues over a three-month period. The following information was contained in the THC database: demographic characteristics, primary indications of CR, number of CR sessions that patients participated, function class, risk stratification (based on history, examination and resting ECG) [12]. Echocardiograpgic data, aerobic capacity and stress test results, oral medications, health related quality of life scores and depression-anxiety scores.

The health-related quality of life (HRQL) was assessed by a standardized self-rating Short Form 36 Health Questionnaire (SF-36). On admission, a data manager proposed the SF-36 questionnaire to the patients in the rehabilitation clinic. The SF-36 is a 36-item tool that covers eight dimensions of health including: physical functioning, role emotional, role physical, bodily pain, social functioning, mental health, vitality, and general health. A higher score on this questionnaire indicates a better QOL [13]. In some recent studies on various groups of subjects in Iran, good-to-excellent reliability and acceptable validity of this questionnaire has been approved [14-16].

Costello-Comrey Depression and Anxiety Scale (CCDAS) was also used to measure depressed and anxious mood. The CCDAS contains 14 items assessing depression and 9 items measuring anxiety. The scales are regarded more as trait, rather than state indicators reflecting a person's general "tendency to experience a depressive mood" or "a predisposition to develop anxious affective states". Scores could range from 14 to 126 on the depression scale and 9 to 81 on the anxiety scale, with higher scores representing greater depression or greater anxiety [17].

The complete cardiac rehabilitation program was three 20-25 min periods of cardiovascular exercise on a treadmill per week for 8 weeks (total of 24 sessions). There was 20 min of stretching and calisthenics for warm-up, and the session finished with 20 min of stretching and calisthenics for cool-down; the total duration of each session was approximately 1 hour [18]. Exercise testing of patients was performed with Bruce or Cornell treadmill protocols [19]. Heart rate and blood

Item	Total (n = 331)	Men group (n = 241)	Women group (n = 70)	p-value
Age (year)	58.8±10.1	58.7±10.4	59.0±9.2	0.846
Body mass index (kg/m^2)	27.2±4.2	26.6±4.0	29.6±5.3	< 0.001
CR indication				
CABG	217 (69.8)	181 (75.1)	36 (51.4)	< 0.001
PCI	64 (20.6)	46 (19.1)	18 (25.7)	0.227
Valve surgery	23 (7.4)	7 (2.9)	16 (22.9)	< 0.001
Functional class				
I	257 (82.6)	212 (88.0)	45 (64.3)	< 0.001
II	54 (17.4)	29 (12.0)	25 (35.7)	
Risk stratification				
Mild	201 (64.6)	167 (69.3)	34 (48.6)	
Moderate	82 (26.4)	57 (23.7)	25 (35.7)	0.004
Severe	28 (9.0)	17 (7.1)	11 (15.7)	
Medications:				
Beta-blockers	269 (87.1)	209 (87.1)	60 (87.0)	0.978
Calcium-blockers	40 (12.9)	31 (12.9)	9 (13.0)	0.978
ACE-inhibitors	90 (29.1)	67 (27.9)	23 (33.3)	0.383
Diuretics	44 (14.2)	23 (9.6)	21 (30.4)	< 0.001
Nitrates	199 (64.4)	155 (64.6)	44 (63.8)	0.901
Anti-hyperlipidemia	257 (83.2)	199 (82.9)	58 (84.1)	0.823
Anti-hyperglycemia	58 (18.8)	38 (15.8)	20 (29.0)	0.014
Antidepressant	3 (1.0)	0 (0)	3 (4.3)	0.011

Data are presented as mean ± SD or n (%)
CR: Cardiac Rehabilitation; CABG: Coronary Artery Bypass Grafting; PCI: Percutaneous Coronary Interventions

Table1: Baseline characteristics and clinical data in patients undergoing cardiac rehabilitation.

Item	Total (n = 331)	Men group (n = 241)	Women group (n = 70)	p-value
Ejection fraction	50.1±7.6	49.6±7.7	51.9±7.3	0.003
Left ventricular end diastolic diameter (mm)	48.9±6.7	49.6±6.7	46.5±6.0	< 0.001
Left ventricle end systolic diameter (mm)	32.7±7.2	33.1±7.2	31.4±6.8	0.015
Left atrial diameter (mm)	38.3±5.4	38.3±4.9	38.1±7.0	0.715
Wall motion abnormality	318 (51.5)	269 (55.8)	49 (35.0)	< 0.001
Mean pulmonary artery pressure (PAP) (mmHg)	31.3±6.1	31.3±5.5	31.2±7.8	0.929
Mitral insufficiency	399 (64.1)	317 (65.8)	82 (58.6)	0.118
Aorta insufficiency	75 (12.1)	51 (10.6)	24 (17.1)	0.036
Tricuspid insufficiency	247 (39.7)	167 (34.6)	80 (57.1)	< 0.001
Pulmonary insufficiency	17 (2.7)	15 (3.1)	2 (1.4)	0.385

Data are presented as mean ± SD or n (%)

Table 2: Echocardiographic findings in patients undergoing cardiac rehabilitation.

Item	Baseline			After CR			Change		
	Men	Women	p-value	Men	Women	p-value	Men	Women	p-value
Resting SBP (mmHg)	113.2±19.5	115.2±21.4	0.522	114.7±16.1	116.6±16.6	0.448	1.5±21.4	1.4±26.5	0.606
Post-exercise SBP (I) (mmHg)	148.5±13.2	133.8±20.1	0.110	138.2±20.8	129.6±24.7	0.018	-10.3±13.9	-4.2±25.8	0.381
Peak heart rate (I) (min $^{-1}$)	130.5±22.6	126.7±23.8	0.264	131.2±22.5	123.2±23.9	0.024	0.7±23.5	-3.5±24.8	0.397
Heart rate recovery (I) (min $^{-1}$)	112.0±20.8	108.6±16.4	0.232	111.8±21.5	102.5±27.4	0.020	-0.2±24.3	-6.1±28.3	0.174
Peak exercise O_2 (mL/kg/min)	43.1±15.4	26.1±16.5	0.119	34.0±23.6	24.2±19.8	0.002	-9.1±16.8	-10.9±21.2	0.395
Metabolic equivalent unit (mets)	10.2±9.5	6.9±2.7	< 0.001	9.3±2.8	6.3±2.2	< 0.001	-0.9±9.8	-0.7±3.1	0.826

Data are presented as mean ± SD
SBP: Systolic Blood Pressure

Table 3: Cardiovascular parameters before and after attending a cardiac rehabilitation program.

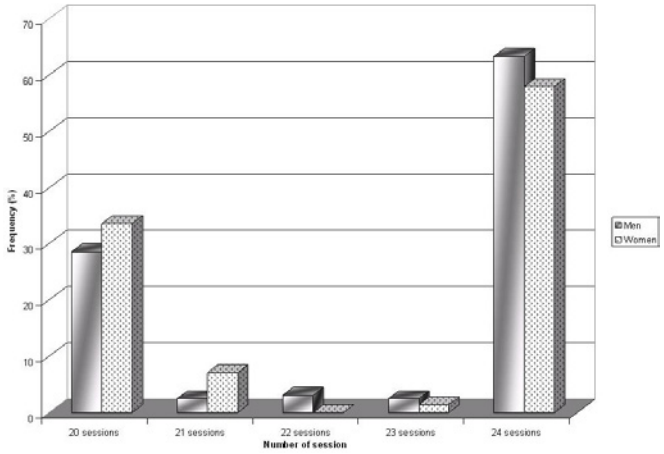

Figure 1: Complete participation rate in cardiac rehabilitation program in men and women undergoing different cardiac interventions.

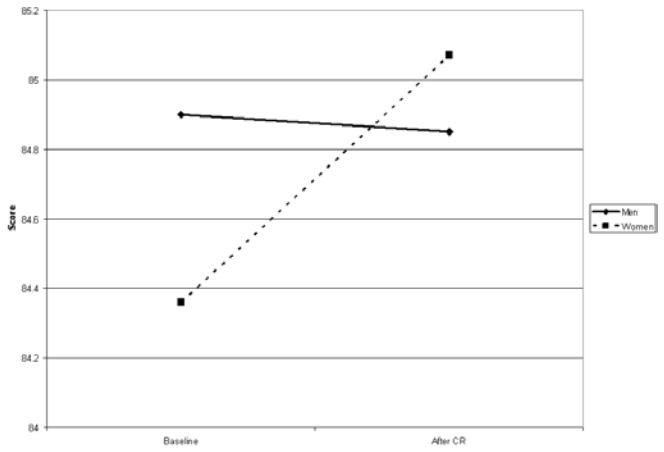

Figure 2: Changes of depression-anxiety scale following cardiac rehabilitation in men and women undergoing different cardiac interventions.

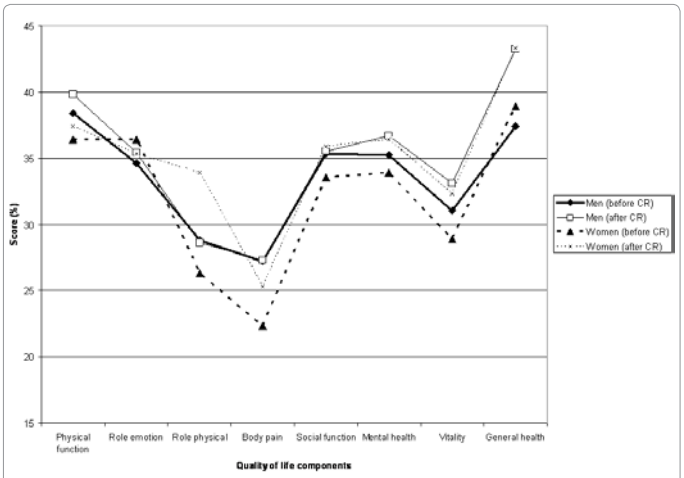

Figure 3: Changes of different components of quality of life following cardiac rehabilitation in men and women undergoing different cardiac interventions.

pressure at baseline and peak exercise, Heart rate 1 minute into a walking cool down period and treadmill speed and grade at peak exercise were recorded. Heart rate recovery was calculated as the difference between HR at peak exercise and HR at 1 minute of the cool down period. Metabolic equivalents (METs) were calculated from treadmill speed and grade at peak exercise according to standard nomograms [20].

All patients also received psychological counseling that patients were offered coping strategies to accept and live with their cardiac incident. Furthermore, nutritional counseling and individualized diet plan was provided to establish a diet goal consistent with the American Heart Association/American Association of Cardiovascular and Pulmonary Rehabilitation recommendations [21].

In current study, all consecutive patients attended 20 or more of the available sessions were included. Studied patients underwent various cardiac interventions and enrolled in an exercise-based CR program at the THC between August 2008 and August 2009. Patients with previous cardiac operations, neurological impairment (stroke, peripheral neuropathy, or traumatic brain injury), severe musculoskeletal disease (fracture or amputation); and any complications within hospitalization such as severe infection, shock, arrhythmia, or prolonged ventilator dependence were excluded. Patients were also excluded if they displayed uncontrolled dysrhythmia during exercise training, such as atrial flutter, fibrillation, or continuous ventricular tachycardia, or if ischemic changes were observed on an electrocardiogram during treadmill exercise. The study was approved by the Research and Ethics Committees of Tehran University of Medical Sciences and all individuals signed an informed consent before taking part in the study.

Results

The current study followed 311 patients who participated in CR program at the THC between August 2008 and August 2009. The mean age of CR participants was 58.8 ± 10.1 (range 18-86 years) and most of them were men (n=241, 77.5%). There were no significant differences between the mean ages of men (58.7 years) and women (59.0 years). However, obesity (body mass index ≥ 30 kg/m^2) was more prevalent in women than men (38.6% versus 17.4%, p <0.001). History of recent myocardial infarction was similar between the two genders (men 9.1%, women 7.1%, p = 0.603). More women than men had a primary diagnosis of valvular disease, whereas men were more likely than men to have undergone coronary artery bypass grafting (Table 1). On average, men attended 63.3% of 24-session CR program while women attended 57.9% of the classes (p = 0.012) (Figure 1). Men had higher function capacity than women that 35.7% of women and only 12.0% of men had function class II (P < 0.001). Regarding risk stratification, women were stratified in higher risk level than men. Except for diuretics, anti-hyperglycemia drugs and anti-depressants that were more administered for women, other oral medications were similar in the two genders (Table 1).

According to the echo cardiographic findings (Table 2), women had higher left ventricular ejection fraction and both left ventricular end systolic and diastolic diameters were more in men. Furthermore, wall motion abnormality was more reported in men. However, aorta and tricuspid insufficiencies were more frequent in women and regurgitation of mitral and pulmonary valves was similarly seen in both genders.

At baseline, men had a higher mean MET level than women (10.22 versus 6.9), whereas there were no differences in other baseline parameters between the two genders. At the end of the three-month program, although men had higher post-exercise systolic blood pressure, peak heart rate and peak O_2 consumption than women, improvements

in these parameters were not statistically different between them (Table 3). The METs level of men was also higher than that of women at the end of CR, but its changes was not significant between the two genders.

Regarding depression-anxiety scale, slight improvement in CCDAS score was observed in men, whereas this score was increased in women after the completion of CR sessions (Figure 2). With regard to health-related quality of life (Figure 3), at baseline, men had higher score of body pain component than women ($p = 0.030$) and other component scores were similar. Also, at the end of sessions, two genders had similar components scores. Men's scores on general health improved following the completion of CR program ($p = 0.004$), but none of the women's components scores were statistically changed.

Discussion

The onset and progression of cardiovascular disease in women often differs from that of men. Therefore, lifestyle modifications in women can be contributing to reduced risks for cardiovascular disease especially in developing countries. Some notable CAD risk factors for this group include higher fat diet, westernized lifestyle, and a rapid decline in the level of physical activity. Furthermore, some studies showed that women were misdiagnosed more frequently than men and dosage levels of prescription drugs, were found to be inadequate for the female [22]. Therefore, some protective schedules such as cardiac rehabilitation in women, especially those who underwent different cardiac interventions can be considerably helpful through improving their quality of life, restricting their physical limitations as well as regulating program of consumed drugs. This program can also avoid the possibility of depression and anxiousness in this subgroup.

In the first stage, we showed that men attended more than women in complete CR program. Low referral rates and membership in CR programs have been consistent problems for cardiac rehabilitation and secondary prevention plans especially in women. Some barriers have been identified for discontinuing participation in CR programs. It seems that the most important barrier is lack of information on CR beneficial effects on physical fitness and psychological status [23,24]. Therefore, efforts should be concentrated to better inform both healthcare personnel and their respective patients about the advantages of recommending CR and the subsequent risks associated with non-participation. Other main determinant of CR attendance in women is physician referral. It was clear that the strength of physician endorsement and enthusiasm for CR can powerfully promote CR attendance in women [5]. Efforts of physician should be focused on explanation of the importance of CR and its comprehensive nature that can motivate women to attend CR program. Another barrier for discontinuing complete CR program can be higher incidence rate of CAD risk profile and also lower physical activity in women than men. The prevalence of traditional CAD risk factors is higher among female CR enrollees and this group tends to have more risk factors than men do. Some studies confirmed that the risk factor burden tended to be higher among women, with a greater prevalence of obesity and trends toward higher rates of hypertension, diabetes mellitus and home stress [25,26]. Furthermore, self-reported physical activity levels and peak exercise capacity at CR enrollment are consistently lower among women than men [27]. Therefore, higher risk stratification level and lower physical function in women that has been also confirmed in current study seems relevant variables in CR attendance in women.

In our study, after the CR program, there were no significant sex differences in improvement in MET level, physical activity and other risk factor profiles. Regarding health-related quality of life scores, both men and women improved in all scores, although men reported more increase in their level of general health, however the changes of all QOL scores and depression-anxiety level were globally similar in both genders. Our findings are comparable with the study by O'Farrel et al. that reported similar improvement in exercise capacity and risk factor profile following CR completion. In their study, health-related quality of life scores improved in all scores in both sexes, although women reported less increase than men in their level of overall vitality [10]. Similarly, Mittag et al. indicated no gender differences in the preferences for cardiac rehabilitation features [28]. However, influence of CR program on various components of QOL has been different in men compared to women. Some studies showed those men's mean scores were significantly higher than women's mean scores on overall quality of life scores [29]. Some others revealed that while men had higher physical function and overall QOL scores both pre- and post-CR, women showed greater improvements in overall scores, as well as in family and socioeconomic parameters [30]. Totally, it seems that although women are the minority of CR patients, they appear to benefit equally well from the program and gender seems not a relevant variable in CR benefits.

In conclusion, cardiovascular disease is still one of the most frequent causes of death of women in the world. CR programs have been seen as an optimal way of improving the function capacity and survival rate as well as psychological status in women and positively change their quality of life. Therefore, increasing CR attendance rate and informing on CR beneficial effects in women should be a first step for achieving this purpose.

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