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ORIGINAL REPORT

GENDER-RELATED DIFFERENCES IN CLINICAL CHARACTERISTICS AND PHYSIOLOGICAL AND PSYCHOSOCIAL OUTCOMES OF JAPANESE PATIENTS AT ENTRY INTO PHASE II CARDIAC REHABILITATION

Kazuhiro P. Izawa, PT, PhD, MS[1], Koichiro Oka, PhD[2], Satoshi Watanabe, PT, BS[1], Hitoshi Yokoyama, PT, MS[1], Koji Hiraki, PT, BS[1],Yuji Morio, PT, MS[1], Yusuke Kasahara, PT, PhD, MS[1] and Kazuto Omiya, MD[3]

From the [1]Department of Rehabilitation Medicine, St Marianna University School of Medicine Hospital, Kanagawa, [2]Faculty of Sport Sciences, Waseda University, Saitama, [3]Division of Cardiology, Department of Internal Medicine, St. Marianna University School of Medicine, Kanagawa, Japan

Objective: **To examine gender differences in clinical characteristics and physiological and psychosocial outcomes at entry into phase II cardiac rehabilitation.**
Design: **Cross-sectional study.**
Subjects: **The study comprised 442 consecutive patients with cardiac diseases assessed at entry into a phase II cardiac rehabilitation programme.**
Methods: **Clinical characteristics of the patients, such as age, education, marital status, employment and body mass index, were obtained from hospital records. Oxygen uptake, handgrip and knee extensor muscle strength were measured to assess physiological outcomes. Self-efficacy for physical activity, hospital anxiety depression scale and health-related quality of life assessed by Short Form-36 were evaluated to assess psychosocial outcomes.**
Results: **The number of married women and their levels of education, employment and body mass index were significantly lower, and their ages higher, than those of the men. Measures of physiological outcome in women were significantly lower than those in men. Measures of self-efficacy for physical activity and Short Form-36 physical and emotional subscale scores were lower and anxiety levels higher in women than in men.**
Conclusion: **Cardiac rehabilitation programmes exclusively for women focusing on physiological outcomes, group counselling, and training to enhance physical and emotional domains may encourage increased participation by women in cardiac rehabilitation.**

Key words: gender difference, cardiac rehabilitation, clinical characteristics, physiological outcomes, psychosocial outcomes.

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Correspondence address: Kazuhiro P. Izawa, Department of Rehabilitation Medicine, St Marianna University School of Medicine Hospital, 2-16-1 Sugao, Miyamae-ku, Kawasaki, Kanagawa 216-8511, Japan. E-mail: izawapk@ga2.so-net.ne.jp

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INTRODUCTION

Effective cardiac rehabilitation (CR) for patients with coronary heart disease (CHD) such as acute myocardial infarction (AMI) or following coronary artery bypass graft (CABG) surgery has been reported to improve exercise capacity, reduce coronary risk factors, improve health-related quality of life (HRQOL), and reduce cardiac events, hospitalization costs, sudden death and all-cause mortality (1–4). In recent years, researchers in several countries, after examining the benefits of CR separately for men and women, have called for added attention to the study of gender-related differences in CR outcomes (1–4).

The risk of developing CHD is known to be markedly different between men and women (5, 6). Several studies address gender-related differences in mortality and risk factors in Japan. Kawano et al. (5) suggested that hypertension, diabetes, current smoking, family history and hypercholesterolemia are associated with AMI in Japanese patients. In addition, there are gender-related differences in the order of importance of these risk factors for AMI. Moreover, Sasaki et al. (6) reported that in a 6-year observational study, the incidence of coronary events was 60% lower in women than in men. Although the correlation of serum total cholesterol and low-density lipoprotein cholesterol concentrations to coronary events was similar in men and women, the low-density lipoprotein cholesterol concentration associated with a decreased risk of coronary events was slightly higher in women. Diabetes mellitus was a stronger risk factor in women than in men and offset the women's advantage of lower risk for coronary events, especially in elderly patients.

However, the presence of CHD is a major predictor of physical disability, compounded by the effects of age and reduced physical activity. Women have significantly higher rates of disability than do men of the same age (7). Additionally, after a cardiac incident, women appear to be at greater risk of psychosocial impairment than do men (8–11). Studies comparing CR outcome between men and women report significantly poorer programme uptake for women (8–11). Thus, despite the benefits of phase II CR, limited data are available on outcomes of these treatments in women (8–11).

Although a few studies have investigated gender-related differences in coronary events and mortality in relation to risk factors, the relationship of gender difference in clinical characteristics and physiological and psychological outcomes in Japanese cardiac patients is unknown (11). We hypothesized

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that at entry into phase II CR, women would have greater levels of physiological and psychological outcome impairment than would men. The purpose of the present study was to investigate whether gender-related differences exist between Japanese men and women in regard to clinical characteristics, physiological outcome measures of peak $\dot{V}O_2$, handgrip strength, and knee extensor muscle strength and measures of psychosocial outcome at entry into phase II CR.

METHODS

Study design and subjects

The present study was a cross-sectional study in which consecutive patients were selected from outpatients who completed an acute-phase CR programme at St Marianna University School of Medicine Hospital from November 1999 to August 2005. Inclusion criteria were a first AMI or CABG and successful completion of cardiopulmonary exercise testing (CPX) and handgrip and knee extensor muscle strength testing (3). Exclusion criteria were pre-existing extensive co-morbidity (e.g. cancer), New York Heart Association (NYHA) functional class IV, and neurological, peripheral vascular, orthopaedic or pulmonary disease. At the end of their acute-phase CR programme, physiological outcomes of 473 patients were assessed, and the patients were asked to complete psychosocial outcome testing.

Of the 473 patients, 442 were included in this study (371 men, mean age 60.6 years (standard deviation (SD) 10.3) and 71 women, mean age 63.6 years (SD 9.1)). Thirty-one patients were excluded due to inability to measure their peak $\dot{V}O_2$ or hand grip and knee muscle strength or because of inappropriate responses to the psychosocial outcome tests.

Ethics

The present study was approved by the St Marianna University School of Medicine Institutional Committee on Human Research (Approval No. 356). Written, informed consent was obtained from each patient.

Clinical characteristics of the patients

A cardiologist assessed left ventricular ejection fraction (LVEF) by ultrasonic echocardiography (UCG) as the index of cardiac function and objective indication of cardiac disease severity. We also evaluated patient age, sex, body mass index (BMI), education level, marital status and employment.

Physiological outcomes at entry into phase II CR

Peak $\dot{V}O_2$, handgrip strength and knee extensor muscle strength were measured to assess physiological outcomes of each patient at entry into a phase II CR programme. Subjects underwent CPX under a ramp treadmill protocol at entry into the programme (3). Peak $\dot{V}O_2$ was measured as the index of exercise capacity. Measurements made from expired gasses were used as indices of cardiovascular dynamics during exercise. Symptom-limited exercise testing was performed on a MAT-2500 treadmill (Fukuda Denshi Co., Tokyo, Japan). Throughout the test, a 12-lead ECG was monitored continuously, and heart rate was measured from the R-R interval of the ECG (ML-5000, Fukuda Denshi Co., Tokyo, Japan). Peak $\dot{V}O_2$ was measured during the exercise period with an AE-300S Aero monitor (Minato Ikagaku Co., Tokyo, Japan) and calculated with a personal computer (Epson Co., Nagano, Japan). The endpoint of exercise testing was determined according to the criteria of the American College of Sports Medicine (12).

Handgrip strength

A standard adjustable-handle JAMAR dynamometer (Bissell Healthcare Co., Grand Rapids, MI, USA) was used to measure handgrip strength as the index of upper-limb muscle strength and was set at the second grip position for all subjects (3). Attention was paid to a possible Valsalva effect, and measurements were made 3 times each on both hands. The highest value measured was used as the index of handgrip strength (kg).

Knee extensor muscle strength

The Biodex System 2 isokinetic dynamometer (Biodex Medical Systems, Inc., New York, USA) was used to measure knee extensor muscle strength as the index of lower-limb muscle strength. Testing was performed at a maximum of 5 repetitions for knee extensors at isokinetic speeds of 60°/sec. Isokinetic test results were analysed with the Biodex System 2 software (3). We measured the knee extensor muscle strength peak torque per body weight value (Nm/kg) of both knees and used the maximum value obtained as the index of knee extensor muscle strength.

Psychosocial outcomes

Self-efficacy for physical activity (SEPA), Hospital Anxiety Depression Scale (HADS) and HRQOL tests were used to assess psychosocial outcomes of each patient at entry into phase II CR.

Self-efficacy for physical activity. SEPA measures self-confidence for performance of a given activity or task and represents an individual's perceptions or beliefs about how capable he or she is of performing that specific activity or task (13–15). General SEPA was measured with the Japanese version of the SEPA because of its reliability and validity (15). The SEPA consists of 4 subscales: domains of walking, stair climbing, weight lifting and push off. It was measured at entry of the patients into a phase II CR programme. After testing of the 4 domains, the upper-body SEPA score (average scores of weight lifting + push off / 2) and lower-body SEPA score (average scores of walking + stair climbing / 2) were calculated. SEPA upper- and lower-body subscale scores range from 0 to 100. Lower scores indicate poorer, and higher scores better, levels of SEPA (15).

Hospital Anxiety Depression Scale. All patients enrolled in the present study completed the HADS to establish a baseline score. The HADS questionnaire, whose reliability has been fully validated (16, 17), is used extensively with hospital patients. It is quickly and easily completed and is well established among patients with cardiac diseases (17). One scale-score for anxiety and one for depression are computed from a 14-item checklist (7 items for anxiety and 7 items for depression). Patients with ≤ 7 points on the scale are not considered to be anxious or depressed, those with 8–10 points are suspected of being anxious or depressed, and those with ≥ 11 points are considered to be anxious or depressed (16, 17).

Health-related quality of life. General HRQOL was assessed with the Medical Outcome Study 36-item Short Form Health Survey (SF-36) (18–20). The SF-36 consists of 36 items representing 8 subscales that cover the domains of physical functioning, role-physical, bodily pain, general health, vitality, social functioning, role-emotional and mental health. The SF-36 is a standardized, generic HRQOL measurement instrument that has been validated in the general normal Japanese population (18–20). It measures multidimensional properties of HRQOL on a 0–100 scale, with lower scores representing lower HRQOL and higher scores higher HRQOL (16–19).

Statistical analysis

Results are expressed as mean and SD. Unpaired *t*-test and χ^2 test were used to analyse differences in clinical profiles of the patients because comparisons between 2 groups (men and women) were performed for grip strength, knee extensor muscle strength and peak $\dot{V}O_2$. In addition, the unpaired *t*-test was used to test for differences between the 2 independent groups in average upper- and lower-body SEPA scores, HADS anxiety and depression scores and the 8 SF-36 subscales. Statistical analyses were performed with SPSS 12.0J statistical software (SPSS Japan, Inc., Tokyo, Japan). A p-value of < 0.05 was considered statistically significant.

RESULTS

Clinical characteristics of the patients

Clinical characteristics for all patients and differences between men and women are summarized in Table I. LVEF, AMI location, number of CABGs and medications were almost identical between the 2 groups. However, age, education, marital status, employment and BMI differed significantly between men and women.

Gender-related differences in physiological outcomes

No patient showed ischaemic ST changes or experienced chest pain or serious arrhythmia during CPX. Data collected from the 2 groups are presented in Table II. Comparisons were performed across the 2 groups after CPX and muscle strength testing. Peak $\dot{V}O_2$ scores in women were significantly lower than those in men ($t=6.5$, $p=0.01$). Scores for handgrip strength ($t=14.3$, $p=0.01$) and knee extensor muscle strength ($t=8.1$, $p=0.01$) in women were also significantly lower than those in men.

Gender-related differences in psychosocial outcomes

HADS. In regard to anxiety scores on the HADS, of the 371 men and 71 women in the present study, 254 (68.5%) men vs 37 (52.1%) women scored ≤ 7 points (no anxiety), 94 (25.3%) men vs 23 (32.4%) women scored 8–10 points (suspected anxiety) and 23 (6.2%) men vs 11 (15.5%) women scored ≥ 11 points (anxiety). In regard to HADS scores for depression, however, 210 (56.6%) men vs 43 (60.6%) women scored ≤ 7 points on the scale (no depression), 115 (31%) men vs 22 (30.9%) women scored 8–10 points (suspected depression) and 46 (12.4%) men vs 6 (8.5 %) women scored ≥ 11 points (depression). HADS anxiety scores in women were significantly higher than those in men ($t=2.1$, $p=0.03$). Although there was a tendency towards difference between the men and women in the HADS depression score, the difference was not significant ($t=1.7$, $p=0.07$). Differences in HADS scores between the 2 groups are shown in Table III.

SEPA. Gender-related differences in upper- and lower-body SEPA scores between the 2 groups are also presented in Table III. Upper-body ($t=6.9$, $p=0.01$) and lower-body ($t=11.1$, $p=0.01$) scores in women were significantly lower than those in men.

HRQOL. Gender-related differences in the 8 SF-36 HRQOL subscales are presented in Table IV. SF-36 scores for physical functioning ($t=4.7$, $p = 0.01$), role-physical ($t=3.3$, $p=0.01$), vitality ($t=2.0$, $p=0.01$) and role-emotional ($t=3.2$, $p=0.01$) subscales were significantly lower in women than in men. No significant difference was detected between groups in the bodily pain ($t=1.4$, $p=0.14$), general health ($t=0.9$, $p=0.34$), social functioning ($t=0.1$, $p=0.84$) or mental health ($t=0.3$, $p=0.75$) subscales scores.

Table I. *Clinical characteristics of the 442 patients*

	Men ($n=371$)	Women ($n=71$)	*p*-value
Age (years), mean (SD)	60.6 (10.3)	63.6 (9.1)	0.03*
BMI (kg/m^2), mean (SD)	22.8 (4.1)	21.6 (3.7)	0.02*
Education (years), mean (SD)	13.1 (2.8)	12.0 (7.1)	0.04*
Married (%)	85	72	0.01*
Employed (%)	57	34	0.03*
LVEF (%), mean (SD)	50.7 (8.2)	52.2 (8.8)	0.07
AMI location (*n*)			
Inferior	153	26	0.43
Anterior	123	23	
Lateral	21	5	
CABG (*n*)	74	17	
Medications (*n*)			
Nitrates	226	45	0.14
Calcium antagonists	79	14	
β-blockers	117	24	
ACEI or ARB	211	37	

*Significant difference between men and women. SD: standard deviation; BMI: body mass index; LVEF: left ventricular ejection fraction; AMI: acute myocardial infarction; CABG: coronary artery bypass graft; ACEI: angiotensin converting enzyme inhibitor; ARB: angiotensin receptor blocker.

Table II. *Comparison of physiological outcomes by gender in patients with cardiac diseases. Data are expressed as mean and standard deviation.*

Variable	Men ($n=371$)	Women ($n=71$)	*t*-value	*p*-value
Peak $\dot{V}O_2$ (ml/kg/min)	24.3 (5.0)	19.9 (3.6)	6.5	0.01*
Handgrip strength (kg)	38.1 (7.9)	22.9 (4.1)	14.3	0.01*
Knee extensor muscle strength (Nm/kg)	1.8 (0.4)	1.4 (0.4)	8.1	0.01*

*Significant difference between men and women.

DISCUSSION

The main purpose of the present study was to assess gender-related differences between men and women at entry into a phase II CR programme in relation to clinical characteristics and physiological and psychosocial outcomes.

Gender-related differences in patient clinical characteristics

There were no statistically significant gender-related differences in LVEF, AMI location, CABG or medications. However, the women were significantly older, fewer were married, and their levels of education, employment and BMI were lower than

Table III. *Comparison of psychosocial outcomes (HADS and SEPA scores) by gender. Data are expressed as mean and standard deviation.*

	Men ($n=371$)	Women ($n=71$)	*t*-value	*p*-value
HADS subscales				
Anxiety	5.3 (3.3)	6.3 (3.6)	2.1	0.03*
Depression	6.8 (3.2)	5.9 (3.1)	1.7	0.07
SEPA				
Upper-body activity	70.3 (21.7)	49.2 (22.3)	6.9	0.01*
Lower-body activity	65.9 (23.4)	30.2 (21.4)	11.1	0.01*

*Significant difference between men and women.
HADS: hospital anxiety depression scale; SEPA: self-efficacy for physical activity.

Table IV. *Comparison of psychosocial outcomes (SF-36 subscale scores) by gender. Data are expressed as mean and standard deviation.*

SF-36 subscales	Men (n=371)	Women (n=71)	t-value	p-value
Physical functioning	83.8 (12.7)	75.0 (15.2)	4.7	0.01*
Role-physical	43.1 (42.4)	36.1 (23.3)	3.3	0.01*
Bodily pain	63.5 (30.7)	57.4 (26.5)	1.4	0.14
General health	54.7 (18.6)	52.3 (14.4)	0.9	0.34
Vitality	59.5 (21.4)	53.3 (19.8)	2.0	0.01*
Social functioning	65.5 (32.4)	64.7 (27.0)	0.1	0.84
Role-emotional	49.0 (36.5)	40.1 (28.4)	3.2	0.01*
Mental health	66.4 (20.9)	65.5 (20.5)	0.3	0.75

*Significant difference between men and women.
SF-36: Short Form-36

those of the men. A previous report (10) suggested that women tend to be older when they begin phase II CR, and a greater number are divorced and/or widowed or have an older spouse who also might require physiological and/or psychosocial care. Moreover, women entering CR are less conditioned than men, which may affect their ability for self-care, performance of routine activities of daily living and other enjoyment (e.g. meeting friends and recreation) (10). In the present study, a significant difference was noted in the number of married men (85%) vs married women (72%). Of the unmarried subjects, 15% of the men and 38% of the women were divorced or widowed. With regard to gender-related differences in survival after AMI, Fiebach et al. (9) reported that a significantly greater number of the women in their study were widowed. Although we did not ascertain what percentage of women were widowed vs divorced in the present study, the average age of the women tended to be higher than that of the men. So, one reason for the number of married women being lower than that of the men might be that the percentage of widowed women was higher.

In the present study, fewer of the women were employed, and they had a lower level of education than the men. These findings support those of previous studies. Stern et al. (21) reported that compared with working men, women working before an AMI or CABG did not return to work as frequently as did men after these events. Boogaard (22) also reported that 67% of women failed to return to work at 6 months after AMI compared with only 10% of men. Education level may not change directly in relation to CR programmes, but employment may change over time as a result of CR.

The BMI of the women in the present study was significantly lower than that of the men. In general, BMI needs to be reduced for secondary prevention after CR and exercise training. Obesity is more common in women with CAD, and previous data have shown that obesity is strongly and independently related to CAD events in women. However, Davos et al. (23) suggested that in patients with chronic heart failure without cachexia, increasing BMI is not an adverse prognostic element and that thinner patients appear to have a poor prognosis. Moreover, Landi et al. (24) suggested that low BMI (<22 kg/m^2) remains a significant and independent predictor of shortened survival in older people living in the community. Thus, BMI in older women with cardiac disease may need to be maintained at >22 kg/m^2.

Gender-related differences in physiological outcomes

In the present study, peak $\dot{V}O_2$ in women was significantly lower than that in men. Previously, a few studies examining baseline gender-related differences in exercise measures have reported that women consistently tend to have lower exercise capacities than men. Recently, Ades et al. (1) reported that peak $\dot{V}O_2$, which was measured in 2896 patients entering CR, was higher in men than women. They suggested that the extremely low peak $\dot{V}O_2$ values of the patients, particularly those of women, on entry into CR underscores the importance of CR after a major cardiac event to improve physical function and long-term prognosis. The present study strongly supports their finding of significantly lower exercise capacity in women than in men.Cannistra et al. (25) also suggested statistical similarities in the improvement noted in men and women in exercise capacity. This improvement in functional capacity for women has been documented previously in other studies of CR (11). Because women begin CR programmes with lower functional capacity (1), the clinical benefit may in fact be greater for women than for men, who already have a good exercise capacity.

In the present study, both grip strength and knee extensor muscle strength were significantly different for men than for women. Grip strength is a predictor of mortality and morbidity in the general population (26). In addition, lower grip and knee extensor muscle strengths are associated with incidence as well as prevalence of disability, suggesting that age-related loss of muscle mass and volitional muscle strength can be a cause as well as a consequence of physical disability (27).

Falls occur frequently in the older population and are often a source of disability in women (28). In a study to determine risk factors for falling in older men and women living in nursing homes and to compare characteristics of fallers vs non-fallers, Sieri & Beretta (29) found that men who had fallen had greater deficits of ankle plantar-flexion strength and power, whereas women who had fallen had greater deficit of knee extensor muscle strength and lower walking speed. These results show that lack of muscle power affects ability in women and that interventions for improving contractile velocity should be pursued. Therefore, it is necessary to enforce more positive training by concentrating on improving both upper- and lower-extremity muscle strength in women.

Gender-related differences in psychosocial outcomes

Although the HADS anxiety and depression scores in the present study indicated neither depression nor anxiety (average scores for anxiety and depression were <8 points in both groups), the women had higher levels of anxiety than did the men. Brezinka et al. (30) suggested that women have higher levels of anxiety and exhaustion at entry into phase II CR programmes, and this, in combination with their significantly lower perceived exercise capacity, might prevent them from participating in physical exercise training. These findings may be supported by the present study in that the women had a higher anxiety level in relation to a lower level of physiological outcome in comparison with the men entering CR. However,

although there was a tendency towards difference between the men and women in the HADS depression score, the difference was not significant (Table III).

Josephson et al. (31) reported that depression scores assessed by the Beck Depression Inventory (BDI) were higher for women than men in a sample of patients with cardiac diseases tested after cardiac surgery such as CABGs. This discrepancy with the results of the present study may be related to differences in patient characteristics and the tool used for evaluation of depression. One possible reason may be that a lower percentage of patients in their study were post-AMI patients. Although our study patients included those with AMI (but not those with angina), only 40% of men and 56% of the women in their study had suffered an AMI. In addition, we used the HADS to assess depression, and they used the BDI. The differences in type of cardiac disease and/or evaluation tool may play a part in attenuating the magnitude of the gender difference in the HADS depression score in the present study.

Engebretson et al. (2) reported that in a 12-week phase II CR programme, affective distress (of both low and high anxiety) decreased, as measured by the Profile of Mood States-Short Form test. Particularly, a phase II CR programme was more effective when participants entered with a baseline of high rather than low anxiety. Another study also suggested that neither depression nor anxiety indices were reduced in women after a CR programme (32). We did not investigate the effects of CR on anxiety and depression with respect to gender difference; therefore, future evaluation of these effects in women is necessary.

Upper- and lower-body SEPA scores in women were also lower than those in men in the present study. Previous studies (4, 10) suggest a cross-sectional correlation of self-efficacy with exercise adherence, physiological outcomes and HRQOL. In the present study, the values of grip strength, knee extensor muscle strength and peak $\dot{V}O_2$ in women are lower than those of men. Thus, SEPA may also be related to physiological outcomes on entry into CR. Moreover, McAuley et al. (33) reported that positive feedback about exercise performance may increase positive affect and reduce negative feelings associated with exercise in women. Thus, to improve SEPA, positive feedback about exercise is necessary to improve HRQOL in women.

With regard to HRQOL, the SF-36 physical functioning and vitality subscale scores in the women were lower than those of the men in the present study. Women's physiological outcomes in relation to SEPA (3, 4, 11) and HRQOL (11) were lower than those of the men. Therefore, the combination of the women's significantly lower physiological outcome measures and lower SEPA scores may be related to their lower physical functioning and vitality scores. In addition, the women's role-physical and role-emotional subscale scores were also significantly lower than those of the men (Table IV).

In comparison with the men in the present study, fewer women were employed or married, and their anxiety level was greater. Men who have been employed in a company or other work outside the home may be likely to view retirement as a reward for many years of hard work or as relief from major responsibility. However, individuals forced into retirement because of failing health often show poor psychosocial adjustment (34). Retired women are expected to continue assuming most domestic tasks (34). Therefore, housewives may be more likely to experience a sense of inadequacy or failure when they are unable to perform everyday tasks associated with home management. These gender differences might be related to the role-physical and emotional scores recorded among the female respondents.

We did not investigate social support and leisure-time physical activity during the day and thus could not correlate these factors with the role-physical and emotional subscale scores of the SF-36. Therefore, a further study is needed to evaluate the relationship between these factors.

In general, after CR, behavioural characteristics and nearly all components of QOL improve to a similar degree in men and women (35). We previously reported that exercise-based CR for AMI and CABG improved not only physiological outcomes but also SEPA and HRQOL (3, 4). Particularly in regard to HRQOL, exercise-based CR improved the physical component and vitality subscales of the SF-36 (3, 4). In the present study, we found that at baseline, women not only had significantly lower exercise capacity and muscle strength but also lower SEPA and higher HADS scores and lower HRQOL than did the men. Therefore, improvement in physiological and psychosocial outcomes may offer greater clinical benefit to women than to men. However, exercise-based CR alone may not change mental health. In female patients particularly, we should consider improvements in exercise training in addition to stress management, coping measures and group counselling.

There are several limitations in the present study. One limitation is the cross-sectional design of the study. It would be highly desirable to document longitudinal change in physiological and psychosocial outcomes in cardiac patients, and evaluation of gender-related differences with regard to the effect of CR and mental status on physiological and psychosocial outcomes over the long-term after CR is necessary. Another limitation is that clinical diagnosis of anxiety and depressive disorders cannot be made with the HADS. However, the HADS has been shown to be a reliable and valid screening instrument for symptoms of anxiety and depression in general internal medicine patients (32). Despite these limitations, we believe that the findings of the present study are important because the sample size was large enough to yield significant results from the test instrument scores.

In conclusion, the present study is an initial step in identifying gender-related differences associated with physiological and psychological outcomes in Japanese patients with cardiac diseases. We found baseline gender-related differences in the areas of physiological outcome and psychosocial functioning that suggest women may have lower SEPA and HRQOL and higher anxiety than men on entry into a phase II CR programme. In particular, the present study indicates that women have reduced physiological and psychosocial outcomes and that both should be addressed in Japanese patients with cardiac

diseases at entry into phase II CR programmes. Eventually, CR programmes exclusively for women that focus not only on physiological outcomes but also on group counselling and training to enhance the role-physical and emotional domains might encourage more women to participate. Additional study is needed to evaluate whether these challenges influence long-term outcomes and affect gender-related differences in CR over longer periods in these patients.

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