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The Effects of Short-term Cardiac Rehabilitation on Post-CABG Patients' Fitness

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Abstract. Complications of post-CABG (coronary artery bypass graft) surgery may include bedridden, extremities edema and a decrease of abilities to physical activities. Many studies have proven that the long-term cardiac rehabilitation can reduce the risk of complications and improve cardiopulmonary function. However, little is known about the effects of short-term physical training in cardiac rehabilitation affects post-CABG patients. Aims: The purpose of this study was to compare the fitness differences between supervised rehabilitation group and home-based exercising group. Methods: 26 recruited patients were assigned to either rehabilitation group (n=11) or home-based exercise group (n=15). All of them took 3 tests: pre-test and 2 post-tests (one was taken a month after discharge and the other three months after discharge). Results: Results showed that the rehabilitation group was significantly better than home-based group in body composition, flexibility and cardiopulmonary function after 4 weeks training. Yet no significant difference was found in muscle power. Conclusions: supervised short-term rehabilitation program can effectively improve post-CABG patients' physical fitness performance.

Key words: Coronary artery disease, Short-term training, Home-base

1. Introduction

Occlusion of Coronary artery not only normally affect physical activities, endurance, muscle strength, working performance and quality of life, but also often leads to myocardial infarction and sudden death[1]. CABGs is one treatment for coronary artery disease, however, lots of complications emerge after surgery, including bedridden, extremities edema, wound pain, the decrease of abilities to physical activities and sometimes depression may be found [2].

Cardiac rehabilitation or exercise training has been proven to improve functional capacity and risk factor profiles, as well as to reduce mortality from heart disease. Encouraging patients to engage in physical activities or to participate in cardiac rehabilitation help them return to a normal life and to reduce sudden cardiac death after acute heart attack or heart surgery [3-5]. These benefits may be obtained because of improving cardiopulmonary capacity, recovered or maintained muscle strength , as well as the generation of positive emotions, all of which promoted better exercise capacity and lowered oxygen consumption of submaximal exercise[6].

Numerous studies suggested that post-cardiac surgery patients could get better physical fitness and better quality of life as well, after receiving exercise training for a long time and post surgery education [6-8]. Kardis also indicated that quality of life on open heart subjects improved significantly after 3 months rehabilitation [9]. Although cardiac rehabilitation has been shown to help the recovery of physical and life functions, literature showed that only 25 to 30% of patients participated in the training [10, 11].

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In foreign publication, lots of experiments dealt with the effects of long-term cardiac rehabilitation on maximum cardiopulmonary capacity. Most subjects began receiving cardiac rehabilitation 4~6 weeks after the surgery [7, 9, 12]. There were few studies discussing the early cardiac rehabilitation approach or focusing on physical fitness. As a whole, maintaining fitness is very important for patients at sub-acute stage after surgery. Thus, the purpose of this study was to compare the fitness differences between supervised rehabilitation group and home-based exercising group after short-term cardiac rehabilitation at subacute phase of post-CABGs.

2. Methods

Participants were recruited from the Chiayi Christian hospital and were divided into 2 groups. This study was approved by institutional review board, and the data were collected from January 2010 to February 2011. All of the participants had their CABGs first time. After discharge, the subjects participating in the cardiac rehabilitation more than 6 weeks were called rehabilitation group, and the rest, following exercise programs by themselves at home, were called home-based group. Patients with movement disability or impaired cognition were excluded. Those who failed to keep in touch after discharge and unable to follow home-base exercise programs were not qualified for the test either.

Rehabilitation group members received aerobic training by treadmill or biking for 6 weeks and more. Each exercise session included about 5~10 minutes of stretching and warm up first, and then more than 20 minutes of aerobic exercise training, and a 5~10 minutes cool down as the ending, Every session took more than 30 minutes. During the period of training, heart rate, EKG, BP and O_2 saturation were monitored. The Exercise prescriptions were based on a target intensity of 60%~85% max. HR (heart rate) or RPE (rating of perceived exertion) 12~14.

Before discharge patients assigned to the home-based group, exercise with the consultations of physical therapist. After the physical therapist called the subjects every month to monitor their progress and provide support and education. Exercise prescriptions were revised if necessary according to the assessment Patients were advised to self-training at least 3 days per week. Each exercise session should include a 5 to 10 minutes warm-up, a more than 20 minutes of aerobic training, and predominantly self-paced walking, and a 5 to 10 minutes cool down.

24 hours before discharge from hospital, BMI, 6 minutes walking test (6 MWT), flexibility and hand grip force were measured as baseline data. The same tests were examined 1 and 3 months after discharged.

Analyses were performed using SPSS 12.01c Chinese vision for Windows. An alpha of 0.05 was used to denote statistical significance. The continuous variables were expressed as the mean ± standard deviation. Student *t* tests and ANCOVA were applied to compare the difference of between groups.

3. Results

Forty one subjects had CABG surgery at Chiayi Christian hospital. Among them, 10 subjects were excluded (7 ESRD, 2 stroke and 1 cancer) and one subject didn't join this trial. There were 30 subjects participated in this trial, 12 subjects were in rehabilitation group first; one subject dropped out of trial. Thus, there were 11 subjects (6 male, 5 female) in rehabilitation group 15 subjects (13 male, 2 female) in home-base group after excluding couldn't follow exercise program and dropped midway.

The baseline demographic and clinical characteristics of the two groups are presented in Table 1. There were not statistically differences at baseline between the two groups in age, flexibility, muscle strength, BMI and 6 MWT.

As shown in Table 2, there were significant improvements in flexibility, hand grip force and 6 MWT after one month discharge in both groups. Rehabilitation group after one month of exercise training improved more than home-base group in BMI and 6 MWT in test 2, and in flexibility and 6 MWT in test 3.

Table 1: Patient characteristic at baseline

	Rehabilitation group	Home-base group	*p*
Subjects	11	15	.10
Age	60.45±6.79	61.33±8.93	.79
Flexibility	-10.36±1022	-13.73±10.23	.42
Hand grip	21.98±5.97	26.11±10.01	.24
BMI	23.9±2.58	26.05±3.38	.09
6 MWT	277.75±96.11	313.14±101.53	.38

P< 0.05 is showed significant difference

Table 2: Patient characteristic at test 2 and test 3

	group	test 2	test 3
flexibility	rehabilitation group	-3.09±9.04[a]	-2.05±8.4[a]
	home-base group	-10.13±9.45[a]	-11.03±9.17
	ANCOVA (p)	.08	.01
Hand grip	rehabilitation group	25.19±7.76[a]	28.92±9.61[a,b]
	home-base group	28.81±8.59[a]	29.97±8.88[a]
	ANCOVA (p)	.98	.23
BMI	rehabilitation group	23.51±2.33	23.47±2.31
	home-base group	26.32±3.45	26.32±3.37
	ANCOVA (p)	.04	.06
6 MWT	rehabilitation group	421.11±81.77[a]	502.34±99.8[a,b]
	home-base group	365.93±106.82[a]	400.1±100.1[a,b]
	ANCOVA (p)	<.01	<.01

"a" showed significant difference compared with test 1 ; *P*< 0.05
"b" showed significant difference compared with test 2 ; *P*< 0.05
ANCOVA: test 1 is baseline data
P< 0.05 is showed significant difference compared with test 1.

4. Discussion and Conclusion

American College of Sports Medicine (ACSM) indicated that the elements of fitness included body composition, flexibility, muscle strength and endurance, and cardiopulmonary function. Good flexibility could improve joint range of motion, coordination, postural and reduced the risk of muscle strain [13,14]. Fatouros reported that doing exercise combining lower extremities resistance exercise with aerobic and stretch exercise will improve or maintain flexibility of elderly in sedentary life style [15]. These findings were consistent with the changes noted in our experimental subjects, who did 5~10 minutes stretching exercise and warm up before treadmill or biking.

Results of measuring indicated both groups improved in their flexibility one month after discharge from hospital. After 3 month discharge from hospital, rehabilitation group still performed significantly better than base data, but home-based group has significant decreased in performance. Maybe chest and leg wound pain led to poor baseline data. Flexibility was significantly improved after 1 month on both group. Rehabilitation group was not significantly better than home-base group in flexibility until test 3.

Decrease of muscle power is often caused by injury or inactivity. Patients who are bedridden more than 4 hours would possibly have weakness or even muscle atrophy at acute phase [16]. In this study, the subjects had to lie in bed more than 48 hours; it's possible to have inactivity and muscle weakness or atrophy after

CABG surgery. Although the program didn't include upper extremities resistance exercise or weight training, the patients' hand grip force was significantly improved on both groups after aerobic exercise training.

Coronary artery disease is often accompanied by overweight, dyslipidemia, DM, or hypertension [17]. Weight control is very important for such patients[18]. There are many ways to assess body composition, BMI is one of them. ACSM suggested that standard range of BMI is between 18.5~24.9. In our study, patient of home-based group were above the standard range of BMI; while rehabilitation group was in standard range. After exercise training, rehabilitation group was significantly better than home-based group in BMI control.

Cardiopulmonary capacity reflected the ability of physical activity. High physical activity will lower the risk of sudden death by cardiac event. Therefore, to improve cardiopulmonary capacity is one of the targets to save life. Myers reported that 6213 men, constantly exercise on treadmill were classified into two groups: with an abnormal exercise test result or a history of cardiovascular disease, or with both, were in one group. The rest were a normal test result and no history of cardiovascular disease was in the other group. 10 years follow-up showed that absolute peak exercise capacity was a stronger predictor of the risk of death, and each 1-MET increase in exercise matched a 12% more in survival [19].

More female participants were in rehabilitation group but no significant difference was found in these two groups. Although the performance of 6 MWT in rehabilitation group was less than home-base group at baseline data, rehabilitation group was significantly better than home-base group after regular exercise training more than 4 weeks.

Besides, According to ACSM, exercise prescription should include exercise frequency, intensity, time and mode. In this trial exercise, frequency, time and mode in home-based group were easy to monitor, but exercise intensity was difficult to control. On the contrary the prescription in rehabilitation group was under control. It may be a reason to cause the difference between both groups after 1 and 3 months discharge.

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