心筋梗塞後患者における集団スポーツリハビリテーションが認知機能に与える影響

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Effects of a Cardiac Sports Rehabilitation Program on Cognitive Function in Elderly Patients after Myocardial Infarction.

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Abstract

Purpose: Although cardiac rehabilitation is associated with numerous benefits, including improved cardiovascular health and a lower mortality rate, the current challenge is to examine whether cardiac rehabilitation can also provide cognitive benefits. This study was conducted to determine the effects of a cardiac sports rehabilitation program (CSP) on cognitive function in elderly patients. **Methods**: Twenty-one male patients after myocardial infarction (MI) (mean age: 68.8 years, mean interval time after a MI 42.1 months) completed this study. The CSP group (n=11) practiced combined Tai Chi and table tennis training once a week together with conventional exercise training for 1 year. The control group (n=10) carried out conventional exercise training only. Cognitive function was measured using a Mini-Mental State Examination (MMSE) at baseline and 1 year later. **Results**: At baseline, the MMSE score and other clinical characteristics did not differ between the two groups. After 1 year, the CSP group showed a slight increase in the MMSE score (from 26.1 +/- 1.92 to 27.3 +/- 2.81, p=0.153), while the control group showed a significant decrease (from 27.0 +/- 2.00 to 25.4 +/- 3.27, p=0.035). **Conclusions**: Supervised CSP may have implications for the prevention of cognitive decline in elderly patients after MI.

keywords: cardiac rehabilitation, cognitive function, elderly, sports, myocardial infarction

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平成21年10月30日　原稿受理
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Introduction

Although cardiac rehabilitation is associated with numerous benefits, including improved cardiovascular health and a lower mortality rate, the current challenge is to examine whether cardiac rehabilitation can also provide cognitive benefits. Longitudinal population-based studies have shown myocardial infarction (MI) [1] and cardiovascular disease [2] to be predictors of cognitive impairment among the elderly. Actually, decline in cognitive function are common problems in the elderly cardiac rehabilitation patients [3].

Exercise and leisure activities have a protective role of cognitive decline in healthy elderly [4, 5]. Especially, variety of physical activity may have positively associated with indices of cognition. Podewils and his colleagues had shown that engaging in a number of different physical activities protects against subsequent risk of dementia [6].

Taken together, additional sports programs during cardiac rehabilitation would be leads to an improved cognitive function in elderly patients with atherosclerotic vascular disease, a high-risk group for cognitive decline. To test this hypothesis, this study was conducted to determine the effects of a cardiac sports rehabilitation program (CSP) on cognitive function in elderly patients.

Methods

Participants

The study population consisted of twenty-one male patients after MI, aged 63-77 years (mean age: 69 +/-5 years), who were admitted to the Department of Rehabilitation Medicine in Saitama Medical University Hospital. Of these patients, 5 had undergone percutaneous transluminal coronary angiography (PTCA) previously and the other 16 had undergone coronary artery bypass grafting (CABG); the mean interval time after the coronary event was 42 +/- 19 months. Patients were excluded if they had stroke or systemic illness likely to affect cognition (e.g., dementia). The purpose and risk of this study were explained to each patient before written informed consent was obtained.

Design

A prospective controlled trial was designed with participants assigned either to CSR (n=11) or conventional exercise training only (control: n=10). In the CSR group, the intervention continued for 1 year. Functional outcomes were measured at baseline and after 1 year.

Intervention

After a group assignment, the CSR group met 3 hours once a week. Each session consisted of warm up, Tai Chi exercise, table tennis, and cool down. During Tai Chi exercise, the patient group was led by an instructor and they imitated the motion, adapted from classical Yang-style Tai Chi. The group practiced these programs together with conventional exercise training.

Measurements

Cognitive function was measured using a Mini-Mental State Examination (MMSE) [7]. MMSE was administered by one occupational therapist blinded to group membership.

To assess aerobic fitness, peak oxygen uptake was measured by cardiac pulmonary exercise testing (CPX) with a bicycle ergometer with an initial workload of 0 watt (W), with subsequent increments of 15W every minute until exhaustion. Oxygen consumption and carbon dioxide production were measured with a metabolic cart (Oxycon Alpha, JAEGER).

Statistical methods

All values were expressed as the mean+/-standard deviation. Differences between groups in the baseline characteristics were assessed by using the t test or χ^2 test as appropriate (SPSS 16.0J for Windows, SPSS inc., Chicago, USA). To compare the effects of CSR program versus the control on changes in outcome during the study period, a repeated two-way ANOVA was utilized. A value of $p<0.05$ was regarded as significant.

Results

All of the 21 enrolled patients fully completed the study. During the study period, medical treatment was maintained almost constant, and no clinical events were recorded.

The baseline characteristics of the study population are given in Table 1. No differences were observed between the CSR participants and the control patients for clinical and functional characteristics.

Table1. Baseline characteristics of patients

	CSR(n=11)	Control(n=10)	*p*
Age(yr)	70.3+/-1.4	67.2+/-1.5	NS
BMI(kg/m^2)	24.7+/-2.3	25.7+/-3.8	NS
Systolic blood pressure(mmHg)	121.9+/-20.0	122.9+/-22.2	NS
Diabetes(%)	45.4	50.0	NS
Hyperlipidemia(%)	72.7	80.0	NS
Walking steps(steps/day)	8163+/-3237	8644+/-5322	NS

Figure 1 shows the changes in MMSE score during the study period. The CSR participants showed a slight increase in MMSE score (from 26.1 to 27.3, p=0.15) while significant decrease was observed in the control patients (from 27.0 to 25.4, p=0.035). These associations persisted after adjustment for age and other covariates. The changes in peak oxygen uptake did not differ between the groups.

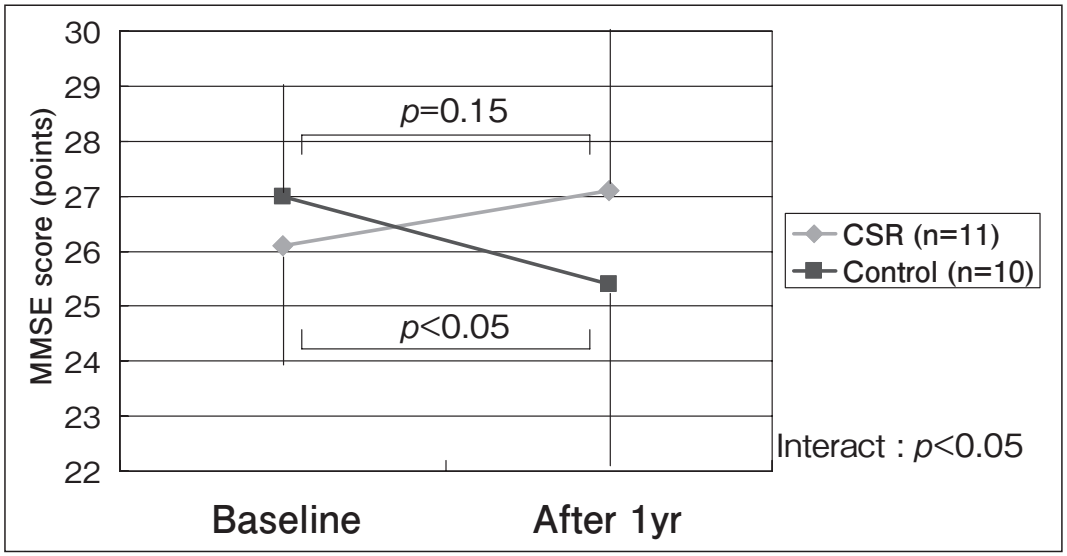

Fig 1. Changes in the MMSE score over 1yr intervention for the CSR and control groups

Discussion

We evaluated the effects of additional CSR program during cardiac rehabilitation on cognitive function in patients after MI. One-year treatment was found to result in a slight increase in the MMSE score in the CSR group while a significant decrease were observed in the control group. On the other hand, there were no significant trends seen in aerobic fitness. These observations suggest that the group sports rehabilitation program provided cognitive benefit to participants. The strength of this study is that the participants were elderly subjects with atherosclerotic vascular disease, a high-risk group for cognitive functional decline.

Variety of physical activity for the elderly is increasingly recognized as an important tool to improve cognitive function. In large prospective cohort study of community-dwelling elderly subjects, the number of different activities has a stronger association with dementia risk than dose energy expenditure [6]. In randomized pilot trail of frail community elderly subjects, those who participated in a group exercise program had a significant increase in MMSE vs. those who participated in a recreational therapy program [8]. Our study provides new insight into the potential benefits of engaging in a large number of different activities indicated specifically for patients with cardiovascular disease.

The mechanism by which CSR program remarkable prevents the cognitive decline in patients after MI remains unclear. We actually accepted that group exercise programs can promote social network among patients. Seemen et al. [9] demonstrated that persons with more developed social networks attenuate the rate of cognitive decline in older adults. Mechanisms might include association between social activity and cognitive function. Recently, the animal and human studies suggest that vigorous exercise might have effects on brain plasticity and functional brain reserves [10]. These neurogenetic mechanisms may be involved in the cognitive responses to CSR program.

In the current study, the one-year CSR program cannot enhance the aerobic fitness (Figure 2). Consequently, total volume of CSR program at relatively high intensity may have been inadequate to improve the cardiopulmonary adaptation for our old patients.

Our study had another several limitations. First, these are characteristics of studies that require intense cognitive screening. Second, we did not obtain relevant clinical data

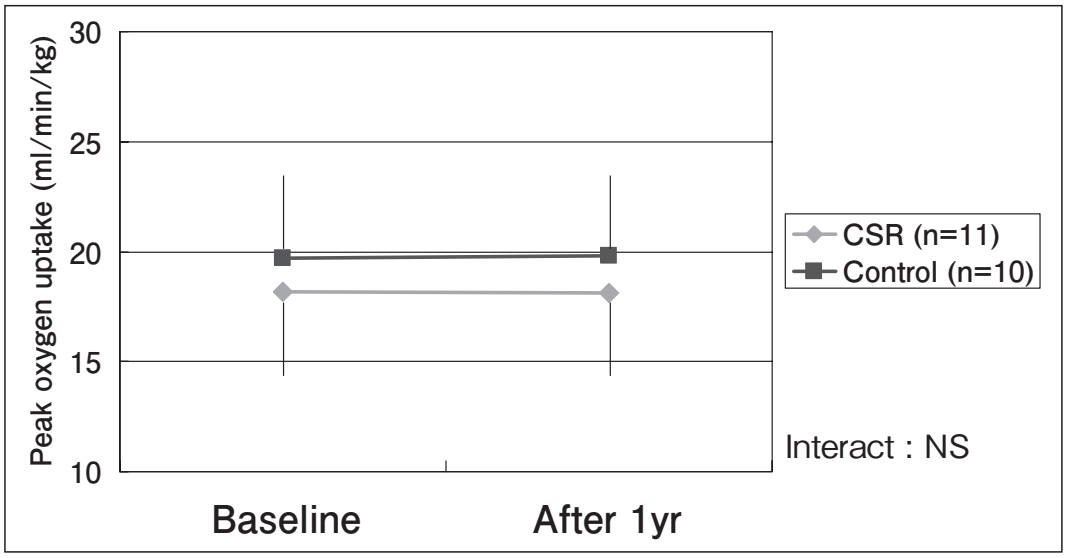

Fig 2. Changes in the peak oxygen uptake over 1yr intervention for the CSR and control groups

for the atherosclerotic risk factors, such as LDL cholesterol, HDL cholesterol, fasting serum glucose, fasting serum insulin and HbA1c. In addition, we had no objective measurement of exercise intensity in cardiac sports rehabilitation group. Further studies are needed to explore an appropriate exercise intensity of the CSR program that affects the cognitive performances.

Conclusions

Supervised CSR may have implications for the prevention of cognitive decline in elderly patients after MI. These findings may aid the designing exercise prescriptions for maintaining or improving cognitive health.

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