Effects of Home-based Exercise Training with Wireless Monitoring on the Left Ventricular Function of Acute Coronary Syndrome Patients

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Abstract. [Purpose] While recent studies have reported that cardiac rehabilitation is an effective treatment, there have been few studies of its effects in rehabilitation for acute coronary syndrome (ACS). Therefore, the purpose of this study was to identify the effects of a home-based exercise training using a wireless electrocardiogram (ECG) monitoring device on ACS patients. [Subjects] Fifty ACS patients were randomly divided into an experimental group of 25 patients and a control group of 25 patients. [Methods] The experimental group received education on the training before discharge from hospital and started home-based exercise training two weeks after discharge from hospital. The control group received conventional treatments. The left ventricular function was measured in both groups before the intervention at and 12 weeks, at the end of the intervention. [Results] Both the experimental group and the control group showed significant improvements in the left ventricular ejection fraction and number of regional wall motion abnormalities. In the comparison of the two groups, the experimental group showed a significantly greater decline in regional wall motion abnormalities than the control group. [Conclusion] Home-based exercise training implemented with a wireless monitoring device was effective at improving the left ventricular function of ACS patients.

Key words: Acute coronary syndrome (ACS), Home-based exercise, Ventricular function

INTRODUCTION

The numbers of patients with circulatory disorders are gradually increasing in Korea and the rest of the world due to health-related factors such as increased intake of animal fat, increased stress levels, decreased amount of exercise, increases in obesity, and an aging population. Every year, Korea also experiences increases in the numbers and the death rates of patients with ischemic heart disease (IHD)1). Cardiac rehabilitation, which has an important part in the overall care of patients with acute coronary syndrome (ACS), has recently been actively implemented as an intervention for IHD2). A study of IHD patients after cardiac rehabilitation within a hospital demonstrated statistically significant changes in their left ventricular function3).

Despite these effects of cardiac rehabilitation, patients who participate in such treatment frequently give up during the course of the treatment for various reasons, indication there are a number of issues with compliance in cardiac rehabilitation4). Thus, patients requiring cardiac rehabilitation require methods suited to home-based rehabilitation, with the exercise intensity and protocols prescribed by hospitals tailored to the needs of individual patients. Studies of the ability of cardiac rehabilitation to treat ACS, which is closely related to sudden deaths, are considered more meaningful in clinical terms than previous studies on various types of IHD patients.

Therefore, the present study attempted to identify the effects of home-based exercise training with a wireless electrocardiogram (ECG) monitoring device on the left ventricular function of ACS patients.

SUBJECTS AND METHODS

The study subjects were 50 ACS patients, who were hospitalized at the Keimyung University Dongsan Center in Korea from October 2010 to March 2011, who received a percutaneous coronary intervention (PCI). The study was carried out until June 2011. Twenty-five of the subjects were randomly placed in an experimental group which received cardiac rehabilitation, and 25 subjects were placed in a control...
Cardiac rehabilitation has been reported to help patients...
with cardiac diseases recover quickly and reduce risk factors associated with reoccurrence. Interventions include exercise to reduce coronary risk factors and medications to prevent coronary artery diseases and sudden cardiac deaths. In addition, the purpose of cardiac rehabilitation is to induce various physiological adaptations in the heart, skeletal muscles, and blood vessels, increasing oxygen content within the arteries during maximal exercises. Some studies have recommended that regular exercise training should, in most cases, be prescribed based on individual programs for primary and secondary interventions6–8).

In the present study, the echocardiography results confirmed a statistically significant increase in the left ventricular ejection fraction of both groups. However, the experimental group attained a more significant increase, on average, than the control group. Also, the number of regional wall motion abnormalities in the experimental group exhibited a statistically more significant decline than the control group. In both groups, the improvements in the left ventricular ejection fraction can be inferred as having been influenced by the PCI and the medications, as well as the exercise training. However, given that the scores of regional wall motion abnormalities showed a more statistically significant decrease in the experimental group, the exercise training can be considered to have been helpful in reducing cardiovascular blood circulation disorders resulting from regional wall motion abnormalities.

A previous study that conducted exercise training for patients with coronary artery diseases reported statistically significant improvements in blood circulation9). In a study of IHD patients treated with cardiac rehabilitation, Ahn et al.41 reported that their patients showed a statistically significant increase in the left ventricular ejection fraction. However, they detected no statistically significant declines in the left ventricular end-diastolic diameter, the left ventricular end-systolic diameter, and the score of regional wall motion abnormalities. Andres et al.10) reported that cardiac rehabilitation can increase heart disease patients’ blood volumes at the left-ventricular end-diastolic and improve cardiac outputs, as well as increasing maximum oxygen consumption, thus slowing the progress of heart disease.

The findings discussed above are similar to the results of the present study of a statistically significant increase in the left ventricular ejection fraction. However, the fact that the present study also observed a statistically significant decline in the scores of regional wall motion abnormalities may be meaningful. Based on the present results, we conclude that stepwise individually prescribed exercises can increase patients’ maximum oxygen consumption and reduce their myocardial burdens, thereby increasing left-ventricle ejection fractions and reducing the occurrence of regional wall motion abnormality. To achieve more significant improvements through exercise training, however, an extended research period with a greater number of subjects should be undertaken.

In conclusion, the present study of ACS patients with IHD found statistically significant improvements in left ventricular function following the implementation of a home-based exercise training program shortly after the subjects were discharged from the hospital. The anxiety that patients generally feel during exercising at home was reduced by wearing the wireless monitoring device in this study, and the results of this study can be considered a clinically meaningful. The findings of this study will need to be confirmed through future studies based on additional cases of clinical utilization of the protocol described in this study.

REFERENCES

1) Statistics Korea: Statistics of cause of death. Mortality of chronic disease. http://www.index.go.kr/egarns/stts/jsp/poral/stts/PO_STTSS_IdxMain.jsp?idx_cd=1438 (Accessed Sep. 10, 2010).
2) Brubaker PH, Kaminsky LA, Whaley MH: Coronary artery disease. Essentials of Prevention and Rehabilitation Programs. Champaign: Human Kinetics press, 2010, pp 171–483.
3) Vonder Muhll I, Daub B, Black B, et al.: Benefits of cardiac rehabilitation in the ninth decade of life in patients with coronary heart disease. Am J Cardiol, 2002, 90: 645–648. [Medline] [CrossRef]
4) Ahn JK, Kim C, Bang IK, et al.: Effectiveness of cardiac rehabilitation on exercise capacity and ventricular function in ischemic heart disease patients. J Korean Sports Med, 2006, 24: 229–236.
5) Kim C, Lim HS, Ahn JK, et al.: The reasons that cardiac patients did not participate in and drop out from the cardiac rehabilitation program. J Korean Acad Rehab Med, 2002, 26: 790–796.
6) Bethell HJ: Exercise-based cardiac rehabilitation. Medicine, 2006, 34: 195–196. [CrossRef]
7) Adres P: Cardiac rehabilitation and secondary prevention of coronary heart disease. N Engl J Med, 2001, 345: 892–902. [Medline] [CrossRef]
8) Joshi SB: Exercise training in the management of cardiac failure and ischaemic heart disease. Heart Lung Circ, 2007, 16: S83–S87. [Medline] [CrossRef]
9) Hambrecht R, Wolf A, Gielan S, et al.: Effect of exercise on coronary endothelial function in patients with coronary artery disease. N Engl J Med, 2000, 342: 454–460. [Medline] [CrossRef]
10) Digenio AG, Noakes TD, Joughin H, et al.: Effect of myocardial ischemia on left ventricular function and adaptability to exercise training. Med Sci Sports Exerc, 1999, 31: 1094–1101. [Medline] [CrossRef]