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Original research article

The long-term effects of individual cardiac rehabilitation in patients with coronary artery disease

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ABSTRACT

Background: The positive effects of cardiac rehabilitation have been repeatedly described and are well-known over the short- and middle-term periods. However there is less knowledge about long-term outcomes in patients with chronic stable coronary artery disease.

Aim: The aim of this study was to evaluate the long-term outcome of individual cardiac rehabilitation in patients with coronary artery disease.

Methods: One hundred fifty-two patients with stable coronary artery disease were retrospectively divided into two groups according to their adherence to individual physical activity recommendations, regardless of their participation in guided cardiac rehabilitation training. The IT+ group which participated in individual exercise programmes according to recommendations, were compared with patients who declined these activities (the IT− group). The median follow-up period was 12.7 years.

Results: The individual training had no long-term effect on survival after being checked for other possible contributing factors, but the multivariate analysis showed a significant association with the occurrence of cardiac events like myocardial infarction, unstable angina, coronary revascularisation and hospitalisation for heart failure: HR (95% CI) 0.51 (0.30–0.89); $p = 0.017$.

Conclusion: Home based cardiac rehabilitation and regular physical activity significantly improves long-term cardiac morbidity in patients with coronary artery disease.

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Introduction

Cardiac rehabilitation (CR) and physical activity in general have many well-reported beneficial effects. Regular physical activity is recommended in guidelines for coronary heart disease and heart failure [1–3]. Regular aerobic activity has beneficial effects on blood pressure, lipid levels, glucose metabolism, body weight and endothelial function [4]. The main objective health benefits that are observed include higher exercise capacity and a reduced number of cardiac events and mortality [5]. There are various types of CR programmes in different centres, but only a minority of the eligible patients takes part in and finish these programmes. Home-based CR increases the adherence of both out- and inpatients to improving their of physical activity in comparison with centre-based CR programmes. Furthermore, an inverse association between the use of antidiabetic, antihypertensive and lipid –lowering drugs and aerobic activity was found [6,7]. The long-term effect of CR has been published in several papers [8,9]; the aim of our study was to verify the outcome of patients with chronic coronary artery disease after very long follow-up period.

Patients and methods

Patient population and study protocol

The basic characteristics of the patients and study protocol were described previously [10]. Briefly, there were 152 consecutive patients with stable chronic coronary artery disease (CAD). The diagnosis of CAD was confirmed by coronary angiography with at least one coronary artery stenosis >50% of luminal diameter. The exclusion criteria were: (1) revascularisation (both coronary artery bypass grafting or percutaneous intervention) less than 3 months before enrolment into the study, (2) a known necessity for future coronary revascularisation, (3) patients with unstable coronary artery disease, (4) hemodynamically significant valvular disease, (5) a non-cardiac disease limiting the prognosis and (6) a non-cardiac disease seriously limiting the participation in cardiac exercise programmes. Supervised outpatient CR and home-based individual aerobic exercise were recommended to all patients. Retrospectively they were divided into four groups according to their adherence to physical exercise. The patients in group 1 continued with their exercise individually after finishing 3 months of supervised CR, whereas the patients in group 2 stopped their exercise after finishing the controlled programme. The patients in group 3 performed only individual exercises and group 4 did not exercise at all. The parameters of exercise were also described in our previous study [10]. However, the best outcomes were obtained by patients with an individual home training programme, regardless of guided CR. So, for the purposes of this study, patients in groups 1 + 3 (cohort IT +) and in groups 2+4 (cohort IT−) were compared over a long follow-up period. During the follow-up period all patients were medically treated according to evidence-based medicine.

Mortality and major adverse cardiac events (MACE) were assessed during the follow-up visits. The primary end-point was all-cause mortality; the secondary end-points were a composite of MACE, including myocardial infarction, unstable angina pectoris, coronary revascularisation, and hospitalisation for heart failure. The study performed was in accordance with the Declaration of Helsinki (2000) of the World Medical Association, and was approved by the institutional ethics committee. Written consent was obtained from each patient.

Statistical analysis

First, the baseline parameters were compared between the groups. Continuous parameters were compared using the Student t-test for independent variables. The Fisher exact test was used for the binary variables and the Pearson χ^2 test for other categorical variables. The log-rank test was performed for making a basic comparison of survival and cardiovascular (CV) complications between the groups. The log-rank test was also performed to assess any potential effects of initial group training. The Bonferroni correction was applied when comparing multiple groups.

The univariate Cox regression analysis was then employed to identify factors contributing to patient survival or CV complications. In the assessment of binary variables (yes/no), the absence of a factor defined the reference group. In multivariate analyses, the effect of training was assessed in an interaction with other factors, excluding pharmacotherapy, where the information about its changes during the follow-up period was not readily available.

Finally, stepwise Cox regression models (p to enter: 0.005, p to remove: 0.051) were constructed to identify the significant and independent predictors of survival and CV complications. Generally, $\alpha = 0.05$ was used in all analyses.

Results

In total, 54 out of 152 patients (36%) participated in home training. The basic characteristics of both groups and their comparison are shown in Table 1. The groups differed significantly in age, sex, the presence of diabetes, and the use of diuretics ($p < 0.05$). There were also trends for smoking, coronary intervention and the use of antiplatelet drugs other than aspirin ($p < 0.10$).

The median survival time for the whole set of patients was 14.7 years and the median time to CV complications was 11.6 years. The total numbers of 93 deaths and 67 cardiac events were recorded. The survival rate did not differ between both groups. On the other hand, there was a highly significant difference in the occurrence of CV complications ($p = 0.002$), with better prognosis determined with the home training group. While complications occurred only in 18 patients (33%) with home training, they affected 57 patients (58%) from the group without home training during the follow-up period. This number was not biased by different survival rates, since the survival times were almost the same (median survival times being 15.0 and 14.7 years, respectively). The Kaplan–Meier curves are shown in Graph 1.

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