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THE IMPORTANCE OF ECHOCARDIOGRAPHY ASSESSMENT IN CORONARY PATIENTS SUBJECT TO CARDIOVASCULAR RECOVERY PROGRAMS

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Abstract

Cardiovascular diseases cause approximately one-third of deaths worldwide and an increasing number of individuals with non-fatal ischemic heart disease live with chronic disabilities and impaired quality of life. Cardiac rehabilitation is designed to limit the physiological and psychological effects of cardiac illness, reduce the risk for sudden death or re-infarction, control cardiac symptoms and enhance the psychosocial and vocational status of selected patients.

The study group included a group of 78 patients who had a coronary event no more than 3 months ago and who are included in cardio-vascular recovery programs. The patients were echocardiographic evaluated at the first admission and later at 6 months. The evolution of the patients was a favorable one, being objectified an increase of both the ejection fraction of the left ventricle, as well as an improvement of MAPSE and TAPSE.

Keywords: *cardiovascular diseases, cardiac rehabilitation, echocardiography.*

Rezumat

Bolile cardiovasculare provoacă aproximativ o treime din decese la nivel mondial și un număr tot mai mare de persoane cu boală cardiacă ischemică non-fatală trăiesc cu dizabilități cronice și afectarea calității vieții. Reabilitarea cardiacă este concepută pentru a limita efectele fiziologice și psihologice ale bolilor cardiace, pentru a reduce riscul de moarte subită sau reinfarct, pentru a controla simptomele cardiace și pentru a spori starea psihosocială și profesională a pacienților selectați.

Lotul de studiu a cuprins un grup de 78 de pacienți care au prezentat un eveniment coronarian în urmă cu cel mult 3 luni și care sunt incluși in programe de recuperare cardiovasculară. Pacienții au fost evaluați ecocardiografic în cadrul primei internări și ulterior la 6 luni. Evoluția pacienților a fost una favorabilă, fiind obiectivată o creștere atât a fracției de ejecție a ventriculului stâng, precum și o îmbunătățire a MAPSE și TAPSE.

Cuvinte cheie: *boli cardiovasculare, reabilitare cardiacă, ecocardiografie.*



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Introduction

Cardiovascular rehabilitation is of extreme importance in patients diagnosticated with coronary heart disease. It represents a set of activities that influence the evolution process of the disease and provides patients with the best physical and mental condition, considering that a long-term effort is being done both by the physician and the patient. The recovery program includes a multidisciplinary team that includes a cardiologist, a physiotherapist, a nutritionist and a psychologist, who will determine the time, intensity and frequency of the effort according to the severity of the pathological process and the sequelae of the acute cardiovascular event[1,2].

Cardiovascular recovery programs sum up exercise, combating risk factors, medical education and psychological support[3]. Cardiac rehabilitation is indicated in patients diagnosticated with ischemic heart disease, cardiovascular surgery, cardiovascular interventional procedures (coronary angioplasty, implantation of a pacemaker / defibrillator, cardiac resynchronization therapy), cardiac chronic insufficiency, heart transplant, peripheral artery disease, diabetes mellitus and metabolic syndrome[4]. Although the components and purpose of cardiovascular recovery are standardized worldwide, differences in legislation, health insurance systems and guidelines for medical practice of different countries lead to major variations in the structure, duration and type of rehabilitation[5].

Cardiovascular recovery programs are structured in 3 distinct phases[4]:

1. the first stage - early intervention in hospitalization, which includes early mobilization measures and prevention of complications associated with prolonged immobilization;
2. the second stage - prevention and rehabilitation actions offered to patients after the cardio-vascular event, aiming at stabilizing the clinical status, stratifying the risk and promoting long-term lifestyle changes. This stage can be performed in a follow-up hospitalization or in a outpatient admission;
3. the third stage - cardiovascular recovery in outpatient regime, continues to provide long-term cardiovascular prevention and rehabilitation measures.

Echocardiography is an investigation that has become "routine" in cardiological practice, allowing the structural and functional evaluation of the heart. Echocardiography is more sensitive than electrocardiogram in the diagnosis of left ventricular hypertrophy and

in predicting cardiovascular risk, especially among patients with pre-existing cardiovascular disease[6].

Matherial and method

We conducted a prospective study that included 78 patients from urban and rural areas, who were investigated at the Cardiovascular Recovery Clinic from Recovery Hospital of Iași, Romania.

They were evaluated when initially admitted and 6 months later. Inclusion criteria consisted of a prior diagnosis of stable angina pectoris, myocardial infarction treated either conservatively, percutaneous angioplasty with implantation of stent or with aorto-coronary bypass no later than 6 months prior to admission. The Ethics Commission's approval was obtained and all the patients signed the participation consent before the study began.

Within the six months of cardiac rehabilitation, patients conducted endurance aerobic exercise at least five days a week. Each training session lasted between 30 and 60 minutes depending on physical condition and comorbidities, and was performed at a medium intensity.

Each patient performed cardiopulmonary exercise testing in initial assessment, being established the characteristics of the type of effort the patients needed to perform[7,8]. The features of the physical effort were frequency, exercise intensity for which we used Borg scale and the actual time of each session[9,10].

The statistical analysis was performed using SPSS software, version 7.0. A value of $p<0,05$ was considered statistically significant. The correlations between variables were performed using Pearson r correlation coefficient.

Results and discussions

A low left ventricular ejection fraction (LVEF) is an independent mortal predictor among patients with chronic ieschemic cardiopathy[11]. The prevalence of left ventricular dysfunction, defined as left ventricle ejection fraction < 50% was 44.61%. The benefit of physical training on ventricular systolic function in patients with ischemic cardiopathy has been documented since 1968[12,13].

The increase in beating volume is directly influenced by the type of physical exercise in the cardiovascular recovery program, the benefit being evident in the case of high-intensity workouts[14]. Adachi et al.[14] showed that the type of exercise within the RCV program significantly influences the effect on the left ventricular function of patients who have suffered an acute myocardial infarction, the benefit being significant only among those who have followed a high-intensity training program. Our study group showed a significant improvement in left ventricular systolic function, documented by improving the volumetric ejection fraction by 4.04% (50.37% versus 54.41%, $p<0.000001$).

The systolic excursion of the mitral ring (MAPSE) indirectly illustrates the left ventricular systolic function. Although almost half of our patients had an ejection fraction of the left ventricle lower than the cut-off of 50%, MAPSE had normal values among all subjects analyzed (MAPSE mean = 15.87 ± 2.57 mm). The average value of MAPSE increased slightly, but statistically significant (15.87 mm versus 17.41 mm, $p=0.00002$) after the recovery program, representing another argument regarding the benefit of cardiac rehabilitation on the systolic function of the left ventricle. Despite similar values in terms of initial ejection fraction (46.9 ±



5.9%), our results are inferior to those reported by a recently randomized trial, which documented the 14.6% increase in the ejection fraction after 3 months of exercise-based cardiovascular recovery among patients with chronic ischemic heart disease[15].

On the other hand, Sadeghi et al.[16] have achieved a benefit almost identical to ours, after 6 months of cardiovascular recovery among coronary patients with left ventricular dysfunction (5.3%, $p < 0.001$). Kim et al.[17] applied a 6-month program of cardio-vascular recovery after acute myocardial infarction in a small group of patients (n=18), objectifying a 6.11% increase in the ejection fraction (p=0.01).

Another study[18] reported a minor benefit (1.54%), but statistically significant (p=0.001), of the cardiovascular recovery program on the left ventricular systolic function of patients who underwent coronary angioplasty surgery. Another study[18] reported a minor benefit (1.54%), but statistically significant (p=0.001), of the cardiovascular recovery program on the left ventricular systolic function of patients who underwent coronary angioplasty surgery. The vast majority of studies in the literature document the benefit of exercise-based cardiovascular recovery on the systolic function of the left ventricle. Differences in the training protocol used may explain the existence of a small number of studies[19] that did not notice significant changes in the ejection fraction after participating in a cardiovascular recovery program.

In our analysis, as in 3 other previous studies[16-18] most of the structural parameters of the left ventricle (SIV, PPVS, DTSVS) did not change significantly after 6 months of recovery. Only the telesistolic diameter of the left ventricle decreased slightly (-1.04 mm, p=0.032) after cardiovascular recovery, without the change showing a significant clinical impact.

On the other hand, Giallauria et al.[20] studied the benefit of 6 months of rehabilitaters among acute post-myocardial infarction patients with moderate dysfunction of the left ventricle, with a lower basal value of the ejection fraction than that of our patients, noting a statistically significant improvement in the telesystolic and telediastolic volumes of the left ventricle indexed to the body surface (LVEDVI: 107.3 ± 18.8 versus 97.4 ± 17.9 ml/m2, $p<0.001$; LVESVI: 60.3±6.9 versus 55.2±11.9 ml/m2, $p<0.05$).

These results suggest that the benefit of cardiovascular recovery in terms of cardiac remodeling is more evident among patients with moderate dysfunction of the left ventricle. The other structural parameters - the interventricular septum and the posterior wall, were not significantly influenced by the cardiovascular recovery program (p=0.570

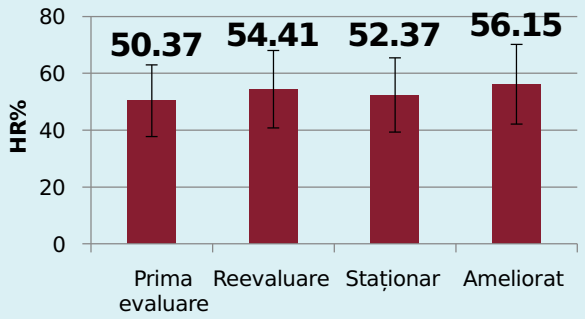


Figure 1. *Average level of EF% at reevaluation*

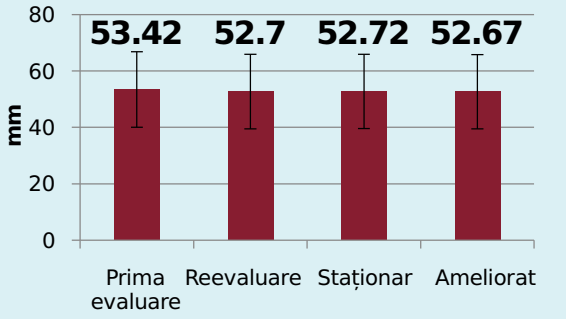


Figure 2. *Evolution of DTDVS at reevaluation*

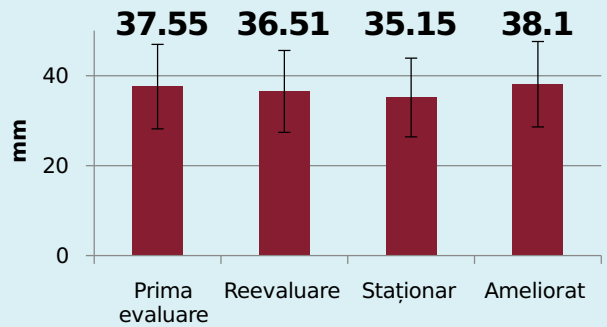


Figure 3. *Evolution of DTSVS at reevaluation*

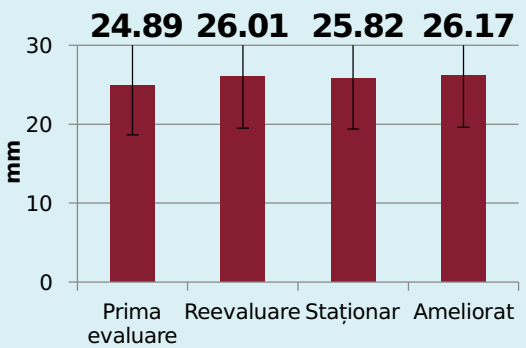


Figure 4. *Evolution of TAPSE at reevaluation*

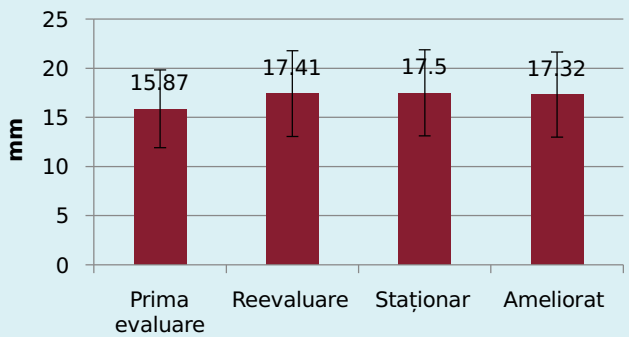


Figure 5. *Evolution of MAPSE at reevaluation*

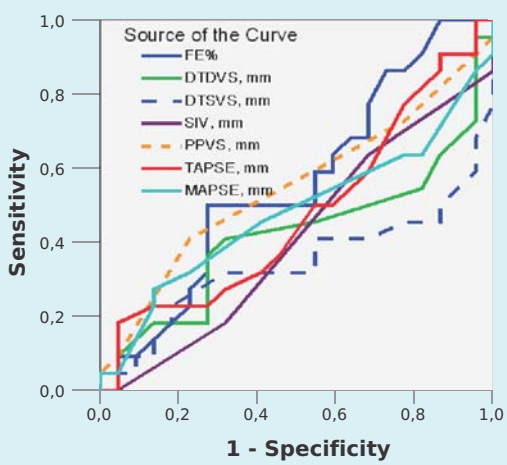


Figure 6. *ROC curve. Cardiological parameters at reevaluation*

and p= 0.321, respectively), probably due to the relatively short follow-up period of the study group.

Data from the literature on the benefit of cardiovascular recovery of patients with ischemic heart disease on right ventricular function are incomplete. A recent study[21] shows, however, that the global strain of the right ventricle has predictive value in terms of the benefit of cardiovascular recovery on exercise capacity. The systolic excursion of the tricuspid ring plan (TAPSE) was validated for the first time in 1984 for the assessment of the longitudinal systolic function of the right ventricle[22], its value being directly correlated with the ejection fraction of the right ventricle measured by radionuclide angiography (r=0.92, p<0001) (82). Soleimannejad et al.[19] reported the absence of statistically significant change in the diameter of the right ventricle after cardiovascular recovery post angioplasty.

Only 1.54% of our patients showed right ventricular systolic dysfunction at the initial evaluation, defined by a tapse value < 15 mm. The TAPSE average of the studied group increased slightly, but statistically significant after 6 months of cardiovascular recovery (24.89 mm vs. 26.01 mm, p=0.004), suggesting a direct benefit of cardiovascular recovery on the systolic function of the right ventricle. Contrary to our results, a previous study[23] did not object to a statistically significant improvement in tapse value after 8 months of cardiovascular recovery among 28 aorto-coronary post-bypass patients.

Conclusions

The key to the success of any cardiovascular recovery program lies in obtaining an optimal adherence of the patients, in the medium and long term, to the drug therapy, but also to the lifestyle changes and the exercise program.

The enrollment of coronary artery disease patients in a cardiovascular rehabilitation program is of vital importance. A 6-month cardiovascular rehabilitation program improves the echochardiographic parameters and overall physical condition in subjects with angina pectoris, myocardial infarction or ischemic cardiomyopathy.

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